U. S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 070-00033/95-001

Docket No. 070-00033

License No. SNM-23

Licensee: Texas Instruments, Inc.
34 Forest Avenue
Attleboro, Massachusetts 02703

Facility Name: Texas Instruments, Inc.

Inspection At: Texas Instruments, Inc.
Attleboro, Massachusetts

Inspection Conducted: March 8-9, 1995

Inspector: Mark C. Roberts 3-31-95
Mark C. Roberts
Senior Health Physicist

Approved by: John D. Kinneman
John D. Kinneman, Chief
Site Decommissioning Section

Areas Inspected: Characterization and remediation of interior areas; characterization and remediation of exterior areas; ground water monitoring program.

Results: The licensee's characterization and remediation activities are proceeding in an effective fashion. No violations were identified.

OFFICIAL RECORD COPY

RETURN ORIGINAL TO
REGION I

IE 07

9504110030 950404

DETAILS

1.0 Persons Contacted

*Michael Elliott, Environmental Manager, Texas Instruments, Inc.
Mark Griffon, CPS Environmental
Fred McWilliams, CPS Environmental

*Denotes those present at exit interview.

2.0 Background

The Texas Instruments, Inc. (TI) facility is located in Attleboro, Massachusetts, 48 kilometers (30 miles) south of Boston. The site is approximately 40 hectares (100 acres) with twelve major buildings. Operations with radioactive materials commenced at the site in 1952 when the General Plate Division of Metals and Controls, Inc. began to fabricate enriched uranium foils. That company merged with TI in 1959. Texas Instruments fabricated enriched uranium fuel elements for the U.S. Navy and commercial customers from 1959 through 1983. Depleted uranium was also used at the facility in research and development. The company no longer uses licensed radioactive material in its manufacturing operations.

Since 1985, TI has performed remediation on a number of areas of the site to remove residual radioactive contamination in buildings and surrounding exterior locations on the site. Remediation and final surveys of contaminated portions of Buildings 4 and 10 were completed in 1985 and are documented in various reports. The licensee has also completed a remediation project involving the removal of scrap material and equipment contaminated with uranium that was buried in a disposal area between Building 11 and what is now Building 12. Other exterior locations on the site were also contaminated with uranium as a result of the licensed operations. In particular, the metals recovery area near Building 5, where zirconium chips contaminated with uranium were incinerated, has recently been remediated. The licensee is in the process of completing the documentation of the final surveys performed in this area and expect to submit this report to Region I by the end of April 1995. The licensee has recently completed a radiological survey of the site, including interior areas, to determine if there is additional uranium contamination.

3.0 Characterization and Remediation of Interior Areas

Texas Instrument's radiological consultant, CPS Environmental, has performed radiological surveys in site buildings where licensed material had been previously used or stored. Although contamination in some of these buildings had been previously remediated, the licensee intends to survey all interior areas where licensed material was previously used. Buildings 10, 4 and 5 are the primary interior locations where licensed materials were used.

Building 10 previously housed the manufacturing operations for the production of uranium fuel elements for use by the U.S. Navy and for use in the High Flux Isotope Reactor (HFIR) Program. Since Building 10 is currently being used for manufacturing operations that do not involve licensed radioactive material, the licensee will clear a portion of the building (typically areas of approximately 100 m^2) and perform characterization, remediation and restoration of the discrete area. Once final surveys and restoration have been completed, the area will be returned to manufacturing use or will be used to receive material and equipment from another area where characterization must be performed. Characterization, remediation, final survey and restoration will be performed on each successive area until the Building is complete. The licensee intends to perform sufficiently detailed characterization measurements so that the results can serve as final surveys in areas that do not require remediation.

Manufacturing operations with licensed material were primarily carried out in the northeast and northwest corners of Building 10. Preliminary characterization measurements in the northeast corner of the building (the unclad manufacturing area) identified non-removable contamination levels as high as 50,000 - 60,000 dpm/100 cm^2 of enriched uranium. Activity was primarily associated with seams in the floor of adjoining slabs of concrete and a floor drain that was no longer in use. Lower levels of contamination were found in a pipe/utility trench running throughout the area. Characterization has been completed and remediation has commenced in the first of the cleared areas in the unclad manufacturing area. Remediation in this area has consisted of scabbling fixed surface contamination from a few square meters of the concrete floor, removing the contaminated concrete around a number of seams and cracks in the floor and removing an old floor drain and pipe elbow. In some locations beneath cracks or seams in the concrete, contaminated soil was also removed. Surveys in the drain line after the floor drain was removed did not identify any residual contamination. Based on the experience gained in this area, the licensee is investigating alternative remediation techniques that may include chemical decontamination or removal of contaminated concrete by a diamond wire cutting method.

Characterization measurements in the former HFIR fuel manufacturing section of Building 10 (northwest corner) also identified non-removable contamination in excess of the criteria for release for unrestricted use. The contamination in this area is generally of much lower levels and less widespread than in the unclad manufacturing area. A small area of contamination along the base of the connecting wall between Buildings 4 and 10 was also identified. This area is the site of a previous loading dock serving Building 4.

Building 4 was primarily used for research and development and a limited amount of manufacturing of uranium fuel prior to the construction of Building 10 in 1955. This building is also being used for manufacturing activities that do not involve licensed material. Characterization, remediation and restoration will also be done on small portions of the

building so that the routine operations are not significantly impacted. Licensed material was only used in a relatively small area of the building; therefore, not all of the building is being treated as an affected area. Preliminary characterization measurements indicate that contamination is very spotty and levels much lower than found in Building 10.

Building 5, a small building southeast of Building 4, previously housed a waste evaporator and collection tanks for contaminated waste water from Building 10. An incinerator for material contaminated with licensed material was also located in this building. The waste evaporator and incinerator were removed in approximately 1983. The entire building was surveyed and remediated during the remediation of the contaminated soil from the metals recovery area that is adjacent to this building. Contamination in excess of the criteria for release for unrestricted use was not found in Building 5; however, a portion of the floor of an addition to the building was removed to allow removal of contaminated soil associated with the remediation performed in the metals recovery area.

No safety concerns were identified.

4.0 Characterization and Remediation of Exterior Areas

As previously described in Inspection Report No. 070-00033/94-001, the licensee identified residual uranium contamination in soil in excess of the criteria for release for unrestricted use in the metals recovery area in the vicinity of Building 5. The contamination was apparently the result of the disposal of residue from the incineration of zirconium chips contaminated with uranium. This contamination was identified in late 1993. Characterization measurements during the first half of 1994 defined the extent of the contaminated soil. During 1994, approximately 100,000 ft^3 of contaminated soil was removed from this area and shipped to the Envirocare facility in Utah for disposal. The licensee has performed final survey measurements for the area and is preparing a final survey report. The licensee expects to transmit the report to Region I in April 1995.

Since the licensee had identified exterior soil contamination in the former burial area between Buildings 11 and 12 and in the metals recovery area, the licensee requested their radiological contractor to perform a walk-over radiation survey of the entire developed portion of the site. The licensee also interviewed current and former employees who were involved in early work involving licensed material at the facility. Based on the survey results and employee interviews, additional exterior areas were identified for further investigation to determine if contamination remained in the area. Sub-surface sampling and subsequent uranium analyses were performed to determine the extent and to quantify uranium soil contamination in the investigated areas.

An extensive area of soil contamination was identified in the stockade area, south of Building 10. The licensee estimates that the volume of contaminated soil in this area may exceed 50,000 ft^3. Remediation of this area will be complicated due to the presence of underground water and electrical utilities. Uranium contamination exceeds the criteria for release for unrestricted use in a smaller area on the south lawn of Building 12. The licensee expects to remediate these areas during the spring and summer of 1995.

Two small areas, a hill near Building 17 and a debris area east of Building 12; were also investigated and small volumes of contaminated soil were removed and disposed from each area. Soil was apparently placed in these areas during small construction projects in areas that were later found to have uranium contamination in excess of the criteria for release for unrestricted use. The area surrounding Building 10 was also identified as a suspect area since previous operations could have led to contamination of the soil outside the building. Analysis of surface and sub-surface soil samples from the perimeter of Building 10 did not identify soil contamination in excess of the criteria for release for unrestricted use.

No safety concerns were identified.

5.0 Ground Water Monitoring Program

Texas Instruments currently has 63 on-site monitoring wells and 13 off-site monitoring wells in place. The wells are not routinely sampled except for a group near Building 3 that are being sampled for non-radiological parameters. Most of the wells were last sampled and analyzed for radiological parameters in approximately 1983. However, wells surrounding the burial area between Buildings 11 and 12 were sampled and analyzed for gross alpha and gross beta activities in 1993. All 1993 results were less than the EPA drinking water criteria of 15 pCi/liter for gross alpha activity and 50 pCi/liter for gross beta activity.

Texas Instruments intends to sample the wells that are down-gradient of each remediated area. Water samples will be filtered prior to performing gross alpha and gross beta analyses. The sensitivity of the analyses will be sufficient to meet the EPA drinking water criteria described above. If the gross alpha or gross beta results exceed the above values, a specific analysis for uranium will be performed on the sample. Monitoring well sampling is expected to commence in the second quarter of 1995.

No safety concerns were identified.

6.0 Exit Interview

The results of the inspection were discussed with the licensee representative identified in Section 1.

April 26, 1995

License No. SNM-23
Docket No. 070-00033
Control No. 118945

David Lederer
Remedial Project Manager
U. S. Environmental Protection Agency, Region I
J. F. K. Federal Building (HRM)
Boston, MA 02203

SUBJECT: TEXAS INSTRUMENTS, INC., ATTLEBORO, MASSACHUSETTS

Dear Mr. Lederer:

On March 23, 1994 Mark Roberts and I discussed the status of the Texas Instruments, Inc. site on Forest Avenue in Attleboro, Massachusetts with you at the Environmental Protection Agency (EPA) Region I office in Boston, Massachusetts. That exchange of information helped us understand some of the concerns that the EPA has in regard to the Attleboro site and the Shpack Landfill site in Norton, Massachusetts where radioactive material from the Attleboro facility has allegedly been disposed. This letter is to formally request that the EPA identify and communicate to the NRC any unresolved concerns that the EPA may have concerning radioactive contamination at the Forest Avenue site or the termination of License No. SNM-23.

Since you explained that your involvement has been primarily with the Shpack site, the following historical information about the Texas Instruments Attleboro site is provided to clarify the Nuclear Regulatory Commission's relationship to the sites. The General Plate Division of Metals and Controls, Inc., began to fabricate enriched uranium foils at its facility in Attleboro, Massachusetts in 1952. In 1959 Metals and Controls merged with Texas Instruments who continued operations at the site using enriched and natural uranium for the fabrication of nuclear fuel for U.S. Navy and commercial customers from 1959 through 1981. Fabrication and associated activities were conducted at various buildings on the Attleboro site under contract to the Atomic Energy Commission (AEC) and under an AEC (later an NRC) license. The current NRC license for the site is License No. SNM-23. Due, in part, to the presence of the buried contaminated soil and scrap on the site, discussed below, in 1990 the NRC placed the Texas Instruments Attleboro site on its Site Decommissioning Management Plan (SDMP) list as a means to elevate NRC attention to the site and ensure more timely decommissioning.

Following the cessation of active operations using NRC licensed material, Texas Instruments, although still licensed by the NRC, began decommissioning the areas of the site where licensed radioactive material had been used. A number of the buildings were cleaned and surveyed for radioactive contamination in 1985 and released for unrestricted use since residual contamination levels met appropriate NRC guidelines. In addition to the radioactive contamination in the buildings, an unknown quantity of uranium

9505030307 950426
PDR ADOCK 07000033

OFFICIAL RECORD COPY

contaminated soil and metal scrap had been buried on site (in an area which is now between Buildings 11 and 12).

In July 1992 Texas Instruments submitted a decommissioning plan for the burial area. The plan was approved by the NRC in August 1992 and Texas Instruments initiated the remediation activities. NRC confirmatory measurements following the completion of the remediation activities identified additional contaminated areas adjacent to the remediated areas. Texas Instruments submitted additional decommissioning plans that were approved by the NRC and implemented in the summer of 1993. A final radiological survey was conducted by Texas Instruments' contractor and submitted to the NRC in September 1993.

With the submission of the final survey report for the burial area, Texas Instruments submitted a request for the NRC to terminate License No. SNM-23 and release the facility for unrestricted use. In response to this request and following NRC review of the final survey report, the NRC requested its contractor, the Oak Ridge Institute for Science and Education (ORISE) to perform measurements and surveys to confirm that these areas have been remediated to meet the NRC's decommissioning criteria for release for unrestricted use. The ORISE survey did not identify any areas that exceed the NRC decommissioning criteria and the February 1994 ORISE confirmatory survey report documents these findings. A copy of this report is enclosed.

In late 1993 Texas Instruments discovered additional soil contaminated with uranium on the site. During 1994 they remediated that contamination and conducted a thorough review of the entire site to ensure that all contaminated areas have been identified. Additional areas of contamination were identified during this review. Those areas are scheduled to be remediated in 1995.

We are currently considering a request from Texas Instruments to approve the site characterization and their final decommissioning plan. Shortly we will publish a Federal Register Notice requesting comments on the final plan and informing the public of the opportunity for a hearing. While a final decision has not yet been made, we expect to resolve any comments or questions concerning the final decommissioning plan and approve final decommissioning of the site. Following implementation of the plan, Texas Instruments will provide a final survey and we will conduct a confirmatory survey.

We will evaluate the submissions from Texas Instruments, the ORISE confirmatory survey report, the confirmatory surveys following the remediation now under way, and historical information concerning the site in order to determine if the entire site can be released for unrestricted use. Based on the information now available to me, it is likely that, following implementation of the final decommissioning plan, in late 1995 or early 1996, we will be prepared to release the site for unrestricted use and terminate License No. SNM-23.

The NRC believes that the decision to terminate License No. SNM-23 and release the Forest Avenue site for unrestricted use may be done without resolution of all concerns regarding radioactive material at the Shpack Landfill. Since it is our understanding that EPA has regulatory authority regarding the

radioactive contamination at the Shpack Landfill site and since that site is not licensed, NRC does not plan involvement in that matter. The NRC will, of course, continue to cooperate with and make available to the EPA any information it has following termination of the license.

We would appreciate a formal response to this letter by August 1, 1995 so that we can continue our reviews, consider your views and comments and complete action on the request to terminate License No. SNM-23.

Please contact Mark Roberts at (610) 337-5094 or me at (610) 337-5252 should you have any questions concerning this letter or would like to discuss this matter further.

Thank you for your cooperation in this matter.

Sincerely,

Original Signed by:

John D. Kinneman, Chief
Site Decommissioning Section
Division of Radiation Safety
and Safeguards

Enclosure:
Confirmatory Survey of the Texas Instruments, Inc.
Former Burial Site - Attleboro, Massachusetts

cc w/encl:

Mr. Robert Hallisey, Director
Radiation Protection Program
Commonwealth of Massachusetts
Department of Health
150 Tremont Street, 11th Floor
Boston, MA 02111

Alexander Williams, Ph.D.
EM-421 Cloverleaf Building
19901 Germantown Road
U.S. Department of Energy
Germantown, MD 20874-1290

Jim Kopotic, Former Sites
Restoration Division
Oak Ridge Operations Office
U.S. Department of Energy
P.O. Box 2001
Oak Ridge, TN 37831-2001

cc w/o encl:

Michael Elliott
Environmental Manager
Texas Instruments, Incorporated
34 Forest Street
Attleboro, MA 02703

Distribution w/encl:
Region I Docket Room (w/concurrences)
PUBLIC
M. Weber, NMSS
W. Hehl, RI
J. Joyner, RI
S. Shankman, RI
D. Chawaga, RI
J. Roth, NMSS

DOCUMENT NAME: S:\FRSSB\TI EPA.LTR
To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	RI:DRSS	C	RI:DRSS	E	RI:DRSS	N
NAME	MCRoberts		JDKinneman		Joyner	
DATE	4/ /95		4/28/95		4/12/95	

OFFICIAL RECORD COPY

CONFIRMATORY SURVEY OF THE TEXAS INSTRUMENTS, INC. FORMER BURIAL SITE ATTLEBORO, MASSACHUSETTS

[DOCKET 070-00033]

.. J. ANSARI

repared for the
.S. Nuclear Regulatory Commission
egion I Office

ORISE

.K RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

The Oak Ridge Institute for Science and Education (ORISE) was established by the U.S. Department of Energy to undertake national and international programs in science and engineering education, training and management systems, energy and environment systems, and medical sciences. ORISE and its programs are operated by Oak Ridge Associated Universities (ORAU) through a management and operating contract with the U.S. Department of Energy. Established in 1946, ORAU is a consortium of 6[illegible] colleges and universities.

NOTICES

The opinions expressed herein do not necessarily reflect the opinions of the sponsoring institutions of Oak Ridge Associated Universities.

This report was prepared as an account of work sponsored by the United States Government. Neither the United States Government nor the U.S. Department of Energy, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe on privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, mark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement or recommendation, or favor by the U.S. Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the U.S. Government or any agency thereof.

ORISE 94/B-71

CONFIRMATORY SURVEY OF THE TEXAS INSTRUMENTS, INC. FORMER BURIAL SITE ATTLEBORO, MASSACHUSETTS

Prepared by

A. J. Ansari

Environmental Survey and Site Assessment Program
Energy/Environment System Division
Oak Ridge Institute for Science and Education
Oak Ridge, Tennessee 37831-0117

Prepared for the

U.S. Nuclear Regulatory Commission
Region I Office

February 1994

FINAL REPORT

This report is based on work performed under an Interagency Agreement (NRC Fin. No. A-9076) between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy. Oak Ridge Institute for Science and Education performs complementary work under contract number DE-AC05-76OR00033 with the U.S. Department of Energy.

CONFIRMATORY SURVEY
OF THE TEXAS INSTRUMENTS, INC.
FORMER BURIAL SITE
ATTLEBORO, MASSACHUSETTS

Prepared by: ______________________ Date: 2/7/94
A. J. Ansari, Project Leader
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: 2/9/94
W. L. Beck, Acting Laboratory Manager
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: [illegible]
M. R. Landis, Project Manager
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: [illegible]
A. T. Payne, Quality Assurance Officer
Environmental Survey and Site Assessment Program

Reviewed by: ______________________ Date: [illegible]
J. D. Berger, Program Director
Environmental Survey and Site Assessment Program

ACKNOWLEDGEMENTS

The author would like to acknowledge the significant contributions of the following staff members:

FIELD STAFF

D. M. Nugent
J. L. Payne
S. E. Potter

LABORATORY STAFF

R. D. Condra
J. S. Cox
R. J. Epperson
M. J. Laudeman
S. T. Shipley

CLERICAL STAFF

T. J. Claiborne
D. A. Cox
R. D. Ellis
K. E. Waters

ILLUSTRATOR

M. A. Henke
T. D. Herrera

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

ASME	American Society of Mechanical Engineers
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
CPS	Creative Pollution Solutions
EML	Environmental Measurement Laboratory
EPA	Environmental Protection Agency
ESSAP	Environmental Survey and Site Assessment Program
m	meter
m^2	square meter
M&C	Metals and Controls, Incorporated
MDA	minimum detectable activity
NaI	sodium iodide
NIST	National Institute for Standards Technology
NRC	Nuclear Regulatory Commission
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
PIC	Pressurized Ionization Chamber
RSAP	Radiological Site Assessment Program
TI	Texas Instruments, Incorporated
μR/h	microroentgen per hour

CONFIRMATORY SURVEY
OF THE TEXAS INSTRUMENTS, INC.
FORMER BURIAL SITE
ATTLEBORO, MASSACHUSETTS

INTRODUCTION AND SITE HISTORY

The Texas Instruments Incorporated site at Attleboro, Massachusetts, was owned and operated by Metals and Controls, Inc. (M&C) until 1959, at which time M&C merged with Texas Instruments, Incorporated (TI). The General Plate Division of M&C began processing nuclear materials in 1952, and between 1952 and 1959 fabricated uranium foils for reactor experiments and fuel components and complete reactor fuel cores for the U.S. Navy. Source material license D-549 was issued permitting acquisition and title to not more than 22.7 kg (50 pounds) of refined source material for use in the production of uranium foils; additional source material was acquired and used under contract with the U.S. Government. Special nuclear materials license No. SNM 23 was issued permitting acquisition and title to 110 kg of enriched uranium for fabrication of the fuel components and cores. After the merger in 1959, Texas Instruments continued fabricating reactor fuel cores, primarily for research and production reactors. Also, source materials, i.e., natural uranium and thorium, were fabricated for sale to various corporations.

A 1964 Texas Instruments health and safety manual states that uranium and thorium contaminated noncombustible scrap material and machinery were collected in 55-gallon steel drums and were disposed of through authorized agencies, or were buried on site in compliance with 10CFR20.304. Records indicate two known burials of radioactive material, one in 1958 of contaminated ductwork, and one in 1961 of 28.4 mCi of enriched uranium noncombustible scrap. The burial site was closed in 1967. Work with nuclear materials was gradually reduced beginning in 1968 and was terminated in 1974. The interiors of the three buildings where radioactive materials were used were decontaminated by the licensee and in 1983 the buildings were released for unrestricted use by the Nuclear Regulatory Commission (NRC).

The Radiological Site Assessment Program (RSAP) of the Oak Ridge Associated Universities (ORAU) conducted a radiological survey of portions of the facility's outdoor areas during April and May, 1984. The results of that survey indicated several areas with surface and/or subsurface uranium concentrations in excess of guidelines.[1] In the summer of 1992, Creative Pollution Solutions, Inc. was contracted by Texas Instruments Inc. to initiate remediation activities. The licensee submitted a post-excavation radiological survey report to the NRC in November of 1992.[2]

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed a confirmatory survey of the excavated area in December of 1992. The results of that survey indicated that the full extent of the burial site, particularly on the west side, adjacent to Building 11 parking lot, had not been determined.[3] Subsequently, further remediation of the former burial site was performed by Creative Pollution Solutions, Inc. Following those remediations, the licensee completed final survey activities and backfilling operations.[4]

The U.S. Nuclear Regulatory Commission, Region I Office, requested that the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) perform an independent confirmatory survey of the former burial site. This report summarizes the procedures and results of that survey.

SITE DESCRIPTION

The Texas Instruments Inc. Facility, Attleboro, MA is located in North Attleboro, approximately 48 kilometers south of Boston on Route 123 (Figure 1). The former burial site is located between Buildings 11 and 12 (Figure 2). The area of concern for remediation activities was approximately 10,000 m^2. The excavated area at the burial site was approximately 2,500 m^2 and the average depth of the excavated area was approximately 1.5 meters. The west end of the excavation extended into the parking lot, adjacent to Building 11. The excavated area has been backfilled and landscaped. The area which extended into the parking lot has been repaved.

OBJECTIVES

The objectives of the confirmatory process are to provide independent document reviews and radiological data, for use by the NRC in evaluating the adequacy and accuracy of the licensee's radiological survey data, relative to established guidelines.

DOCUMENT REVIEW

The final radiological status report, provided by the Texas Instruments Incorporated, was reviewed by ESSAP as part of the confirmatory activities.[4] Analytical procedures and methods utilized by the licensee were reviewed for adequacy and appropriateness. The data were reviewed for accuracy, completeness, and compliance with applicable NRC guidelines.

PROCEDURES

On December 14 and 15, 1993, ESSAP performed a confirmatory survey of the former burial site and the areas of concern immediately adjacent to the burial site. The survey was conducted in accordance with a survey plan which was submitted to and approved by the NRC, Region I Office.[5]

REFERENCE GRID

A 10 m x 10 m grid was established during ESSAP's radiological survey of this site in 1984 which was subsequently used by the licensee.[2,4] The same reference grid was used in this survey.

SURFACE SCANS

Surface scans of the former burial site (approximately 10,000 m^2) were performed using NaI detectors coupled to countrate meters with audible indicators. Surface scans for gamma radiation

were performed on 100% of the former excavation and the two meter perimeter immediately surrounding that area. Approximately 50% of the remaining surface area was also scanned.

EXPOSURE RATE MEASUREMENTS

Background exposure rates, determined during a previous ESSAP survey of this facility, were used for comparison.[1]

Exposure rate measurements were performed at 1 m above the surface at 12 locations, using a pressurized ionization chamber (PIC). Measurement locations are illustrated in Figure 3.

SOIL SAMPLING

The analytical results of background soil samples, collected during a previous ESSAP survey of this facility, were used for comparison.[1]

Five surface soil samples were obtained at the center of randomly selected grid blocks. In addition, two surface soil samples were collected from the area between grid coordinates 185N, 170E and 195N, 180E where the licensee had reported slightly elevated gamma radiation.[3] Sampling locations are illustrated in Figure 4.

Thirty-seven soil samples were collected from 14 boreholes. The boreholes were drilled on and around the former excavated area to depths of approximately 2 meters, except for a number of locations where relatively large pieces of rock were encountered at a depth of approximately 1-1.5 meters. On the west side of the excavation, boreholes were drilled 3 meters from the edge of the former excavation at approximately 20 meter intervals. For the remaining perimeter area, boreholes were drilled at approximately 40 meter intervals. The location of a number of boreholes had to be moved because of their proximity to buried water, gas, and compressed air lines.

The boreholes were scanned for gamma activity, using a collimated NaI detector coupled to a countrate meter with an audible indicator. Systematic soil samples were collected from the surface (0-15 cm), the middle (85-100 cm), and the bottom (185-200 cm) of each borehole. In the parking lot area, the "surface" soil sample was approximately 30 cm below the surface of the pavement. Furthermore, when the depth of a borehole was 1.5 m, the bottom soil sample was collected at 135-150 cm. When the depth of a borehole was 1 m, only two samples were collected from that borehole (0-15, and 85-100 cm).

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ORISE's ESSAP laboratory in Oak Ridge, TN for analysis and interpretation. Exposure rates were reported in μR/h. Soil samples were analyzed by gamma spectrometry. Spectra were reviewed for U-235, U-238, Th-232, Th-228, and any other identifiable photopeaks. Soil sample results were reported in units of picocuries per gram (pCi/g). Additional information concerning major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B. Results were compared to NRC guidelines which are provided in Appendix C.

FINDINGS AND RESULTS

DOCUMENT REVIEW

ESSAP reviewed the licensee's radiological survey data and comments were provided to the NRC.[6] In ESSAP's opinion, the licensee documents provide an adequate description of the radiological condition of the facility relative to the NRC guidelines for release for unrestricted use.

SURFACE SCANS

Surface scans for gamma activity did not identify any locations of elevated direct radiation.

EXPOSURE RATE MEASUREMENTS

The background exposure rates, previously measured at this site, ranged from 10 to 11 μR/h and averaged 10 μR/h.[1]

Exposure rates, measured at 12 locations in the vicinity of the former burial site, ranged from 9 to 11 μR/h. (Table 1).

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES

Total uranium concentrations in background soil samples, previously determined for this site, ranged from 1.0 to 2.4 pCi/g.[1]

Concentrations of U-235, U-238, and total uranium in surface soil samples ranged from <0.1 to 0.4 pCi/g, 0.7 to 10 pCi/g, and 3.0 to 20 pCi/g, respectively. Concentrations of U-235, U-238, and total uranium in subsurface soil samples ranged from <0.1 to 0.6 pCi/g, 0.6 to 13 pCi/g, and 2.9 to 27 pCi/g, respectively (Table 2).

COMPARISON OF RESULTS WITH GUIDELINES

The NRC guidelines for residual concentrations of radionuclides in soil, established for license termination or release of a facility for unrestricted use are presented in Appendix C. The primary contaminant of concern at this site is enriched uranium.

The soil concentration guideline for enriched uranium is 30 pCi/g.[2] The total uranium concentrations in all surface and subsurface soil samples were within this limit.

At this site, the applicable NRC guideline for exposure rate at 1 m above the surface is 10 μR/h above background, consistent with the Branch Technical Position.[2] All exposure rates were within this limit.

SUMMARY

During the period December 14 and 15, 1993, at the request of the NRC Region I Office, the Environmental Survey and Site Assessment Program of ORISE performed a confirmatory survey of the former burial site at Texas Instruments Incorporated. The survey activities consisted of surface scans for gamma activity, exposure rate measurements, and soil sampling.

Exposure rates were all within the 10 μR/h above background criterion. The radionuclide concentrations in surface and subsurface soil samples were less than the applicable guidelines for release for unrestricted use. In ESSAP's opinion, the licensee documents provide an adequate description of the radiological condition of the facility.

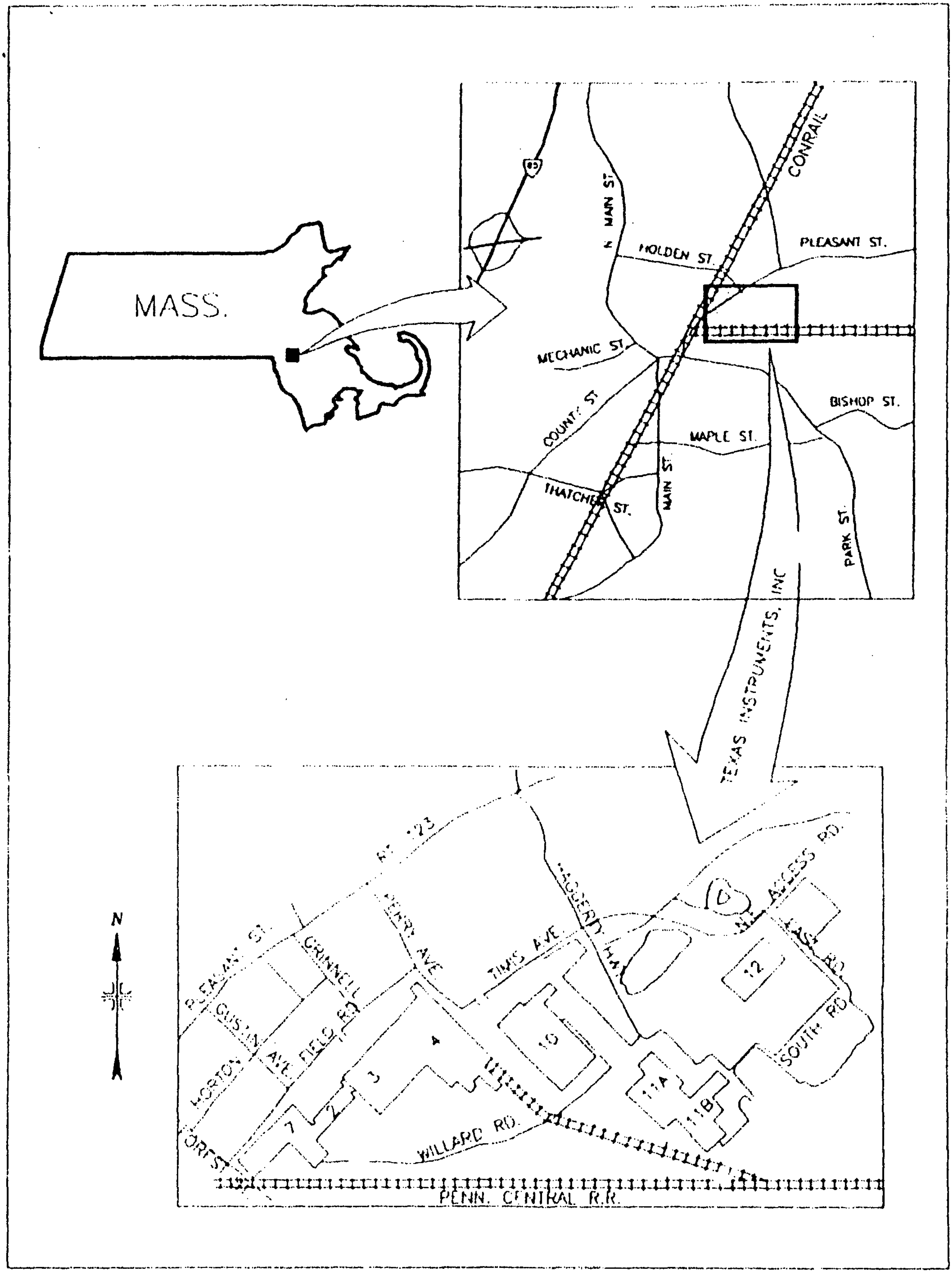


FIGURE 1: Map of Attleboro, Massachusetts -- Location and Plan View of the Texas Instruments Site

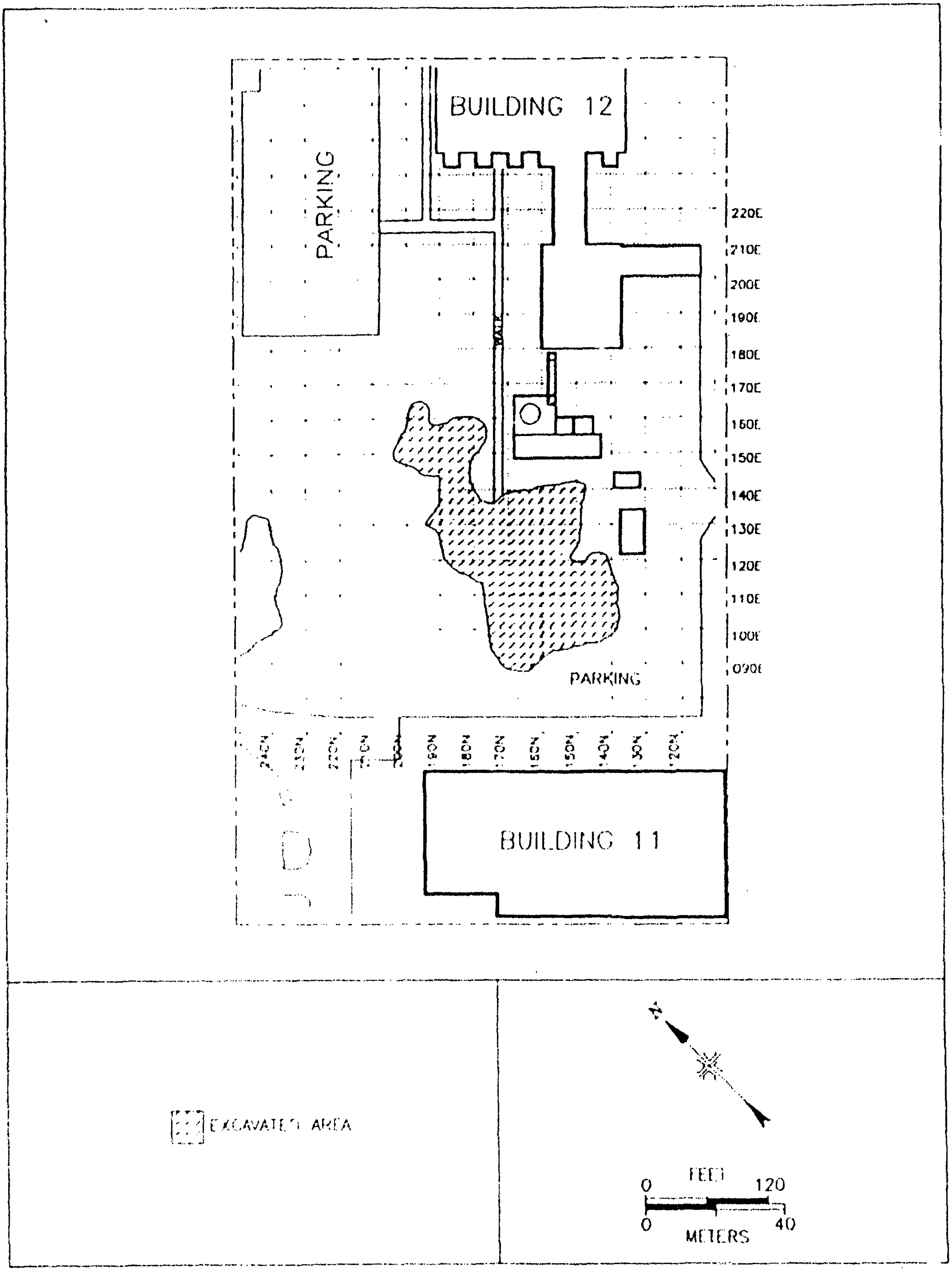


FIGURE 2: The F rmer Burial Site -- Extent of Excavation

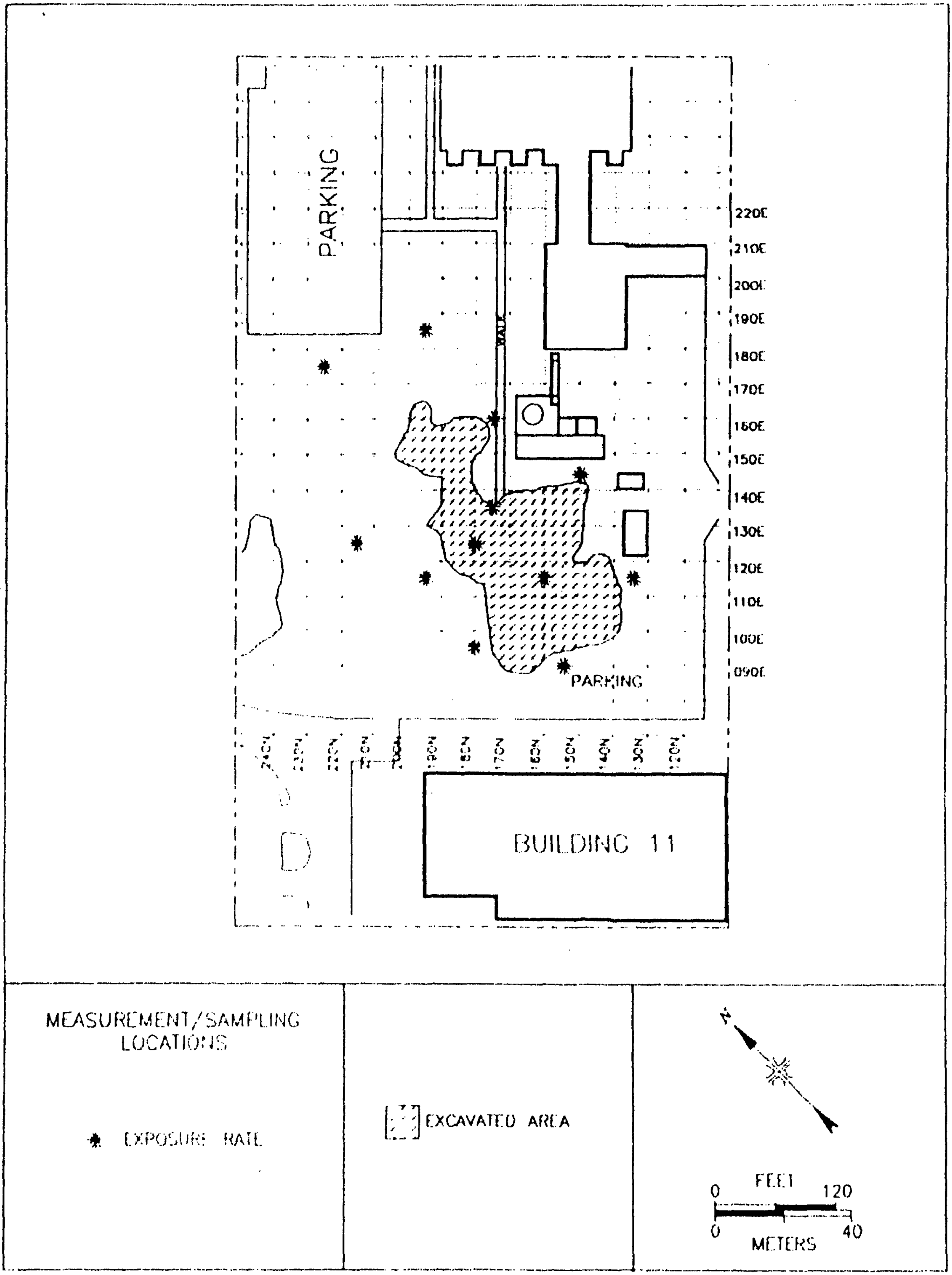


FIGURE 3: The Former Burial Site - Exposure Rate Measurement Locations

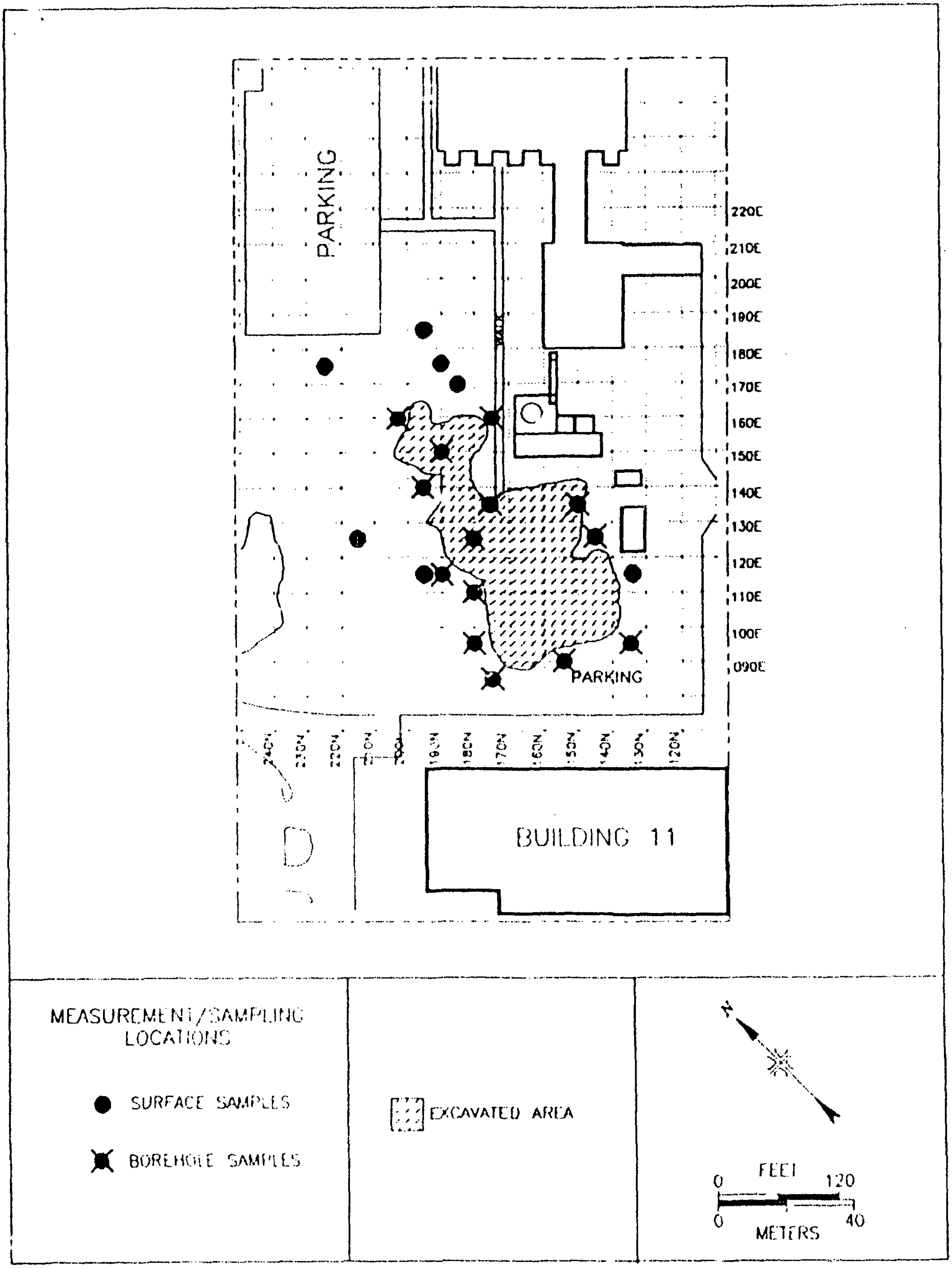


FIGURE 4 The Former Burial Site – Soil Sampling Locations

TABLE 1

EXPOSURE RATE MEASUREMENTS
TEXAS INSTRUMENTS, INC.
FORMER BURIAL SITE
ATTLEBORO, MASSACHUSETTS

Location[a]	Exposure Rate at 1 m above the surface (μR/h)
135N, 115E	9
150N, 145E	9
155N, 90E	11
160N, 115E	9
175N, 135E	9
175N, 160E	10
180N, 95E	11
180N, 125E	9
195N, 115E	10
195N, 185E	9
215N, 125E	9
225N, 175E	9

[a]Refer to Figure 3.

TABLE 2

URANIUM CONCENTRATIONS IN SOIL SAMPLES
TEXAS INSTRUMENTS, INC.
FORMER BURIAL SITE
ATTLEBORO, MASSACHUSETTS

Location[a]	Depth (cm)	Uranium Concentrations (pCi/g)[b]		
		U-235	U-238	Total U[c]
135N, 95E	0-15	0.3 ± 0.1	3.2 ± 1.2	10
	85-100	<0.1	0.6 ± 1.4	<2.9
	185-200	0.2 ± 0.1	2.3 ± 1.2	6.9
135N, 115E	0-15	0.2 ± 0.1	0.9 ± 1.0	5.5
145N, 125E	0-15	<0.1	6.0 ± 1.7	<8.3
	85-100	0.2 ± 0.1	4.4 ± 1.3	9.0
150N, 135E	0-15	<0.1	2.6 ± 1.1	<4.9
	85-100	0.3 ± 0.1	4.1 ± 0.9	11
155N, 90E	0-15	<0.1	1.1 ± 1.0	<3.4
	85-100	<0.1	2.2 ± 0.8	<4.5
	185-200	0.2 ± 0.1	3.2 ± 1.4	7.8
175N, 85E	0-15	0.1 ± 0.1	1.5 ± 1.0	3.8
	85-100	<0.1	1.8 ± 1.4	<4.1
	135-105	<0.1	1.6 ± 1.3	<3.9
175N, 135E	0-15	<0.1	2.0 ± 1.5	<4.3
	85-100	0.3 ± 0.1	7.2 ± 1.5	14
175N, 160E	0-15	0.2 ± 0.1	1.6 ± 1.1	5.6
	85-100	0.2 ± 0.1	1.6 ± 1.4	6.2
	185-200	0.2 ± 0.1	1.8 ± 0.9	6.4
180N, 95E	0-15	<0.2	3.7 ± 1.3	<8.3
	85-100	<0.1	1.7 ± 1.2	<4.0
	185-200	0.1 ± 0.1	3.4 ± 1.2	5.7
180N, 110E	0-15	0.4 ± 0.1	10.4 ± 2.1	20
	85-100	0.4 ± 0.1	12.7 ± 1.7	22
	135-150	<0.1	2.4 ± 1.8	<4.7

TABLE 2 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
TEXAS INSTRUMENTS, INC.
FORMER BURIAL SITE
ATTLEBORO, MASSACHUSETTS

Location[a]	Depth (cm)	Uranium Concentrations (pCi/g)[b]		
		U-235	U-238	Total U[c]
185N, 125E	0-15	<0.1	1.7 ± 1.2	<4.0
	85-100	0.3 ± 0.1	4.5 ± 1.3	11
185N, 170E	0-15	<0.1	0.7 ± 0.9	<3.0
190N, 115E	0-15	<0.1	2.4 ± 1.5	<4.7
	85-100	0.5 ± 0.1	2.1 ± 1.5	14
190N, 150E	0-15	<0.1	0.8 ± 1.0	<3.1
	85-100	0.4 ± 0.1	6.5 ± 1.6	16
	185-200	0.6 ± 0.1	10.3 ± 1.8	24
190N, 175E	0-15	0.1 ± 0.1	1.5 ± 1.0	3.8
195N, 115E	0-15	0.4 ± 0.1	3.4 ± 1.6	13
195N, 140E	0-15	<0.1	1.2 ± 0.9	<3.5
	85-100	0.3 ± 0.1	2.1 ± 1.1	9.0
	185-200	<0.1	1.7 ± 1.1	<4.0
195N, 185E	0-15	<0.1	1.1 ± 0.8	<3.4
200N, 160E	0-15	<0.1	1.2 ± 1.2	<3.5
	85-100	0.6 ± 0.1	13 ± 2.0	27
	185-200	0.5 ± 0.1	2.8 ± 1.0	14
215N, 125E	0-15	<0.1	1.4 ± 0.9	<3.7
225N, 175E	0-15	<0.1	1.6 ± 1.2	<3.9

[a]Refer to Figure 4.
[b]Uncertainties represent the 95% confidence level based only on counting statistics.
[c]Total uranium concentrations are calculated based on a U-234 to U-235 activity ratio of 22:1.

REFERENCES

1. "Radiological Survey of the Texas Instruments Site, Attleboro, Massachusetts," Oak Ridge Associated Universities, January, 1985.

2. "Post Excavation Radiological Survey Report, Texas Instruments Incorporated Burial Site, Attleboro, Massachusetts," Creative Pollution Solutions, Inc., November 28, 1992.

3. Letter from A. Jaberaboansari (ORISE) to J. Roth (NRC), reference: "Interim Radiological Survey Report for the Texas Instruments Incorporated Burial Site," January 25, 1993.

4. "Remediation of the Former Radioactive Waste Burial Site," Final Report, Creative Pollution Solutions, Inc., September 1993.

5. "Confirmatory Survey Plan for the Texas Instruments Incorporated Burial Site, Attleboro, Massachusetts," Oak Ridge Institute for Science and Education, December 6, 1993.

6. Letter from A. J. Ansari (ORISE) to M. C. Roberts (NRC), reference: "Comments on the Final Report: Remediation of the Former Radioactive Waste Burial Site at Texas Instruments Incorporated," December 1, 1993.

7. U.S. Nuclear Regulatory Commission, "Disposal of Onsite Storage of Thorium and Uranium Wastes from Past Operations," 46 FR 52061, Washington, D.C., October 23, 1981.

APPENDIX A

MAJOR INSTRUMENTATION

APPENDIX A

MAJOR INSTRUMENTATION

The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the authors or their employers.

DIRECT RADIATION MEASUREMENT

Instruments

Eberline Pulse Ratemeter
Model PRM-6
(Eberline, Santa Fe, NM)

Ludlum Ratemeter-Scaler
Model 2200
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Detectors

Reuter-Stokes Pressurized Ion Chamber
Model RSS-111
(Reuter-Stokes, Cleveland, OH)

Victoreen NaI Scintillation Detector
Model 489-55
3.2 cm x 3.8 cm Crystal
(Victoreen, Cleveland, OH)

LABORATORY ANALYTICAL INSTRUMENTATION

High Purity Extended Range Intrinsic Detectors
Model No: ERVDS30-25195
(Tennelec, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-11
(Nuclear Lead, Oak Ridge, TN) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Detector
Model GMX-23195-S, 23% Eff.
(EG&G ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Surface scans for gamma activity were performed by passing the probes slowly over the surface; the distance between the probe and the surface was maintained at a minimum. The scans were performed using NaI detectors coupled to countrate meters with audible indicators. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument.

Exposure Rate Measurements

Measurements of gamma exposure rates were performed at 1 m above the surface, using a pressurized ionization chamber (PIC).

Soil Sampling

Approximately 1 kg of soil was collected at each sample location. Surface soil samples were collected at 0-15 cm depth. Samples from boreholes were collected from the surface (0-15 cm), the center (85-100 cm), and the bottom (185-200 cm) of each borehole. When the depth of a borehole was 1.5 m, the bottom soil sample was collected at 135-150 cm. When the depth of a borehole was 1 m, only two samples were collected from that borehole (0-15, and 85-100 cm). Collected samples were placed in a plastic bag, sealed, and labeled in accordance with ESSAP survey procedures.

ANALYTICAL PROCEDURES

Gamma Spectrometry

Samples of soil were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. Net material weights were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks used for determination of radionuclides of concern were:

U - 235	0.186 MeV
U - 238	0.063 MeV from Th-234*
Th-228	0.583 MeV from Tl-208
Th-232	0.911 MeV from Ac-228*

*Secular equilibrium assumed.

Spectra were also reviewed for other identifiable photopeaks.

UNCERTAINTIES AND DETECTION LIMITS

The uncertainties associated with the analytical data presented in the tables of this report represent the 95% confidence level for that data based only on counting statistics. Additional uncertainties associated with sampling and measurement procedures, have not been propagated into the data presented in this report.

Detection limits, referred to as minimum detectable activity (MDA), were based on 2.71 plus 4.66 times the standard deviation of the background count. When the activity was determined to be less than the MDA of the measurement procedure, the result was reported as less than MDA. Because of variations in background levels, measurement efficiencies, and contributions

from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.

CALIBRATION AND QUALITY ASSURANCE

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST, when such standards/sources were available. In cases where they were not available, standards of an industry recognized organization were used. Calibration of pressurized ionization chambers was performed by the manufacturer.

Analytical and field survey activities were conducted in accordance with procedures from the following ESSAP documents:

- Survey Procedures Manual, Revision 7
- Laboratory Procedures Manual, Revision 8
- Quality Assurance Manual, Revision 6

The procedures contained in these manuals were developed to meet the requirements of DOE Order 5700.6C and ASME NQA-1 for Quality Assurance and contain measures to assess processes during their performance.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.
- Participation in EPA and EML laboratory Quality Assurance Programs.
- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

APPENDIX C

GUIDELINES FOR RESIDUAL CONCENTRATIONS OF THORIUM AND URANIUM WASTES IN SOIL

Guidelines for Residual Concentrations of Thorium and Uranium Wastes in Soil

On October 23, 1981, the Nuclear Regulatory Commission published in the Federal register a notice of Branch Technical Position on "Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations." This document established guidelines for concentrations of uranium and thorium in soil, that will limit maximum radiation received by the public under various conditions of future land usage. These concentrations are as follows:

Material	Maximum Concentrations (pCi/g) for various options			
	1[a]	2[b]	3[c]	4[d]
Natural Thorium (Th-232 + Th-228) with daughters present and in equilibrium	10	50	--	500
Natural Uranium (U-238 + U-234) with daughters present and in equilibrium	10	--	40	200
Depleted Uranium:				
Soluble	35	100	--	1,000
Insoluble	35	300	--	3,000
Enriched Uranium:				
Soluble	30	100	--	1,000
Insoluble	30	250	--	2,500

[a]Based on EPA cleanup standards which limit radiation to 1 mrad/yr to lung and 3 mrad/yr to bone from ingestion and inhalation and 10 μR/h above background from direct external exposure.
[b]Based on limiting individual dose to 170 mrem/yr.
[c]Based on limiting equivalent exposure to 0.02 working level or less.
[d]Based on limiting individual dose to 500 mrem/yr and in case of natural uranium, limiting exposure to 0.02 working level or less.

copy
5/11

[7590-01]

NUCLEAR REGULATORY COMMISSION

DOCKET NO.: 70-00033

AGENCY: Nuclear Regulatory Commission

ACTION: Notice of Receipt of Amendment Request for Decommissioning the Texas Instruments, Inc., site in Attleboro, Massachusetts and Opportunity for a Hearing

SUMMARY:

This is a notice to inform the public that the U.S. Nuclear Regulatory Commission is considering issuance of an amendment to Special Nuclear Material License No. SNM-23, issued to Texas Instruments, Inc. for possession of special nuclear material and decommissioning of the licensee's site in Attleboro, Massachusetts. Successful implementation of the amendment would lead to completion of decommissioning, termination of the license, and release of the Attleboro site for unrestricted use.

DATES:

The NRC hereby provides notice of an opportunity for a hearing on the license amendment under the provisions of 10 CFR Part 2, Subpart L, "Informal Hearing Procedures for Adjudications in Materials and Operator Licensing Proceedings." Pursuant to §2.1205(a), any person whose interest may be affected by this proceeding may file a request for a hearing in accordance with §2.1205(c). A request for a hearing must be filed within thirty (30) days of the date of publication of this Federal Register notice.

ADDRESSES:

Written comments on the amendment request should be sent to USNRC, Region I, Attn: Mark Roberts, Senior Health Physicist, 475 Allendale Road,

9506190209 950511
PDR ADOCK 07000033
C PDR

King of Prussia, Pennsylvania 19406 and should refer to Control No. 121534. Hand deliver comments to 475 Allendale Road, King of Prussia, PA 19406 between 7:45 a.m. and 4:15 p.m. on Federal workdays.

In addition to meeting other applicable requirements of 10 CFR Part 2 of the NRC's regulations, a request for a hearing filed by a person other than an applicant must describe in detail:

(1) The interest of the requestor in the proceeding;

(2) How that interest may be affected by the results of the proceeding, including the reasons why the requestor should be permitted a hearing, with particular reference to the factors set out in §2.1205(g);

(3) The requestor's areas of concern about the licensing activity that is the subject matter of the proceeding; and

(4) The circumstances establishing that the request for a hearing is timely in accordance with §2.1205(c).

In accordance with 10 CFR 2.1205(e), each request for a hearing must also be served, by delivering it personally or by mail, to:

(1) The applicant, Texas Instruments, Inc., 34 Forest Street, Attleboro, Massachusetts 02703, Attention: Michael Elliott; and

(2) The NRC staff, by delivery to the Executive Director for Operations One White Flint North, 11555 Rockville Pike, Rockville, MD 20852 or by mail addressed to the Executive Director for Operations, U.S. Nuclear Regulatory Commission, Washington DC 20555.

FOR FURTHER INFORMATION CONTACT:

Mark Roberts, Division of Radiation Safety and Safeguards, Region I, 475 Allendale Road, King of Prussia, PA 19406, Telephone (610) 337-5094.

SUPPLEMENTARY INFORMATION:

The licensee (Texas Instruments, Inc.) requested an amendment, by letter dated December 19, 1994, to approve the Supplement to the 1992 Remediation Plan (the Supplement) submitted with the letter. Texas Instruments, Inc. has been remediating portions of the Attleboro facility since it terminated active operations with licensed material in 1981. The NRC staff has reviewed and approved various remediation activities throughout that time, most recently the 1992 Remediation Plan for the Building 12 Burial Area on August 26, 1992. The request before the NRC at this time is to approve the Supplement which, if properly implemented and completed, will lead to release of the Attleboro site for unrestricted use and termination of the license.

The staff of the NRC's Region I Division of Radiation Safety and Safeguards has reviewed the adequacy of the amendment request and has asked the licensee to provide additional information and commitments. However, the staff expects the commitments to be forthcoming and that satisfactory information will be supplied. Therefore, the NRC staff anticipates approval of the Supplement based on receipt and review of the additional information.

NRC is inviting public comment on the amendment request prior to acting on the request. NRC considers public involvement more meaningful at this stage prior to authorizing final decommissioning activities at the site than if it were offered immediately prior to license termination and after completion of decommissioning.

For further details with respect to this action, the application for amendment request is available for inspection at the Commission's Public Document Room, 2120 L Street NW., Washington, DC 20555 or at NRC's Region I offices located at 475 Allendale Road King of Prussia, PA 19406. Persons

desiring to review documents at the Region I Office, should call Ms. Sheryl Villar at (610) 337-5239 several days in advance to assure that the documents will be readily available for review.

Dated at Rockville, Maryland this 11th day of May, 1995

FOR THE NUCLEAR REGULATORY COMMISSION

Michael F. Weber

Michael F. Weber, Chief
Low-Level Waste and Decommissioning Projects Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON D.C. 20555-0001

MAY 2 5 1995

Parameter, Inc.
ATTN: Richard A. Lofy
13380 Watertown Plank Road
Elm Grove, Wisconsin 53122

Dear Mr. Lofy:

Subject: Task Order No. 70, "Follow up to Service Water System Operational Performance Inspection (SWSOPI) H.B. Robinson" under Contract No. NRC-03-93-026

In accordance with Section G.4, Task Order Procedures, of the subject contract, this letter definitizes Task Order No. 70. The effort shall be performed in accordance with the enclosed Statement of Work and Parameter Inc.'s technical proposal dated May 17, 11, 1995 incorporated herein by reference.

Task Order 70 shall be in effect from May 22, 1995 through August 4, 1995 with a cost ceiling of $15,641.70. The amount of $15,232.22 represents the estimated reimbursable costs, the amount of $64.72 represents the facilities capital cost of money, and the amount of $409.48 represents the fixed fee. The amount presently obligated for this task order is $15,641.70.

Accounting data for Task Order No. 70 are as follows:

B&R No.:	520-15-11-10-0
FIN No.:	J2062-5
BOC:	252A
RFPA No.:	NRC0393026-70
APPN No.:	31X0200.520
Obligated Amount:	$15,641.70

The following individual is considered to be essential to the successful performance for work hereunder: Mr. Michael Shlyamberg. The contractor agrees that such personnel shall not be removed from the effort under the task order without compliance with Contract Clause H.1, Key Personnel.

The issuance of this task order does not amend any terms or conditions of the subject contract.

9506190271 950525

MAR 20 1996

Docket No. 070-00033 License No. SNM-23

Michael Elliott, Environmental Manager
Texas Instruments, Inc.
34 Forest Avenue
Attleboro, Massachusetts 02703

SUBJECT: ROUTINE INSPECTION NO. 070-00033/95-002

Dear Mr.Elliott:

On August 10-11, 1995, Mark Roberts of this office conducted a routine decommissioning inspection at the facilities at 34 Forest Avenue, Attleboro, Massachusetts, of activities authorized by the above listed NRC license. The inspection was an examination of your licensed activities as they relate to radiation safety and to compliance with the Commission's regulations and the license conditions. The inspection consisted of observations by the inspector, interviews with personnel, and a selective examination of representative records. The findings of the inspection were discussed with you at the conclusion of the inspection. A copy of the NRC inspection report is enclosed. This also refers to the telephone conversation on October 16, 1995 between you, Mark Griffon, Fred McWilliams and Mr. Roberts.

Within the scope of this inspection, no violations were identified.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the Public Document Room. No reply to this letter is required.

Your cooperation with us is appreciated.

Sincerely,

Original Signed By:

Ronald R. Bellamy, PhD., Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

Docket No.: 070-00033
License No.: SNM-23

Enclosure:
NRC Region I Inspection Report Number 070-00033/95-002

RETURN ORIGINAL TO REGION I

cc w/enclosure:
Commonwealth of Massachusetts

OFFICIAL RECORD COPY

250037

IE07

9603250224 960320

Distribution:
PUBLIC w/encl
Nuclear Safety Information Center (NSIC) w/encl
Region I Docket Room (w/concurrences) w/encl

DOCUMENT NAME: R:\WPS\07000033.LTR
To receive a copy of this document, indicate in the box "C" = Copy w/o attach/encl "E" = Copy w/ attach/encl "N" = No copy

OFFICE	DNMS/RI	N	DNMS/RI	N				
NAME	MRoberts							
DATE	03/15/96		03/ /96		03/ /96		03/ /96	

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No. 070-00033/95-002

Docket No. 070-00033

License No. SNM-23

Licensee: Texas Instruments, Inc.
34 Forest Avenue
Attleboro, Massachusetts 02703

Facility Name: Texas Instruments, Inc.

Inspection At: Texas Instruments, Inc.
Attleboro, Massachusetts

Inspection Conducted: August 10 and 11, 1995

Inspector: Mark C. Roberts 3-11-96
Mark C. Roberts date
Senior Health Physicist

Approved by: Ronald R. Bellamy March 15, 1996
Ronald R. Bellamy, PhD., Chief date
Decommissioning and Laboratory Section

Areas Inspected: Remediation of exterior areas; remediation of interior areas.

Results: No violations were identified. The licensee agreed to provide additional information to the NRC concerning the gross alpha counting methodology and surface contamination calculations. The information would be provided as additional information for the Supplement to the 1992 Remediation Plan.

RETURN ORIGINAL TO REGION I

OFFICIAL RECORD COPY

9603250231 960320

DETAILS

1.0 Persons Contacted

*Michael Elliott, Environmental Manager, Texas Instruments, Inc.
Jeff Slater, Assistant Project Manager, Roy F. Weston, Inc. (Weston)
Bill Feltovic, Construction Engineer, Weston
Mark Griffon, Health Physics Consultant, CPS Environmental (via telephone on October 16, 1995)
Fred McWilliams, Health Physics Consultant, CPS Environmental (via telephone on October 16, 1995)

*Denotes those present at exit interview.

2.0 Background

The Texas Instruments, Inc. (TI) facility is located in Attleboro, Massachusetts, 48 kilometers (30 miles) south of Boston. The site is approximately 40 hectares (100 acres) with twelve major buildings. Operations with radioactive materials commenced at the site in 1952 when the General Plate Division of Metals and Controls, Inc. began to fabricate enriched uranium foils. That company merged with TI in 1959. Texas Instruments fabricated enriched uranium fuel elements for the U.S. Navy and commercial customers from 1959 through 1983. Depleted uranium was also used at the facility in research and development. The company no longer uses licensed radioactive material in its manufacturing operations.

Since 1985, TI has performed remediation on a number of areas of the site to remove residual radioactive contamination in buildings and surrounding exterior locations on the site. Remediation and final surveys of contaminated portions of Buildings 4 and 10 were completed in 1985 and are documented in various reports. The licensee has also completed a remediation project involving the removal of scrap material and equipment contaminated with uranium that was buried in a disposal area between Building 11 and what is now Building 12. This area was the subject of remediation and final surveys which were completed in October 1993. A confirmatory survey in this area, conducted by the Oak Ridge Institute for Science and Education (ORISE) in December 1993, did not identify any remaining residual contamination in excess of the current criteria for release for unrestricted use in this area.

Other exterior locations on the site were also contaminated with uranium as a result of the licensed operations. The licensee completed a radiological survey of the site, including both interior and exterior areas, which identified areas that are contaminated in excess of the NRC criteria for release for unrestricted use. The licensee has brought in additional health physics and remediation contractor support in order to complete the project on a more timely basis.

3.0 Remediation of Exterior Areas

Characterization measurements identified an extensive area of soil contamination in the stockade area, south of Building 10. The licensee estimates that the volume of contaminated soil in this area may exceed

50,000 ft^3. Smaller contaminated areas on the lawn south, east and north of Building 12 and an area south of Building 17 have also been identified as areas where residual uranium soil contamination exceeds the criteria for release for unrestricted use. The lawn area south of Building 12 was being remediated during this inspection.

Excavations are performed in each 10 x 10 meter grid square where surface and sub-surface soil sampling identified uranium contamination in excess of the criteria for release for unrestricted use. Soil from each area is removed in approximately one-foot layers until an area of contamination is reached. A laser-light guidance apparatus is used for vertical positioning of the excavation equipment. All excavated soil is removed to the material processing area, a fenced area in a parking lot near Building 12. In this area, contaminated soil and clean soil are segregated for disposal and re-use, respectively. Soil with a total uranium concentration that is below the criteria for release for unrestricted use is used to back-fill areas where remediation has been completed and sampling has indicated that the areas meet the release criteria. Contaminated soil is passed through a mechanical screening device to remove large rocks. The rocks are washed and then surveyed for residual contamination. Rocks that are free of radioactive contamination are used for back-fill in remediated areas. Wash water is collected, filtered and sampled before being released. All water samples have not exceeded ten percent of the applicable 10 CFR 20, Appendix B effluent concentration.

Contaminated soil is stored in a plastic-lined area in the materials processing area and is covered at night to prevent erosion. The soil will be loaded into large, covered boxes that hold approximately 27 cubic yards of soil. These large boxes are designed to stack on flatbed rail cars for shipment to the disposal facility in Utah. Air samples taken in the area during soil movement activities have not identified any significant airborne activity. All results have been less than ten percent of the applicable effluent concentration value in 10 CFR 20, Appendix B.

Following excavation of contaminated soil, each 10 x 10 meter grid square is surveyed with a pancake GM survey meter. Preliminary soil samples are collected and analyzed by the gross alpha counting method discussed below. Approximately thirteen samples are collected from each grid square. Additional samples may be collected if indicated based on survey meter results for the area. Additional excavations are performed as needed based upon sample results. Once the preliminary soil sampling indicates that the grid square meets the release criteria, five final samples are collected and analyzed by the gross alpha counting method. If all samples provide acceptable results, a composite of the five samples is sent to an off-site vendor for alpha spectrometry analysis. Back-filling of the area is performed once the alpha spectrometry results confirm that the release criteria has been met.

The health physics contractor who had performed much of the earlier soil sample analysis on the site (CPS Environmental) used a unique gross alpha sample analysis technique to determine if the total uranium concentration of samples met the criteria for release for unrestricted

use (30 pCi/gram). This technique is discussed in Inspection Report 070-00033/94-001 (May 10 and 25, 1994). The technique involves counting an aliquot of a soil sample that has been dried and screened to provide a consistent counting geometry. The prepared sample was placed in contact with a zinc sulfide (ZnS) wafer in a disposable petri dish. Scintillation events caused by alpha particles interacting with the ZnS wafer were detected and processed with a photomultiplier tube and suitable electronic apparatus. After a ten-minute count, the net sample count rate was then correlated to a total uranium concentration that had been developed from counting data from a series of samples that had been analyzed by alpha spectrometry and by this technique. Samples split with the NRC and analyzed by ORISE validated the technique.

For recent surveys, the analytical technique was adjusted by the Weston contractor staff by substituting a ZnS alpha scintillation detector for the ZnS wafer and the photomultiplier tube. A larger sample aliquot is also used in the newer method. The contractor representative stated that the results from this adjusted method have also been correlated with alpha spectrometry results from soil samples with a range of different total uranium concentrations. The adjusted counting method was performed in accordance with recorded instructions; however, the inspector requested that the methodology be formally documented and correlation data provided to the NRC as additional information to append to the Supplement to the 1992 Remediation Plan.

No safety concerns were identified.

4.0 Remediation of Interior Areas

Interior characterization measurements identified residual contamination in excess of NRC guidelines in Buildings 4, 5, and 10. The characterization measurements indicate that contamination is primarily found in cracks and joints in the concrete floor. In some areas, contaminated drain lines that are no longer in use have also been identified. Because the buildings are currently utilized for activities that do not involve the use of licensed material, remediation of the contaminated areas is performed on relatively small areas of the floor after equipment has been moved. Typical areas are approximately 100 m^2. Following completion of remediation and the successful demonstration that the area meets the guidelines for release for unrestricted use, the area is restored and equipment is returned. This process is repeated for each successive contaminated area.

Surface contamination surveys are performed with large-area gas-flow proportional detectors coupled to scaler/rate-meter survey instruments. Data from the surveys are recorded on raw data sheets and then input into a computer file. Data reports will then be generated for inclusion into a final survey report for submission to the NRC following completion of the remediation activities. The inspector requested that the contamination survey methodology, including the surface activity calculations, be submitted to the NRC as additional information to be appended to the Supplement to the 1992 Remediation Plan. Soil beneath

the concrete floor and samples of crushed concrete are analyzed by the gross alpha methodology discussed above.

No safety concerns were identified.

5.0 Exit Interview

The results of the inspection were discussed with the licensee representative identified in Section 1

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No. 070-00033/95-002

Docket No. 070-00033

License No. SNM-23

Licensee: Texas Instruments, Inc.
34 Forest Avenue
Attleboro, Massachusetts 02703

Facility Name: Texas Instruments, Inc.

Inspection At: Texas Instruments, Inc.
Attleboro, Massachusetts

Inspection Conducted: August 10 and 11, 1995

Inspector: Mark C. Roberts 3-11-96
Mark C. Roberts, Senior Health Physicist — date

Approved by: Ronald R. Bellamy March 15, 1996
Ronald R. Bellamy, PhD., Chief, Decommissioning and Laboratory Section — date

Areas Inspected: Remediation of exterior areas; remediation of interior areas.

Results: No violations were identified. The licensee agreed to provide additional information to the NRC concerning the gross alpha counting methodology and surface contamination calculations. The information would be provided as additional information for the Supplement to the 1992 Remediation Plan.

RETURN ORIGINAL TO REGION I

OFFICIAL RECORD COPY

9603250231 960320

DETAILS

1.0 Persons Contacted

*Michael Elliott, Environmental Manager, Texas Instruments, Inc.
Jeff Slater, Assistant Project Manager, Roy F. Weston, Inc. (Weston)
Bill Feltovic, Construction Engineer, Weston
Mark Griffon, Health Physics Consultant, CPS Environmental (via telephone on October 16, 1995)
Fred McWilliams, Health Physics Consultant, CPS Environmental (via telephone on October 16, 1995)

*Denotes those present at exit interview.

2.0 Background

The Texas Instruments, Inc. (TI) facility is located in Attleboro, Massachusetts, 48 kilometers (30 miles) south of Boston. The site is approximately 40 hectares (100 acres) with twelve major buildings. Operations with radioactive materials commenced at the site in 1952 when the General Plate Division of Metals and Controls, Inc. began to fabricate enriched uranium foils. That company merged with TI in 1959. Texas Instruments fabricated enriched uranium fuel elements for the U.S. Navy and commercial customers from 1959 through 1983. Depleted uranium was also used at the facility in research and development. The company no longer uses licensed radioactive material in its manufacturing operations.

Since 1985, TI has performed remediation on a number of areas of the site to remove residual radioactive contamination in buildings and surrounding exterior locations on the site. Remediation and final surveys of contaminated portions of Buildings 4 and 10 were completed in 1985 and are documented in various reports. The licensee has also completed a remediation project involving the removal of scrap material and equipment contaminated with uranium that was buried in a disposal area between Building 11 and what is now Building 12. This area was the subject of remediation and final surveys which were completed in October 1993. A confirmatory survey in this area, conducted by the Oak Ridge Institute for Science and Education (ORISE) in December 1993, did not identify any remaining residual contamination in excess of the current criteria for release for unrestricted use in this area.

Other exterior locations on the site were also contaminated with uranium as a result of the licensed operations. The licensee completed a radiological survey of the site, including both interior and exterior areas, which identified areas that are contaminated in excess of the NRC criteria for release for unrestricted use. The licensee has brought in additional health physics and remediation contractor support in order to complete the project on a more timely basis.

3.0 Remediation of Exterior Areas

Characterization measurements identified an extensive area of soil contamination in the stockade area, south of Building 10. The licensee estimates that the volume of contaminated soil in this area may exceed

50,000 ft². Smaller contaminated areas on the lawn south, east and north of Building 12 and an area south of Building 17 have also been identified as areas where residual uranium soil contamination exceeds the criteria for release for unrestricted use. The lawn area south of Building 12 was being remediated during this inspection.

Excavations are performed in each 10 x 10 meter grid square where surface and sub-surface soil sampling identified uranium contamination in excess of the criteria for release for unrestricted use. Soil from each area is removed in approximately one-foot layers until an area of contamination is reached. A laser-light guidance apparatus is used for vertical positioning of the excavation equipment. All excavated soil is removed to the material processing area, a fenced area in a parking lot near Building 12. In this area, contaminated soil and clean soil are segregated for disposal and re-use, respectively. Soil with a total uranium concentration that is below the criteria for release for unrestricted use is used to back-fill areas where remediation has been completed and sampling has indicated that the areas meet the release criteria. Contaminated soil is passed through a mechanical screening device to remove large rocks. The rocks are washed and then surveyed for residual contamination. Rocks that are free of radioactive contamination are used for back-fill in remediated areas. Wash water is collected, filtered and sampled before being released. All water samples have not exceeded ten percent of the applicable 10 CFR 20, Appendix B effluent concentration.

Contaminated soil is stored in a plastic-lined area in the materials processing area and is covered at night to prevent erosion. The soil will be loaded into large, covered boxes that hold approximately 27 cubic yards of soil. These large boxes are designed to stack on flatbed rail cars for shipment to the disposal facility in Utah. Air samples taken in the area during soil movement activities have not identified any significant airborne activity. All results have been less than ten percent of the applicable effluent concentration value in 10 CFR 20, Appendix B.

Following excavation of contaminated soil, each 10 x 10 meter grid square is surveyed with a pancake GM survey meter. Preliminary soil samples are collected and analyzed by the gross alpha counting method discussed below. Approximately thirteen samples are collected from each grid square. Additional samples may be collected if indicated based on survey meter results for the area. Additional excavations are performed as needed based upon sample results. Once the preliminary soil sampling indicates that the grid square meets the release criteria, five final samples are collected and analyzed by the gross alpha counting method. If all samples provide acceptable results, a composite of the five samples is sent to an off-site vendor for alpha spectrometry analysis. Back-filling of the area is performed once the alpha spectrometry results confirm that the release criteria has been met.

The health physics contractor who had performed much of the earlier soil sample analysis on the site (CPS Environmental) used a unique gross alpha sample analysis technique to determine if the total uranium concentration of samples met the criteria for release for unrestricted

use (30 pCi/gram). This technique is discussed in Inspection Report 070-00033/94-001 (May 10 and 25, 1994). The technique involves counting an aliquot of a soil sample that has been dried and screened to provide a consistent counting geometry. The prepared sample was placed in contact with a zinc sulfide (ZnS) wafer in a disposable petri dish. Scintillation events caused by alpha particles interacting with the ZnS wafer were detected and processed with a photomultiplier tube and suitable electronic apparatus. After a ten-minute count, the net sample count rate was then correlated to a total uranium concentration that had been developed from counting data from a series of samples that had been analyzed by alpha spectrometry and by this technique. Samples split with the NRC and analyzed by ORISE validated the technique.

For recent surveys, the analytical technique was adjusted by the Weston contractor staff by substituting a ZnS alpha scintillation detector for the ZnS wafer and the photomultiplier tube. A larger sample aliquot is also used in the newer method. The contractor representative stated that the results from this adjusted method have also been correlated with alpha spectrometry results from soil samples with a range of different total uranium concentrations. The adjusted counting method was performed in accordance with recorded instructions; however, the inspector requested that the methodology be formally documented and correlation data provided to the NRC as additional information to append to the Supplement to the 1992 Remediation Plan.

No safety concerns were identified.

4.0 Remediation of Interior Areas

Interior characterization measurements identified residual contamination in excess of NRC guidelines in Buildings 4, 5, and 10. The characterization measurements indicate that contamination is primarily found in cracks and joints in the concrete floor. In some areas, contaminated drain lines that are no longer in use have also been identified. Because the buildings are currently utilized for activities that do not involve the use of licensed material, remediation of the contaminated areas is performed on relatively small areas of the floor after equipment has been moved. Typical areas are approximately 100 m². Following completion of remediation and the successful demonstration that the area meets the guidelines for release for unrestricted use, the area is restored and equipment is returned. This process is repeated for each successive contaminated area.

Surface contamination surveys are performed with large-area gas-flow proportional detectors coupled to scaler/rate-meter survey instruments. Data from the surveys are recorded on raw data sheets and then input into a computer file. Data reports will then be generated for inclusion into a final survey report for submission to the NRC following completion of the remediation activities. The inspector requested that the contamination survey methodology, including the surface activity calculations, be submitted to the NRC as additional information to be appended to the Supplement to the 1992 Remediation Plan. Soil beneath

the concrete floor and samples of crushed concrete are analyzed by the gross alpha methodology discussed above.

No safety concerns were identified.

5.0 Exit Interview

The results of the inspection were discussed with the licensee representative identified in Section 1

MAY 21 1996

Werner Schuele
Senior Vice President and Sit Manager
Texas Instruments Incorporated
34 Forest Street
Attleboro, Massachusetts 02703-0964

SUBJECT: SPECIAL INSPECTION NO. 070-00033/96-001

Dear Mr. Schuele:

On April 17 and 18, 1996, Mark C. Roberts of this office conducted a special safety inspection at 34 Forest Street, Attleboro, Massachusetts of activities authorized by the NRC license listed below. The inspection was limited to a review of the activities involved in the preparation and transportation of uranium contaminated soil and debris from your remediation activities at the site. The inspection consisted of observations by the inspector, interviews with personnel, and a selective examination of representative records. In addition, our inspection examined the activities covered in your correspondence dated March 19, 1996 to the State of Utah. The findings of the inspection were discussed with Michael Elliott of your staff and Texas Instruments' contractor representatives from Roy F. Weston, Inc. and Judge Technical Services at the conclusion of the inspection. A copy of the NRC inspection report is enclosed.

Within the scope of this inspection, no violations were identified. The activities involved in the preparation and transportation of uranium contaminated soil and debris are being conducted in accordance with your revised corrective action plan described in your March 16, 1996 letter to the State of Utah.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter and the enclosed report will be placed in the Public Document Room. No reply to this letter is required.

Your cooperation with us is appreciated.

Sincerely,

Ronald R. Bellamy, Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

Docket No.: 070-00033
License No.: SNM-23

070056

OFFICIAL RECORD COPY

RETURN ORIGINAL TO REGION I

IE 07

9606070173 960521
PDR ADOCK 07000033

Enclosure:
NRC Region I Inspection Report Number 070-00033/96-001

cc w/enclosure:
Michael Elliott, Environmental Manager

Commonwealth of Massachusetts

William J. Sinclair, Director
State of Utah
Division of Radiation Control
Department of Environmental Quality
P.O. Box 144850
Salt Lake City, Utah 84114-4850

Greg Copeland, Director of Operations
Envirocare of Utah
46 W. Broadway
Suite 240
Salt Lake City, Utah 84101

Distribution:
PUBLIC w/encl
Nuclear Safety Information Center (NSIC) w/encl
Region I Docket Room (w/concurrences) w/encl

DOCUMENT NAME:
To receive a copy of this document, indicate in the box: "C" = Copy w/o attach/encl "E" = Copy w/ attach/encl "N" = No copy

OFFICE	DNMS/RI	N	DNMS/RI					
NAME	MRoberts mr		RBellamy					
DATE	05/10/96		05/10/96					

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No. 070-00033/96-001

Docket No. 070-00033

License No. SNM-23

Licensee: Texas Instruments, Inc.
34 Forest Avenue
Attleboro, Massachusetts 02703

Facility Name: Texas Instruments, Inc.

Inspection At: Texas Instruments, Inc.
Attleboro, Massachusetts

Inspection Conducted: April 17 and 18, 1996

Inspector: Mark Roberts 5-10-96
Mark C. Roberts — date
Senior Health Physicist

Approved by: Ronald R. Bellamy May 10, 1996
Ronald R. Bellamy, PhD., Chief — date
Decommissioning and Laboratory Section

Inspection Summary: Announced, special inspection of waste preparation activities for transportation (Inspection No. 070-00033/96-001).

Areas Inspected: Inspection and preparation of rail car containers; Materials handling; Container sealing; Oversight of corrective action plan

Results: No violations were identified. The licensee was preparing shipments of uranium-contaminated soil and debris in accordance with the revised "Corrective Action Plan (March 1996) for Free-Standing Liquid in Intermodal Containers". The licensee was notified on April 16, 1996 that a shipment of waste containers made on April 4, 1996 that had been prepared in accordance with the Corrective Action Plan, arrived in satisfactory condition at the Envirocare of Utah facility on April 12, 1996.

9606070175 960521
PDR ADOCK 07000033
C PDR

RETURN ORIGINAL TO
REGION I

IE 07

DETAILS

1.0 Persons Contacted

*Michael Elliott, Environmental Manager, Texas Instruments, Inc.
*Joseph Barber, Environmental Engineer, Judge Technical Services
*Bill Feltovic, Project Manager, Roy F. Weston, Inc. (Weston)
Miles Gelatt, Project Engineer, Weston
Ned Morley, Health Physicist, Weston
Christopher Collins, Technician, Miller Engineering & Testing, Inc.

*Denotes those present at exit interview.

2.0 Background

The Texas Instruments, Inc. (TI) facility is located in Attleboro, Massachusetts, 48 kilometers (30 miles) south of Boston. Operations with radioactive materials commenced at the site in 1952 when the General Plate Division of Metals and Controls, Inc. began to fabricate enriched uranium foils. That company merged with TI in 1959. Texas Instruments fabricated enriched uranium fuel elements for the U.S. Navy and commercial customers from 1959 through 1983. Depleted uranium was also used at the facility in research and development. The company no longer uses licensed radioactive material in its manufacturing operations at the Attleboro, Massachusetts facility.

Since 1985, TI has performed remediation on a number of areas of the site to remove residual radioactive contamination in buildings and surrounding exterior locations. Since 1994, TI has been involved in a major soils remediation project to remove large quantities of uranium-contaminated soil from a number of areas on-site. The licensee has shipped the contaminated soil and remediation debris to the Envirocare of Utah, Inc. (Envirocare) facility, a licensed low level radioactive waste disposal facility, via a series of rail car shipments.

On February 27, 1996, Envirocare notified the State of Utah, Department of Environmental Quality, Division of Radiation Control, that they had suspended Texas Instruments' access to their low level radioactive waste disposal facility. On three occasions, the most recent being February 22, 1996, Envirocare had received shipments of radioactive waste, for disposal, from TI, which contained free standing liquid (water). The Envirocare license from the State of Utah prohibits the company from receiving liquids as a normal course of business. Although Envirocare recognizes that inadvertent shipments of liquid as a component of dry wastes might occur, the company is committed to suspend shipments if corrective actions taken by a waste generator have been ineffective, and a third liquid in waste incident has occurred.

TI conducted an investigation to determine the cause of the free standing liquid in the rail car containers. Their investigation concluded that two likely causes were water infiltration during transit or the pooling of excess water, already in the soil, during transit. On March 19, 1996, TI transmitted a revised Corrective Action Plan to the State of Utah and to Envirocare that delineated a series of inspection techniques and mitigation methods to ensure that no further free standing liquids would be present in the rail car shipments of low level

contaminated soil and debris. On March 25, 1996, TI received a completed "Notice to Transport" form from Envirocare that re-authorized shipments of low level radioactive waste to be received by Envirocare from the TI facility.

3.0 Inspection and Preparation of Rail Car Containers

The licensee uses rail car containers (intermodal containers or IMCs) that have been specifically designed for bulk shipment of solids. Six of the 28 - 30 yd^3 containers fit on a special flat-bed rail car. The containers and the flat-bed rail car have a special interlocking connector feature to secure the container to the rail car. The containers are moved around the site on special flat-bed trucks.

Prior to loading contaminated soil or debris into an IMC, the container is inspected to ensure that the doors and top covers are properly fitting. Containers that do not appear to have properly fitting closures or covers are repaired or rejected as appropriate. During this NRC inspection, one container was rejected because the top cover was not closing properly. The project manager stated that the rejection rate was only about two to three per hundred, and the rejected containers only required minor repair. Free standing water that may have infiltrated into the container during the return shipment to the TI site is removed using a wet/dry vacuum. The quantity of water in a container has ranged from virtually none to over a hundred gallons. The physical condition of the container and the amount of water removed from the container are recorded on a quality assurance (QA) check list.

After inspecting the containers and removing any water, workers place five bags of an absorbent material into the bottom of the containers. The absorbent material used is one of two materials (use is based on availability) that passed tests by the licensee's contractor. The inspector reviewed a copy of a memorandum dated January 16, 1996 that included test data for five different absorbents. The contractor, Weston rejected three of the materials because they did not adequately absorb water during the test. Following placement of the absorbent, the container is lined with a double plastic liner. The placement of the absorbent and the liner are also recorded on the QA check list.

No safety concerns were identified.

4.0 Materials Handling

Excavated soils are placed in a designated portion of the site identified as the materials processing area. Contaminated soil, clean soil, and soil waiting for confirmatory sample analysis are stored in different sections of this area. All contaminated soil and soil waiting for sample analysis are covered with plastic tarpaulins to prevent rainwater from entering the soil piles. Contaminated soil that will be loaded into the IMCs is initially tested for soil moisture content by a sub-contractor using a nuclear soil moisture/density gauge. Sand is added to the soil that has a high moisture content to reduce the percentage of water. The contaminated soil/sand mixture is then loaded directly into a lined container. The truck and its container are

weighed before and after loading to obtain the net quantity of contaminated soil. After the container is loaded the soil moisture content is measured by the subcontractor using the nuclear soil moisture/density gauge. Following completion of the soil moisture measurements, bags of absorbent material are spread over the soil in the container. The container is then closed and moved to the railroad spur and loaded onto the rail car. Soil moisture measurements, weights of material and quantity of absorbent used are all recorded on the QA form.

No safety concerns were identified with the material handling and loading activities.

Because the operation of nuclear soil moisture/density gauges requires a license by the NRC or an Agreement State, the inspector specifically examined the activities conducted by the gauge operator. No safety concerns were identified with the nuclear gauge operations.

5.0 Container Sealing

Once the container is loaded onto the rail car, workers ensure that all doors are properly closed and the top cover is in place. A polyurethane sealant is then applied to the edges of the top cover. Strips of wide duct tape are then placed over each sealed area as an additional barrier against water infiltration during transit. A security seal is then affixed to the cap to be used as indicator that the container has not been opened. The sealing and security seal steps are recorded on the QA form.

No safety concerns were identified.

6.0 Oversight of Corrective Action Plan

The elements of the TI corrective action plan for addressing the problem of free-standing liquid in the shipping containers are examined by a separate TI contractor. The inspector observed this individual to be actively examining the various operations of the container inspection, loading and sealing processes. This individual also signs the completed QA form.

No safety concerns were identified.

7.0 Exit Interview

The results of the inspection were discussed with the individuals identified in Section 1.

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No.	070-00033/96-001
Docket No.	070-00033
License No.	SNM-23
Licensee:	Texas Instruments, Inc. 34 Forest Avenue Attleboro, Massachusetts 02703
Facility Name:	Texas Instruments, Inc.
Inspection At:	Texas Instruments, Inc. Attleboro, Massachusetts
Inspection Conducted:	April 17 and 18, 1996

Inspector: Mark Roberts (signature) 5-10-96
Mark C. Roberts, Senior Health Physicist — date

Approved by: Ronald R. Bellamy (signature) May 10, 1996
Ronald R. Bellamy, PhD., Chief, Decommissioning and Laboratory Section — date

Inspection Summary: Announced, special inspection of waste preparation activities for transportation (Inspection No. 070-00033/96-001).

Areas Inspected: Inspection and preparation of rail car containers; Materials handling; Container sealing; Oversight of corrective action plan

Results: No violations were identified. The licensee was preparing shipments of uranium-contaminated soil and debris in accordance with the revised "Corrective Action Plan (March 1996) for Free-Standing Liquid in Intermodal Containers". The licensee was notified on April 16, 1996 that a shipment of waste containers made on April 4, 1996 that had been prepared in accordance with the Corrective Action Plan, arrived in satisfactory condition at the Envirocare of Utah facility on April 12, 1996.

9606070175 960521
PDR ADOCK 07000033
C PDR

RETURN ORIGINAL TO
REGION I

OFFICIAL RECORD COPY

IE 07

DETAILS

1.0 Persons Contacted

*Michael Elliott, Environmental Manager, Texas Instruments, Inc.
*Joseph Barber, Environmental Engineer, Judge Technical Services
*Bill Feltovic, Project Manager, Roy F. Weston, Inc. (Weston)
Miles Gelatt, Project Engineer, Weston
Ned Morley, Health Physicist, Weston
Christopher Collins, Technician, Miller Engineering & Testing, Inc.

*Denotes those present at exit interview.

2.0 Background

The Texas Instruments, Inc. (TI) facility is located in Attleboro, Massachusetts, 48 kilometers (30 miles) south of Boston. Operations with radioactive materials commenced at the site in 1952 when the General Plate Division of Metals and Controls, Inc. began to fabricate enriched uranium foils. That company merged with TI in 1959. Texas Instruments fabricated enriched uranium fuel elements for the U.S. Navy and commercial customers from 1959 through 1983. Depleted uranium was also used at the facility in research and development. The company no longer uses licensed radioactive material in its manufacturing operations at the Attleboro, Massachusetts facility.

Since 1985, TI has performed remediation on a number of areas of the site to remove residual radioactive contamination in buildings and surrounding exterior locations. Since 1994, TI has been involved in a major soils remediation project to remove large quantities of uranium-contaminated soil from a number of areas on-site. The licensee has shipped the contaminated soil and remediation debris to the Envirocare of Utah, Inc. (Envirocare) facility, a licensed low level radioactive waste disposal facility, via a series of rail car shipments.

On February 27, 1996, Envirocare notified the State of Utah, Department of Environmental Quality, Division of Radiation Control, that they had suspended Texas Instruments' access to their low level radioactive waste disposal facility. On three occasions, the most recent being February 22, 1996, Envirocare had received shipments of radioactive waste, for disposal, from TI, which contained free standing liquid (water). The Envirocare license from the State of Utah prohibits the company from receiving liquids as a normal course of business. Although Envirocare recognizes that inadvertent shipments of liquid as a component of dry wastes might occur, the company is committed to suspend shipments if corrective actions taken by a waste generator have been ineffective, and a third liquid in waste incident has occurred.

TI conducted an investigation to determine the cause of the free standing liquid in the rail car containers. Their investigation concluded that two likely causes were water infiltration during transit or the pooling of excess water, already in the soil, during transit. On March 19, 1996, TI transmitted a revised Corrective Action Plan to the State of Utah and to Envirocare that delineated a series of inspection techniques and mitigation methods to ensure that no further free standing liquids would be present in the rail car shipments of low level

contaminated soil and debris. On March 25, 1996, TI received a completed "Notice to Transport" form from Envirocare that re-authorized shipments of low level radioactive waste to be received by Envirocare from the TI facility.

3.0 Inspection and Preparation of Rail Car Containers

The licensee uses rail car containers (intermodal containers or IMCs) that have been specifically designed for bulk shipment of solids. Six of the 28 - 30 yd^3 containers fit on a special flat-bed rail car. The containers and the flat-bed rail car have a special interlocking connector feature to secure the container to the rail car. The containers are moved around the site on special flat-bed trucks.

Prior to loading contaminated soil or debris into an IMC, the container is inspected to ensure that the doors and top covers are properly fitting. Containers that do not appear to have properly fitting closures or covers are repaired or rejected as appropriate. During this NRC inspection, one container was rejected because the top cover was not closing properly. The project manager stated that the rejection rate was only about two to three per hundred, and the rejected containers only required minor repair. Free standing water that may have infiltrated into the container during the return shipment to the TI site is removed using a wet/dry vacuum. The quantity of water in a container has ranged from virtually none to over a hundred gallons. The physical condition of the container and the amount of water removed from the container are recorded on a quality assurance (QA) check list.

After inspecting the containers and removing any water, workers place five bags of an absorbent material into the bottom of the containers. The absorbent material used is one of two materials (use is based on availability) that passed tests by the licensee's contractor. The inspector reviewed a copy of a memorandum dated January 16, 1996 that included test data for five different absorbents. The contractor, Weston rejected three of the materials because they did not adequately absorb water during the test. Following placement of the absorbent, the container is lined with a double plastic liner. The placement of the absorbent and the liner are also recorded on the QA check list.

No safety concerns were identified.

4.0 Materials Handling

Excavated soils are placed in a designated portion of the site identified as the materials processing area. Contaminated soil, clean soil, and soil waiting for confirmatory sample analysis are stored in different sections of this area. All contaminated soil and soil waiting for sample analysis are covered with plastic tarpaulins to prevent rainwater from entering the soil piles. Contaminated soil that will be loaded into the IMCs is initially tested for soil moisture content by a sub-contractor using a nuclear soil moisture/density gauge. Sand is added to the soil that has a high moisture content to reduce the percentage of water. The contaminated soil/sand mixture is then loaded directly into a lined container. The truck and its container are

weighed before and after loading to obtain the net quantity of contaminated soil. After the container is loaded the soil moisture content is measured by the subcontractor using the nuclear soil moisture/density gauge. Following completion of the soil moisture measurements, bags of absorbent material are spread over the soil in the container. The container is then closed and moved to the railroad spur and loaded onto the rail car. Soil moisture measurements, weights of material and quantity of absorbent used are all recorded on the QA form.

No safety concerns were identified with the material handling and loading activities.

Because the operation of nuclear soil moisture/density gauges requires a license by the NRC or an Agreement State, the inspector specifically examined the activities conducted by the gauge operator. No safety concerns were identified with the nuclear gauge operations.

5.0 Container Sealing

Once the container is loaded onto the rail car, workers ensure that all doors are properly closed and the top cover is in place. A polyurethane sealant is then applied to the edges of the top cover. Strips of wide duct tape are then placed over each sealed area as an additional barrier against water infiltration during transit. A security seal is then affixed to the cap to be used as indicator that the container has not been opened. The sealing and security seal steps are recorded on the QA form.

No safety concerns were identified.

6.0 Oversight of Corrective Action Plan

The elements of the TI corrective action plan for addressing the problem of free-standing liquid in the shipping containers are examined by a separate TI contractor. The inspector observed this individual to be actively examining the various operations of the container inspection, loading and sealing processes. This individual also signs the completed QA form.

No safety concerns were identified.

7.0 Exit Interview

The results of the inspection were discussed with the individuals identified in Section 1.

JUL 12 1996

Docket No. 070-00033
License No. SNM-23
Amendment No. 17
Control No. 121534

Michael J. Elliott
Environmental Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703-0964

Dear Mr. Elliott:

This is in reference to your letter dated December 19, 1994, to amend License No. SNM-23 and to your letters dated June 6, 1995 and October 2, 1995 providing additional information requested by the NRC. The December 19, 1994 letter incorporates changes to the "Remediation Plan for the Identified Building 12 Burial Area", submitted to the NRC in a July 30, 1992 letter to address additional contamination found in interior and exterior areas of the site. The June 6, 1995 and October 2, 1995 letters provide answers to NRC questions posed in a April 13, 1995 letter from the NRC and questions that arose during an NRC inspection conducted August 10 - 11, 1995 (NRC Inspection No. 070-00033/95-002), respectively. These changes, as supported with the additional information requested, will allow for the completion of decommissioning at the site.

In accordance with your application and pursuant to Title 10, Code of Federal Regulations, Part 70, Special Nuclear Materials License No. SNM-23 is hereby amended to change condition 19 to read as follows:

Condition 19. The licensee shall decontaminate the facility and site in accordance with the "Radiological Health and Safety Plan", dated July 20, 1992 and the "Remediation Plan for the Identified Building 12 Burial Area", presented on July 14, 1992, and changes to these two documents described in letters dated December 19, 1994, June 6, 1995 and October 2, 1995, so that the facility and site can be released for unrestricted use. The financial surety arrangement, to assure that funds will be available for decommissioning, dated August 14, 1992 is hereby incorporated as a condition of the license.

OFFICIAL RECORD COPY

9703120345 960712

Should you have any further questions, please contact Mark Roberts at (610) 337-5094 or me at (610) 337-5200.

Your cooperation with us is appreciated.

Sincerely,

ORIGINAL SIGNED BY:

Ronald R. Bellamy, Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

Docket No. 070-00033
License No. SNM-23
Amendment No. 17
Control No. 121534

DOCUMENT NAME: S:\PENDING\T_INST.LTR
To receive a copy of this document, indicate in the box: "C" = Copy w/o attach/encl "E" = Copy w/ attach/encl "N" = No copy

OFFICE	DNMS/RI	DNMS/RI		
NAME	MRoberts mlr	RBellamy		
DATE	05/21/96	05/21/96		

OFFICIAL RECORD COPY

WESTON
MANAGERS DESIGNERS/CONSULTANTS

Roy F. Weston, Inc.
6501 Americas Parkway, NE, Suite 800
Albuquerque, New Mexico 87110-1517
505-884-5050 • Fax 505-837-6870

12 December 1995

070-00033

Control No. 121534
SNM License No. 23
Docket No. 70-33

Mr. Mark Roberts
Senior Health Physicist
UNITED STATES NUCLEAR
REGULATORY COMMISSION REGION I
475 Allendale Road
King of Prussia, PA 19406

RE: Texas Instruments Incorporated
Attleboro, Massachusetts
Building Interiors Remediation Project RFW WO#: 10923-004-001

Dear Mr. Roberts:

In support of the Building Interiors Remediation Project at the Texas Instruments Attleboro Facility (TI), Roy F. Weston, Inc. (WESTON) is providing the following discussion to support processing of bulk quantities of concrete exhibiting surface uranium contamination. This remediation project is being performed in support of application for termination of Special Nuclear Materials License 23 (SNM-23) with the United States Nuclear Regulatory Commission (NRC). Processing is proposed to change the physical dimensions of the waste stream to reduce waste volumes for disposal, and in some cases allow for on-site disposal if bulk (volumetric) uranium contamination criteria are not exceeded.

Much of the following discussion has been developed based upon information contained in Support Document Control Number 1212, "Crushing Leads to Waste Disposal Savings for FUSRAP" prepared by the U.S. Department of Energy. This document is included as an attachment to this letter. WESTON seeks NRC approval of the proposed processing action based upon the following discussion.

PROPOSED ACTION

WESTON proposes that bulk concrete exhibiting average surface contamination levels ranging from 2000 - 10,000 dpm/100 cm^2 and maximum point surface contamination

121534

OFFICIAL RECORD COPY ML 10 DEC 13

levels as high as 40,000 dpm/100 cm^2 be staged on-site until an economical volume is available for processing in a concrete and rock crushing unit. Concrete exhibiting surface contamination levels exceeding the average and maximum ranges will not be processed and will be disposed directly as radioactive waste.

Crushed material will be sampled and analyzed for total and isotopic uranium concentration and enrichment (by weight percent) of each isotope derived. Crushed material exceeding the total uranium clean-up criteria of 30 pCi/g (35 pCi/g - depleted uranium) will be packaged for transport to the Envirocare facility for disposal. Crushed material not exceeding the total uranium clean-up criteria will be retained on-site for alternate uses.

MATERIAL DESCRIPTION

As part of the remediation program, an extensive concrete slab characterization/termination survey program has been implemented as described in a 27 July 1995 submittal to NRC. The characterization program involves the collection of systematic and biased concrete core samples in a distribution as described in NUREG/CR-5849. All exposed concrete surfaces are subject to survey for average and maximum surface contamination levels expressed in dpm/100 cm^2.

Characterization of affected building interior areas has indicated that approximately 10,000 - 20,000 ft^2 of concrete floor surfaces within the facility require decontamination due to average surface contamination levels ranging from 2000 - 10,000 dpm/100 cm^2 and/or migration of uranium contamination into cracks and expansion joints. At an average slab depth of six inches the resulting concrete volume is estimated to be 5000 - 10,000 ft^3. Total slab removal has been selected as the most cost effective method reducing impact to active TI facility operations.

All affected building areas have been delineated within a grid system with primary delineations of 10 meter square grid blocks. The following Table presents average and maximum surface contamination ranges over sections of grid blocks that have been or are scheduled to be decontaminated. The isotopic uranium analyses of one composite concrete core sample is presented for each grid block. The composite sample typically includes systematic and biased cores collected through the grid block.

Grid Block	Average Surface[1] Contamination Range (dpm/100 cm²)	Maximum Point[1] Contamination Range (dpm/100 cm²)	Total Uranium[2] (pCi/g)
08-7B	3000 - 6000	3000 - 6000	2.5
10-8G	1000 - 5000	10000 - 22000	2.4
08-6B	1000 - 2000	1000 - 2000	3.7
12-5E	1000 - 6000	10000 - 24000	2.4
12-6D	1200 - 3500	5000 - 12000	3.5
11-6G	2000 - 5000	2000 - 5000	1.6
11-5G	1000 - 5000	5000 - 16000	56.8
11-6H	1200 - 5000	5000 - 12000	2.8
09-7E	2000 - 6000	10000 - 38000	5.2
09-7F	2000 - 8000	10000 - 111000	2.3
10-7G	1500 - 3000	7500	2.3
12-6F	1000 - 5000	10000 - 30000	4.1

[1]Surface contamination levels are reported as "above background"
[2]Total uranium concentrations are calculated as the sum of the isotopic uranium-234, 235, and 238 concentrations in pCi/g.

Elevated total uranium concentration in the composite sample from Grid 11-5G is attributable to small pieces of contaminated expansion joint material biasing the average concentration.

SUMMARY

The data presented in the preceding table support the conclusion that the crushing of surface-contaminated concrete as encountered at the TI facility will serve as an effective volume reduction measure yielding bulk material with total uranium concentrations significantly lower than the clean-up criteria of 30 pCi/g. Post-process confirmatory samples will provide supplemental total uranium concentration information.

WESTON has acquired significant data regarding the contamination characteristics of bulk materials encountered in the Building Interiors Remediation Project. Should any

additional technical information be needed to support the approval of this process, please contact me at (508) 236-1631. Thank you.

Sincerely,

ROY F. WESTON, INC.

Michael V. Madonia
Project Manager

Attachment

cc: Mike Elliott (TI)
Frank Veale (TI)
John Price (WESTON)
Weston Project File, code 2.5

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

Crushing Leads to Waste Disposal Savings for FUSRAP

The Formerly Utilized Sites Remedial Action Program (FUSRAP) is a Department of Energy (DOE) program to clean up low levels of radioactivity remaining at 46, mostly privately owned, industrial sites in 14 states. Because most of the radioactive wastes generated must be shipped to the western United States for costly disposal, volume reduction and waste minimization are essential.

Because the floors of many of these 1940-50s era factories are cracked and broken, contaminants have migrated beneath the floors and contaminated the sides of the cracks, the bottom surfaces of the floors, and the underlying soils. FUSRAP must remove the floors to reach the contaminated soils, and the concrete removed during demolition must either be decontaminated by labor-intensive methods and certified as meeting DOE surface release guidelines or else shipped for disposal, often at a cost penalty for high volumes of debris.

FUSRAP devised the alternative of using a commercially available, semi-trailer-mounted rock crusher to render the concrete to a soil-like consistency. If the resultant material is below all applicable volumetric soil guidelines, it is released for use without radiological restrictions and can be used as backfill at additional cost savings. If the material fails to meet guidelines and must be sent for disposal, significant savings are still realized by transporting and disposing of soil rather than debris.

BACKGROUND

From the 1940s through the 1960s, in the early days of the nation's nuclear weapons and energy programs, DOE's predecessor agencies, the Manhattan Engineer District (MED) and Atomic Energy Commission (AEC), entered into contracts with private companies that had specialized capabilities to process, store, sample, assay, extrude, or machine radioactive materials consisting primarily of uranium, uranium metal, or thorium. The companies were indemnified for the environmental consequences of these activities, and the sites were decontaminated to the radiological standards current at that time. In 1974 the AEC recognized that some sites might not meet current radiological release standards, so FUSRAP was created by the AEC under authorities granted under the Atomic Energy Act of 1954, as amended.

The early years of the program were spent researching the locations of these contract operations and conducting radiological surveys to determine whether they were contaminated above present-day standards. Substantive work on remediating these sites

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

began about 1979. To date, over 400 locations have been assessed, and 46 sites in 14 states have been designated for further remediation by FUSRAP. Several of these sites are noncontract commercial operations that processed radioactive materials for profit and were subsequently assigned to DOE by direction of Congress. To date, 20 sites have been completed and released for use without radiological restrictions.

THE PROBLEM

FUSRAP sites range from large commercial manufacturing facilities to small, privately owned businesses or dwellings. Many sites have changed ownership several times, buildings have been demolished, new buildings have been constructed, dirt floors have been covered with asphalt and concrete, and contaminated materials have been hauled offsite, creating related vicinity properties that also must be addressed under FUSRAP.

During processing and machining operations, radioactive residues and metal dusts, grindings, and filings were generated. Haphazard practices in containing and controlling these materials allowed them to spread throughout the facilities onto walls, floors, overhead trusses, on and behind wall and ceiling fixtures, into floor drains, into soils beneath the floors and around the buildings, and in other areas. In addition, uranium fires sometimes resulted in overhead contamination of building trusses and beams, and airborne contamination was also drawn out of vents onto roofs and surrounding soils.

Unlike the large DOE reservations with onsite waste disposal capabilities, FUSRAP is generally precluded from safely or legally disposing of radioactive materials above release criteria where they are generated. Instead, the wastes must be shipped to the western United States for costly disposal. Because substantial quantities of soil and debris are generated during site remediation, volume reduction and waste minimization have become essential elements of the program.

NEMESIS: CONCRETE

Cleanup guidelines applicable to soil and debris are established on a site-by-site basis using DOE Order 5400.5 as a foundation. Residual contamination guidelines are as follows:

<u>Soil</u>	
Total uranium	100 pCi/g when averaged over any 15-cm-thick soil layer below the surface

Surface

Uranium-natural	5,000 dpm/100 cm^2 (alpha) average
Uranium-235	15,000 dpm/100 cm^2 (alpha) maximum
Uranium-238 and associated decay products	1,000 dpm/100 cm^2 (alpha) removable

The typical FUSRAP site is an old machine or foundry shop with concrete floors, the upper surfaces of which can be easily decontaminated with minimum waste. Often, however, the floor is old and cracked, and radioactive contaminants have migrated into the underlying soils. The cracks and the irregular subfloor surfaces also become contaminated surfaces. Based on the nature and extent of the contamination beneath the floor, FUSRAP must remove either portions of the concrete floor or the entire floor to reach the underlying soils that are above release criteria. The resulting concrete debris must either be decontaminated by labor-intensive methods, certified as meeting DOE surface release criteria, and then left onsite or disposed of as industrial debris, or else it must be shipped for radioactive waste disposal as bulk debris.

Unfortunately, one of the commercial radioactive waste disposal facilities that FUSRAP frequently uses has regulator-imposed restrictions that limit the thickness of each lift in the disposal cell to 12 in. Debris dimensions are limited to 10 in. thickness by 8 ft length and 8 ft width. Because the facility also can place no more than a nominal 10 percent debris within any given cell lift, that same percentage restriction is applied to soil waste streams being received. Shipments with more than 10 percent debris are considered all debris. The disposal rate for debris streams is essentially double that for soils.

THE SOLUTION

Initially faced with the dilemma of having to dispose of large quantities of concrete debris at twice the rate of an equal volume of soil, FUSRAP purchased a commercially available, semi-trailer-mounted rock crusher to render the concrete debris to a soil-like consistency.

Size reduction of debris has the potential for substantial disposal cost savings. Disposal of debris material at a licensed facility can be \$17.75/ft^3 or more versus the cost of disposing of soil at \$8.33/ft^3 or more.

Changing the form of the debris to a soil-like material allows the use of volumetric release criteria. In most instances, only the surfaces of the debris have residual contamination levels. If the crushed material is below the site volumetric criteria, and release of the material is allowed by the regulators, substantial cost savings are possible. Transportation

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

costs range from \$3.70/ft^3 to \$7.40/ft^3, depending on the mode of transport. Total cost savings (transportation and disposal) for release of crushed material onsite versus disposal offsite could be \$21.45/ft^3 or more. A very significant bonus was achieved at several sites in Pennsylvania and New York, when sampling of the crushed concrete soil substantiated that the material was well below the volumetric site-specific soil release criteria DOE had derived for those sites. Therefore, the New York and Pennsylvania radiation regulators were approached with the logic that because soils above background but below release criteria were being left onsite, it made sense to leave the crushed concrete on site as backfill material as well. Both states concurred in writing with this approach. Significant savings in loading, transportation, and disposal were thus achieved.

There are further benefits from size reduction. It is desirable to dispose of debris in a manner that discourages reuse of the material in its original form, and debris crushed to a soil-like material minimizes the potential for building materials (concrete block, brick, concrete slabs, etc.) to be reused. Size reduction also helps to protect packaging integrity. Packaging and transportation of debris must comply with Department of Transportation (DOT) regulations and DOE orders. Packaging of large debris segments (e.g., fragments of a concrete sidewalk) into a transportation container with a plastic liner can damage the container or cause the liner to fail. Shifting or vibrating loads during transport can also cause the packaging to be damaged. Size reduction significantly reduces the potential for packaging failure during loading and transport by eliminating large, sharp- edged materials from the waste stream.

Case 1 - Aliquippa Forge Site, Aliquippa, Pennsylvania
This presently idle foundry was the site of FUSRAP's first use of the crusher. The foundry had extruded uranium metal rods for the AEC in the late 1940s. The concrete floor of the over 28,000-ft^2 building was badly cracked and deteriorated. The contaminant identified was processed natural uranium metal (i.e., characterized by activity ratios of 0.48, 0.5, and 0.022, respectively, for uranium-238, uranium-234, and uranium-235). For the remedial action, soil samples were compared to a site-specific cleanup criterion of 100 pCi/g for total uranium in accordance with DOE Order 5400.5. A concentration of 50 pCi/g for uranium-238 was used as an indicator because the material was natural uranium metal. The average background concentration of uranium-238 in soil representative of the site was 5.4 pCi/g. The surface remedial action guidelines of DOE Order 5400.5 for alpha activity from uranium were used for Aliquippa Forge.

Radiation surveys of the concrete debris indicated that the surfaces that were formerly the top or bottom or adjacent to preexisting cracks were frequently contaminated in excess of

DOE Order 5400.5 criteria. Total scans of all surfaces and decontamination of areas above criteria would have been necessary to release the material without radiological restrictions. Because the labor costs for scanning and decontamination of each piece of debris would have been prohibitively expensive, past FUSRAP practice would have been to simply ship the material as radioactive waste at the prevailing disposal rate for debris. At the time of this activity, that rate was \$17.15/ft^3.

The 500 yd^3 of concrete and brick was instead fed through the newly purchased crusher. Samples of crushed brick and concrete had uranium-238 levels of less than 10 to 15 pCi/g. These levels were well below the cleanup guideline for the soils remaining in place, 50 pCi/g of uranium-238. The crushed materials were used as fill material onsite, with agreement from the state regulators. If the crushed material had been sent to an offsite disposal facility, it would have qualified at the soil disposal rate of \$8.06/ft^3.

The Pennsylvania Department of Environmental Resources had periodically monitored FUSRAP activities throughout its work at the Aliquippa site and was present at DOE's request during crusher startup to review issues related to the potential for fugitive air emissions during crushing. The agency was subsequently presented with sampling results of the crushed material and concurred in writing that the material could be replaced into the area that would be covered by the replacement floor. Because more than 600 yd^3 of soil had been removed from beneath the building, a further savings was realized by not having to purchase clean backfill.

Case 2 - C.H. Schnoor Site, Springdale, Pennsylvania
This active industrial facility had previously machined uranium metal under contract to MED. Various business lines and building additions had taken place since the contract work for MED; the current occupant is a conveyor belt fabricator for the mining and utility industry. Building additions had been placed on soil contaminated with uranium metal, which necessitated the removal of portions of the slab-on-grade concrete floor to remove 626 yd^3 of contaminated soil. Remediation of this facility took place concurrently with the Aliquippa Forge site.

The average background concentration of uranium-238 in soil for the Schnoor site was 2.37 pCi/g. The average concentration of natural uranium in Schnoor waste shipments was 192.02 pCi/g. Concrete that was above DOE 5400.5 release criteria was crushed with the FUSRAP rock crusher. The crushed material was sampled and determined to have an average uranium-238 concentration of 7.50 pCi/g, well below the cleanup criterion of

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

50 pCi/g. Approximately 41 yd^3 of concrete was crushed and, with approval of the Pennsylvania Department of Environmental Resources, used as fill material at the site.

Case 3 - Alba Craft Site, Oxford, Ohio
This concrete block, slab-on-grade, single-story building had been the site of a uranium metal machining operation in the 1950s. Again, building additions had been placed on contaminated soil, and the building was most recently used for vending produce storage and as an embroidery shop.

Because uranium fires had contaminated the block walls and overhead trusses and roof and contamination was prevalent beneath much of the concrete slab, it was determined that instead of costly decontamination it was more prudent to demolish the entire building. After the wood roof decking and metal trusses were removed, all building walls and the concrete slab were demolished and crushed. Concrete block and floor slabs were crushed and transported to an offsite disposal facility. Samples of the crushed material had a nominal reading of 1.5 pCi/g or less of uranium-238 (approximately 3.0 pCi/g total uranium). The Alba Craft site-specific criterion for soil is 35 pCi/g for total uranium. The option of leaving the crushed material onsite was not allowed by the state regulators. The regulators asserted that (in accordance with Title 37 of the Ohio Revised Code Annotated, 3701.914 and 3734.027) all low-level radioactive waste, regardless of whether the material is below DOE release criteria or has been reclassified as below regulatory concern, must be disposed of at a facility licensed to accept low-level radioactive waste.

Case 4 - Colonie Site, Colonie, New York
At the FUSRAP Colonie site, several building wall decontamination techniques were tested to determine the effect of decontamination before crushing building debris. Different decontamination methods were used, including Vacublast™, vacuuming and fixative, vacuuming, and no action, and the wall was then crushed to a soil-like material and sampled. A concrete block wall was used for the test. The highest fixed beta-gamma reading on the wall was 1,301,000 dpm/100 cm^2, with an average beta-gamma reading of 237,000 dpm/100 cm^2. The DOE 5400.5 guideline for fixed beta-gamma surface contamination is 5,000 dpm/100 cm^2. The analytical results indicated that the crushed building material from all of the tests contained radionuclide levels below those currently recommended for the site (35 pCi/g for uranium-238 and 5 pCi/g for radium-226 and thorium-232). Concentrations of uranium-238 found in the crushed material ranged from 5.7 to 29.4 pCi/g, with an average concentration of 15.4 pCi/g. The radium-226 and thorium-232 concentrations were at background levels for all tests. Current plans are to crush the entire building and slab; after it has been demonstrated to the regulators that the

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

resulting material is below volumetric release guidelines, the material will be disposed of onsite at an anticipated savings of $4,000,000.

CRUSHER

The following performance criteria were used as a basis for selecting a rock crusher:

- Product is soil-like material, per ASTM D-698-91.
- Design throughput is approximately 100 tons/hour.
- Crusher operates with variable feed rate and feed material sizes.
- Crusher is capable of handling material with some tramp steel and rebar.
- Crusher is transportable and easy to set up.
- Crusher is easy to decontaminate.
- Maintenance requirement is low.

Commercial rock crushers use various mechanical methods to crush feed material. Three rock crusher design types were considered for use on FUSRAP: gyratory crusher, jaw crusher, and secondary impact crusher. Based on best fit with the selection criteria, cost, and availability, a secondary impact crusher was chosen. Features of the gyratory crusher that disqualified it are that it requires a long startup period; disassembly, decontamination, and re-assembly are more difficult; it operates best with a continuous feed rather than intermittent feed; and unit sizes in the 100 ton/hour range are not readily available. Significant points of comparison between the jaw crusher and secondary impact crusher are that jaw crusher capital cost per ton of capacity is greater; generally, jaw crusher maintenance costs are lower; jaw crushers have a lower tolerance for tramp metal and rebar; set-up time for jaw crushers is greater; and jaw crushers produce less fine material in the product stream.

The rock crusher selected for FUSRAP was a Torgeson model AX Impactor Plant supplied by Fabtec, Inc. of Moscow, Idaho. This machine is a standard, off-the-shelf design. Crusher technical specifications are

Capacity	150 tons/hour
Feed size	
Hard rock (up to)	14 in.
Concrete (up to)	20 in.
Feed opening	16 in. × 43 in.
Diesel powered	288 hp
Weight	77,000 lb
Size	48 ft 10 in. long × 8 ft 6 in. wide × 14 ft high
Transportable	Setup time 2 days (approximately)

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

A typical rock crusher product sieve analysis for concrete from a FUSRAP building demolition is presented below.

Sieve Size	Cumulative percent retained
2 in.	5
1 in.	9
0.375 in.	27
No. 10	70
No. 40	90
No. 200	99

Primary safety concerns during operation of the rock crusher are operator safety, noise minimization, and dust control. Features included in the rock crusher designed to address operator safety include full compliance with Occupational Safety and Health Administration (OSHA) requirements (e.g., drive guards, platforms and railings, and emergency stop system).

Additional safety features were added to the rock crusher based on FUSRAP experience:
- A plexiglass shield was installed on the operating deck for additional protection from flying debris, for additional noise protection, and as an additional personnel protection guard from the nearby hot muffler.
- The water control valve was moved to the operating deck from the opposite side of the unit.
- A platform was installed for access to the feed hopper.
- A lockout was added to the emergency stop switch.

During operation, a 75-ft protected zone is established around the rock crusher. Personnel inside the protected zone are required to wear ear plugs and ear muffs. Operations personnel communicate using earphone radios.

Sound level survey measurements taken during crusher operation are as follows:

Location	3 ft from equipment	12 ft from equipment
Diesel engine	88 dBA	80 dBA
Crusher	91	83
Conveyor	80	76

Control Number 1212
William M. Seay
U. S. Department of Energy
P.O. Box 2..., Oak Ridge, Tennessee 37831-8723
(615) 576-1830, Fax (615) 576-0956

Dust control features in the crusher are a belt curtain on the feed hood and a water spray system with nozzles on the feed inlet and discharge chutes. Operating experience has shown that dust generation is not a concern with the water spray system in operation. However, care must be taken to not add too much water during crushing to avoid oversaturating the product stream. A typical optimum moisture content for crushed concrete is 10 percent, and addition of excessive water could result in having to dry the product stream before disposal.

The rock crusher is operated by one worker on the operating deck. Maintenance is performed daily and in accordance with the manufacturer's recommendations. The crusher is decontaminated inside and out using a steam cleaner to remove loose material. Generally, all parts of the crusher can be decontaminated except for the inside of the crushing chamber, which is sealed before transportation offsite.

RESULTS

The FUSRAP rock crusher has been used at three sites. At the Aliquippa Forge site, approximately 500 yd^3 of concrete and brick rubble was generated from the removal of the building floor. The rubble was processed to a soil-like consistency. Samples of the crushed concrete and brick showed a small amount of residual uranium (10 to 15 pCi/g of uranium-238). Both the crushed brick and crushed concrete uranium levels were well below the cleanup guideline for the soils remaining in place on the site of 50 pCi/g of uranium-238. The crushed materials were used as fill material onsite, with agreement from the state regulators.

At the Schnoor site, approximately 41 yd^3 of concrete was crushed and used as backfill at the site, with agreement of the state regulators. Residual uranium-238 contamination levels of 7.5 pCi/g in the crushed material were well below the cleanup guideline of 50 pCi/g for the soils remaining in place.

Concrete block and floor slabs were crushed at the Alba Craft site. Approximately 500 yd^3 of material was processed and transported to the offsite disposal facility. Samples of the crushed material had a nominal reading of 3.0 pCi/g total uranium. The Alba Craft site-specific criterion for soil is 35 pCi/g for total uranium.

The listing below summarizes the operating costs and cost savings for the three FUSRAP sites discussed. A typical cost range for shipping (transportation, overweight permits, escort service, and route survey), mobilization, and setup is $5,000 to $7,000. The cost for

crusher operation and maintenance is approximately $150 to $175/hour. For crushed material that can be disposed of onsite, less clean backfill material is needed for an additional savings of $8.45/yd^3.

	Aliquippa	Schnoor	Alba Craft
Material Crushed	500 yd^3	41 yd^3	500 yd^3
Disposal Savings	$232,000	$19,000	$127,000
Transportation Savings	$92,000	$7,500	
Operating Costs	$16,000	$2,000	$16,000
Backfill Savings	$4,000	$400	
Total Savings	$304,000	$24,100	$111,000

Future use of the rock crusher on FUSRAP is expected to be on building demolition sites. The greatest cost benefit from crushing debris into soil-like material is achieved when the crushed material can be left onsite and offsite disposal is not required. State regulations vary considerably in how materials with measurable levels of radioactivity may be disposed of. Review of the applicable regulations and discussions with the regulators may provide opportunities for savings of up to $600/yd^3 or more if the crushed material can be left onsite.

Coauthors:

James D. Kopotic
U. S. Department of Energy
P.O. Box 2001, Oak Ridge, Tennessee 37831-8723
(615) 576-9441, Fax (615)576-0956

Preston W. McDaniel
Bechtel Environmental, Inc.
151 Lafayette Drive, Oak Ridge, Tennessee 37830
(615) 576-1728, Fax (615) 576-4898

WESTON
MANAGERS DESIGNERS CONSULTANTS
6501 AMERICAS PARKWAY, N.E.
SUITE 800
ALBUQUERQUE, NM 87110-1517
505-884-5050 • FAX: 505-884-5388

31 October 1995

Control No. 121534
SNM License No. 23
Docket No. 70-33

Mr. Mark Roberts
Senior Health Physicist
UNITED STATES NUCLEAR
REGULATORY COMMISSION REGION I
475 Allendale Road
King of Prussia, PA 19406

Re: Texas Instruments Incorporated
Attleboro, Massachusetts Facility
Nuclear Remediation Projects - Update RFW WO#: 10923-004-001

Dear Mr. Roberts:

The following summaries of Interior and Exterior Remediation Project activities are provided for your information.

Building Interiors Remediation

A drain line sampling and characterization program was completed in September 1995. Program data were used to identify drain lines requiring removal and replacement.

Decontamination and repair of Building 10 roof areas were completed on 24 October 1995. Decontamination crews have restarted concrete and soil removal activities within Building 10 in Areas 8, 9, 10, and 11. These areas are scheduled for completion in mid-November 1995. The attached figure presents the relative location of these areas within Building 10. The anticipated project completion date is on or about 22 January 1996.

Exteriors Soil Remediation

Current remediation activities are focused in the rail siding excavation area, with an anticipated completion date of 10 November 1995. Excavation in a localized area near Building 12 will begin on 6 November, and will be completed approximately two weeks

OFFICIAL RECORD COPY ML 10

afterward. The handling, treatment, and disposal will continue through the remainder of 1995.

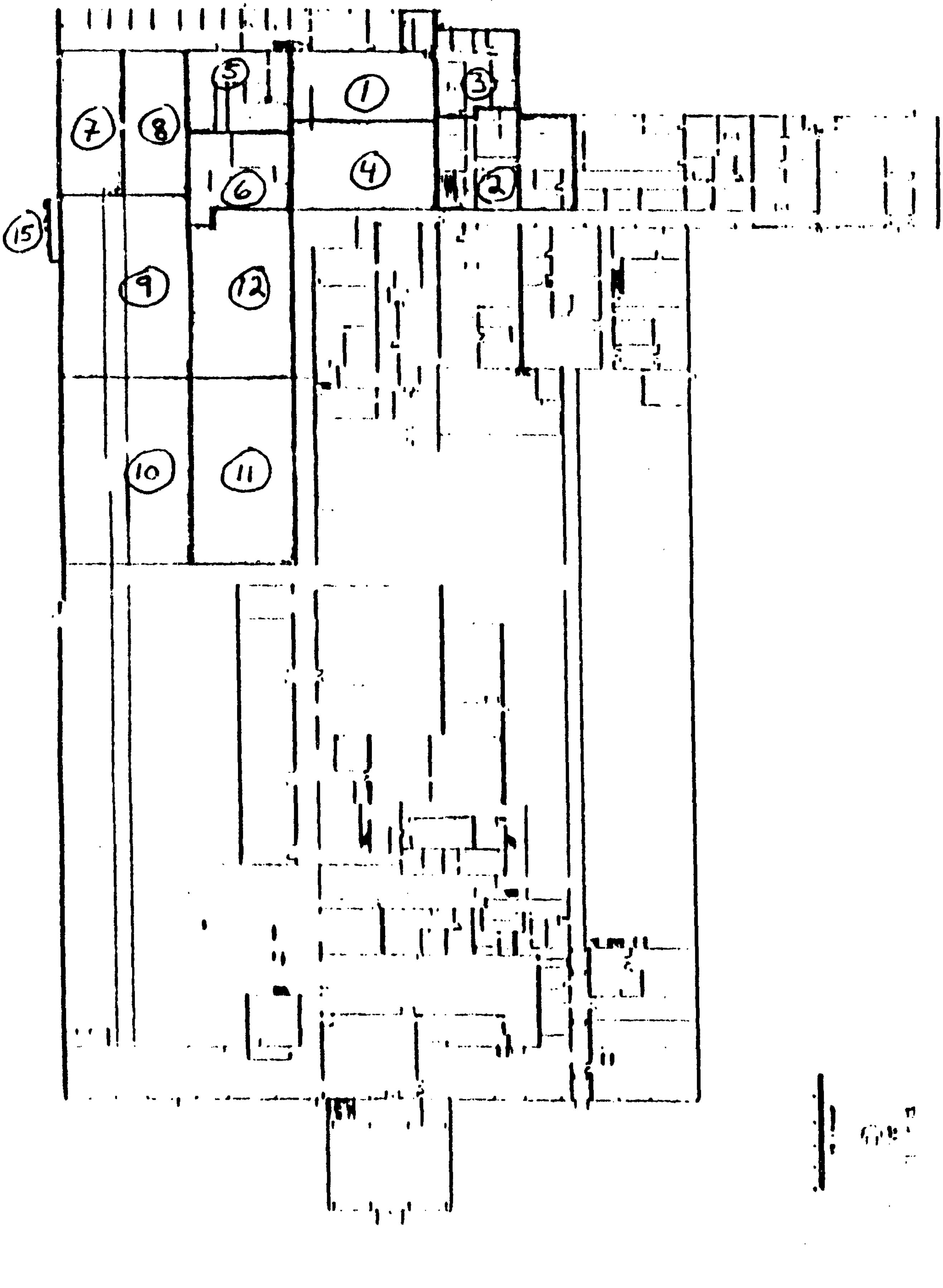
Sincerely,

Michael Madonia

Michael V. Madonia
Project Manager

CC: Michael Elliott (TI)
John Price (WESTON)
Todd Walles (WESTON)

DECONTAMINATION AREAS RELATIVE TO THE INTERIOR FLOOR PLAN OF BUILDING 10



Texas Instruments Incorporated

TEXAS INSTRUMENTS

34 Forest Street
P O. Box 2964
Attleboro, MA 02703-0964

(508) 236-3800

October 25, 1995

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

070-00033

SNM No. 23
Docket No. 70-33
Control No. 121534

Mr. Mark Roberts
U.S. NUCLEAR REGULATORY COMMISSION
Region I, NMSS
475 Allendale Road
King of Prussia, PA 19406-1415

SU: Additional information with respect to TI's License Amendment/Supplement Plan Approval as a result of discussions during the NRC inspection conducted August 10 and 11, 1995 (NRC Inspection No. 70-033/95002)

Dear Mr. Roberts,

In the attached correspondence, Texas Instruments Incorporated (TI) is submitting additional information that you requested during your most recent site inspection of August 10 and 11, 1995. In combination with the previously submitted letter of October 2, 1995, this completes TI's response to your request for additional information related with this most recent site inspection.

The attached response explains the meaning of the information contained in Table 1 of Question 4 that appeared in a June 6, 1995 correspondence from TI to the U.S. Nuclear Regulatory Commission (NRC). TI's June 6 correspondence was in response to a written request for additional information that the NRC transmitted to TI on April 13, 1995. The April 13 written request pertained to TI's Supplement Decommissioning Plan (December 1994).

If I can clarify anything or be of further assistance on this matter, please don't hesitate to contact me at (508) 236-1809.

Sincerely yours,
MATERIALS & CONTROLS GROUP,

M. J. Elliott

Michael J. Elliott
Environmental Manager

CC: Maurice Axelrad, Esq. - Morgan, Lewis & Bockius
Richard L. Joosten Jr., Esq. - TI Corporate Legal
Francis J. Veale Jr., Esq. - TI Attleboro

Attachment: Letter from CPS Environmental to Michael Elliott (October 18, 1995)

121534

CPS Environmental
P.O. Box 9253
Lowell, MA 01853
(603) 893 4977

18 October 1995

Michael Elliott
Environmental Manager
Texas Instruments Incorporated
34 Forest Street
Attleboro, MA 02703

Dear Mr. Elliott:

Apparently there was some confusion regarding Table I within Question 4 of a letter to the NRC dated June 6, 1995. This letter is written in response to the verbal request for clarification of Table I by Mr. Mark Roberts of the USNRC to Mike Elliott of Texas Instruments on August 11, 1995 and as follow-up to the tele-conference between Mark Roberts (USNRC), Mike Elliott (TI), Mark Griffon (CPS), and Fred McWilliams (CPS) on October 16, 1995.

The intent of Table I (copy attached) was to establish an effective criteria for beta response instrumentation (e.g., GM pancake type detectors and proportional counters) that would equate to the 5,000 dpm/100 cm^2 total uranium criteria. Column 1 of Table 1, represents the major radionuclides associated with the Uranium series as shown in Figure 1 (attached). The second column title is apparently where some of the confusion originates and should perhaps have been titled as the "Fraction of each Uranium Species relative to Total Uranium". This column (2) represents the fraction of each uranium species relative to total uranium and was derived from an average of representative samples obtained from the Texas Instruments Incorporated complex as analyzed by alpha spectroscopy. The third column represents the number of beta particles emitted for the specific radionuclide of a particular decay series and is readily obtained from literature (i.e., Radiological Health handbook, USPHS, 1970). The remaining column (4) is the result of multiplying the second and third columns together for each specific radionuclide which emits a beta particle via the particular decay path. The summation of column 4, therefore represents the expectation fractional beta emission per uranium decay for total uranium as observed for this site and is given as 0.825. This beta emission fraction multiplied by the Total Uranium criteria of 5,000 dpm/100 cm^2 results in an effective beta particle criteria which represents the Uranium criteria.

We hope this clarifies any questions regarding Table I and if you have any further questions, please do not hesitate to contact us.

Sincerely,

Mark Griffon
Health Physicist

Table 1: Principal Uranium and Uranium Progeny Radiations
(Based on Site Specific Samples)

Radionuclide	Alpha Activity Fraction	Beta Particles per Uranium Alpha Decay	Weighted Beta/Alpha Ratios
U-234	0.568		
U-235	0.025		
Th-231		1	0.025
U-238	0.4		
Th-234		1	0.4
Pa-234m		1	0.4
TOTAL	1		0.825
TOTAL ALPHA/BETA RATIO =		1.212121212	

Modified Criteria equals 0.825 x 5000 dpm/100 cm ^{2}
Modified Criteria 4200 dpm/100 cm ^{2}

Figure 1

Uranium Decay Series
for Radionuclides of Concern

$$^{235}U \xrightarrow[(7.0E8y)]{\alpha} {}^{231}Th \xrightarrow[(25h)]{\beta^-} {}^{231}Pa \text{ (3.3E4y)}$$

$$^{238}U \xrightarrow[(4.5E9y)]{\alpha} {}^{234}Th \xrightarrow[(24d)]{\beta^-} {}^{234m}Pa \xrightarrow[(1.2min)]{\beta^-} {}^{234}U$$

$$^{234}U \xrightarrow[(2.4E5y)]{\alpha} {}^{230}Th \text{ (7.7E4y)}$$

Texas Instruments Incorporated

TEXAS INSTRUMENTS

34 Forest Street
P.O Box 2964
Attleboro, MA 02703-0964
(508) 236-3800

L8

October 2, 1995

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

SNM No. 23
Docket No. 70-33
Control No. 121534

Mr. Mark Roberts
U.S. NUCLEAR REGULATORY COMMISSION
Region I, NMSS
475 Allendale Road
King of Prussia, PA 19406-1415

SU: Additional information with respect to TI's License Amendment/Supplement Plan Approval as a result of discussions during the NRC inspection conducted August 10 and 11, 1995 (NRC Inspection No. 70-033/95002)

Dear Mr. Roberts:

In response to discussions with the U.S. Nuclear Regulatory Commission, Region I - NMSS (hereafter referred to as NRC) during a site inspection on August 10 and 11, 1995, Texas Instruments Incorporated, Materials & Controls Group (hereafter referred to as TI) located in Attleboro, Massachusetts, is submitting the requested additional information in the following correspondence. For consistency, the responses are organized according to the four (4) categories that were detailed in the closing meeting of the inspection. The four categories are summarized below:

1. Describe the gross alpha screening methodology.

   Describe the analytical methodology for both the interior and the exterior projects. Describe how the correlation was derived between alpha spec and gross alpha counting. Describe sample preparation and sample counting. (Note: counting should include QA protocols.)

2. How do we ensure that soils or surfaces within a remediated grid cell, but not one of the sampled locations, meet the release criteria?

OFFICIAL RECORD COPY ML 10

121534
10-5-95

3. Concerning termination surveys for building interiors using a large area gas flow surface monitoring system.

   3.1 How do we convert meter output into dpm/100 sq. cm?
   3.2 How do we perform a termination survey with a large area detector and demonstrate compliance with both surface activity release criteria: 5000 dpm/100 sq. cm. over a 1 sq. m. area, and 15000 dpm/100 sq. cm. over a 100 sq. cm. area?
   3.3 How do we derive the beta equivalency factor for our particular range of enrichment data?
   3.4 Document the calibration and MDA of each instrument.

4. Clarify TI's response to Question #4 of the NRC's April 13 letter.

Each of these items is addressed in the attached response. Please note that the response is divided into two (2) independent sections: 1) responses related to the building interior remediation project, and 2) responses related to the exterior soil remediation project.

At the closing meeting, it was indicated that the response to this additional information request was all that remained in order to proceed with approval of the Supplement Plan and issuance of a License Amendment. As you know, Texas Instruments Incorporated (TI) has followed a very aggressive schedule of remediation to bring a timely completion to this project. We greatly appreciate your efforts to ensure TI obtains its license amendment prior to promulgation of any further decommissioning rules.

TI looks forward to the prompt and timely approval of its Supplement Plan/License Amendment. If there is anything further TI can do to expedite such an outcome, please do not hesitate to contact Mike Elliott. He can be reached at (508) 236-1809.

Sincerely yours,

Materials & Controls Group

M.J. Elliott

Michael J. Elliott
Environmental Manager

Attachment: Response to NRC requested information

cc: Richard L. Joosten, Esq. - TI Corporate Legal
Francis J. Veale Jr., Esq. - TI Attleboro

RESPONSE TO NRC

OBSERVATIONS AND COMMENTS

INTERIOR PROJECT

I. INTERIOR REMEDIATION PROJECT RESPONSES

The following discussion addresses U.S. Nuclear Regulatory Commission (NRC) comments and observations regarding the Building Interiors Remediation Project at the Texas Instruments (TI) Attleboro Facility resulting from an on-site inspection by Mark Roberts on August 10 and 11, 1995. The remediation project is being performed in support of termination of Special Nuclear Materials License (SNM-23). Many of the questions and observations are addressed in detail in several of the standard operating procedures (SOPs) developed and implemented to control site operations and ensure a consistent quality of data. Specific SOPs are referenced in the following responses, and are contained in an attachment to this discussion.

General Response Regarding Termination Surveys of Concrete and Wall Surfaces

Termination surveys of concrete and wall surfaces are being performed using gas flow proportional detectors with the following characteristics:

Ludlum Model 2350 Data Logger/Model 43-68 Gas Flow Detector - 100 cm^2 active area
Ludlum Model 2350 Data Logger/Model 43-37 Gas Flow Floor Monitor - 425 cm^2 active area

It is important to note that both systems are operated concurrently in ratemeter and integrating scaler mode. The operation in ratemeter mode allows the surveyor to identify localized hot spots, while integrated scaler counts are useful in identifying larger areas of contamination. When ratemeter measurements exceed two standard deviations of the background or general survey area count rate, surveyors note the elevated locations on field diagrams. Integrated one-minute counts over each 1 meter square grid block are also recorded.

WESTON termination survey procedures using both methods are described in detail in standard operating procedure (SOP) 16.0 contained within Attachment 1 to this document. Since minimum detectable activities (MDAs) may be calculated using both methods, the thorough survey procedure provides additional "insurance" that termination and unrestricted surface contamination criteria have been achieved. The calculation of ratemeter and integrated count MDAs for the large-area gas proportional counter (Ludlum Model 43-37) is discussed in following sections of this document.

WESTON acknowledges that the application of large-area detectors in termination surveys is a topic of current technical discussion. To provide additional information on the termination survey implementation, WESTON has performed follow-on surveys utilizing 100 cm^2 detection systems on 1 meter by 1 meter grid blocks originally surveyed with the large-area detectors. The purpose of performing these follow-on surveys was to ensure that compliance with surface contamination criteria was obtained with the large area gas-flow systems. WESTON believes that this technical approach in association with discussions contained in the following responses will provide a sound approach for future remediation activities.

1.1 Gross Alpha Analytical Screening Technique

Comment:

Describe the analytical methodology for the Building Interiors Project. Describe how the correlation was derived between laboratory alpha spectrometry data and gross alpha protocol. Include discussion regarding quality assurance (QA) protocol.

Response:

WESTON has implemented a Project Plan (PP) directing all activities associated with the Building Interiors Remediation Project. This PP contains a distinct Quality Assurance Plan (QAP) and SOPs which are implemented to ensure the quality of site operations, data collection and reporting. The SOPs directly addressing the preparation, counting, and total uranium correlation of concrete and soil samples are presented in Attachment 1 and include:

SOP 13.0 - Preparation and Analysis of Concrete Core and Soil Samples with Ludlum Model 2000 Scaler/Model 43-10 Alpha Tray Counter

SOP 26.0 - Operation of Bico Chipmunk Crusher

It is important to note that the Building Interiors Project did not have previous concrete and soil sample analyses for total and isotopic uranium from which to develop a gross alpha counting correlation. At the onset of the Building Interiors Pilot Project (28 June 1995) several concrete samples were collected from undisturbed background locations in Building 10, processed and analyzed to determine a mean background gross alpha count rate. Based on this exercise it was determined to use the background mean count rate plus two standard deviations as a preliminary cleanup criteria, until such time that analytical data could be received and/or a counting correlation developed. The mean background count rate was measured to be 3.5 counts per minute (cpm) and a standard deviation of 0.45 cpm, with a subsequent decision criteria of 4.4 cpm. It was acknowledged that this criteria was likely to be conservative given the alpha contribution from thorium decay series radionuclides contained naturally in concrete.

The Building Interiors Pilot Project characterization proceeded according to the Sampling and Analysis Plan (SAP) as transmitted to the NRC by WESTON in July 1995. Selected concrete and soil samples were packaged and transferred utilizing Chain of Custody seals and forms to TMA Eberline in Oak Ridge, Tennessee for laboratory analyses. Over the duration of the Pilot Project (28 June - 15 August) approximately 33 concrete and soil samples were submitted for total uranium analysis using ASTM Method D5174. Of the 33 samples, 20 were analyzed for isotopic uranium using Method EML U-02 Modified. All analytical samples were assigned an identification number referencing site grid, date of collection, matrix, depth, and systematic versus biased location.

Analytical results received to date are included in a summary table within Attachment 2 to this document. WESTON has attempted to derive a linear regression between net alpha count rate measured in the field laboratory and total sample uranium activity as derived from isotopic analyses. An adequate correlation is defined as having a correlation coefficient (CC) of greater than 0.8, while an excellent correlation is defined as having a CC of greater than 0.9. To date, no sets of data have demonstrated an adequate correlation coefficient. Isotopic sample data have been sorted into seven characteristic groups in an attempt to derive a correlation, including, all samples, Caged Area, Screen Print Room, enriched uranium samples, natural and depleted uranium samples, biased concrete sample locations, and biased soil sample locations. Correlation outputs are illustrated in Attachment 3.

As additional isotopic uranium data are gathered during the Building Interiors Remediation Project, WESTON will update the correlation databases and attempt to derive adequate correlations with current information. The failure to derive an adequate correlation has resulted in the need to terminate grid cells based on rapid turnaround total uranium and isotopic uranium analyses. The sampling network for remaining concrete slab and exposed soil grids will be as proposed in the SAP, with the addition that the four primary sample locations (or fewer for partial blocks) will be submitted individually for total uranium analyses, with a composite of these samples submitted for isotopic uranium by alpha spectroscopy. Supplemental samples as described in the SAP and NUREG/CR-5849 methodology will be collected and held in archive pending analytical data receipt. Upon receipt of analytical data indicating average total uranium concentrations below 30 pCi/g the grid block will be considered terminated.

I.3.1 Converting Meter Output into dpm/100cm^2.

Comment:

How do we convert meter output into dpm/ 100 cm^2 (Large-area detector)?

Response:

The Ludlum Model 2350 (with Ludlum Model 43-37 floor monitor) may be programmed with multiple calibration or conversion factors to modify the ratemeter output shown digitally on the meter face. The calibration factor can be developed based on the following algorithm:

$CF = (100/A)/E = (100/425)/0.2 = 1.2$ Equation (1)

where:

CF = calibration factor in dpm/cpm per 100 cm^2
A = the active probe area in cm^2 = 425
E = the corrected detector efficiency (given enrichment) in cpm/dpm

Note: Modified CF when removing E is calculated as 0.21.

After programming of the CF, the meter output has been corrected to read in dpm/100 cm^2 (inclusive of background). The efficiency, E, may be removed from equation 1 to allow the ratemeter to read in cpm. When using the detection system with the modified CF, the surveyor may readily compare the count rate to the "diluted count rate" (see response to comment 2.3.2) associated with the maximum surface contamination criteria of 15,000 dpm/100 cm^2 .

I.3.2 Termination Surveys with a large area detector

Comment:

How do we perform a termination survey with a large-area detector and demonstrate compliance with surface activity criteria?

Response:

A valid concern is that the response to a point source might not be consistent over the entire volume of the proportional detector, thus ratemeter response would be rendered inconsistent. At the time of full voltage plateau calibration to natural uranium, WESTON determines response at three evenly spaced locations over the probe face (see Attachment 4). This response testing assures uniform efficiency over the detector volume.

A secondary concern is that a point source will suffer an amount of count rate "dilution" when divided surface area of the probe (if it is greater than 100 cm^2) as applied in a CF (see response to Comment 2.3.1). This leads to the question of what is the minimum point source activity that can be discerned on the ratemeter element of the detection system, and is it less than the maximum surface contamination criteria of 15,000 dpm/100 cm^2.

This problem is addressed through scaling the target surface contamination criteria (15,000 dpm/100 cm^2) from the large-area detector active surface area to a 100 cm^2 basis. Scaling results in a gross count rate value that, upon application of efficiency and background factors, must be statistically and audibly discernible when compared to the background count rate over the entire detector. This relationship is demonstrated as:

$$\frac{(X + B_R)}{E * (100/A)} < 15{,}000 \text{ dpm/100 cm}^2 \qquad \text{Equation (2)}$$

where:

X = the minimum count rate in cpm that must be observed on the ratemeter to ensure compliance with the maximum surface contamination criteria of 15,000 dpm/100 cm^2

B_R = the background count rate over the entire detector volume - 250 cpm

E = detector efficiency in cpm/dpm = 0.2 cpm/dpm as modified for 2% enrichment (see response to comment 2.3.3)

A = active probe area in cm^2 = 425 cm^2

Input of the aforementioned parameters yields a minimum count rate (X) of 706 cpm. It is obvious from the aforementioned inequality, that as the surface area of a detector increases, the dilution is increased. At such point where the minimum count rate is indistinguishable from detector background (over the entire volume) the detection system is inadequate to demonstrate compliance with the maximum surface contamination release criteria. Typical detector backgrounds for the entire volume ranges from 250-300 cpm, subsequently the target readout with the 43-37 system is audibly discernible.

1.3.3 Derivation of beta equivalency factor

Comment:

How do we derive the beta equivalency factor for our particular range of enrichment data?

Response:

As of 24 August, WESTON has received alpha spectrometry data on 17 out of 20 samples submitted. Based on the reported isotopic concentrations, enrichments for each sample were derived and averaged over the entire project (shown in Attachment 2). The average enrichments were calculated as follows: uranium-238 - (97.97 w%); uranium-235 - (2.01 w%); uranium-234 - (0.014 w%). Average enrichments were entered into a spreadsheet (shown as Table 3-1) to calculate the total alpha/beta emission ratio for natural uranium, enriched uranium at 2 w% uranium-235, and enriched uranium at 5 w% uranium-235.

Table 3.1 Relative Beta Emission Rate at Varying Uranium Enrichments

[redacted]	*Alpha Activity Fraction*	[redacted]	*Weighted Beta/Alpha Ratios*
	0.501		
	0.022		
			0.022
	0.477		
			0.477
			0.477
	1.00		0.976
	0.976		
	Alpha Activity Fraction		*Weighted Beta/Alpha Ratios*
	0.698		

[redacted]		[redacted]	0.035
	0.267		
			0.267
			0.267
	1.00		0.570
	0.570		
	Alpha Activity Fraction		***Weighted Beta/Alpha Ratios***
	0.878		
	0.030		
			0.030
	0.091		
			0.091
			0.091
	1.00		0.212
	0.212		

Natural uranium was selected as the "emission reference point" since WESTON proportional counters have been calibrated to plated natural uranium sources. The relative alpha and beta emission ratios for each enrichment as calculated using Table 3-1 methods are as shown in Table 3-2 below:

Table 3.2 Relative Emission and Efficiency Factors

[redacted]	***Relative Alpha Emission***	[redacted]	***Efficiency CF to U-nat***
	1.0		0.977
	1.0		0.570
	1.0		0.213

The primary instrument utilized in termination surface contamination surveys of concrete slabs and walls was a Ludlum Model 43-68 gas flow proportional counter coupled to a Ludlum Model 2350 Data Logger. The system provides a 100 cm^2 active probe area and is subject to a voltage plateau performed with a plated natural uranium source (voltage plateau included as Attachment 4).

As shown in Table 3-1 and 3-2, it is apparent that alpha and beta particles are emitted in approximately a 1:1 ratio from a natural uranium source. As the enrichment increases, the uranium-238 (and its daughter beta particles emitted by protactinium 234m[1] and thorium 234) are displaced by the pure alpha emitter, uranium-234. The overall effect is a lowering of the relative beta emission as the enrichment increases. Since the detectors were originally calibrated at relative beta emission of approximately 1, it is necessary to apply an efficiency correction factor (CF) to the detection efficiency as determined from the natural

[1] metastable radionuclides

[redacted]

uranium source. For instance, a gas flow proportional detector with an efficiency of 40% to natural uranium beta emissions must be multiplied by a CF of .570 if it is known that an area contained uranium at approximately 2% enrichment. The resulting decreased efficiency of 23% may result in a higher surv .y system MDA, and is considered in calculations of the following response to comment II.3.4.

In the beta voltage plateau region, the system is capable of detecting both alpha and beta radiations. As surfaces become irregular or coated with dusts, oils or other debris, the alpha response becomes more erratic and difficult to quantify. Although alpha particles are likely to contribute to the overall detection system response, no credit will be taken in the final quantification of surface contamination, resulting in a degree of conservatism in the termination surveys.

I.3.4 MDA of each counting system

Comment:

What are the MDA's of each counting system utilized to perform termination surveys?

Response:

The following MDA determinations are based on direct application of algorithms presented in NUREG/CR-5849. Variations from the: algorithms are identified and supported with technical discussion appropriate to the detector application.

Ludlum Model 2350 Data Logger/Model 43-68 Gas Flow Detector - 100 cm² active area

The MDA of the 43-68 system when used in integrating scaler mode is given by the equation:

$$MDA = \frac{2.71 + 4.65 * (B_R * t)^{0.5}}{t * E * A/100} \quad \text{Equation (3)}$$

where:

MDA = minimum detectable activity in dpm/100 cm^2

B_R = background count rate in cpm = 250 cpm

t = integrated count time in minutes = 1 min

E = detector efficiency in cpm/dpm = 0.2 cpm/dpm as modified for 2% enrichment

A = active probe area in cm^2 = 100 cm^2

Since the integrated measurement is being performed over a 1 square meter grid block, the integrated count time must be optimized to "project" the MDA as if the integrated count was a series of stationary measurements performed over the entire grid block. Solution of equation 3 for time given an input MDA of 5000 dpm/100 cm^2 yields a minimum count time of 0.01 minute assuming that the detector is held in a stationary position. Given that there are 100 elements of 100 cm^2 within a 1 meter square grid block, it follows that the minimum count time required to meet the MDA within one element must be multiplied by 100 if the detector surface area is 100 cm^2. Application of this multiple to the minimum count time for an element yields an integrated count time of 1 minute given the input parameters described above and a target MDA of 5000 dpm/100 cm^2 (total surface contamination release criteria). It should be noted that the input efficiency, E has been modified by the "beta sensitivity factor" to reflect the measurement of uranium at an enrichment of approximately 2 w%.The MDA of the 43-68 system when used in scanning ratemeter mode is given by the equation:

$$MDA = \frac{2 * B_R}{E * A/100} \quad \text{Equation (4)}$$

where:

MDA = minimum detectable activity in dpm/100 cm^2

B_R = background count rate in cpm = 250 cpm

E = detector efficiency in cpm/dpm = 0.2 cpm/dpm as modified for 2% enrichment

A = active probe area in cm^2 = 100 cm^2

The factor of 2 is estimated as the audible response factor given an approximate scanning speed of 2 cm per second.. Application of these input parameters yields an MDA of approximately 2500 dpm/100 cm^2 for ratemeter measurements. It should be noted that the input efficiency, E has been modified by the "beta sensitivity factor" to reflect the measurement of uranium at an enrichment of approximately 2 w%. When operated in scanning mode, this detection system is adequate to demonstrate compliance with the total surface contamination release criteria of 5000 dpm/100 cm^2 and maximum surface contamination release criteria of 5000 dpm/100 cm^2.

Ludlum Model 2350 Data Logger/Model 43-37 Gas Flow Floor Monitor - 425 cm^2 active area

The MDA of the 43-37 system when used in integrating scaler mode is given by the equation:

$$MDA = \frac{2.71 + 4.65 * (B_R * t)^{0.5}}{t * E * A/100} \quad \text{Equation (5)}$$

where:

MDA = minimum detectable activity in dpm/100 cm^2

B_R = background count rate in cpm = 300 cpm

t = integrated count time in minutes = 1 min

E = detector efficiency in cpm/dpm = 0.2 cpm/dpm as modified for 2% enrichment

A = active probe area in cm^2 = 425 cm^2

Since the integrated measurement is being performed over a 1 square meter grid block, the integrated count time must be optimized to "project" the MDA as if the integrated count was a series of stationary measurements performed over the entire grid block. Solution of equation 5 for time given an input MDA of 5000 dpm/100 cm^2 yields a minimum count time of 0.01 minute assuming that the detector is held in a stationary position. Given that there are 23.5 elements of 425 cm^2 within a 1 meter square grid block, it is evident that the minimum count time required to meet the MDA within one element must be multiplied by 23.5 if the detector surface area is 425 cm^2. Application of this multiple to the minimum count time for an element (0.00035 minute) yields an integrated count time of 0.0823 minute given the input parameters described above and a target MDA of 5000 dpm/100 cm^2 (total surface contamination release criteria). It should be noted that the input efficiency, E has been modified by the "beta sensitivity factor" to reflect the measurement of uranium at an enrichment of approximately 2 w%.

L4 Clarification of response to question #4 of NRC April 13 letter

Comment:

Regarding NRC's issue with TI's statement in the June 6 response that the beta equivalency factor is moot as it pertains to final termination surveys.

Response:

TI's comment was made under the premise that termination surveys would be based on total alpha measurements. Since current uranium enrichments (on average) allow the implementation of total beta measurements, TI retracts the comment and provides appropriate beta equivalency factor discussion in previous comment response. As uranium enrichments exceed 5%, a significantly lower beta emission intensity may warrant the reevaluation of total alpha contamination termination surveys.

ATTACHMENT 1

STANDARD OPERATING PROCEDURE APPROVAL

TEXAS INSTUMENTS ATTLEBORO SITE

ROY F. WESTON, INC.

TITLE: Gross Alpha Counting of Concrete and Soil With Large Area Alpha Detector (Ludlum Model 43-1)

SOP #: 13.0

DATE: July 31, 1995

AUTHOR:	DATE:
REVIEWED BY: Mark Madson	DATE: 7-31-95

STANDARD OPERATING PROCEDURE 13.0
GROSS ALPHA COUNTING OF CONCRETE AND SOIL WITH LARGE AREA ALPHA DETECTOR (LUDLUM MODEL 43-1)

TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0 PURPOSE

To describe the rapid field counting method to count concrete and soil samples from archives, decontamination and decommissioning (D&D) areas within Buildings 4, 5, and 10, and exterior remediation sites at the Texas Instruments Incorporated Attleboro Facility. Gross alpha activity analyses will be performed using the Ludlum Model 43-1 large area alpha detector and Ludlum Model 2000 scaler (or equivalent).

2.0 DISCUSSION

Prompt field assays for total uranium concentration in soil samples will be performed on-site using a gross alpha counting technique. The sample is ground, sieved, and placed in an open-face 3-inch diameter petri dish. To maintain a fixed, repeatable counting geometry, the petri dish is counted in an aluminum well jig. The sample is counted using a Ludlum Model 43-1 alpha scintillator and a Ludlum Model 2000 scaler (or equivalent). Count times will be specified by the Site Health Physicist, based on counting statistics and associated parameters.

Alpha counts registered by the counting system are the result of alpha particle emissions within the top few microns across the area of the sample. The overall thickness or weight of the sample does not impact the sample count rate above 10. Thorough sample grinding, homogenization, and sieving ensures that even the small mass in this thin top layer yields a count rate representative of the entire sample.

Resulting gross alpha count rates of concrete and soil samples will be compared with total uranium concentration analyses as determined by a commercial laboratory. Both data sets will be used to develop a correlation between gross alpha count rates and total uranium concentration. This will allow soil samples to be field assayed for their total uranium concentration.

2.1 Associated Procedures

SOP 10.0	Function Check of Portable and Stationary Radiation Detection Instrumentation
SOP 26.0	Use of Bico Chipmunk Crusher

3.0 PROCEDURE

3.1 Concrete Sample Preparation

A. Obtain all concrete samples after crushing per SOP 26.0.

B. Place each sample bag in plastic-lined work tray.

C. Tare petri dish to be used for sifted sample.

D. Using plastic spoon, sift concrete through strainer into 3-inch diameter plastic petri dish. The strainer allows sieving to approximately 0.625 inch.

E. Return larger pieces to sample bag.

F. Using small spatula or similar object, smooth and pack sample into petri dish. Add additional sifted material to result in a flat surface flush with the edge of the petri dish.

G. Weigh filled petri dish and record mass on Appendix 4.1.

H. Label petri dish lid with sample ID#, date weighed, and mass.

I. Decontaminate processing materials prior to reuse.

3.2 Counting System Preparation

A. Verify that the daily function check has been completed pci SOP 10.0.

B. Place a petri dish (bottom) in the counting jig and verify that the top edge of the dish is just even with the detector ledge of the jig. If not, adjust the height of the petri dish by changing the number of spacers (washers) under it.

3.3 Counting

A. Place a petri dish containing a soil sample in the counting jig.

B. Place the Ludium 43-1 detector into the counting jig.

C. Set the count time to 10 minutes, or other time as specified by the Site Health Physicist (SHP).

D. Verify that the scaler WINDOW is "out" if the scaler is so equipped.

E. Start the count by pressing the COUNT button.

F. Enter the count date, operator's initials, and background counts on the FIELD SOIL SCREENING DATA FORM.

G. When the count is complete, enter the gross alpha counts on the FIELD SOIL SCREENING DATA FORM.

H. Calculate the soil concentration of uranium by using the linear regression equation, and enter the result on the FIELD SOIL SCREENING DATA FORM.

4.0 APPENDICES

4.1 Gross Alpha Sample Analysis

APPENDIX 4.1

GROSS ALPHA SAMPLE ANALYSIS FORM

Note: Use only one form per day

COUNTER INFORMATION

Scaler Model No.	Detector Model No.
Seriel No.	Serial No.
Efficiency (cpm/dpm)	

DAILY BACKGROUND COUNT INFORMATION

Count Time (min.):
Gross Count:
Count Rate (cpm):

SAMPLE INFORMATION

Sample ID	Sample Mass (g)	Count Time (min)	Gross Counts	Net Counts (cpm)	Correlation Concentration (pCi/g)	Initial

Reviewed By:	Date:

STANDARD OPERATING PROCEDURE APPROVAL

TEXAS INSTUMENTS ATTLEBORO SITE

ROY F. WESTON, INC.

TITLE: Use of the Bico Chipmunk Crusher

SOP #: 26.0

DATE: June 30, 1995

AUTHOR: Jeffrey A Slater	DATE: 7/10/95
REVIEWED BY: Michael Madonia	DATE: 7-10-95

STANDARD OPERATING PROCEDURE 26.0
USE OF THE BICO CHIPMUNK CRUSHER

TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0 PURPOSE

This procedure provides the necessary guidance to safely operate the Bico Chipmunk Crusher so that concrete samples may be processed for counting. This procedure describes sample processing during interior building decontamination and decommissioning (D&D) activities at the Texas Instruments Incorporated (TI) Attleboro Facility.

2.0 DISCUSSION

The Chipmunk crusher is an electrically driven device designed to break up small pieces of concrete into various sizes. The concrete crusher is to be used only to process concrete samples taken from cores and waste slabs from decontamination activities.

2.1 Related Procedures

11.0 Removable Alpha Contamination Measurements

3.0 PROCEDURE

3.1 Non-contaminated or Background Samples

Background samples or concrete cores collected from work areas that have been frisked and determined to have contamination levels less than the minimum detectable activity (MDA) of the monitoring equipment.

A. Plug in the concrete crusher to the 220 volt single phase cord running from the bottom of the command trailer.

B. It may be necessary to turn off the air conditioners in the trailer to prevent tripping the fuse at the fuse box. If the crusher does not operate it is possible the fuse needs to be reset.

C. All personnel operating the crusher are required to wear safety glasses.

D. Check to ensure that the crushing plates are not touching before switching the machine on. The adjustment knob for the crusher plates is located on the right front side of the crusher.

E. The machine is activated by flipping the switch on the control box located at the end of a 6 ft. blue cord running from the rear of the crusher. Turn the crusher on for one minute to ensure proper operation.

F. Once the crusher has been tested, place the sample between the crusher plates and move away as far as the switch cord will allow. Activate the switch and allow approximately 30-60 seconds for the machine to crush the core.

G. Switch off the crusher and allow the plates to stop completely before approaching the machine.

H. Check the crusher plates to ensure that the entire sample has been processed. If the sample has been processed completely remove the tray from below the crusher plates. If the sample has not been completely processed, repeat beginning at step E.

I. Remove the sample by pouring the soil back into the original sample bag.

J. After each use, decontaminate the crush plates by dry wiping the surfaces. The crush plates should be wiped with a cotton pom-pom to avoid accidental crushing of fingers. Residual debris may be cleaned with a deionized water rinse. All rinse water must be containerized.

K. Record sample ID number on Appendix 5.1 Sample Crushing Form. Complete other entries.

L. Collect a removable alpha contamination smear for every 10th sample crushed. The smear should be collected and analyzed per SOP 11.0. Should removable alpha contamination be detected, contact the Site Health Physicist (SHP).

3.2 Contaminated Samples

Any sample exhibiting a gross counting response of greater than 2x background as measured with a pancake GM detector will be marked as "contaminated material". Crushing procedure steps A-K as defined in Section 3.1 are applicable, with the exception that the top of the crusher must be covered with plastic sheeting to limit potential airborne dispersion of contaminants. Additional procedural steps are as follows.

A. Collect a removable alpha contamination smear for every sample crushed. The smear should be collected and analyzed per SOP 11.0, prior to crushing additional samples.

B. Ensure that plastic sheeting is not contaminated. Perform smears and surface contamination measurements where necessary.

4.0 POST OPERATION

At the end of the day after the crusher has been decontaminated, unplug the machine and cover with the tarp provided. Store the plug end of the cord under the trailer to prevent infiltration of moisture.

5.0 APPENDICES

5.1 Sample Crushing Log

Appendix 5.1

Sample Crushing Form

# of Samples Crushed	Date	Sample #	Sample Depth	Hot Sample (YorN)	Swipe Taken (YorN)	Swipe Count (cpm)	Initials
1							
2							
3							
4							
5							
6							
7							
8							
9							
10					Y		
11							
12							
13							
14							
15							
16							
17							
18							
19							
20					Y		
21							
22							
23							
24							
25							
26							
27							
28							
29							
30					Y		

Reviewed by: Date:

ATTACHMENT 2

SAMPLE CORRELATION INPUT DATA SUMMARY/ANALYTICAL DATA SUMMARY

U-238 Specific Activity (pCi/ug) **0.33866**
U-235 Specific Activity (pCi/ug) **2.17806**
U-234 Specific Activity (pCi/ug) **6287.86**

Sample ID#	Date Collected	Abbrev	Net Count	Total U (ug/g)	ISO U-238 (pCi/g)	U-238 w%	ISO U-235 (pCi/g)	U-235 w%	ISO U-234 (pCi/g)	U-234 w%	Total Act. (pCi/g)	Uranium enrichment	Location
0707-01-4B-SC-03-06-00 (3-6")	21-Jul-95	TI-001		11.4	1.5	99.99533	0	0	1.3	0.0047	2.8	natural	Caged Area
0707-01-4B-SC-03-06-00 (3-6")	9-Aug-95	TI-001		2.4	1.4	99.00571	0.09	0.9893	1.3	0.006	2.79	natural	Caged Area
0706-04-3C-SC-01-06-00 (0-3")	21-Jul-95	TI-002		2.5									Caged Area
0706-03-3C-SC-02-06-00 (0-3"0	21-Jul-95	TI-003		2.5									Caged Area
0712-04-4C-BS-00-I (0-3")	21-Jul-95	TI-004		6.8	5.9	96.66511	1.3	3.3106	27.3	0.0241	34.5	enriched	Caged Area
0712-04-3C-BS-00-0 (0-3")	21-Jul-95	TI-005		104									Caged Area
0712-04-3C-BS-00-0 (0-3")	9-Aug-95	TI-005		356.2	203	99.6164	5	0.3814	83.5	0.0022	291.5	depleted	Caged Area
0712-04-3C-BS-00-0 (0-3") DUP	21-Jul-95	TI-013		144.9									Caged Area
0707-04-4C-SC-03-06-00 (0-3")	21-Jul-95	TI-006		2.2									Caged Area
0707-04-4C-SC-02-06-00 (0-3")	21-Jul-95	TI-007		2.5									Caged Area
0712-04-3C-BS-00-P (0-3")	21-Jul-95	TI-008		2.8									Caged Area
0707-04-4C-SC-01-06-00 (0-3")	21-Jul-95	TI-009		2	0.78	98.81383	0.06	1.1815	0.68	0.0046	1.52	natural	Caged Area
0706-07-8C-BS-SPR-SW1 (0-3")	21-Jul-95	TI-010		4.1									Screen Print
0706-07-8C-BS-SPR-SW1 (0-3")	9-Aug-95	TI-010		7	3.8	91.96603	2	7.9439	49.5	0.0881	55.1	enriched	Screen Print
0712-01-4B-BS-00-G (0-3")	21-Jul-95	TI-011		2.4									Caged Area
0712-01-3B-BS-00-D (0-3")	21-Jul-95	TI-012		24.1	17.2	94.46547	6.4	5.4956	131.7	0.039	155.3	enriched	Caged Area
0714-04-4D-SC-02-06-00 (0-3")	21-Jul-95	TI-014		81.7									Caged Area
0714-04-4D-SC-02-06-00 (0-3")	9-Aug-95	TI-014		469.8	288.8	99.76264	4.4	0.2363	89.1	0.0011	382.3	depleted	Caged Area
0712-07-8B-BS-00-A	21-Jul-95	TI-015		304.5	95.2	99.52695	2.9	0.4713	31.5	0.0018	129.6	depleted	Screen Print
0712-01-3B-BS-00-D (3-6")	21-Jul-95	TI-016		34.2	12.9	93.95209	5.3	6.0002	121.7	0.0477	139.9	enriched	Caged Area
Background North 1 (0-3")	9-Aug-95	TI-017		2.2	1.8	99.30916	0.06	0.6861	1.6	0.0048	3.46	natural	Background
0706-01-4B-BSS-NORTH	9-Aug-95	TI-018		3.5	1.8	97.13969	0.34	2.8622	2.8	0.0081	4.94	enriched	Caged Area
0728-07-8B-BSS-WALL	9-Aug-95	TI-019		82.9	58.1	99.57264	1.6	0.4262	12.1	0.0011	71.8	depleted	Screen Print
0728-07-8B-BSS-PIPE	9-Aug-95	TI-020		7.9	4.9	99.52129	0.15	0.4736	4.7	0.0051	9.75	natural	Screen Print
0728-07-8B-SS-01-06-00	9-Aug-95	TI-021		4.1	2.6	98.81275	0.2	1.1815	2.8	0.0057	5.6	enriched	Screen Print
0807-01-3B-BSS-00-NE	9-Aug-95	TI-022		3.1	1.5	98.16468	0.18	1.8311	1.2	0.0042	2.88	enriched	Caged Area
0809-04-3C-BSS-00-BEAM	9-Aug-95	TI-024		4.7	3.6	99.1746	0.19	0.8136	7.8	0.0118	11.59	natural	Caged Area
0815-04-4C-BSS-01-CI-PIPEIN	18-Aug-95	TI-025		7.5	624.7	67.47122	1920	32.236	50600	0.2943	53144.7	enriched	Caged Area
0815-04-4C-BSS-00-VC-PIPEIN	18-Aug-95	TI-026		783.2	529.2	98.45786	53	1.5328	935.5	0.0094	1517.7	enriched	Caged Area
0817-04-4C-BSS-SOIL-OUT	18-Aug-95	TI-027		1833	3839	88.86953	3068	11.042	54660	0.0881	61567	enriched	Caged Area
0817-04-3C-SS-04-06-00	18-Aug-95	TI-028		2.8									Caged Area
0817-04-3C-SS-02-06-00	18-Aug-95	TI-029		4.3									Caged Area
0817-04-3C-SS-01-06-00	18-Aug-95	TI-030		3.1									Caged Area
0817-04-3C-SS-03-06-00	18-Aug-95	TI-031		2.8									Caged Area
0817-04-4D-SS-02-06-00	18-Aug-95	TI-032		4.8									Caged Area
0817-04-4D-SS-01-06-00	18-Aug-95	TI-033		4.3									Caged Area

Tot	Mean	Tot	Mean	Tot	Mean
1920.34	112.86	79.05	4.65	0.61	0.04

ATTACHMENT 3

Alpha Soil Screening Correlation Analysis

ALL DATA

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-001	SC	3.4	2.8
TI-001	SC	3.4	2.79
TI-004	BS	4.2	34.5
TI-005	BS	5.2	291.5
TI-009	SC	4.3	1.52
TI-010	BS	4.3	55.1
TI-012	BS	12	155.3
TI-014	SC	9.8	352.3
TI-015	BS	15.6	129.6
TI-016	BS	11.2	139.9
TI-017	BKG	3.4	3.48
TI-018	BSS	8.4	4.94
TI-019	BSS	8.1	71.8
TI-020	BSS	3.8	9.75
TI-021	SS	5.7	5.6
TI-022	BSS	8.6	2.88
TI-024	BSS	5.9	11.59
TI-002	SC	4.8	
TI-003	SC	4	
TI-006	SC	6.1	
TI-007	SC	4.7	
TI-008	BS	4.7	
TI-011	BS	5.1	
TI-013	BS	6.8	

Regression Output:		
Constant		5.7
Std Err of Y Est		3.3086843
R Squared		0.2093082
No. of Observations		17
Degrees of Freedom		1
X Coefficient(s)	0.01538695	
Std Err of Coef.	0.007721781	

ATTACHMENT 3

CONCRETE

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-001	SC	3.4	2.8
TI-017	BKG	3.4	3.48
TI-004	BS	4.2	34.5
TI-009	SC	4.3	1.52
TI-010	BS	4.3	55.1
TI-005	BS	5.2	29[illegible]5
TI-014	SC	9.8	352.3
TI-016	BS	11.2	139.9
TI-012	BS	12	155.3
TI-015	BS	15.6	129.6

Regression Output:		
Constant		21.237674
Std Err of Y Est		116.37784
R Squared		0.214093
No. of Observations		10
Degrees of Freedom		8
X Coefficient(s)	12.99214247	
Std Err of Coef	8.800758378	

SOIL

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-020	BSS	3.8	9.75
TI-021	SS	5.7	5.6
TI-024	BSS	5.9	11.59
TI-019	BSS	8.1	71.8
TI-018	BSS	8.4	4.94
TI-022	BSS	8.6	2.88

Regression Output:		
Constant		-6.296569
Std Err of Y Est		28.815214
R Squared		0.0660587
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	3.563936199	
Std Err of Coef.	6.700306596	

CAGED AREA

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-001	SC	3.4	2.8
TI-004	BS	4.2	34.5
TI-009	SC	4.3	1.52
TI-005	BS	5.2	291.5
TI-024	BSS	5.9	11.59
TI-022	BSS	8.6	2.88
TI-016	BS	11.2	139.9
TI-012	BS	12	155.3

Regression Output:		
Constant		7.8906211
Std Err of Y Est		108.17608
R Squared		0.1090587
No. of Observations		8
Degrees of Freedom		6
X Coefficient(s)	10.52673414	
Std Err of Coef.	12.28322293	

SCREEN PRINT

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-010	BS	4.3	55.1
TI-015	BS	15.6	129.6
TI-018	BSS	8.4	4.94
TI-019	BSS	8.1	71.8
TI-020	BSS	3.8	9.75
TI-021	SS	5.7	5.6

Regression Output:		
Constant		-21.81789
Std Err of Y Est		35.241674
R Squared		0.5983733
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	8.882294942	
Std Err of Coef.	3.63848331	

ATTACHMENT 3

ENRICHED URANIUM

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-004	BS	4.2	34.5
TI-010	BS	4.3	55.1
TI-021	SS	5.7	5.6
TI-018	BSS	8.4	4.94
TI-022	BSS	8.6	2.88
TI-016	BS	11.2	139.9
TI-012	BS	12	155.3

Regression Output:		
Constant		-49.09927
Std Err of Y Est		53.293262
R Squared		0.439283
No. of Observations		7
Degrees of Freedom		5
X Coefficient(s)	13.63814187	
Std Err of Coef.	6.890803155	

NATURAL/DEPLETED URANIUM

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-001	SC	3.4	2.8
TI-017	BKG	3.4	3.48
TI-020	BSS	3.8	9.75
TI-009	SC	4.3	1.52
TI-005	BS	5.2	291.5
TI-024	BSS	5.9	11.59
TI-019	BSS	8.1	71.8
TI-014	SC	9.8	352.3
TI-015	BS	15.6	129.6

Regression Output:		
Constant		-1.068932
Std Err of Y Est		129.70079
R Squared		0.1953774
No. of Observations		9
Degrees of Freedom		7
X Coefficient(s)	14.85647718	
Std Err of Coef.	11.3953001	

CODE BS

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-004	BS	4.2	34.5
TI-010	BS	4.3	55.1
TI-005	BS	5.2	291.5
TI-016	BS	11.2	139.9
TI-012	BS	12	155.3
TI-015	BS	15.6	129.6

Regression Output:		
Constant		111.93454
Std Err of Y Est		100.84155
R Squared		0.0184102
No. of Observations		6
Degrees of Freedom		4
X Coefficient(s)	2.557957031	
Std Err of Coef.	9.338981957	

CODE BSS

Abbrev. Sample #	Code	Gross Alpha (cpm)	Total Acitivity (pCi/g)
TI-020	BSS	3.8	9.75
TI-024	BSS	5.9	11.59
TI-019	BSS	8.1	71.8
TI-018	BSS	8.4	4.94
TI-022	BSS	8.6	2.88

Regression Output:		
Constant		-0.31406
Std Err of Y Est		32.810986
R Squared		0.0441176
No. of Observations		5
Degrees of Freedom		3
X Coefficient(s)	2.946273003	
Std Err of Coef.	7.917878536	

ATTACHMENT 4

CERTIFICATE OF CALIBRATION

WESTON
MANAGERS DESIGNERS CONSULTANTS

6501 AMERICAS PARKWAY, N.E.
SUITE 800
ALBUQUERQUE, NM 87110-1617
505-884-5050 • FAX: 505-884-5388

BENCH TEST DATA FOR DETECTOR LUDLUM 43-68 **S/N** 076100

CUSTOMER : ______ **Work Order No.** ______

Counter DATA LOGGER LUDLUM 2350 **S/N** 98641 **Distance–Source to Detector** 3/8"

Count Time 1 min **Counter Mode** SCL **Counter Input Sensitivity** ______

Comments SUPPLEMENT PLATEAU W/ UNAT SOURCE @2120 DPM S/N 9[illegible] 47[illegible]

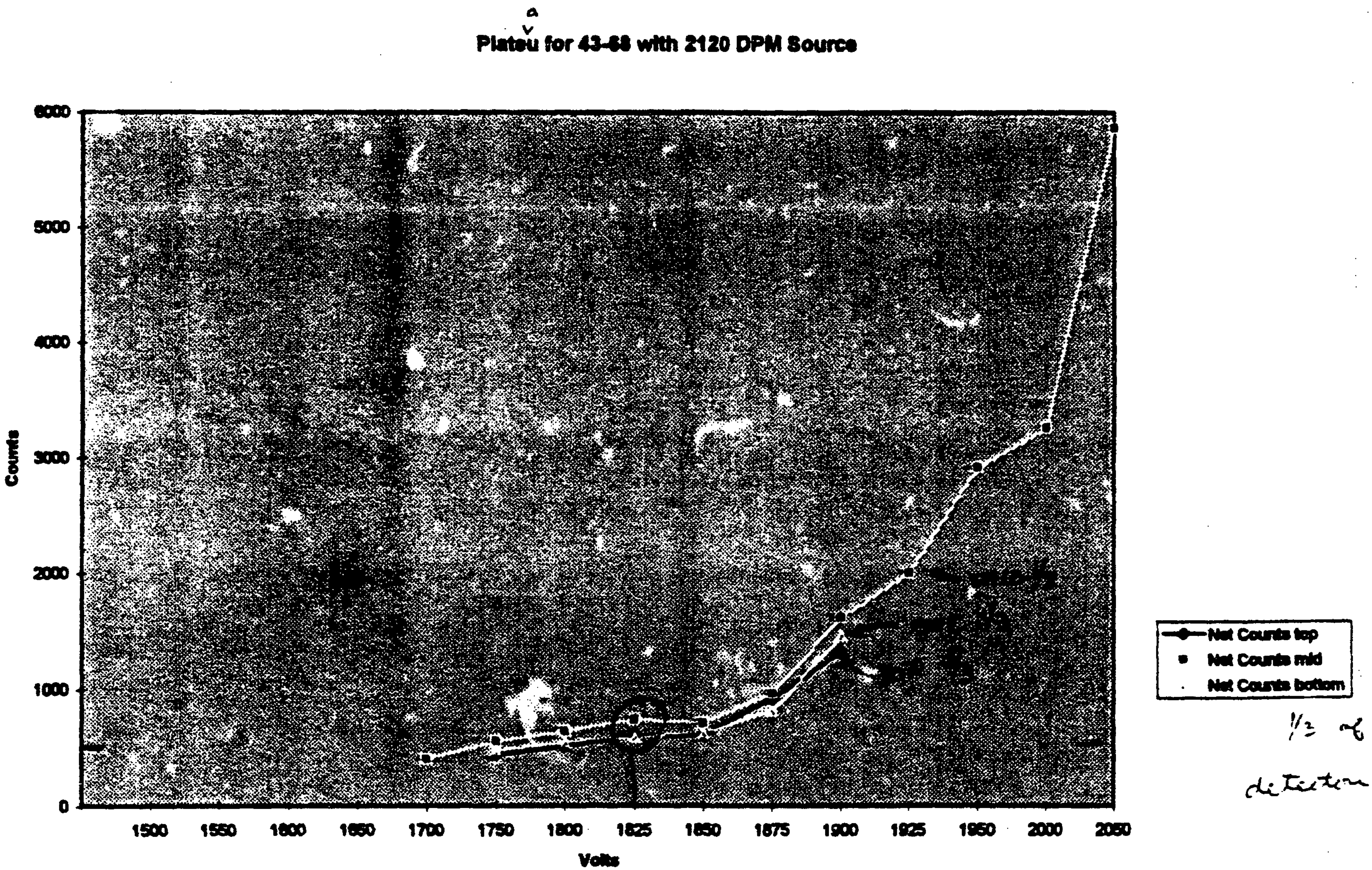
High Voltage (V) Plateau	Background Counts	Source S/N, Isotope (TOP), Activity — Gross Counts	Source S/N, Isotope (MID), Activity — Gross Counts	Source S/N, Isotope (BOTTOM), Activity — Gross Counts
1700	93		500	
1800	168	613	730	651
1825	273	792	917	870
1850	270	881	1012	933
1875	301	917	1014	1103
1900	290	1209	1253	1818
1925	360	1675	1473	

Detector Operating Voltage 1825 V **Detector Efficiency** 30.7% **for** U NAT

Date 7/27/95 **Bench Test Performed by** CHUCK FARR (Print) **Signature** Chuck Farr

Calibration Due 2/27/96 **Quality Control Review** [signature]

Ludlum Model 43-68 with Ludlum Datalogger 2350								
U-Nat Source 95U @ 2120 DPM								
Voltage	Bkg		Counts		Voltage		Net Counts	
		top	mid	bottom		top	mid	bottom
1500	2				1500			
1550	7				1550			
1600	21				1600			
1650	50				1650			
1700	93		500		1700		407	
1750	168	613	730	651	1750	445	562	483
1800	273	792	917	823	1800	519	644	550
1825	270	881	1012	870	1825	611	742	600
1850	301	917	1014	933	1850	616	713	632
1875	290	1209	1253	1103	1875	919	963	813
1900	360	1675	1973	1818	1900	1315	1613	1458
1925	418		2420		1925		2002	
1950	420		3335		1950		2915	
2000	1049		4303		2000		3254	
2050	2025		7892		2050		5867	
		Efficiecy =	0.307075					
		At 1825 Volts						


Plateu for 43-68 with 2120 DPM Source
a
Counts
Volts
0
1000
2000
3000
4000
5000
6000
1500
1550
1600
1650
1700
1750
1800
1825
1850
1875
1900
1925
1950
2000
2050
Net Counts top
Net Counts mid
Net Counts bottom
1/2 of
detection

CERTIFICATE OF CALIBRATION

WESTON
MANAGERS DESIGNERS CONSULTANTS
6501 AMERICAS PARKWAY, N.E.
SUITE 800
ALBUQUERQUE, NM 87110-1517
505-884-5050 • FAX: 505-884-5388

BENCH TEST DATA FOR DETECTOR LUDLUM 43-37 **S/N** PR 124946

CUSTOMER : ______ **Work Order No.** ______

Counter LUDLUM DATA LOGGER 2350 **S/N** ERG 110-646 **Distance–Source to Detector** 1/4" - 1/2"

Count Time 1 MINUTE **Counter Mode** SCL **Counter Input Sensitivity** ______

Comments SOURCE UNAT @ 2120 DPM S/N 95-U4700365-4

High Voltage (V) Plateau	Background Counts	Source S/N Isotope (LEFT) Activity Gross Counts	Source S/N Isotope (MIDDLE) Activity Gross Counts	Source S/N Isotope (RIGHT) Activity Gross Counts
1500	4	270	309	
1550	5	307	282	
1600	16	346	335	
1650	59	470	451	
1675	102	536	504	
1700	146	584	596	
1725	208	681	650	
1750	264	792	813	
1775	385	940	956	
1800	533	1117	1155	
1825	685	1302	1411	
1850	897	1728	1773	
1875	1084	1842	1930	
1900	1119	1998	2041	

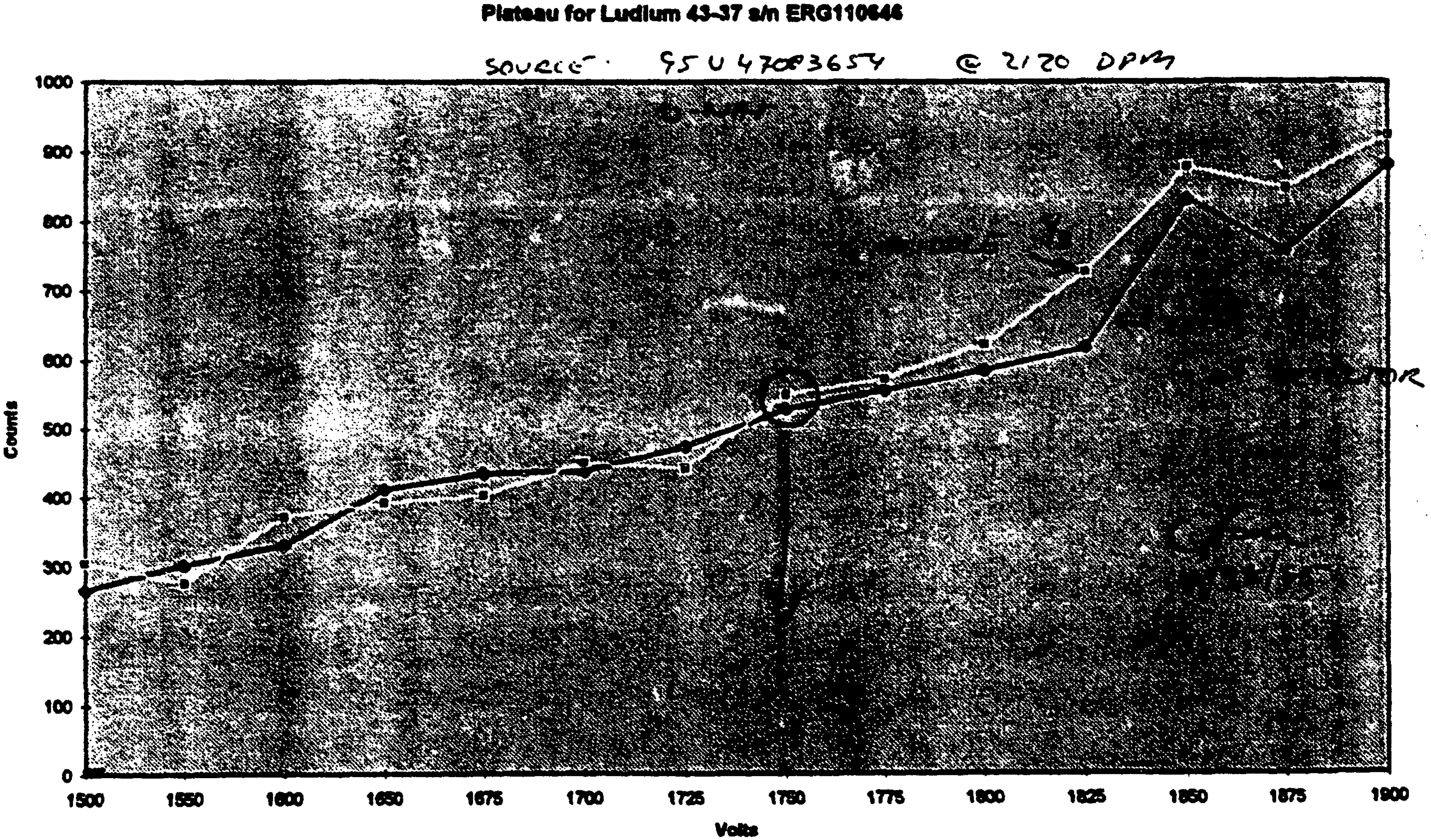
Detector Operating Voltage 1750 V **Detector Efficiency** 25.4 % **for** U-NAT

Date 7/28/95 **Bench Test Performed by** CHUCK FARR (Print) **Signature** [signature]

Calibration Due 2/28/96 **Quality Control Review** [signature]

Plateu for Ludlum 43-37 S/N: PR124946								
Source: U-Nat @ 2120 DPM S/N: 95U47003654								
Voltage	Bkg	Gross Counts			Voltage	Net Counts		
		left	middle	right		left	middle	right
1500	4	270	309		1500	266	305	-4
1550	5	307	282		1550	302	277	-5
1600	16	346	388		1600	330	372	-16
1650	59	470	451		1650	411	392	-59
1675	102	536	504		1675	434	402	-102
1700	146	584	596		1700	438	450	-146
1725	208	681	650		1725	473	442	-208
1750	264	792	813		1750	528	549	-264
1775	385	940	956		1775	555	571	-385
1800	533	1117	1155		1800	584	622	-533
1825	685	1302	1411		1825	617	726	-685
1850	897	1728	1773		1850	831	876	-897
1875	1084	1842	1930		1875	758	846	-1084
1900	1119	1998	2041		1900	879	922	-1119

Sheet1 Chart 1



RESPONSE TO NRC

OBSERVATIONS AND COMMENTS

EXTERIOR PROJECT

II. EXTERIOR REMEDIATION PROJECT RESPONSES

II.1 Gross Alpha Analytical Screening Technique

Comment:

Describe the analytical methodology for both interior and the exterior projects.

Response:

Exterior Project Analytical Methodology

The exterior project is utilizing a variation of the alpha soil screening protocol that was utilized during the TI facility supplemental radiological survey study that is included as Appendix C of the Supplemental Radiological Survey Plan December 1994. The analytical instrumentation utilized for the current (1995) remediation detects alpha radiation by the same theory as the previous (1994) system, but is set up in a different geometry. The previous detection system methodology utilizes ZnS (Ag) in direct contact with the soil in a petri dish. The petri dish is then placed on top of a photomultiplier tube in a light tight container and then counted. The current counting system utilizes an alpha scintillation detector (Ludlum Model 43-1) that contains a 83 cm^2 mylar window with an active area of 75 cm^2, a ZnS (Ag) layer, a light pipe, and a photomultiplier tube housed in a light tight probe. A schematic of the probe is included as Attachment 1.

Soil samples are collected and processed according to SOP 29.0 (Attachment 2). After processing, the samples are placed in a sample holder directly under the Ludlum 43-1 probe and counted for 10 minutes according to SOP 30.0 (Attachment 3).

Comment:

Describe how the correlation was derived between the Alpha Spec. and the Gross Alpha Counting.

Response:

The field gross alpha counting system was correlated to known analytical results from an outside analytical laboratory. Twelve archive samples from the 1994 Supplemental Radiological Survey Study were split and sent to an outside laboratory for isotopic uranium analysis. The sample isotopic results were summed for total uranium activity which ranged from 3.01 pCi/g to 60.7 pCi/g. The splits from these samples were processed according to SOP 29.0 and counted eight times according to SOP 30.0. The counting results are provided as Attachment 4. The average gross counts/10 minutes were then correlated with the offsite analytical results through a linear regression. The results of the linear regression are provided as Attachment 5. The slope of this comparison provided a calibration factor for conversion of counts/10 minutes to pCi/g.

Comment:

Describe sample preparation and sample counting. (Counting should include QA protocols.)

Response:

Sample preparation is described in SOP 29.0 and sample counting is described in SOP 30.0. QA protocols are included in SOP 10.0 (Attachment 6) and are also provided by Section 8.0, "Quality Assurance Program" of the Exterior Remediation Project Plan (Attachment 7).

II.2 Activities to ensure compliance in areas outside sample collection locations.

Comment:

How does WESTON ensure that soils or surfaces within a grid cell, but not one of the sampled locations meet the release criteria?

Response:

WESTON is currently utilizing Ludlum 44-9 GM-pancake probes to scan 100% of each grid area including excavation walls during remediation as discussed in SOP 35.0 (see Attachment 8). Excavation walls are surveyed utilizing Ludlum 44-40, shielded GM-pancake probes and with Ludlum 44-1, Beta Scintillator Probes to ensure that changes in geometry and the influence of Compton scattered gamma-rays from surrounding soils are minimized. These instruments have an advantage over the Ludlum 44-9 for delineating false anomalies that could be interpreted as contaminated soils. In some cases when the technicians can not determine if wall contamination is present, a biased wall sample is collected, processed, and analyzed using the gross alpha field screening technique.

In order to establish background for field survey instrumentation for remediation activities, direct background readings and samples were collected in unaffected areas at the TI site and in surrounding communities. The background locations are documented and described in WESTON logbook #455. Results are as follows;

Background Location #	Ludlum 44-9 GM-Pancake (cpm) (*)	Ludlum 44-1 Beta Scint. (cpm)	Ludlum 43-1 Alpha Scint. Gross Alpha (cnts/10 min.)	Gross Alpha Screen. (pCi/g)
1	65-70	56,61,54	72	12
2	60-70	68,60,77	60	7
3	70-90	50,62,52	52	2
4	40-60	60,68,58	41	<MDA
5	70-90	88,60,88	64	8
6	60-70	70,50,64	62	8
7	80-100	86,64,64	49	1

MDA = 16 pCi/g

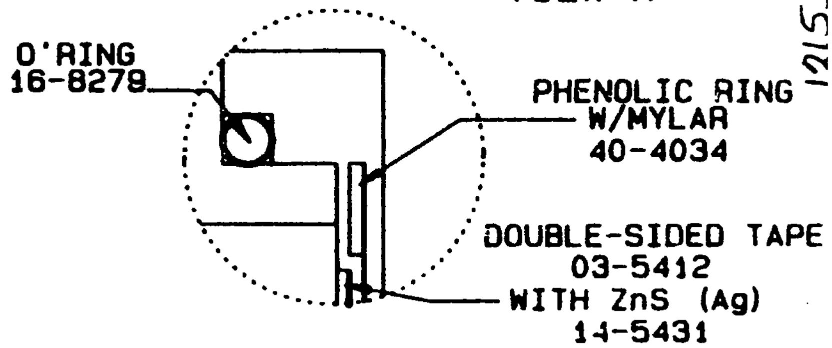
(*) The Ludlum 44-40 Shield GM-Pancake detector background is equal to the Ludlum 44-9 GM-Pancake detector.

When the HP technicians have determined by portable instrument surveys that 100% of the soil locations inside the grid are less than or equal to 2 times background, then preliminary verification sampling is initiated. The preliminary sampling protocol calls for the technicians to collect 13 soil samples inside each surveyed grid cell. These samples are

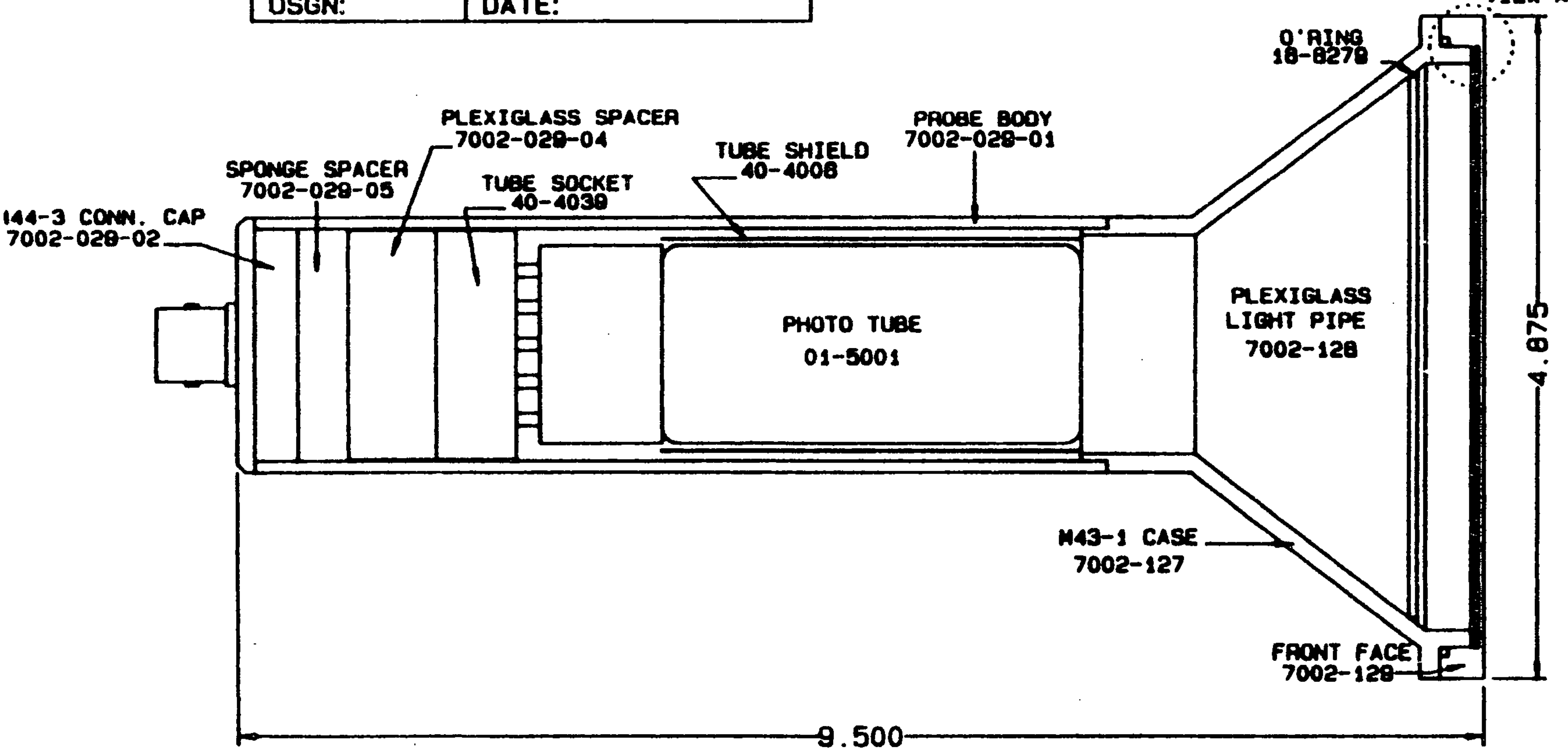
processed and counted utilizing the onsite gross alpha field screening system. Figure 4-5, page 4.18 of NUREG CR-5849 represents the sampling pattern utilized for the preliminary grid concentration check (see Attachment 9).

If field gross alpha screening results from the preliminary verification sampling average 30 pCi/g or less for the grid cell then verification sampling for that grid is implemented. The verification samples are collected in accordance with SOP 31.0 (Attachment 10) and a modified pattern of Figure 4-4, page 4.17 of NUREG CR-5849 (see Attachment 11). The verification pattern is slightly modified with the addition of one sample being collected at the center point of each grid. The five verification samples are then composited into one sample and sent to TMA/Eberline for isotopic uranium analysis. A split of this composite sample is archived for future reference.

121534



DESC: ASSEMBLY VIEW	
MODEL: 43-1	
PART #: 4002-237	
DWN: CLG	DATE: 7/17/90
DSGN:	DATE:



OFFICIAL RECORD COPY ML 10

CLG 7/17/90		
TOL:	SCALE: FULL	
TITLE M43-1 ALPHA SCINT. DETECTOR		
LUDLUM	2	172

LUDLUM MODEL 43-1 ALPHA SCINTILLATOR

1. GENERAL:

The Model 43-1 Alpha Scintillator is a large area Alpha detector with a 75 cm^2 active area. The large area detector is useful for radiation surveys and wipe test analysis.

2. SPECIFICATION:

WINDOW: 0.8 mg/cm^2 metalized mylar

WINDOW AREA: 75 cm^2 active area

EFFICIENCY: 60% of 2 pi emission for Pu-239

HIGH VOLTAGE: 500-1000 volts

SCINTILLATION MATERIAL: ZnS(Ag)

CONNECTOR: SERIES "C"; other connectors available upon request.

3. MAINTENANCE:

Malfunctions are normally due to either light leaks, a defective photomultiplier tube, contamination or high voltage not set properly. The malfunction caused by light holes gives an increase in Background count up to complete saturation, where the instrument may indicate zero counts.

It is important to make sure that the voltage to the detector is set properly by running a plateau and setting the operating point in the first third of the plateau, above the knee of the curve.

To check for a light leak, cover the window with an opaque material. If the instrument indicates a change in count after a few minutes, the source of the light can sometimes be determined by visual inspection of the window or by uncovering small areas of the window and looking for a change in count.

The photomultiplier tube rarely fails, but a tube malfunction can be isolated by insuring the instrument is not saturated due to light leaks and does not indicate any counts in a known radiation field.

4. **REPAIR/REPLACEMENT OF MYLAR WINDOW:** (Refer to drawing 2 x 172)

1. Remove the four screws from the front face of the detector.
2. Remove the front face from the body of the detector.
3. Carefully place the detector so as to not disturb the ZnS(Ag) on the face of the light pipe.
4. Remove mylar window from the detector face.
5. Check that o'ring on probe body is positioned properly.
6. Replace the mylar window so that phenolic ring is facing inward and centered on the light pipe. (Refer to 2 x 172).
7. Replace the detector front face and secure with the four screws. Check that the o'ring is properly positioned before tightening.
8. Wait approximately 20 minutes to check for detector response. If the instrument indicates zero counts, refer to the above steps on maintenance.
9. The detector should not be calibrated for at least 24 hours after window replacement to allow for light decay from the ZnS(Ag) scintillation properties.

5. **REPLACEMENT OF PHOTOMULTIPLIER TUBE:** (Refer to drawing 2 x 1/2)

1. Unfasten end connector cap- 4 screws.
2. Slowly remove end connector cap and pull out as far as wires will allow.
3. Remove ground and high voltage wires from end connector cap.
4. Remove foam sponge and plastic spacers.
5. To remove PMT- twist and firmly pull on tube socket.
6. Remove tube from tube socket.
7. Remove metallic shield.
8. Install new tube to tube socket.
9. Clean coupling grease from plexiglass light pipe.
10. Slide the metal shield over the tube and tape to tube socket.

11. Apply optical coupling grease (Dow Type 4) to the face of the tube. Use only that amount which when pressed firmly against the plexiglass will spread and cover the face of the tube. (Approximately 1/2 teaspoon).

12. Place the tube with socket into the probe body. Press unit firmly against the plexiglass with a little back and forth twisting movement. Do not pull out on the tube after pressing tube to plexiglass. This will cause air bubbles to form between the tube and plexiglass of the probe.

13. Install the plastic spacers, foam, and reconnect the HV and ground wires to the end cap.

14. Install end cap to complete final assembly.

Attachment 2

Texas Instruments SOP 29.0

Preparation of Soil Samples for Gross Alpha Counting

STANDARD OPERATING PROCEDURE 29.0
PREPARATION OF SOIL SAMPLES FOR GROSS ALPHA COUNTING WITH LARGE AREA ALPHA DETECTOR (LUDLUM MODEL 43-1)

TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0 PURPOSE

To specify the steps required to prepare soil samples from sample archives, decontamination and decommissioning (D&D) areas within Buildings 4, 5, and 10, and the exterior remediation activities at the Texas Instruments (TI) Attleboro Facility for gross alpha activity analysis using the Ludlum Model 43-1 large area alpha detector and Ludlum Model 2000 scaler (or equivalent).

2.0 DISCUSSION

Prompt field assays for total uranium concentration in soil samples will be performed using a gross alpha counting technique in an on-site field trailer. The sample is ground, sieved, and placed in an open-face 3-inch diameter petri dish. To maintain a fixed, repeatable counting geometry, the petri dish is counted in an aluminum counting jig. The sample is counted using a Ludlum Model 43-1 alpha scintillator and a Ludlum Model 2000 scaler (or equivalent). Count times will be specified by the Site Health Physicist, based on counting statistics and associated parameters.

Alpha counts registered by the counting system are the result of alpha particle emissions within the top few microns of the sample, so the overall thickness of the sample does not impact the sample count rate. Thorough sample grinding and homogenization ensures that even the small mass in this thin top layer yields a count rate representative of the entire sample.

The gross alpha counts of soil samples from the sample archive will be compared with total uranium concentration analyses and isotopic uranium analyses of the same samples at a commercial laboratory to develop a correlation between gross alpha counts and total uranium concentration. This will allow soil samples to be field assayed for their total uranium concentration.

3.0 PROCEDURE

3.1 MICROWAVE DRYING

A. Clean two (2) glass drying dishes, the stainless steel mixing bowl,

and the stainless steel spoon.

B. Empty the entire sample container into the stainless steel mixing bowl and thoroughly homogenize the material using the stainless steel spoon.

C. Transfer approximately 100 grams of homogenized sample to each of the glass drying dishes using the stainless steel spoon. Transfer the remaining sample back into the original sample container.

D. Place the filled glass drying dishes in the microwave oven and dry at the high power setting for 6 to 8 minutes.

E. Remove drying dishes from microwave oven. **CAUTION! the dishes may be hot!**

F. Dump the sample from the drying dishes into a clean mortar and pestal and grind until all clods are broken up and soil is of nearly uniform grain size.

G. Mark the sample number on both the top and bottom of a clean petri dish and tare the balance with the petri dish (top and bottom).

H. Pour the ground sample from the mortar in to a sieve and sieve the sample into a clean pan. Use care to avoid creating dust. Transfer the oversize portion back into the original sample container.

I. Transfer sieved sample into the marked petri dish, lightly packing with a stainless steel spatula. Use a straight edge of the same spatula to screen the sample material in the petri dish so it is just even with the top edge of the petri dish. Place the top on the petri dish and weigh.

J. Complete the first three columns of the "FIELD SOIL SCREENING DATA FORM"; SAMPLE NUMBER, GRID NUMBER, AND SAMPLE WT.(g). The sampl is now prepared for counting.

3.2 TOASTER OVEN DRYING

A. Clean an aluminum loaf or tart pan, the stainless steel mixing bowl, and the stainless steel spoon.

B. Empty the entire sample container into the stainless steel mixing bowl and thoroughly homogenize the material using the stainless steel spoon.

C. Transfer approximately 200 grams of homogenized sample to the aluminum loaf pan using the stainless steel spoon. Transfer the remaining sample back into the original sample container.

D. Place the filled loaf pan in the toaster oven and dry at 400 degrees for 5 to 10 minutes.

E. Remove the loaf pan from microwave oven. **CAUTION! the pan may be hot!**

F. Dump the sample from the loaf pan into a clean mortar and pestal and grind until all clods are broken up and soil is of nearly uniform grain size.

G. Mark the sample number on both the top and bottom of a clean petri dish and tare the balance with the petri dish (top and bottom).

H. Pour the ground sample from the mortar in to a sieve, and sieve the sample into a clean pan. Use care to avoid creating dust. Transfer the oversize portion back into the original sample container.

I. Transfer sieved sample into the marked petri dish, lightly packing with a stainless steel spatula. Use a straight edge of the same spatula to screen the sample material in the petri dish so it is just even with the top edge of the petri dish. Place the top on the petri dish and weigh.

J. Complete the first three columns of the "FIELD SOIL SCREENING DATA FORM"; SAMPLE NUMBER, GRID NUMBER, AND SAMPLE WT.(g). The sample is now prepared for counting.

4.0 APPENDICES

4.1 FIELD SOIL SCREENING DATA FORM.

APPENDIX 4.1

GROSS ALPHA SAMPLE ANALYSIS FORM

Note: Use only one form per day

COUNTER INFORMATION

Scaler Model No.	Detector Model No.
Serial No.	Serial No.
Efficiency (cpm/dpm)	

DAILY BACKGROUND COUNT INFORMATION

Count Time (min.):
Gross Count:
Count Rate (cpm):

SAMPLE INFORMATION

Sample ID	Sample Mass (g)	Count Time (min)	Gross Counts	Net Counts (cpm)	Correlation Concentration (pCi/g)	Initial

Reviewed By:	Date:

Attachment 3

Texas Ins[illegible]ents SOP 30.0

Gross Alph[illegible]g of Soil Samples

STANDARD OPERATING PROCEDURE 30.0
GROSS ALPHA COUNTING OF SOIL SAMPLES WITH LARGE AREA ALPHA DETECTOR (LUDLUM MODEL 43-1)

TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0 PURPOSE

To specify the steps required to alpha count soil samples from sample archives, decontamination and decommissioning (D&D) areas within Buildings 4, 5, and 10, and the exterior remediation activities at the Texas Instruments (TI) Attleboro Facility for gross alpha activity analysis using the Ludlum Model 43-1 large area alpha detector and Ludlum Model 2000 scaler (or equivalent).

2.0 DISCUSSION

Prompt field assays for total uranium concentration in soil samples will be performed using a gross alpha counting technique in an on-site field trailer. The sample is ground, sieved, and placed in an open-face 3-inch diameter petri dish. To maintain a fixed, repeatable counting geometry, the petri dish is counted in an aluminum counting jig. The sample is counted using a Ludlum Model 43-1 alpha scintillator and a Ludlum Model 2000 scaler (or equivalent). Count times will be specified by the Site Health Physicist, based on counting statistics and associated parameters.

Alpha counts registered by the counting system are the result of alpha particle emissions within the top few microns across the area of the sample, so the overall thickness or weight of the sample does not impact the sample count rate. Thorough sample grinding and homogenization ensures that even the small mass in this thin top layer yields a count rate representative of the entire sample.

The gross alpha counts of soil samples from the sample archive will be compared with total uranium concentration analyses of the same samples at a commercial laboratory to develop a correlation between gross alpha counts and total uranium concentration. This will allow soil samples to be field assayed for their total uranium concentration.

2.1 ASSOCIATED PROCEDURES

SOP 29.0 Preparation of Soil Samples for Alpha Counting with a Large Area Alpha Detector (LUDLUM MODEL 43-1)

APPENDIX 4.1

GROSS ALPHA SAMPLE ANALYSIS FORM

Note: Use only one form per day

COUNTER INFORMATION

Scaler Model No.	Detector Model No.
Serial No.	Serial No.
Efficiency (cpm/dpm)	

DAILY BACKGROUND COUNT INFORMATION

Count Time (min.):
Gross Count:
Count Rate (cpm):

SAMPLE INFORMATION

Sample ID	Sample Mass (g)	Count Time (min)	Gross Counts	Net Counts (cpm)	Correlation Concentration (pCi/g)	Initial

Reviewed By:	Date:

3.0 PROCEDURE

3.1 PREPARATION

A. Verify that the daily function check has been completed for the counting system. If not, perform the function check.

B. Place a petri dish (bottom) in the counting jig and verify that the top edge of the dish is just even with the detector ledge of the jig. If not, adjust the height of the petri dish by changing the number of spacers (washers) under it.

3.2 COUNTING

A. Place a petri dish containing a soil sample in the counting jig.

B. Place the Ludlum 43-1 detector into the counting jig.

C. Set the count time to 10 minutes.

D. Verify that the scaler WINDOW is "out" if the scaler is so equipped.

E. Start the count by pressing the COUNT button.

F. Enter the count date, operator's initials, and background counts on the FIELD SOIL SCREENING DATA FORM.

G. When the count is complete, enter the gross alpha counts on the FIELD SOIL SCREENING DATA FORM.

H. Calculate the soil concentration of uranium by using the linear regression equation, and enter the result on the FIELD SOIL SCREENING DATA FORM

4.0 APPENDICES

4.1 FIELD SOIL SCREENING DATA FORM

Attachment 4

Gross Alpha Screening Correlation

Texas Instruments Archive Sample Counting Results

GROSS ALPHA SCREENING CORRELATION SYSTEM 1											
SAMPLE NUMBER	SAMPLE LOCATION	SYSTEM 1 (CP/10 min.)								SYSTEM 1 AVERAGE (CP/10 min.)	TMA EBERLINE RESULTS (pCi/g)
4805	170N185E	51	47	63	49	56	52	63	46	53.4	3.01
4801	167N190E	186	174	182	196	184	170	157	169	177.3	60.7
4880	115N165E	89	90	111	89	109	77	103	110	97.3	28.34
6247	91N184E	113	105	96	139	115	100	112	100	110.0	22.5
6327	96N163E	152	143	149	161	155	137	151	142	148.8	50.4
6421	106N189E	105	101	115	119	104	119	117	119	112.4	36.2
6305	97N173E	311	320	311	350	362	303	341	322	327.5	343.9
6205	88N193E	50	73	58	59	66	79	71	67	65.4	7.06
4881	115N165E	78	94	88	98	94	105	123	92	96.5	12.89
6374	114N210E	81	100	117	87	100	106	109	104	100.5	18.05
6365	170N195E	529	537	540	507	525	533	498	440	513.6	323.2
4877	125N180E	52	46	69	54	64	68	55	48	57.0	4.98
4815	103N160E	76	95	91	72	107	119	111	102	96.6	16.71
4804	170N185E	55	57	49	66	52	63	49	87	59.8	323.2
4807	167N195E	416	452	403	449	441	436	386	420	425.4	376.5
TMA EBERLINE RESULTS ARE TOTAL ISOTOPIC URANIUM (U-234, U-235, U-238)											

GROSS ALPHA SCREENING CORRELATION SYSTEM 2											
SAMPLE NUMBER	SAMPLE LOCATION	SYSTEM 2 (CP/10 min.)								SYSTEM 2 AVERAGE (CP/10 min.)	TMA EBERLINE RESULTS (pCi/g)
4805	170N185E	54	54	46	50	57	67	32	54	51.8	3.01
4801	167N190E	212	201	184	164	199	193	233	180	195.8	60.7
4880	115N165E	96	104	116	101	94	117	112	127	108.4	28.34
6247	91N184E	113	127	112	155	119	155	114	133	128.5	22.5
6327	96N163E	169	177	150	154	171	191	165	196	171.6	50.4
6421	106N189E	126	126	142	142	106	101	104	136	122.9	36.2
6305	97N173E	360	395	371	403	415	381	385	367	384.6	343.9
6205	88N193E	53	59	77	68	75	54	74	60	65.0	7.06
4881	115N165E	84	95	129	100	116	127	115	124	111.3	12.89
6374	114N210E	127	124	114	135	109	111	101	125	118.3	18.05
6365	170N195E	583	635	602	582	599	638	583	618	605.0	323.2
4877	125N180E	61	44	72	61	54	50	53	54	56.1	4.98
4815	103N160E	106	77	95	87	78	112	120	105	97.5	16.71
4804	170N185E	53	45	55	28	60	70	45	57	51.6	323.2
4807	167N195E	515	488	505	537	519	506	491	559	515.0	376.5

TMA EBERLINE RESULTS ARE TOTAL ISOTOPIC URANIUM (U-234, U-235, U-238)

Attachment 5

Gross Alpha Screening Correlation

Linear Regression Results for Remediation Systems

ALPHA SOIL SCREENING SYSTEM 1 CORRELATION

ARCHIEVE SAMPLE#	GROSS ALPHA (cnts/10 min.)	EBERLINE ALPHA SPEC. (pCi/g)
4805	53.375	3.01
4880	97.25	28.34
6247	110	22.5
6327	148.75	50.4
6421	112.375	36.2
4881	96.5	12.89
6374	100.5	18.05
4877	57	4.98
6205	65.375	7.06
4815	96.625	16.71
4804	59.75	4.82
4801	177.25	60.7

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.963485356
R Square	0.928304032
Adjusted R Square	0.921134435
Standard Error	5.247939353
Observations	12

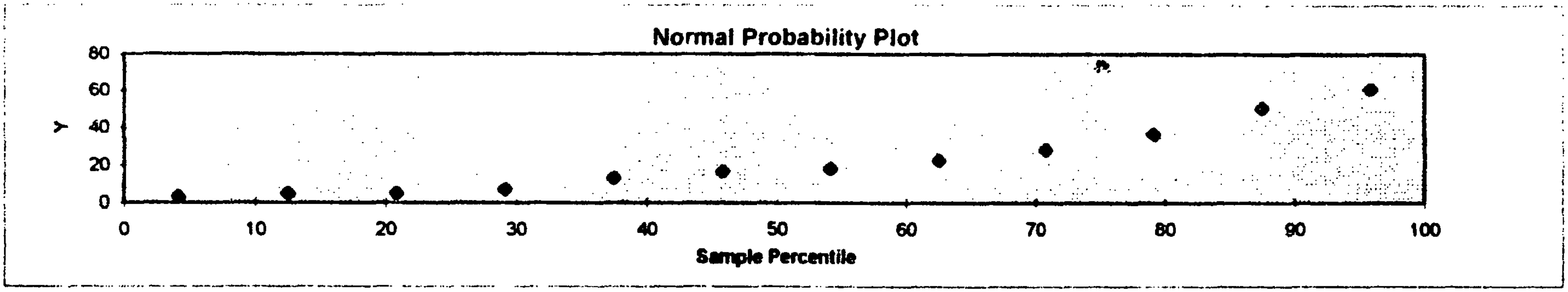
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3565.932492	3565.932492	129.4778568	4.80807E-07
Residual	10	275.4086745	27.54086745		
Total	11	3841.341167			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.000%*	*Upper 95.000%*
Intercept	-24.94256505	4.406210023	-5.660775341	0.000209316	-34.76021449	-15.12491561	-34.76021449	-15.12491561
X Variable 1	0.480928521	0.042265186	11.37883372	4.80807E-07	0.386755803	0.57510124	0.386755803	0.57510124

PROBABILITY OUTPUT

Percentile	*Y*
4.166666667	3.01
12.5	4.82
20.83333333	4.98
29.16666667	7.06
37.5	12.89
45.83333333	16.71
54.16666667	18.05
62.5	22.5
70.83333333	28.34
79.16666667	36.2
87.5	50.4
95.83333333	60.7



ALPHA SOIL SCREENING SYSTEM 2 CORRELATION

ARCHIEVE SAMPLE#	GROSS ALPHA (cnts/10 min.)	EBERLINE ALPHA SPEC. (pCi/g)
4805	51.75	3.01
4880	108.375	28.34
6247	128.5	22.5
6327	171.625	50.4
6421	122.875	36.2
4881	111.25	12.89
6374	118.25	18.05
4877	56.125	4.98
6205	65	7.06
4815	97.5	16.71
4804	51.625	4.82
4801	195.75	60.7

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.945342458
R Square	0.893672363
Adjusted R Square	0.8830396
Standard Error	6.390936774
Observations	12

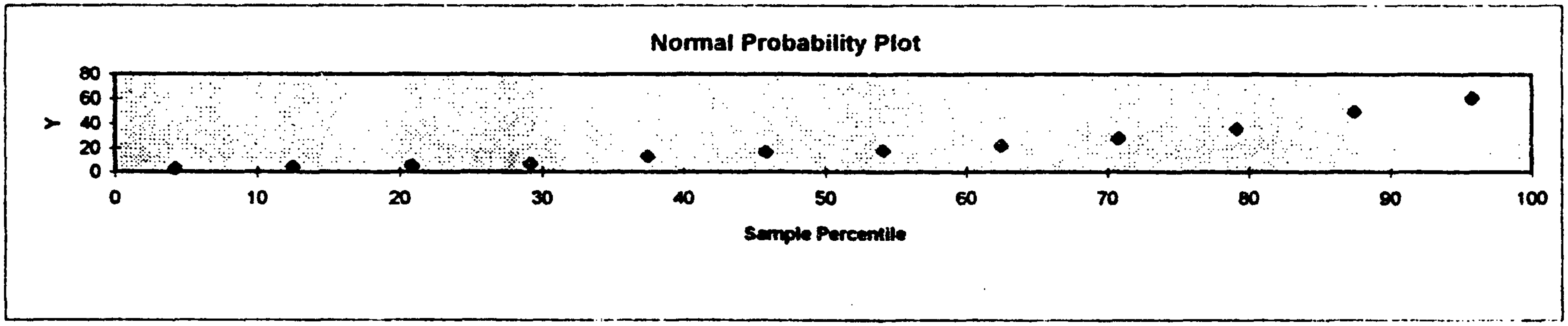
ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3432.900438	3432.900438	84.04892557	3.50366E-06
Residual	10	408.4407284	40.84407284		
Total	11	3841.341167			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.000%*	*Upper 95.000%*
Intercept	-18.61002732	4.812398245	-3.86710043	0.003123886	-29.33272068	-7.887333968	-29.33272068	-7.887333968
X Variable 1	0.382426691	0.041714027	9.16782011	3.50366E-06	0.289482032	0.47537135	0.289482032	0.47537135

PROBABILITY OUTPUT

Percentile	*Y*
4.166666667	3.01
12.5	4.82
20.83333333	4.98
29.16666667	7.06
37.5	12.89
45.83333333	16.71
54.16666667	18.05
62.5	22.5
70.83333333	28.34
79.16666667	36.2
87.5	50.4
95.83333333	60.7



Attachment 6

Texas Instruments SOP 10.0

Equipment Function and Source Check

ı SHP based on the
detectable activity.
⁼orm.

jig or guide location,
nated by the SHP.

will be performed at

time as designated
or over source until

ı Check Data Form.

on Data Form and

graph log with the

· 20% of reference

, repeat procedure.
'OUT OF SERVICE

A Calculation Form

ıppendix 4.1).

:k must initial the

4.1 Appendix 4.1 - Function Check Data Form

4.2 Appendix 4.2 - Function Check Graph Log

4.3 Appendix 4.3 - MDA Calculation Form

Table 4-2. WESTON Soil Sample Alpha Spectroscopy Data

Table 4-2. WESTON Archive Soil Sample Alpha Spectroscopy Data TMA Eberline							
SAMPLE NUMBER	SAMPLE LOCATION	U-234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)	U-234/U-235	U-238/U-234	TMA EBERLINE RESULTS (pCi/g)
4805	170N185E	1.4	0.11	1.5	12.73	1.07	3.01
4801	167N190E	29.4	2.3	29	12.78	0.99	60.7
4880	115N165E	8	0.94	18.6	8.51	2.33	27.54
6247	91N184E	12.3	0.6	9.6	20.50	0.78	22.5
6327	96N163E	27.9	2.5	20	11.16	0.72	50.4
6421	106N189E	13.6	1.6	21	8.50	1.54	36.2
6305	97N173E	212.6	16.7	114.6	12.73	0.54	343.9
6205	88N193E	3.1	0.16	3.8	19.38	1.23	7.06
4881	115N165E	5.3	0.29	7.3	18.28	1.38	12.89
6374	114N210E	8.2	0.45	9.4	18.22	1.15	18.05
6365	170N195E	196	17.2	110	11.40	0.56	323.2
4877	125N180E	1.3	0.08	3.6	16.25	2.77	4.98
4815	103N160E	7.2	0.61	8.9	11.80	1.24	16.71
4804	170N185E	2.5	0.12	2.2	20.83	0.88	4.82
4807	167N195E	150.7	9.5	216.3	15.86	1.44	376.5

The CPS sample analytical results in Table 4-1 and the WESTON sample analytical results in Table 4-2 indicate that gross alpha counting results showed excellent correlation for activities as low as 10-15 pCi/g in soil and that average uranium-238 to uranium-234 and uranium-235 activity ratios ranged from 1-2 (indicating a slight enrichment above natural abundance. Total and isotopic uranium analyses will be used to develop a correlation for field screening of soil samples to control excavation during the remediation activities.

4.2 Radioanalytical Laboratories and Techniques

4.2.1 Radioanalytical Laboratories

One laboratory, TMA Eberline of Knoxville, Tennessee has been selected to provide primary radioanalytical services for the exterior remediation project. A second laboratory, Quanterra of Richland Washington may be utilized as a backup laboratory to perform analysis on sample duplicate splits for QA purposes. TMA will receive the majority of the samples and will be sent approximately 10% of the sample volume in the form of duplicative splits. TMA Eberline was selected as the primary laboratory because it holds a Utah Certification, EPA Certification, and NRC Certification.

WESTON will provide approximately 10% of the samples as duplicates, for which TMA has agreed to no additional charge. Both laboratories are providing a copy of their QA program for WESTON project documentation.

4.2.2 Radioanalytical Techniques

Total uranium will be determined through the use of Kinetic Phosphorescence Activation (KPA) method ASTM D5174. This method employs laser activation of uranium mass as dissolved in solution. Excited electrons subsequently leave the activated energy state, emitting characteristic x-rays which are counted. TMA Eberline has quoted a detection limit of 0.6 pCi/g total uranium in concrete, while Quanterra's detection limit is stated as 0.5 pCi/g.

Urine and water samples also will be analyzed using the KPA method, with a detection limit of 0.1 ug/g.

Both laboratories will utilize EPA Environmental Measurements Laboratory (EML) U-02 modified for the determination of isotopic uranium by alpha spectrometry. This method involves the dissolution of a sample in an acidic solution, followed by electroplating of the suspended metals onto a stainless steel, nickel, or platinum planchet. The planchet or sample disc is then counted with an alpha spectroscopy system (most commonly utilizing a surface barrier detector) with peak identification and quantification of alpha-emitting uranium isotopes

4.3 TCLP Laboratories

One laboratory, TMA Eberline of Knoxville, Tennessee has been selected to provide TCLP analytical services for the exterior remediation project. A second laboratory, WESTON Analytical may be utilized as a backup laboratory to perform analysis on sample duplicate splits for QA purposes. TMA will receive the majority of the samples and will be sent approximately 10% of the sample volume in the form of duplicative splits. TMA Eberline was selected as the primary laboratory because it holds a Utah Certification, EPA Certification, and NRC Certification.

WESTON will provide approximately 10% of the samples as duplicates, for which TMA has agreed to no additional charge. Both laboratories are providing a copy of their QA program for WESTON project documentation.

4.4 Preparation of Sample Shipments

Preliminary sample estimates include approximately 100 soil samples for isotopic uranium, 50 samples for KPA total uranium, 25 samples for total uranium in urine, and 25 samples for total uranium in water. Soil samples will be homogenized in the field screening laboratory and placed in zip-lock sample bags. Each sample will be labeled according to the sampling code discussed in SOP 33.0 and sealed with a WESTON chain of custody seal. Chain of custody forms will be completed indicating sample numbers, specified, analysis, etc. The chain of custody form will be placed on the inner lid of the shipping container. WESTON personnel will log all samples on Chain of Custody forms, and place appropriate copies in the shipping container for transmittal to the specified analytical laboratory.

4.5 Shipping

It is anticipated that all material shipped from the site including waste will have total uranium concentrations less than 3000 pCi/g (DOT level of concern is 2000 nCi/g) and contain no hazardous or toxic chemicals. For these reasons, sample shipments require no special labeling on the cooler exterior, nor do WESTON shippers require Department of Transportation (DOT) shippers training. In the event that toxic or hazardous chemicals or radionuclide concentrations greater than 2000 nCi/g are encountered, the WESTON PM will modify the sample shipping program, procure the services of additionally-trained personnel, and utilize SOP 32.0.

4.5.1 Sample Shipping

WESTON personnel will double bag all soil samples and ensure that the proper sample codes have been written on the soil sample bags. All urine and water sample containers will placed in plastic bags and packed in vermiculite and packaged in a separate shipping cooler. WESTON personnel will log all samples on Chain of Custody

forms, and place appropriate copies into the cooler for transmittal to the specified analytical laboratory.

4.5.2 Envirocare Waste Shipping

Construction subcontractor personnel will load all intermodal waste containers with waste soil and will place lids on the containers. WESTON personnel will sample the waste during loading. WESTON personnel will label and inspect each container prior to it being loaded onto the railcars. WESTON personnel will ensure that all checks and procedures specified in SOP 15.0 and 32.0 have been followed.

5.0 RECORD KEEPING

All project data, notes, documents, and other information will be maintained in the WESTON filing system presented in Attachment A. WESTON will maintain two types of files, off-site permanent project files and onsite working files which are to be located in the WESTON field trailer.

5.1 Site Logbooks and Procedure Forms

Many of the SOPs presented in section 2.0 include data forms that must be completed to adequately execute the requirements of the SOP. Upon completion, original copies of these forms should be sent to the off-site WESTON filing system, with photocopies retained in the on-site files.

Site logbooks will be issued to the Project/Site Manager, SHP, SHSC and the field and laboratory technicians. It is not necessary to repeat field data collected on SOP forms in logbooks. Information to be entered to site logbooks is specified in SOP 36.0. This information includes, but should not be limited to unusual observations, contacts with TI and regulatory personnel, and data not covered under SOP form completion.

Logbook entries must include a reported time (in military format) and at the completion of each working day, the holder of each logbook should draw a line through the remaining space on the page and sign and date the bottom of the page.

5.2 Permanent Records

The permanent project files will be maintained by the TI Environmental Health and Safety Department.

Attachment 8

Texas Instruments SOP 35.0

Excavation Control Utilizing a GM-Pancake and Plastic Beta Scintillation Detectors

STANDARD OPERATING PROCEDURE 35.0

EXCAVATION CONTROL UTILIZING A GM PANCAKE AND PLASTIC BETA SCINTILLATOR

1.0 PURPOSE

To describe the methodology for measuring beta-gamma radiation levels.

2.0 DISCUSSION

The Health and Safety Plan (HASP) and Sampling and Analysis Plan provide information on the scope of Texas Instruments, Attleboro Facility operations, related health and safety requirements, and the applicability of this procedure to the remediation and D & D activities.

Potential hazards from radionuclides that are beta-gamma emitters (like Natural Uranium) arise from ingestion or inhalation and external radiation that penetrates critical body organs. Protection requires the measurement and control of internal and external pathways.

Beta and gamma radiations are considered together because many radioactive materials emit both. The techniques for measuring the two are similar. A calibration source should be selected that most closely represents the energies of the radiation field to be measured.

For survey purposes, beta-gamma measurements can be used to verify the presence of anomalous radiation levels. Because of the attenuation of the beta particles and photons by the soil, these measurements are difficult to correlate to radionuclide concentrations in soil without performing soil sampling with alpha spectroscopy analysis for identification of the specific radionuclides.

For general beta-gamma radiation monitoring, the ionization chamber and the Geiger-Mueller (GM) counter are the primary instruments. For general beta radiation detection a plastic scintillation detector coupled with a scaler is the primary instrument. Only the technique using the GM counter and the beta scintillator will be described here.

The GM probe configuration described in this procedure is a pancake probe. The pancake probe consists of a flat, thin-windowed GM tube in a shielded housing. It measures radiation coming primarily from in front of the thin window and is used for measuring beta-gamma contamination on surfaces but can also detect alpha radiation.

The beta scintillator configuration consists of a thin mylar window with a plastic scintillator coupled to a photomultiplier tube. The plastic scintillator is too thick for penetration and interaction of alpha particles and is not dense enough to cause interaction of gamma photon with the scintillation material. Therefore it only detects beta particles that penetrate the window. Because of this it is an excellent instrument for directional contamination detection and directing excavation.

2.1 Limitations

GM counters have several characteristics that can lead to erroneous results unless the user is aware of them.

A. At high radiation levels, the counter will not recover from a count soon enough to measure the next entering particle. This causes a decreased response at higher radiation levels; at extremely high levels, the response may no longer increase with increased radiation. In certain cases, the response may decrease or go to zero at very high level.

B. At extreme temperatures, the instrument may respond erratically or not at all. Under these conditions, a check source is needed to ensure reliable behavior.

C. The GM tube is delicate and sensitive to damage if dropped or exposed to significant changes in air pressure. If a rattling sound is heard when the user blows air across the probe face, it is likely that the tube has broken. To avoid a common means of tube breakage, do not ship the probe in an unpressurized airplane.

D. The GM detector may experience detection of gamma emitters for soil contaminants due or changes in geometry. This phenomenon is known as shine.

2.2 Limitations of Beta Scintillation Detectors

Beta scintillation detectors have one limitation and that is the mylar window can be easily damaged by coming into contact with a blade of grass or soil. Great care has to be utilized when using this instrument for excavation control.

3.0 PROCEDURE

3.1 Associated References and Procedures

SOP 10.0 Function Check of Portable and Stationary Radiation Detection Instrumentation

SOP 34.0 Measurement of Gamma-Ray Field

Weston Quality Assurance Plan

3.2 Preparation

3.2.1 Office

A. Review the HASP and QAPP.

B. Coordinate schedules/actions with the installation staff.

C. Obtain appropriate permission and training for access to TI facility.

D. Assemble the equipment and supplies listed in Appendix 5.1. Ensure the current calibration of the probe and the ratemeter/scaler.

3.2.2 Documentation

A. Obtain a logbook from the site H.P.

B. Record results of the equipment function check as described in SOP 10.0.

C. Obtain a sufficient number of the appropriate grid data collection forms.

3.2.3 Determination of Background

A. Take five background counts of background soil with the GM pancake and beta scintillator to ensure the probe is not contaminated and to determine the contamination criteria. Calculate the mean background. In past studies at TI it has

been demonstrated that background soils are approximately 50 cpm when measured with a GM pancake. If a criteria of 2 times background is applied as a field screening action point an effective sample concentration in the field has been conservatively calculated as approximately 52 pCi/g. Therefore, results at or below twice background can be instituted as a technique for determining when to suspend remediation.

Background should be determined by both the beta scintillator and the GM pancake prior to checked during remediation activities.

3.3 Operation

3.3.1 Obtaining Measurements

A. Record beta-gamma measurements with the GM detector and/or beta scintillator Remediation Gird block Field Data Form (Appendix 5.2).

B. Place the GM probe or beta scintillator at a small distance (one-half inch) from the location to be monitored.

NOTE: The thin window of the probes is easily punctured. Care should be taken to protect the surface from sharp objects.

C. Take a scaler or a count rate count of predetermined duration (1 minute) and record the count rate.

D. Compare the counts to the contamination criteria. The Site H.P. may require further characterization of samples or locations exceeding these criteria. Samples or locations with counts greater than 2 times background are considered contaminated and remediation should continue.

E. If the grid excavation area survey indicates that the soils are at or below twice background then excavation can be haulted and soil sampling and gross alpha screening can be implemented to determine the actual contamination levels.

3.4 Postoperation

3.4.1 Field

A. Turn all switches to the off position.

B. Ensure that all equipment is accounted for, decontaminated, and ready for use the next day.

C. If necessary, make sure all survey or sampling locations are properly staked and the location ID is readily visible on the location stake.

3.4.2 Documentation

A. Record any uncompleted work (like additional monitoring) in the logbook.

B. Complete logbook entries, verify the accuracy of entries, and sign/initial all pages.

C. Review data collection forms for completeness.

D. Turn data forms over the site H.P. for review.

4.0 Appendices

4.1 Equipment and Supplies Checklist

4.2 Remediation Area Grid Block Field Data Form

APPENDIX 4.1

EQUIPMENT AND SUPPLIES CHECKLIST

______ Ratemeter/scaler (Ludlum Model 12/Ludlum 2221 or the equivalent)

______ GM pancake probe (Ludlum 44-9 or the equivalent)

______ Beta scintillator probe (Ludlum 44-1 or the equivalent)

______ Ratemeter/scaler (Ludlum 2221 or the equivalent)

______ Cables

______ Beta source (TC-99 or Sr-90)

______ Natural Uranium

______ Remediation Grid block Field Rate Forms

Remediation Area Grid Block Field Data
(GRID SIZE 10m X 10m)

N

Grid Coordinates; (NW Corner) ____________________

Average Grid Contamination level; _____ pCi/g

Instrumentation: ____________________

Serial Number: ____________________

Readings in: __________

Comments
____
____
____
____
____
____
____

Surveyed By ____________________ Date __________

Attachment 9

Concentration Check Sampling Pattern from NUREG CR-5849

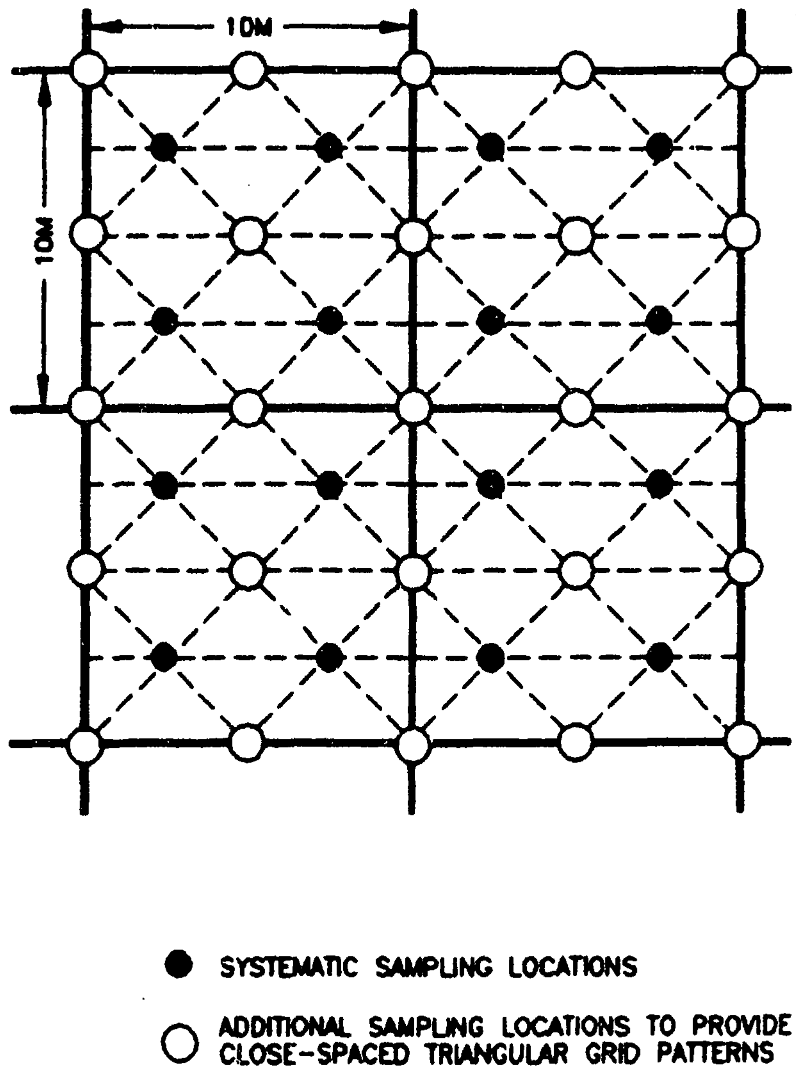


FIGURE 4-5: Sampling Pattern to Identify Soil Areas of Elevated Activity

Attachment 10

Texas Instruments SOP 31.0

Collection of Surface Soil Samples

STANDARD OPERATING PROCEDURE 31.0
COLLECTION OF SURFACE SOIL SAMPLES
TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0 PURPOSE

To describe a method for collecting surface soil samples from the 0-15cm below the surface at the Texas Instruments (TI) Attleboro Site.

2.0 DISCUSSION

Sampling of the soil horizons above the groundwater table can detect contaminants before they migrate into the water table. Soil sample analysis can assist in determining the extent of the contaminant source term and verify that the soil horizon has been remediated to 30 pCi/g total uranium limit.

Accurate, representative samples can be collected with this procedure, if care and precision are demonstrated by the technician. The spade and-scoop method can be used in most soil types, but is somewhat limited to sampling near the soil surface. Sample collection from depths greater than 50 inches can become extremely labor-intensive. Collection of samples from near the soil surface can be accomplished with tools like spades, shovels, and scoops. A stainless steel scoop is used to collect a sample at a depth interval of 0-15cm. The use of a flat, pointed mason trowel often aids in collecting undisturbed soil profile samples. To the extent possible, the sampling process should not alter the medium being investigated. Samples should be kept at their at-depth temperature or lower, protected from direct light, sealed tightly in ziplock bags, and analyzed as soon as possible.

The TI Attleboro Site has interior soils beneath the slabs and exterior subsurface soils that contain residual uranium (slightly enriched isotopic abundance) at above background concentrations. The contamination under the slabs in the buildings may have resulted from spills seeping through cracks into the concrete. If the underside of slabs are found to be contaminated then the soil beneath will be sampled utilizing the procedure described below. Subsurface soils down to 10 feet have been confirmed as being contaminated above the 30 pCi/g Total Uranium limit as described in the Texas Instruments Radiological Surveys of Open Land Areas report.

Utilizing characterization data, remediation activities will remove contaminated soil from areas (grids): Once it is determined by field screening methods that soils inside the grid are at or below 2 times background, verification soil samples will be collected according to Chapter 5.0 (Sampling & Analysis) for the QAPP and this procedure.

3.0 PROCEDURES

3.1 Associated Procedure

Before every operation, a review of the QAPP is necessary. The QAPP contains information and SOPs on the performance of TI field activities. The QAPP and SOPs should be consulted for specific information about equipment and supplies; sample collection, preservation, packaging, and shipping; decontamination procedures; and documentation requirements. Procedures directly associated with this SOP are listed below.

SOP 7.0	Personnel and Equipment Frisking with Ludlum Model 12 / Model 43-5
SOP 22.0	Sample Identification Procedure
SOP 31.0	Excavation Control Doing Portable Radiation Detection Instrumentation
SOP 32.0	Transport of Radioactive Materials (RAM)
SOP 9.0	Personnel Decontamination Procedure

3.2 Preparation

3.2.1 Office

A. Review TI Quality Assurance Management Plan and SOPs listed in Section 3.1.

B. Coordinate schedules/actions with the installation staff.

C. Obtain appropriate certifications for work at Texas Instruments as described in SOP 1, Training Requirements for site workers.

D. Assemble the equipment and supplies listed in Appendix 5.1. Ensure the proper operation of all sampling equipment.

E. Notify the analytical laboratory of sample types, the number of samples, and the approximate arrival date.

3.2.2 Documentation

A. Obtain logbook the QA officer.

B. Record results of the equipment check in logbook.

C. Obtain a sufficient number of appropriate data

collection forms (see INDEX TO SOPs).

D. Consult site manager for a current list of location IDs and sample numbers for completion of data forms.

3.2.3 Field

Decontaminate all sampling equipment before taking the first sample and between sampling intervals by dry wiping or utilizing light water spray and wiping dry with a paper towel.

3.3 Operation

A. Whenever a sample is collected, complete a description of the sample in field log book and on grid data form.

B. Procedure for soil sampling

1. Carefully remove the top layer of soil to the desired sample depth with a precleaned spade.

2. Using a precleaned, stainless steel or trowel, remove and discard a thin layer of soil from the area that comes in contact with the shovel.

3. Transfer the sample into an appropriate sample container with a stainless steel scoop, lab spoon, or equivalent.

4. Label the sample container on the side and lid with a sharpie.

NOTE: Whenever a sample is collected, a custody record must be initiated on the Custody Transfer Record/Lab Work Request form and a Soil Sample Identification number written on the sample container. Sample Identification and Archive Procedure can be found in SOP 27.0

5. Decontaminate equipment between sample locations by dry wiping or utilizing light water spray and then wiping with a paper towel.

4.0 POST OPERATION

4.1 Field

A. **Ensure that all equipment is accounted for, decontaminated and ready for shipment.**

B. **Prepare samples and transport according to SOP 33, Sample Identification and SOP 32, Transport of Radioactive Materials (RAM).**

4.2 Documentation

A. Record pertinent sample location information in the logbook and on Grid Location Data form.

B. Complete logbook entries, verify the accuracy of entries, and sign/initial all pages.

C. Review data collection forms and chain of custody for completeness.

D. Transport samples to field laboratory for gross alpha screening.

4.3 Office

A. Deliver original forms and logbooks to the site manager for technical review. He/she will review, sign forms, and transmit to the document control officer (copies to the files) for eventual delivery to the Department of Energy.

B. Inventory equipment and supplies. Repair or replace all broken or damaged equipment. Replace expendable items. Return equipment to the equipment manager and report incidents of malfunction or damage.

C. Contact the analytical laboratory to ensure that the samples arrived safely and the instructions for sample analyses are clearly understood.

D. Frisk sample container utilizing an alpha scintillator prior to removing from the Radiological Control Area as described in SOP 7.0, Personnel and Equipment Frisking with Ludlum Model 12 / Model 43-5.

5.0 Source

Ford Patrick J., Paul J. Turina, and Douglas E. Seely. 1984. Available Sampling

Methods, 2d ed. Vol. 2, Charac'erization of Hazardous Waste Sites - A Methods Manual. U.S. Environmental Protection Agency document EPA/600/4-84/076. Washington, D.C.: U.S. Government Printing Office.

5.0 APPENDIX

5.1 Equipment and Supplies Checklist

APPENDIX 5.1

EQUIPMENT AND SUPPLIES CHECKLIST

- ______ Stainless steel scoop or lab spoon (scoopulas)
- ______ Stainless steel shovel or fat-pointed mason trowel
- ______ Stainless steel spade
- ______ Tape measure (tenths)
- ______ Stainless steel sampling trays
- ______ Plastic Sheet
- ______ Decontamination tub
- ______ Trash bags
- ______ Buckets (galvanized, stainless steel, and plastic)
- ______ Garden pressure sprayer
- ______ Cleaning wipes
- ______ Kim wipes or paper towels
- ______ Storage containers for waste decontamination solutions
- ______ Disposable laboratory gloves
- ______ Any additional supplies listed in associated procedures, as needed
- ______ Chain of custody forms
- ______ Chain of custody seals

Attachment 11

Modified Verification Sampling Pattern from NUREG CR-5849

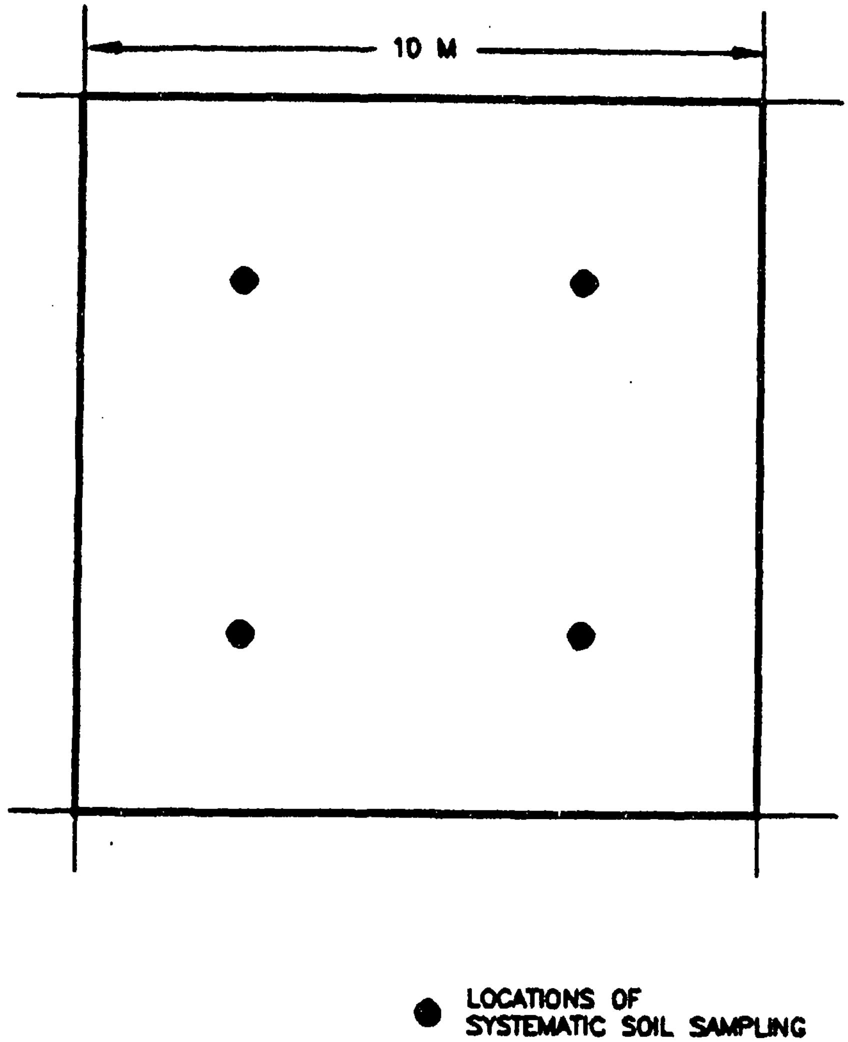


FIGURE 4-4: Standard Sampling Pattern for Systematic Grid Survey of Soil

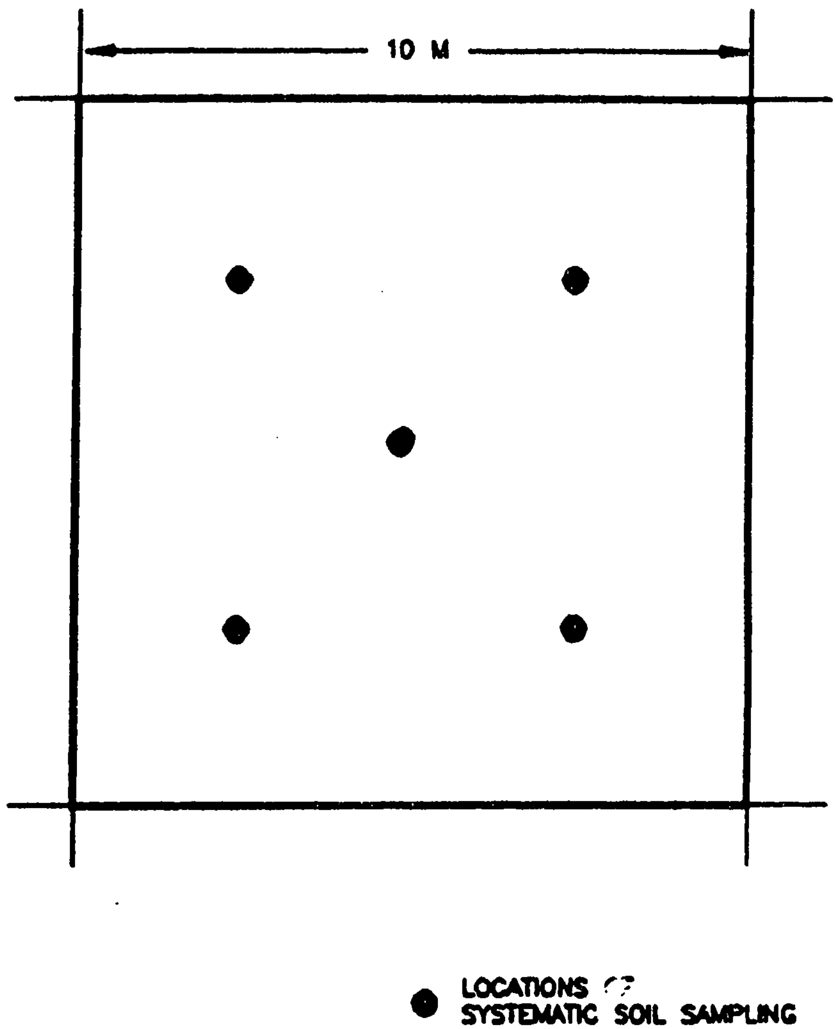


FIGURE 4-4: Standard Sampling Pattern for Systematic Grid Survey of Soil

121534
10-5-95

OFFICIAL RECORD COPY

WESTON
MANAGERS DESIGNERS/CONSULTANTS
6501 AMERICAS PARKWAY, N.E.
SUITE 800
ALBUQUERQUE, NM 87110-1517
505-884-5050 • FAX: 505-884-5388

27 July 1995

Control No. 121534
SNM License No. 23
Docket No. 70-33

Mr. Mark Roberts
Senior Health Physicist
UNITED STATES NUCLEAR
REGULATORY COMMISSION REGION I
475 Allendale Road
King of Prussia, PA 19406

RE: Texas Instruments Incorporated
Attleboro, Massachusetts

RFW WO #: 10923-004-001

Dear Mr. Roberts:

Attached for your review and comment is the Sampling and Analysis Plan (SAP) to be utilized in the characterization and release of building materials associated with the Building Interiors Remediation project at Texas Instruments Incorporated in Attleboro, Massachusetts.

If you have any questions or comments, please contact me at (508) 223-3996.

Very truly yours,

ROY F. WESTON, INC.

Michael Madonia

Michael V. Madonia
Project Manager

Attachment

cc: Michael J. Elliott, TI
John B. Price, WESTON

121534

JUL 31 1995

OFFICIAL RECORD COPY ML 10

ATTACHMENT

SAMPLING AND ANALYSIS PLAN FOR THE DEVELOPMENT OF DECONTAMINATION PROFILES - INTERIOR BUILDING AREAS, TEXAS INSTRUMENTS ATTLEBORO FACILITY

SAMPLING AND ANALYSIS PLAN FOR THE DEVELOPMENT OF DECONTAMINATION PROFILES - INTERIOR BUILDING AREAS, TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0 INTRODUCTION

In support of the decontamination and decommissioning (D&D) of building interiors at the Texas Instruments Incorporated (TI) site in Attleboro, Massachusetts, Roy F. Weston, Inc. (WESTON) has prepared the following Sampling and Analysis Plan (SAP). This SAP addresses interior areas of Building 10 as part of the pilot scale D&D project as defined in a 14 June, 1995 proposal submitted by WESTON to TI. This plan identifies a method to delineate the limits of decontamination of concrete floor slabs and underlying soils located within approximately 7000-8000 ft^2 of Building 10. After delineation, the contamination profile will be used to guide decontamination, which may include physical cutting, breaking, and removal of concrete slabs. Contaminated soils will be excavated and the resulting excavation subject to termination survey and sampling.

WESTON proposes to use both volumetric and surface contamination measurements to identify large contaminated volumes of building materials and underlying soils, as well as the basis for unrestricted release of non-contaminated building materials. This SAP is contained as a module within the WESTON Project Plan (PP), which has been prepared as a deliverable item under interior construction management support to TI.

Many of the affected areas are known to have underlying ceramic and cast iron drain lines, sumps, and drain traps. These and other features that have been identified as carrying or transferring radiologically-contaminated material will be surveyed and removed as necessary.

2.0 BACKGROUND

2.1 Release Criteria

A February 1995 test decontamination effort performed in the former unclad area of building 10 indicated that uranium contamination had migrated through concrete pore spaces and cracks to varying depths. In some cases, it was verified that the contamination had migrated through concrete cracks to the underlying soils. Based on this information, it is assumed that a system of assessing total uranium concentration distribution through concrete slab volume must be implemented in conjunction with surface contamination measurements.

Section 3.3.1 of the "Supplement to the 1992 Remediation Plan" defines a volumetric

release criteria for soils to be removed during remediation of exterior soil areas. These release criteria are 30 pCi/g total uranium and where depleted uranium is identified, 35 pCi/g. In addition to the volumetric criteria, surface contamination levels on personnel, equipment, and materials leaving contaminated areas are required not to exceed the surface contamination limits specified in US NRC Guide 1.86.

2.2 Sampling Methodology

No systematic sampling methodology for building materials exhibiting volumetric contamination is presented in NUREG/CR-5849. Building and other unusual materials exhibiting volumetric contamination (in addition to surface contamination) fall into a "gray area" with respect to distinct regulatory guidance, thus a licensee must submit a SAP unique to the contamination characteristics at their site.

The following characterization methods and release criteria for concrete slabs are based on application of NUREG/CR-5849 methods for assessing soil contamination. Additional "biased" sampling has been added to further refine extent of contamination for waste volume estimates. The same sampling methodology will be applied to exposed soils following the removal of contaminated concrete.

3.0 PROPOSED RELEASE CRITERIA FOR CONCRETE SLABS

Based on the following SAP (which is derived from soil sampling locations and frequencies presented in NUREG/CR-5849, section 4.2), WESTON proposes the following release criteria for concrete slabs or potions thereof that are not designated for disposal as radioactive waste:

* Average total uranium concentration in the slab does not exceed 30 pCi/g.

* Average depleted uranium concentration (where identified) does not exceed 35 pCi/g.

* All exposed surfaces do not exceed the surface contamination limits as defined in Appendix E of the "Supplement to the 1992 Remediation Plan".

Based on the following SAP, WESTON proposes that underlying soil concentrations do not exceed the aforementioned volumetric criteria for concrete (30 pCi/g-total uranium, 35 pCi/g-depleted uranium).

4.0 TECHNICAL BASIS

4.1 Development of Background Uranium Concentrations and Surface Contamination Levels

WESTON will designate one 10 meter by 10 meter grid block for routine background measurements. The background area will be located in an unaffected area of Building 10. Two core samples will be collected from the grid block and analyzed for total uranium. Prior to termination surveys, WESTON health physics personnel will perform background measurements at this location using gas-flow proportional detection systems. All grid blocks subject to this sampling methodology have been incorporated to a "building-wide" grid coordinate system.

4.2 Sampling Methodology

Section 4.2 of NUREG/CR-5849 presents a methodology for systematic sampling of affected soil areas. For the Pilot Scale Interior Project, WESTON proposes concrete core sampling at four initial locations defined within 7 or 8 reference 10 meter by 10 meter grids, (a maximum initial number of 40 sampling locations). Concrete cores will be collected to an average depth of 6 inches, with subsequent analyses of 3 inch intervals (for total uranium). Additional sampling locations will be derived (at triangular locations as shown in Figure 4-5 of NUREG/CR-5849) based on analytical results of initial core samples. Up to four biased cores will be collected at crack or other locations across the grid exhibiting elevated surface activity measurements.

Analytical results for core samples will be used to develop a three-dimensional decontamination profile. WESTON will review data to determine potential background uranium concentrations associated with differing concrete placement or "pours". Following the removal of contaminated concrete portions remaining concrete surface areas will be vacuumed and subject to surface contamination surveys at grid intervals as defined in NUREG/CR-5849. At this stage, remaining slabs are considered acceptable for unrestricted release, unless there is evidence of underlying soil contamination. In this case, the underside of each slab will be subject to a surface contamination survey upon removal.

After removal of contaminated concrete slab portions, a radiological survey of underlying soils will be performed. If this survey indicates elevated activity, the exposed soil will be sampled to the same pattern and frequency as the overlying concrete. Soil also will be sampled if obvious transfer pathways are noted during concrete removal.

4.3 Analytical Techniques

Previous soil remediation efforts have achieved a soil clean-up standard of 30 pCi/g total uranium in soil based on application of a rapid assay field technique for total uranium. The assay technique involved correlation of gross alpha count rates to isotopic uranium analyses on higher activity soil samples.

Currently, no such standard for building materials (primarily concrete) has been submitted as part of the "Supplement to the 1992 Remediation Plan" or in other NRC Correspondence. WESTON proposes to develop a similar gross alpha counting correlation for concrete and related building materials through application of a photomultiplier-based alpha counting system. To develop and support this correlation, WESTON will submit 40-70 concrete samples for total uranium analyses using laser KPA method ASTM D5174, and 20-25 samples for isotopic uranium analyses using EML Method U-02 Modified.

5.0 DRAIN LINE SURVEY AND REMOVAL

Previous decontamination efforts have identified several capped ceramic drain lines that apparently were used for floor and roof drain discharge. Where identified, these lines will be uncapped and surveyed for evidence of radiological contamination. WESTON will utilize a thin GM-probe to survey drain lines to a depth of 6 feet or until blockage is encountered. Lines exhibiting surface contamination levels exceeding those specified in the "Supplement to the 1992 Remediation Plan" will be removed and disposed of as radioactive waste.

WESTON
MANAGERS DESIGNERS/CONSULTANTS
6501 AMERICAS PARKWAY, N.E.
SUITE 800
ALBUQUERQUE, NM 87110-1517
505-884-5050 • FAX: 505-884-5388

070-00033

19 July 1995

Control No. 121534
SNM License No. 23
Docket No. 70-33

Mr. Mark Roberts
Senior Health Physicist
UNITED STATES NUCLEAR
REGULATORY COMMISSION REGION I
475 Allendale Road
King of Prussia, PA 19406

RE: Texas Instruments Incorporated
Attleboro, Massachusetts

RFW WO #: 10923-003/004-001

Dear Mr. Roberts:

This letter will serve to document certain information that was discussed during telephone conversations on 06 July 1995. As requested, Roy F. Weston, Inc. (WESTON) is submitting schedule information regarding both the Building Interior D&D and Exterior Soil Remediation projects at Texas Instruments Incorporated (TI) in Attleboro, Massachusetts.

Anticipated Schedule for Interior Remediation Activities:

Location	#Grids	Approx. Start Date
Area 1 - Caged Area	4	18 July 1995
Area 7 - Screen Print Room	4 (partial)	21 July 1995
Area 4 - Caged Area	2 (partial)	26 July 1995

Other areas are currently being scheduled to limit impact to TI facility operations, and are scheduled for 1 August 1995 to 15 October 1995.

OFFICIAL RECORD COPY ML 10

121534

WESTON

Anticipated Schedule for Soil Remediation Activities:

Location	#Grids	Approx. Start Date	Duration
Bldg. 12 Lawn-West	5	21 July 1995	3-5 days
Bldg. 12 Lawn-South	13	27 July 1995	7-10 days
Bldg. 17 Area-North	20	10 August 1995	10-15 days
Bldg. 11 Area-Railsiding	39	5 September 1995	15-20 days

If you have any questions regarding the Exterior Soil Remediation Project, please contact Mr. Todd Walles at (508) 223-1459. Likewise, you may contact Mr. Mike Madonia at (508) 296-3996, regarding the Building Interior D&D Project.

Very truly yours,

ROY F. WESTON, INC.

Michael V. Madonia
Project Manager

cc: Michael J. Elliott, TI
John B. Price, WESTON
Todd Walles, WESTON

NRCSched.Ltr

Texas Instruments Incorporated

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964
(508) 236-3800

MS-16
L8

June 6, 1995

SNM No. 23
Docket No. 70-33
Control No. 121534

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Mark Roberts
U.S. Nuclear Regulatory Commission
Region I, NMSS
475 Allendale Road
King of Prussia, PA 19406-1415

RE: ***Response toNRC letter dated April 13, 1995 requesting additional information regarding the December 1994 Supplement to the 1992 Remediation Plan for the Attleboro Site.***

Dear Mr. Roberts,

In response to a letter dated April 13, 1995 from the U.S. Nuclear Regulatory Commission, Region I - NMSS (hereafter referred to as NRC), Texas Instruments Incorporated, Materials & Controls Group (hereafter referred to as TI) located in Attleboro, Massachusetts, is submitting the requested additional information in the following correspondence. For simplicity, the responses to each question are organized in the same order that they appear in the original NRC letter. Each response is structured as a separate, stand-alone section which includes; 1) the original NRC question, 2) the TI narrative response, and 3) any attachments such as figures, diagrams and/or forms.

Additionally, TI is including a section describing revisions to Appendix B of the December 1994 Supplement Plan "Groundwater Radiological Monitoring Work Plan." These revisions are included to provide relatively minor enhancements to the Plan while it is still under NRC review.

TI is pleased to submit the following correspondence, and hopes that it will meet the satisfaction of the NRC. TI looks forward to the timely approval of the Supplement Plan. If there is anything further TI can do to expedite such an outcome, please do not hesitate to contact me. I can be reached at (508) 236-1809.

Sincerely yours,

Materials & Controls Group

M. J. Elliott

Michael J. Elliott
Environmental Manager

cc: Richard L. Joosten, Esq. - TI Corporate Legal
Francis J. Veale Jr., Esq. - TI Attleboro

OFFICIAL RECORD COPY ML 10

121534
JUN - 8 1995

1. Q The characterization report (discussed in section 9 of the Supplement) is necessary to evaluate the adequacy of the characterization that has been performed at the facility. Provide the date that you will transmit this report to Region I.

A The "Supplemental Radiological Survey" which is entitled "Radiological Surveys of Open Land Areas" as described in Section 9 of Appendix A of the Supplement has been completed and is undergoing final review. We expect that this report should be completed and transmitted to Region I presently (on or about June 12, 1995).

2. Q In Section 3.1 of the Supplement and in Section 7 of Appendix A to the Supplement you discuss surface scans for affected and unaffected exterior areas of the site. At what distance above the ground surface are these measurements performed? What specific follow-up is performed for locations that exceed 1.5 times nominal background?

A Surveys of open land areas are discussed in Section 3.1 of the Supplement and in greater detail in section 7 of Appendix A ("Supplemental Radiological Survey ...."). Although not specifically stated, surface scans are conducted in a manner that meets or exceeds the recommendations presented in NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination". NUREG 5849 recommends that surface scans of open land areas be conducted such that "the detector is kept as close as possible to the surface ...". In accordance with this recommendation open land area surface scans are conducted at distances above the surface of nominally one (1) to two (2) inches. This distance is assured through the use of a spacer at the end of the probe designed to maintain consistent distances and to protect the delicate NaI(Tl) probe.

In accordance with the criteria established within section 7.1 "Survey Description of the Open Land Areas" (7.1.1 Affected Open Land Areas and 7.1.2 Unaffected Open Land Areas) of Appendix A to the Supplement, all elevated readings (e.g. 1.5 times above background) obtained during surface scans are referenced to a facility map and surface soil samples are obtained at these locations in addition to direct measurements at these locations. These locations are further identified for subsurface sampling.

3. Q Describe the criteria or method that you have used for determining background for use in the evaluation of the results of exterior surface scans.

A Background for each instrument used is established daily by surveying a predetermined area which is established as nominal background (compared to off-site background) for the site. The area in which daily background was obtained is correlated to more extensive background determinations and instrument cross comparisons. This extensive background determination was based upon previous surveys including those of ORAU (Ref 1), ORISE (Ref 2), and TI (Ref 3). The instruments used to perform background measurements (both on and off-site) included a Reuter-Stokes High Pressure Ionization Chamber (HPIC), Ludlum micro-R meters, NaI(Tl) detector arrangements, Bicron microrem meter, and a Victoreen 450P Survey meter. These measurements were compared to each other during various phases of the remediation of the former Burial Site. Nominal background for the area is reported to be 10-13 μR/h and was correlated to a nominal NaI(Tl) response of 2000-2500 cpm. For more detailed information, please refer to Appendix E of Reference 3.

References:

1 ORAU (1985), "Radiological Surveys of the Texas Instruments Site, Attleboro, Massachusetts," Oak Ridge Associated Universities, January, 1985.

2 ORISE (1992), "Radiological Survey for the Texas Instruments Incorporated Burial Site, Attleboro, Massachusetts, Oak Ridge Institute for Science and Education, Environmental Survey and Site Assessment Program (ESSAP).

3 TI (1993), "Remediation of the Former Radioactive Waste Burial Site, Final Report, Appendix, E, Final Survey Methods and Results", Texas Instruments Incorporated, Attleboro, Massachusetts, September, 1993.

4. Q In section 3.2 of the Supplement you discuss surface (radiological) scanning for interior surfaces. Describe the methodology and the instrumentation that you are employing. Include a description of the instrumentation and the detection sensitivity for this equipment. You may find it useful to refer to section 5.2 of NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", for the calculations of detection sensitivity of a radiation survey meter.

A Radiological scanning of interior surfaces has been conducted using guidance established within NUREG/CR-5849. Specifically, instrumentation was chosen to meet the guidance established for free release. In this regard, the sensitivity/response characteristics of instrumentation to the contaminant, uranium, is dependent upon the expected enrichments. We have reviewed and followed the intent of the NUREG/CR-5849 guidance with respect to instrumentation selection and use. In addition to the NUREG guidance, we have also considered Uranium enrichment information established for the site as it would affect MDA.

The instruments used during the scoping survey were pancake type GM detectors, clustered pancake detector arrangements and large area proportional counters. The effective detection surface area of these detectors are 15 cm^2, 50 cm^2, and 100 cm^2 respectively. These detectors are capable of detecting both alpha and beta type radiations. Although the detection sensitivity of GM type detectors to alpha particle radiations on convoluted dusty surfaces is limited, these detectors will none the less respond to alpha emissions from the contaminated surface. No credit will be taken for the response of the detectors to alpha particle radiations and therefore the survey results will tend to be conservative.

In order to determine the overall sensitivity of these instruments, assuming only beta detection capability, a weighted or equivalent derivation of a release criteria needs to be established. This equivalent beta release criteria is established based on the relative yields of each uranium series and relative abundances (enrichment) of each uranium isotope. Table 1 presents the data used to obtain the equivalent beta release criteria of 4200 dpm/100 cm^2. From this data, and using the minimum detectable activity methods presented in NUREG/CR-5849 the detection sensitivities can be derived as follows for static measurements:

$$MDA = 4.65\ (B_r/2\ t_c)^{1/2} / (E * A/100)$$

and for scanning:

$$MDA = (S * B_r)/ (E * A/100)$$

Where:

MDA	is the minimum detectable activity,
B_r	is the background counting rate (40 cpm and 150 cpm for the pancake and cluster respectively),
t_c	is the instrument time constant (22 sec),
A	is the area of the detector ($15cm^2$ and $50cm^2$ for the pancake and cluster respectively),
E	is the detector efficiency (0.2), and
S	is the sensitivity factor.

For static measurements the MDA for the Pancake type detector and the Pancake cluster probe arrangement are 1100 dpm/$100cm^2$ and 665 dpm/$100cm^2$. For scanning measurements, the value of S must be established. NUREG guidance has indicated that for audible measurements of count rates on the order of a couple of thousand that this value is approximately 0.25 to 0.5, whereas for "a few counts per minute" background this value can be as high as 2 to 3. The measurement methods used during the scanning process incorporated a meter reading method coupled with audible response indication. Field experience has shown that twice background is easily observed and conservative for the low background count rates encountered. Therefore the sensitivity factor chosen is 2 for the GM and cluster probe arrangements. The MDA values determined for this case are therefore 2700 and 3000 respectively.

These MDA values are below the derived release criteria. However, since these MDA values are not below the 25% criteria within NUREG/CR-5849 guidance, static measurements will be taken at one meter intervals to satisfy the requirements when these detectors and data will be used as final status surveys.

In all likelihood, the remediation Contractor will use large-area gas flow detection systems that are operated at voltages optimized for beta detection. In that case, the derivation of the "equivalent beta release criteria" would become moot since the detector would be measuring only beta particles. In addition, the differing probe surface areas, detection efficiencies, time constants, and detector background count rates would likely result in lower MDA's.

Table 1: Principal Uranium and Uranium Progeny Radiations (Based on Site Specific Samples)

Radionuclide	Alpha Activity Fraction	Beta Particles per Uranium Alpha Decay	Weighted Beta/Alpha Ratios
U-234	0.568		
U-235	0.025		
Th-231		1	0.025
U-238	0.4		
Th-234		1	0.4
Pa-234m		1	0.4
TOTAL	1		0.825
TOTAL ALPHA/BETA RATIO =		1.212121212	

Modified Criteria equals 0.825 x 5000 dpm/100 cm^2
Modified Criteria 4200 dpm/100 cm^2

5. Q Describe the training or instructions provided to individuals working in or near the areas to be remediated, but not directly involved in the decommissioning efforts.

A TI has an extensive program to protect the health and safety of its employees. An important part of this program is maintaining employee awareness of planned and ongoing activities at areas adjacent to their work location and informing them of any necessary precautions. Planned and ongoing remediation activities are the subject of facility-wide bulletins to all supervisors informing them to keep employees at a safe distance. Periodic bulletins to supervisors include reminders as to ongoing remediation activities.

Before each remediation activity is initiated, each supervisor and all affected employees are briefed on the activity, its location and expected duration, and are provided appropriate general or specific instructions. For example, the attached schedule shows the dates that instructions were conveyed to all employees within Buildings 4, 5, and 10 who might be affected by the upcoming Building Interior Remediation activities. Similar instructions are provided for open land area activities though there are usually fewer employees involved as few employees spend much time near the remediation locations.

In addition, of course, locations of remediation activities are appropriately posted to alert workers and visitors of any hazards (see response to Question No. 8).

BRIEFINGS FOR EMPLOYEES WHO WORK AT OR NEAR LOCATIONS SUBJECT TO BUILDING INTERIOR REMEDIATION

SCHEDULE

January 9, 1995

13:30-14:00: Safety Department (Bldg. 10)
14:05-14:25: R&M and Fork Truck Repair (Bldg. 10)
15:00-15:10: Facilities Building and Equipment Maintenance (Bldg. 10)
15:15-15:30: Facilities Construction Services (Bldg. 10)

January 10, 1995

06:30-07:15: Wire Dept. 1st and 3rd shifts (Bldg. 10)
14:30-15:00: Wire Dept. 2nd shift (Bldg. 10)
15:00-15:30: Bldg. 4 TM and IMD (Bldg. 4)

January 11, 1995

06:30-07:15: TM and IMD (Bldg. 4)
14:45-15:15: Metals Recovery Area (Bldg. 5)

6. Q In the Remediation Plan you included a description of your gross alpha counting technique for determining total uranium concentrations in soil. In the Remediation Plan and in your September 1993 Final Report of the Remediation of the Former Radioactive Waste Burial Site you included data that validates this technique as sufficiently sensitive to meet the NRC criteria for release for unrestricted use (30 pCi/gram for enriched uranium). Although you described aspects of the Quality Assurance (QA) program relating to the gross alpha measurements in Section 7.3.4 of Appendix A to the Supplement, provide additional explanation on how your QA program will compare the numbers from alpha and gamma spectroscopy results and how differences or anomalies will be resolved.

A Results from samples processed by an independent laboratory are reviewed. The reviews include comparison of alpha spectroscopy versus gamma spectroscopy and each is compared to gross alpha counting. It is expected that some variation will exist. The predominant variation has occurred in comparing results of gamma spectroscopy to alpha spectroscopy and gross alpha counting. This variation has been related to uncertainties in counting data for low yield photons of low activity samples, inference assumptions and variation in the scaling factor used to infer ^{234}U activity concentrations. As indicated in Item 11, there exists a known standard bias in low activity samples (<20 pCi/g) where gross alpha counting yields conservative results.

Regardless, anomalies and/or differences are identified through the QA/QC process and resolution is attempted. For each sample, the following QA checks are performed: (1) compare values of ^{235}U and ^{238}U reported for alpha and gamma spectroscopy; (2) compare total uranium obtained from alpha spectroscopy to results obtained from gross alpha counting technique; and (3) using the ^{234}U to ^{235}U ratio obtained for alpha spectroscopy, correct the gamma spectroscopy data for total uranium for comparison to alpha spectroscopy and gross alpha counting.

Investigation of variations or anomalies may include re-analyses (including sample preparation) by the same laboratory and gross alpha counting. In some instances, an investigation of a variation or anomaly may be unnecessary if the sample is from an excavated area. The sample may no longer be of consequence if the sampled soil has been disposed of off-site or if the samples surrounding the location of the sampled soil confirmed that the sampled area was indeed elevated.

Samples used for final survey data should be resolved and if resolution is not accomplished via the methods presented or by methods of statistical analysis, then the following may be considered: (1) if both gamma spectroscopy and alpha spectroscopy were performed then alpha spectroscopy will generally over-ride

gamma spectroscopy analysis, (2) if only gamma spectroscopy analysis was performed then re-submittal of the sample for alpha spectroscopy analysis will be considered, and (3) if the approaches described above do not resolve the anomalies, re-sampling the area may be considered.

7. Q We have no objection to the concurrent survey, remediation, and restoration of interior areas of the building as described in the Supplement. However, we need more detailed plans for this activity so that we may inspect these activities while they are in progress. Please provide the following information:

a. A map or figure on your proposed segmentation of areas.

b. A tentative schedule for the resolution of each area.

c. A commitment that you will provide an updated schedule to Region I approximately once or twice per month.

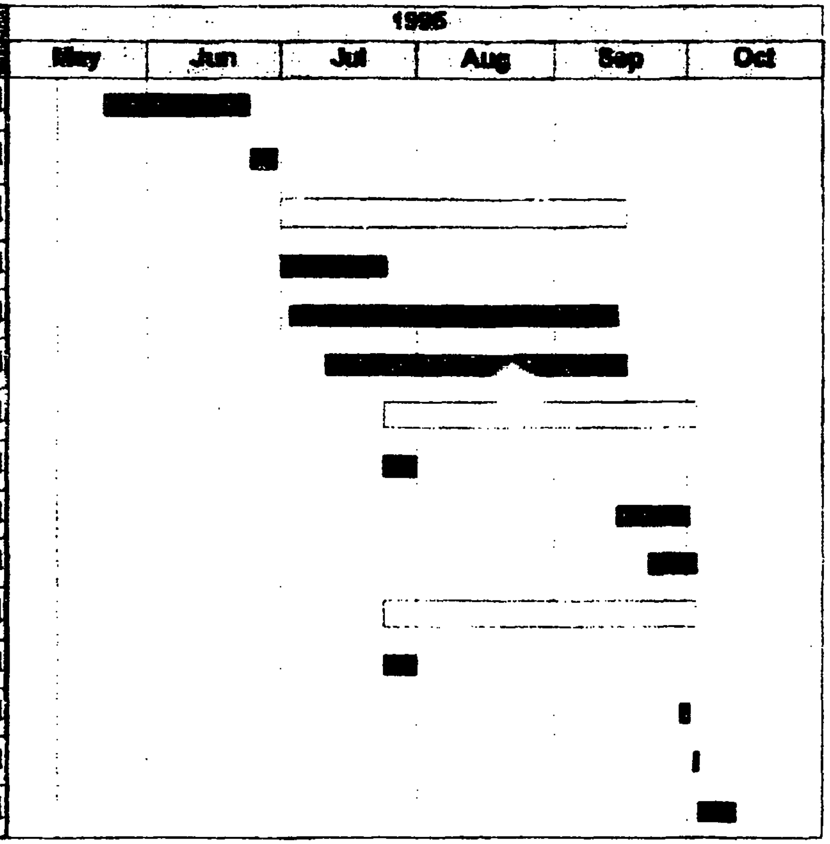
A The following preliminary schedule for the decontamination of buildings 4, 5, and 10 at the Texas Instruments (TI) Attleboro Plant is attached. This tentative schedule assumes mobilization of a decontamination contractor (DC) on or about June 24, 1995. It is expected that this schedule will be frequently adjusted as the effort progresses to take into account actual building conditions, availability of personnel and other factors. Starting dates, milestones and completion dates are all subject to adjustment as deemed appropriate by TI to conduct this effort efficiently.

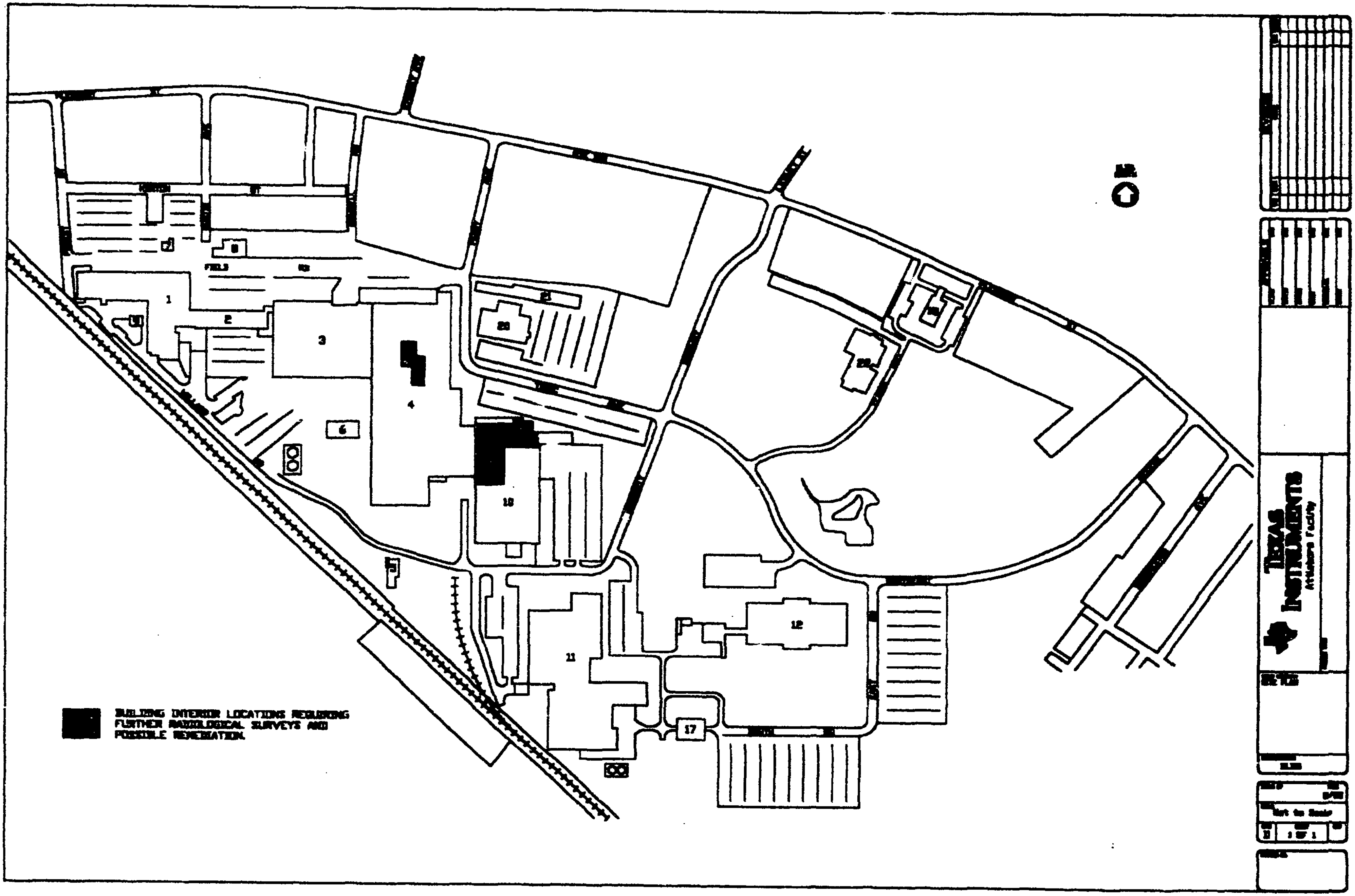
Following the schedule diagram, four figures are also attached. These figures show the general locations on the TI Attleboro site where building interior activities will take place. It is premature to show segmentation within the buildings until there is a better understanding of the remediation process. The initial activities within Bldg. 10 are intended to develop a working model of the process, and that in turn, will allow more accurate scheduling of subsequent areas. As soon as a more detailed and reliable schedule is developed, it will be forwarded to the U.S. NRC.

Texas Instruments will notify the U.S. Nuclear Regulatory Commission (NRC) by the first of each month regarding progress against the attached schedule, and of changes in the schedule for the continuing effort. Since it is likely that the schedule will be dynamic in nature, TI suggests that, if the NRC desires to observe any specific activity on the schedule, it should check with the TI project manager, in advance, for the current project status.

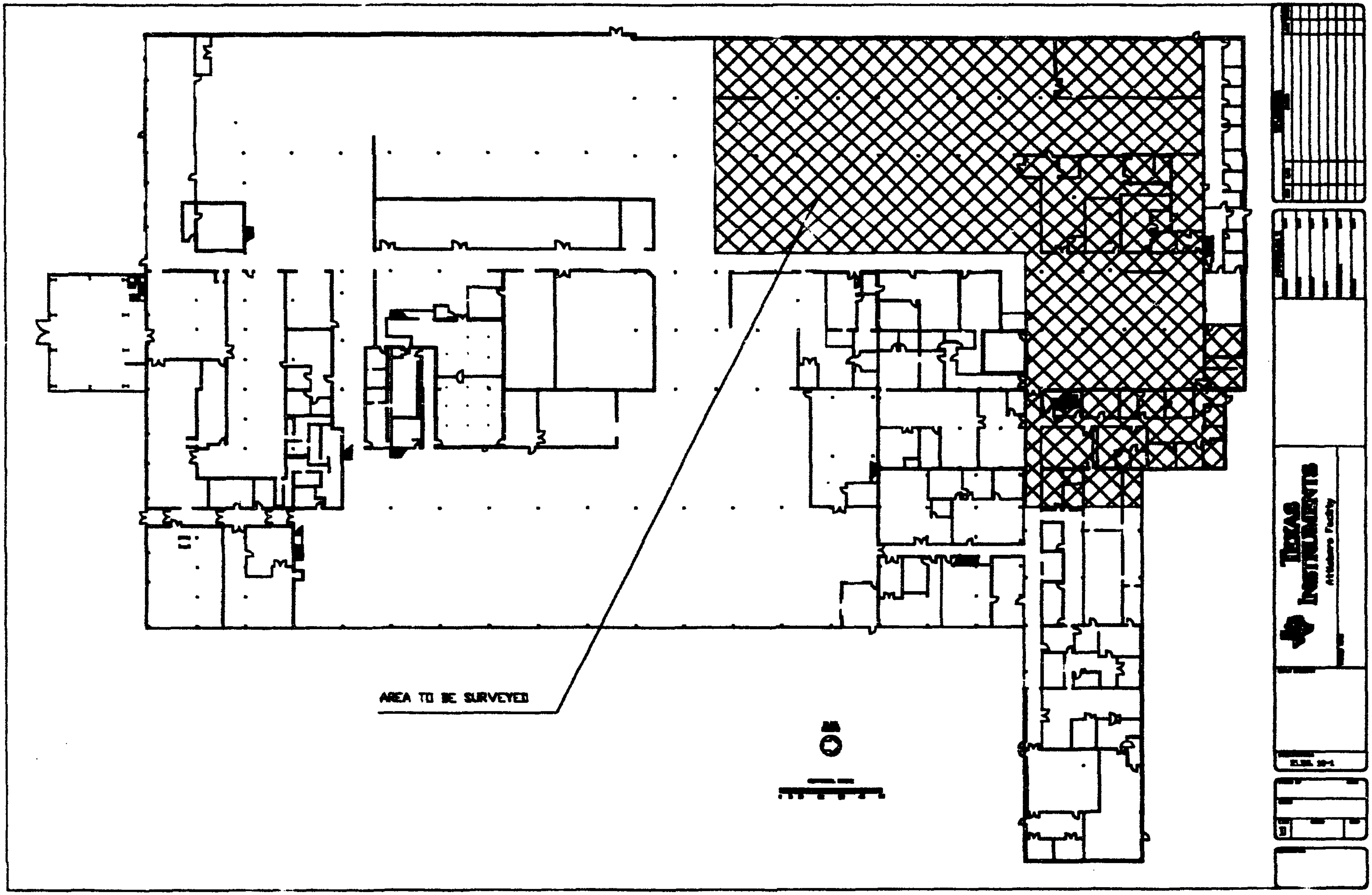
Preliminary Schedule for the Decontamination and Decommissioning of Buildings 4, 5, and 10 - Texas Instruments Attleboro Plant

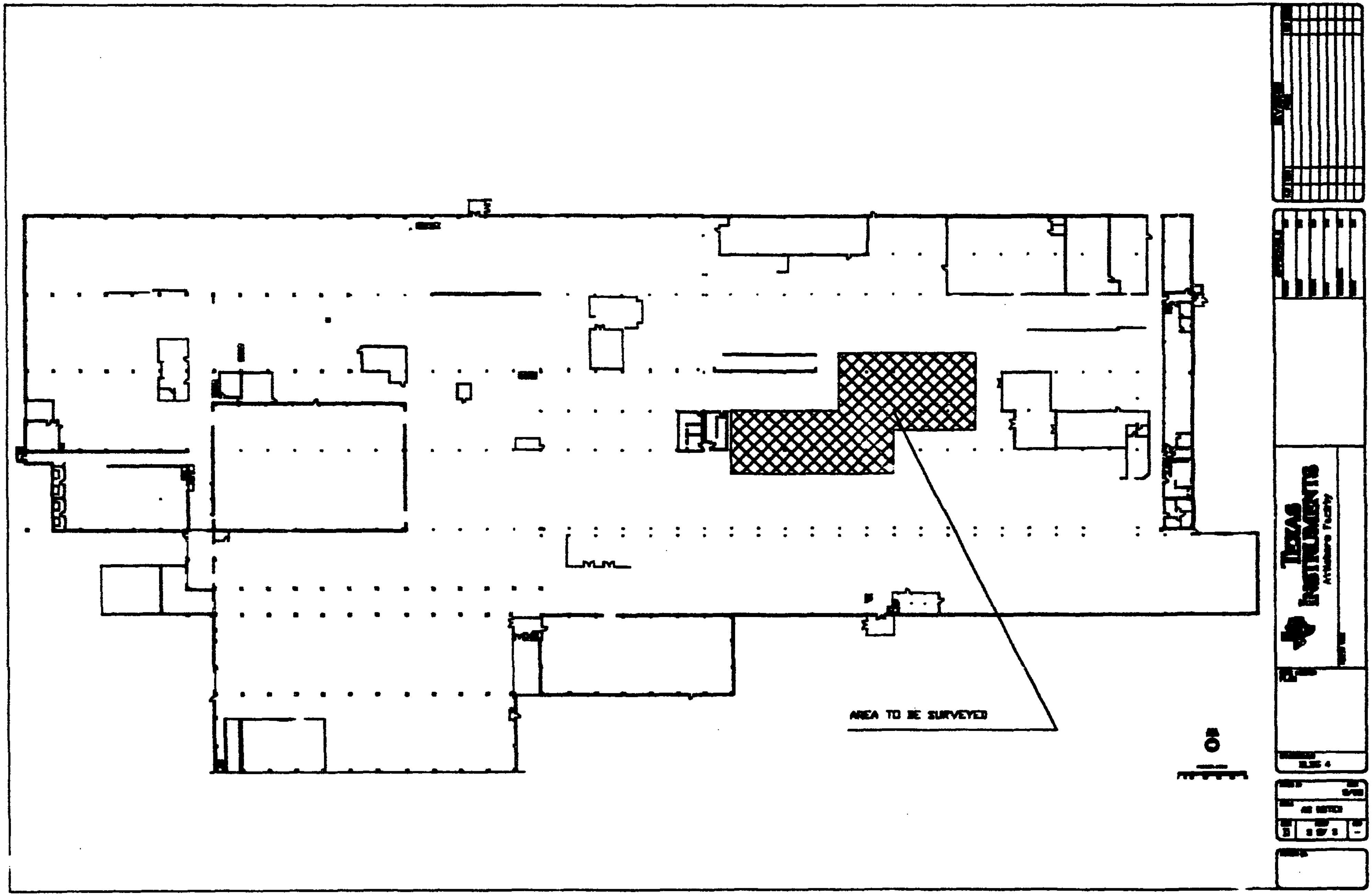
D & D Contractor Procurement	5/22/95	6/23/95	32.00d
Mobilization	6/24/95	6/29/95	6.00d
Building 10	7/1/95	9/16/95	78.00d
Survey	7/1/95	7/24/95	24.00d
Decontaminate	7/3/95	9/14/95	74.00d
Restore	7/11/95	9/16/95	68.00d
Building 4	7/24/95	10/2/95	70.00d
Survey	7/24/95	7/31/95	8.00d
Decontaminate	9/15/95	9/30/95	16.00d
Restore	9/22/95	10/2/95	10.00d
Building 5	7/24/95	10/2/95	70.00d
Survey	7/24/95	7/31/95	8.00d
Decontaminate	9/29/95	9/30/95	2.00d
Restore	10/2/95	10/2/95	1.00d
Demobilization	10/3/95	10/11/95	7.00d

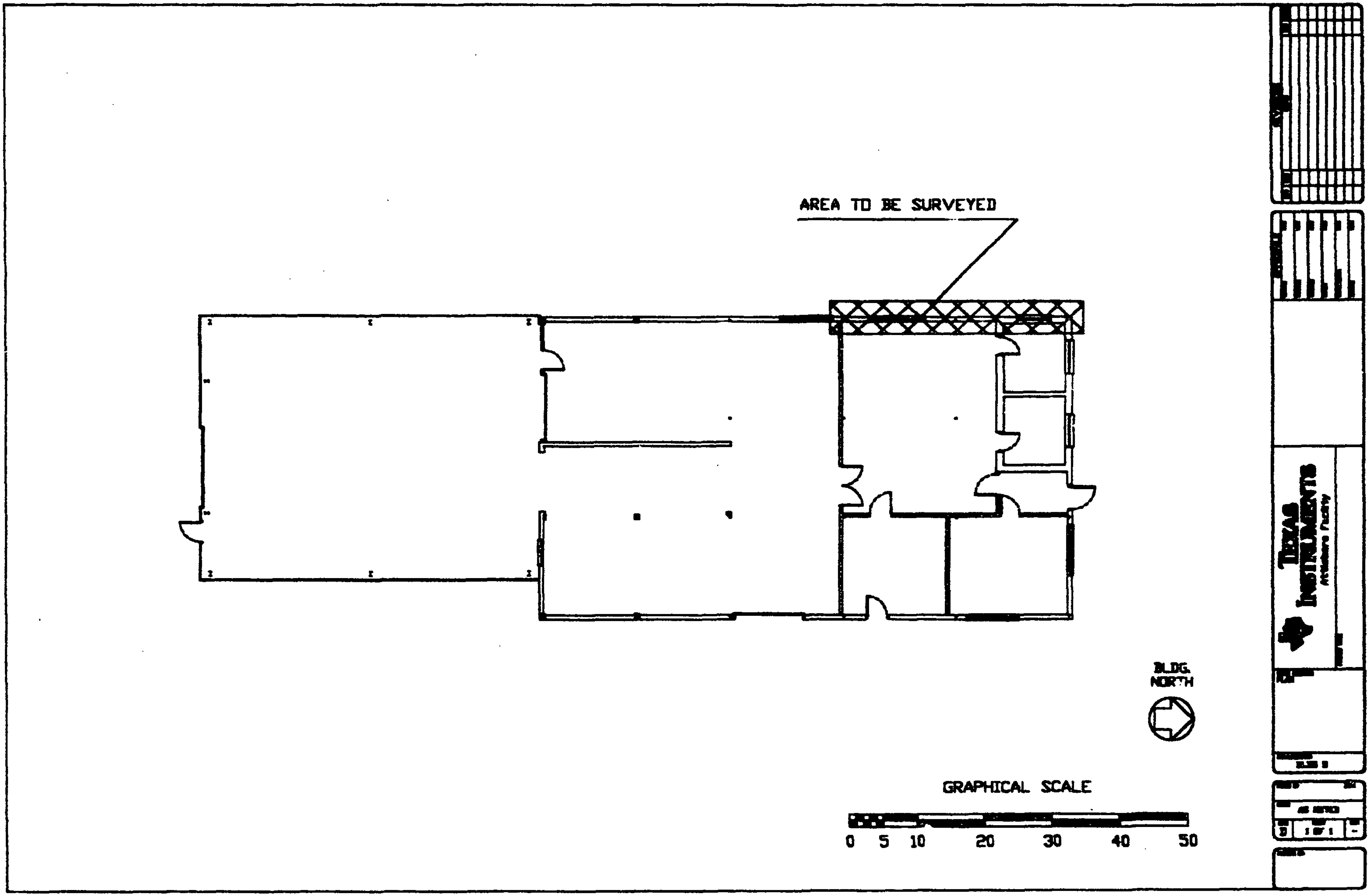




OFFICIAL RECORD COPY


AREA TO BE SURVEYED
TEXAS INSTRUMENTS
Attleboro Facility


AREA TO BE SURVEYED
TEXAS INSTRUMENTS
Attleboro Facility
BLDG 4
AS NOTED


AREA TO BE SURVEYED
BLDG. NORTH
GRAPHICAL SCALE
0 5 10 20 30 40 50
TEXAS INSTRUMENTS
Attleboro Facility

1215.34

8. Q In Section 3.3 of the Supplement you discuss work plans that will be consistent with the 1992 practices. In our review of the Remediation Plan and the Supplement, it is not clear what you define as a work plan. The information provided in Section 3.3.3.2 of the Supplement is not specific enough for us to understand: the preparation of areas; protective clothing requirements for workers; signs and notifications to workers; and controls for the prevention of non-radiation workers from entering the areas under remediation. Please submit a description of a "typical" work plan for the survey, remediation and restoration of an interior area segment that, at minimum, addresses these items.

A Prior to the execution of any decontamination activities by the selected decontamination contractor (DC), Texas Instruments (TI) will require the submission of a comprehensive set of procedures addressing radiological safety, contamination control, radiological equipment calibration and usage, and handling and packaging of radioactive waste. The issues raised in question #8 of the Nuclear Regulatory Commission (NRC) memorandum dated April 13, 1995 will be addressed under the radiological safety program procedures. To demonstrate an understanding of the needs of this program, TI is providing the following discussion on the preparation of work areas, protective clothing requirements for workers, signs and notifications to workers, and controls for the prevention of non-decontamination workers from entering the areas under remediation.

Specific information on control of radiological safety and radiological materials control information relevant to the aforementioned issues will be incorporated into area radiation work permits (RWPs). Each area RWP will contain information necessary to assess the potential for decontamination worker and TI non-decontamination worker exposure to radioactive materials, and specify the means of controlling this exposure. The RWP will contain, at a minimum, work area exposure rates, postulated airborne radionuclide concentrations, and bioassay and dosimetry requirements. These RWPs will also include a description of the work tasks to be performed, personal protective equipment (PPE) requirements, respiratory protection, and required radiological monitoring. A sample RWP (which may be modified in accordance with the procedures of the selected DC) is provided as Attachment A.

The following discussion provides the TI programmatic approach to the subject areas identified in question #8.

<u>Controls for the Prevention of Non-Decontamination Workers from Entering Remediation Areas</u>

All remediation areas will be restricted by temporary barriers that are clearly marked as described below. At times when the DC is not working, remediation areas will be locked or otherwise secured by the TI Facility Manager or DC Supervisor.

Signs and Notifications to Decontamination and Other Facility Workers

All segmented work areas will be posted and controlled according to the requirements of 10 CFR 19 and 10 CFR 20. It is anticipated that most work areas will be posted as "radioactive materials" and to a lesser extent "airborne radioactive materials" due to the relatively low surface contamination levels and bulk volume activity concentrations. A copy of the segmented area RWP and worker sign-in log will be posted at the access control point of entry to the work area. Postings will be placed in conspicuous areas to ensure that TI facility workers do not inadvertently enter controlled areas.

Preparation of Work and Waste Storage Areas

Access to segmented work areas undergoing active decontamination will be limited to a conspicuously posted control point. This control point will be the access location through which all workers may enter the area (only after reading and signing the associated RWP). Each access control point will include a frisking station to assess and limit the transfer of contamination from the work area. Depending on the decontamination worker traffic flow through the areas, the access control point may be manned by a health physics technician (HPT). During low-traffic work periods, trained workers will be allowed to frisk themselves.

Depending on the work activity specified in the RWP and the results of frisking, workers may be required to remove and dispose of PPE in waste receptacles maintained at the access control station. At the close of daily decontamination activities, waste drums for PPE and other contaminated disposable items will be sealed and swiped for removable contamination. Materials necessary to decontaminate workers such as water, non-toxic detergents and other agents will be maintained at the access control station and used as necessary.

If it is determined that special containment enclosures are required to limit the potential dispersion of airborne radioactive material, a more restrictive radiological control area will be serviced and posted. It is anticipated that these restrictive access control zones will provide a support service to activities requiring respiratory protection.

Selection of PPE and Radiological Monitoring Equipment

PPE will be selected based on the work area condition assessment. It is anticipated the standard work ensemble in radioactive materials areas will include coveralls, work boots, and gloves. This PPE may be upgraded to disposable Tyvek coveralls, boot covers, and hoods if the potential for significant removable contamination (in excess of the surface contamination limits defined in NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination Licenses for By-product, Source or Special Nuclear Material") exists. The standard work

ensemble in airborne radioactive materials areas will include disposable Tyvek coveralls, boot covers, hoods, disposable gloves, and respiratory protection.

Respiratory protection may consist of air purifying respirators, self-contained breathing apparatus (SCBA), or supplied air lines depending on the airborne activity concentrations and the work activities undertaken. If respiratory protection programs are implemented, they will be maintained in accordance with American National Standards Institute (ANSI) Z88.6-1984 recommendations and 10 CFR 20.1502.

As specified in the RWP, decontamination workers will be supplied with a radiation dosimeter as appropriate that may be read on a quarterly basis (or more frequently if needed). In the unlikely event elevated gamma exposure rates are encountered (defined as greater than 2 mR/hr), the DC Supervisor may implement a self-reading dosimeter (SRD) or remote tracked "Chirper" system to monitor elevated worker exposures.

The DC will provide radiological equipment capable of determining fixed and removable surface alpha and/or beta-gamma contamination, gamma exposure rates, and alpha and/or beta-gamma airborne radionuclide concentrations adequate to meet termination survey criteria. All instruments shall be calibrated in accordance with the specifications contained in ANSI N323-1977 or more recent versions. Detailed calibration records (including date, method, source description, and results) shall be kept as quality assurance records under the supervision of the DC Supervisor. On a daily basis, or as frequently as required, each type of instrumentation shall be checked to ensure proper tolerance within calibration limits.

ATTACHMENT A
(Question No. 8)
SAMPLE RADIATION WORK PERMIT

RWP Title: ______________________

RWP No: ____________ Date of Issue ____________ Date of Expiration ____________

Requested By: ____________ Work Location: ____________

Description of Work to be Performed: ______________________

____

____

____

Radiological Survey History:

Radiation Levels General Area	____________	uR/hr
Radiation Levels Work Area	____________	uR/hr
Radionuclides Present	____________	
Airborne Radionuclide Concentration	____________	uCi/ml
Total Surface Contamination Levels	____________	dpm/100 cm2
Removable Surface Contamination Levels	____________	dpm/100 cm2

Surveyed By: ____________ Date of Survey: ____________

Monitoring Schedule and Frequency:

Lapel Sampling	____________
General Air Sampling	____________
Radon Sampling	____________
Gamma Exposure Rate	____________

Personnel Protective Equipment Required:

TLD Badge	________	Gloves-Cotton	________
SRD	________	Gloves-Rubber	________
Shoe Covers	________	Goggles	________
Tyvek Coveralls	________	Saranex Coveralls	________
Other Dosimetry	________	Other	________
Full Face Respirator	________	1/2 Face Respirator	________
Supplied Air Line	________	SCBA	________

Special Instructions: ______________________

Urine Sample Req? ________ Whole Body Req? ________

General Rules For Working In Radiologically Contaminated Areas:

1. All work will be conducted in a practical manner maintaining a minimum of exposure to personnel.
2. All required dosimetry will be donned prior to entry into work area.
3. All protective equipment will b donned prior to entry into the work area.
4. Eating, drinking, and chewing are prohibited in the work area.
5. Visitors and/or persons unfamiliar with site safety procedures will require an escort upon site entry.
6. All individuals entering the work area must sign the Access Control Log.
7. Personnel entering the site are required to be familiar with procedures for decontamination and frisking.
8. Personnel will notify the Site HP of unusual conditions or equipment malfunction.

Reviewed By: ____________ Date: ____________

Approved By: ____________ Date: ____________
(RSO or designee)

Terminated For: ________ Completion of Job ________ Expiration of RWP
________ Cancellation of RWP

RSO Signature: ____________ Date: ____________
Change in Radiological Conditions: ____________

ATTACHMENT A
(Question No. 8)
SAMPLE RADIATION WORK PERMIT SIGNATURE FORM

RWP Title______________________
RWP # _______________________

Signing this RWP indicates that you have had a pre-job briefing, have read the RWP, and fully understand all the requirements and radiological hazards related to this job.

RWP Briefing Date	Name (Print)	Signature	SSN#	TLD #

Briefing Performed By__________________________________Date____________________

9. Q Briefly describe your system for archiving samples described in Section 3.4 of the Supplement. Approximately how much sample is retained for further analysis?

A Soil samples collected in the field include but are not limited to; surface samples, sub-surface samples, floor (excavated area) grab samples, processed soil samples and confirmatory samples (including duplicates/replicates). Samples are normally collected in one liter jars. Volume of soil within the jars is typically to capacity but will vary depending on the recovery of soil from the sample process such as those obtained from some subsurface (split spoon) samples. The mass of the soil sample retained is typically 500 to 1000 grams. The amount of soil used for the gross alpha analysis is minimal constituting approximately 20 grams.

The criteria for archiving samples vary depending on the specific phase of the project. Characterization survey soil samples are archived until remediation is complete and include surface and subsurface samples. Final status survey samples are maintained until license termination is complete. These include excavated area samples, excavation perimeter samples (sub-surface and surface samples) and characterization survey samples outside of excavated areas. Samples to be archived are assigned unique numbers in the form of AAA-XXX-MMDD-NNNN, where AAA denotes the area from which the sample was obtained (i.e., B10 for Building 10 area), XXX denotes the type of sample obtained (i.e., SSS, FGS, etc for split spoon sample and floor grab sample), MMDD denotes the month and day the sample was obtained, and NNNN is a consecutive number for the sample. In addition to this unique archiving designation, the physical location (grid coordinate) from which the sample was obtained is recorded in a reference file. All archived samples are placed into a "wrangler" (a 1 cubic yard container) labeled with respect to its contents (approximately 200 per container) and located in a secured storage trailer dedicated for this purpose. To date over 6000 samples have been archived.

10. Q In Attachment C of Appendix C to the Supplement (the Radiological Health and Safety Plan), there appears to be an error in the units for uranium bioassay results. A uranium concentration of 5 g/l in urine (the specified action level) would yield a value that is several times the Annual Limit on Intake in 10 CFR 20, Appendix B (assuming inhalation of a class Y compound). Please correct this error.

A The appropriate action limit for bioassay is 5 µg/l. This was a conversion error created when the original document was transferred from one word processing program to another and special characters were not recognized during the conversion process. Unfortunately this was not identified in final review prior to submittal.

11. Q In the telephone conversation with Mr. Roberts on April 7, 1995 you stated that your gross alpha counting technique appears to over-estimate low concentrations of total uranium in soil. Describe the methodology that you will use for applying a correction factor to the lower concentration results using this technique.

A It has been previously recognized (ORISE: Ref. 4) that the gross alpha counting methods over predicts the "true" activity at concentrations below 20 pCi/g. The reason for this over prediction, especially at background concentrations of 1-2 pCi/g is related to the natural Uranium daughters in some state of equilibrium (i.e., Ra-226 and its progeny) resulting in approximately 8 alphas per pCi/g total uranium rather than the three alphas normally associated with uranium devoid of its progeny. Generally, this has not been an issue since the results tend to be conservative and controlling actions [illegible] most often continue to be based on acceptance of the over-predicted value. However, it may be desirable in cases of grid cell averaging to account for this over prediction in instances where averages marginally exceed the criteria. In order to account for this discrepancy at concentrations near background, an evaluation of a larger sample population was performed which supported this observation. The samples evaluated in this analysis compared gross alpha screening to alpha spectroscopy rather than gamma spectroscopy, since the minimum detectable activity for gamma spectroscopy is approximately 8 pCi g^{-1}.

This evaluation demonstrated that an average total uranium concentration of 1.71 $\pm$ 0.41 pCi g^{-1} obtained from alpha spectroscopy resulted in an average alpha screening value of 11.2 $\pm$ 3.1 counts/10 min (sample population of 20).

In applying this analysis to field data, a conservative assumption of using the average plus 1 standard deviation as a lower boundary condition is appropriate. Accordingly, all gross alpha counting results less than or equal to 14 counts/10 minutes will be attributed to natural uranium levels assumed to be 2 pCi/g. This assumption and correction to the data will not markedly affect grid cell averaging but will result in samples more closely approaching actual values.

Reference:

4 ORISE (1993), "Confirmatory Analysis, Gamma Spectroscopy and Alpha Screening, Texas Instruments Incorporated, Attleboro, Massachusetts" Letter to Jerome Roth, USNRC, from Armin Jaberaboansari, ESSAP, dated February 4, 1993.

12. Q In the telephone conversation with Mr. Roberts on April 7, 1995 you stated that the uranium contaminated soil in some locations appears to be located in sub-surface layers and that you will be removing the clean surface soil and using it to fill excavated areas where contaminated soil was removed. Although we have no objection to this procedure, please include a brief discussion on the mechanics of the operations used to accomplish the removal and disposal.

A The method used will vary depending upon the prevailing field conditions encountered such as extent and depth of contamination and extent of clean overburden and its variations. Regardless, the approach will be somewhat the same and is presented as follows for a general case:

1. For a given area identified for remediation, the survey data is reviewed with respect to the extent of contamination.

2. Overburden soil is removed from the surface to the expected depth of contamination. The removal process is accomplished using conventional excavation equipment capable of removing 6 inch to 12 inch lifts. In some instances the excavating bucket is fitted with a flat bucket rather than a toothed bucket to preclude depth mixing. The lifts will vary in thickness depending upon the depth to which contamination is expected. Coarse lifts will be used at near surface levels and finer lifts will be used as the depth approaches the expected contaminated soil depth.

   At all phases each lift layer is surveyed using surface scan methods and direct measurement methods with pancake type GM detectors as appropriate. If the levels detected by this instrumentation indicate no contamination, surface soil samples are obtained from the exposed surface resulting from excavation and analyzed on site. Detection of contamination using field survey methods will signify that the depth at which the contamination starts has been determined. In addition, each lift layer will be mechanically processed to remove bulk aggregate and sampled to ensure uranium contamination levels are below the acceptance criteria. All removed overburden soil which is below the criteria is staged for disposition as "clean" fill for on-site use (i.e., backfill for excavated area). Any removed overburden soil which is found to be in excess of the criteria will be staged for final disposition to a licensed disposal facility.

3. Contaminated soil is then removed in much the same manner using lifts to the final depth of contaminated soil. Each lift layer is removed, mechanically processed to remove aggregate, and sampled to determine activity concentration. Upon approaching the final depth, surveys are continued at each lift to determine the final extent of contamination. Once

complete, a final survey is conducted within the confines of the excavated area.

4. Soil designated for backfill is used to fill in the excavated area. Any supplemental fill brought in from off site is randomly sampled to ensure its concentration is below the criteria.

5. Final surveys are conducted in the method described in the Supplement.

REVISIONS TO APPENDIX B: GROUNDWATER RADIOLOGICAL MONITORING WORK PLAN of the SUPPLEMENT TO THE 1992 REMEDIATION PLAN

Submitted: June, 1995

In the following attachment, TI is submitting a revised version of the Groundwater Radiological Monitoring Work Plan that appeared as Appendix B of the Supplement Plan (December 1994).

Upon further review of the Groundwater Monitoring Plan, TI realized that the plan contained certain language that was specific to single contractor. The plan cited certain forms and procedures that, if strictly interpreted, might limit TI to using a single contractor for performing the work. TI would prefer not to be impeded by such limitations, so many of the modifications to the plan are motivated by an attempt to create a more universal plan that can be implemented by any qualified contractor or TI. Additional modifications are intended to clarify the plan and to improve TI's ability to implement it effectively.

The following paragraphs summarize the modifications that were included in the attached Groundwater Monitoring Work Plan. In places where there is more than a simple language edit, a brief description is included that explains the nature of the change.

LIST OF MODIFICATIONS:

---

1. INTRODUCTION

Language was modified to reflect that Rev. 2 was prepared by TI. Removed phrase that specified that sampling will occur only after remediation is complete.

2. GROUNDWATER MONITORING PROGRAM

Minor edit of language referring to NES/IES.

2.2.1 Groundwater Potentiometric Surface Measurements

Title was changed from "Groundwater Flow Mapping" to the current version listed above.

Language was edited that referred to NES/IES.

Requirement to generate groundwater flow maps was modified to measuring groundwater elevations in the monitor wells. As modified, the same objectives are accomplished but in a more manageable approach.

OFFICIAL RECORD COPY ML 10

121534

2.2.2 Sample Collection Procedures

Language was edited that referenced NES/IES.

Narrative was modified to reflect the fact that some sampling of existing wells will be performed prior to remediation.

The listing of typical sampling equipment was modified to reflect that which is ordinarily used by TI and other qualified contractors.

Requirement was removed to screen well air for the presence of organic contamination. This was originally included to test for the presence of explosive gases. Explosive gases have never been a problem in 12 years of collecting groundwater samples at TI. Additionally, the recommended method would not have distinguished between explosive gases and solvent vapors. The latter would almost certainly be present, so it would just lead to confusion.

Requirement was removed to containerize and hold all purge water until receipt of radiological test results. This would prove to be an onerous burden in the case of TI's bedrock monitoring wells that might generate as much as a few thousand gallons of purge water at each well. In place of this requirement, TI has developed a more manageable procedure that involves pre-sampling of the monitor wells prior to purging; collection of a composite sample during purging to demonstrate compliance; and collection of the formal sample used for reporting purposes.

2.2.4 Analytical Program

Language was inserted that refers to the formal samples used for reporting purposes, as distinguished from the "pre-samples" and the "purge composite samples."

2.2.5 Quality Assurance/Quality Control

Language was modified or deleted that referred to NES/IES.

The procedure for decontaminating non-disposable sampling equipment was modified; replaced the first potable water rinse step with a methanol rinse step (this will address any organics should they be present), and deleted deionized water rinse at the end.

Reduced the frequency of collecting field blanks from once per day to once per week.

2.3 INVESTIGATION RESULTS REPORT

Contents of the report were scaled down to include summary tables of all test results and the raw data. TI feels this is adequate in scope and is more manageable, thus ensuring completion in a timely manner.

ATTACHMENT 1 List of Relevant NES/IES Standard Operating Procedures

This attachment was deleted from the plan.

APPENDIX B

GROUNDWATER RADIOLOGICAL MONITORING WORK PLAN

TEXAS INSTRUMENTS FACILITY
ATTLEBORO, MASSACHUSETTS

Prepared for:

TEXAS INSTRUMENTS INCORPORATED
MATERIALS & CONTROLS GROUP
ENVIRONMENTAL, SAEFTY AND HEALTH DEPARTMENT
P.O. BOX 2964
34 FOREST STREET
ATTLEBORO, MASSACHUSETTS 02703-0964

Prepared by:

INTEGRATED ENVIRONMENTAL SERVICES
A DIVISION OF NES, INC.
44 SHELTER ROCK ROAD
DANBURY, CONNECTICUT

REV 2.0
JUNE 5, 1995
PREPARED BY TEXAS INSTRUMENTS INCORPORATED
MATERIALS & CONTROLS GROUP

TABLE OF CONTENTS

FIGURES

1. INTRODUCTION

This document was originally prepared by Integrated Environmental Services, a division of NES, Inc. (NES/IES) for Texas Instruments Incorporated (TI) to present a plan for radiological monitoring of groundwater at the TI facility in Attleboro, Massachusetts (the "Site"). Rev. 2.0 is a modified version which was prepared by TI. TI has proposed to remediate several areas where radiologically contaminated soil has been documented. Such areas will be referred to in this report as a Remediation Area (RA). As part of the decommissioning activities, groundwater monitoring will be performed to determine whether radiological constituents are contained in the groundwater in the vicinity of an RA. Identification and discussion of each RA is not included in this report.

1.1 PURPOSE

The purpose of this workplan is to describe the methodology and logic of the monitoring program to ascertain the presence of radionuclides in the groundwater at each RA. The results of this investigation are intended to be used in support of the completion of decommissioning efforts at the Site and termination of TI's Special Nuclear Materials License No. 23.

1.2 SITE HYDROGEOLOGY

The following description of Site hydrogeology was summarized from Appendix F, Site Hydrogeology in the 1993 Burial Site Final Report submitted by TI to the NRC in September 1993. The site is located within the bounds of the Narraganset basin. Bedrock consists of folded metasediments of the Rhode Island Formation containing fractures parallel to the northeast-southwest trending folds.

Bedrock is overlain by 10 to 40 feet of unconsolidated overburden which includes glacio-alluvial sediments consisting of a poorly sorted basal till (hydraulic conductivity 10E-5 to 10E-6 cm/s) overlain by interbedded silts, sands, and gravels (hydraulic conductivity 10E-2 to 10E-5 cm/s), with peat and other organic deposits near the surface representing a pre-development wetland in some locations.

Both the bedrock and overburden are waterbearing zones with some degree of hydraulic connection between them as indicated by pump test results. The water table is generally 4 to 5 feet below grade and a northwest-southeast trending divide is observed in the overburden aquifer. Shallow groundwater to the west of the divide flows towards the Ten Mile River Watershed and shallow groundwater east of the divide flows towards Cooper's Pond and the Taunton River Watershed.

2. GROUNDWATER MONITORING PROGRAM

The following sampling program is designed to investigate the potential presence of radionuclides in groundwater at each of the RAs utilizing the existing groundwater monitoring network to the greatest extent possible. Existing monitoring wells located in the immediate vicinity and on the downgradient side of each RA will be sampled, if possible. If no overburden wells are immediately adjacent to and downgradient from the RA, an overburden well will be installed within a short distance downgradient of the area. Bedrock wells in the immediate vicinity will also be sampled to provide information on this aquifer; however, no additional bedrock wells are proposed in this scope of work.

2.1 EXISTING MONITORING WELL NETWORK

According to information provided by TI, there are a total of 63 monitoring wells that currently exist on-site and one that has been abandoned. In addition, there are 13 monitoring wells off-site North and South of the Western half of the Site (See Figure 1). Twenty five of these wells extend into the bedrock, two of which are production wells used for the on-site manufacturing and two are located off-site, to the South of the Site. The balance of the wells, a total of 51, are completed in the overburden and 11 of these are located off-site. A potentiometric map, generated in May 1990, of the overburden aquifer was provided by TI (TI, 1990), and shows the hydraulic gradient of the Site (See Figure 2).

TI is presently conducting a groundwater remediation program in the area where 24 wellpoints have been completed in the overburden South of Building #3. However, that program is not relevant to this investigation, since that area is not an RA.

2.2 INVESTIGATION PROCEDURES, METHODS AND PROTOCOLS

2.2.1 Groundwater Potentiometric Surface Measurements

In accordance with TI's standard protocol, the groundwater elevations of monitor wells will be gauged prior to any sampling activities. Such information will be used to interpret groundwater flow direction. In the event that a new monitor well is required, the groundwater flow direction will be used to select the proper placement downgradient of the RA.

2.2.2 Sample Collection Procedures

Groundwater samples will be collected from identified wells adjacent to each individual RA. At a minimum, groundwater will be sampled as remediation of each RA is completed. In a number of locations where there are existing monitoring wells, samples will also be collected prior to remediation. The following equipment will be used for well sampling:

Either Disposable Polyethylene Bailers or Re-useable Teflon Bailer	Electric submersible pump Disposal cord

Appropriate discharge tubing
TI data collection forms
Stop watch or equivalent
Conductivity type water level detector
Appropriate Health and Safety Equipment
Well location and site map
Misc. tools

Equipment decontamination will be according to the procedures stated in Section 2.2.5 - Quality Assurance/Quality Control. The depth of standing water will be measured using the conductivity type water level detector.

The volume of water standing in overburden monitoring wells will be calculated and three to five well volumes of water will be purged prior to sampling to ensure the collection of a representative groundwater sample. In the case of bedrock monitoring wells, standing water will be purged prior to sampling until equilibrium is reached as defined by temperature, pH and conductivity, or until three volumes are withdrawn, whichever is the lesser volume.

Disposition of purged standing water will be based on a baseline screening sampling protocol. Prior to purging the monitor wells, and prior to formal sampling, a preliminary screening sample will be collected from each monitor well and analyzed for gross alpha concentrations. Preliminary screened samples will be compared against USEPA drinking water regulations (40 CFR 141) which specify a maximum contaminant level (MCL) for gross alpha of 15 pico-curies per liter (15 pCi/l).

After successful completion of the screening process, formal sampling will proceed. Formal sampling involves purging groundwater to the ground surface prior to sampling. During the purging process, additional water samples will be collected every 5 minutes, combined into a composite sample, and analyzed for gross alpha concentration. The purging process sample will be used to demonstrate that compliance was maintained. After purging has ceased, and the water level in a monitoring well has recovered to at least 75% of its original level, a sample will be collected using a sampling bailer.

Any new monitoring wells will be installed according to Massachusetts Department of Environmental Protection Guidance "Standard References for Monitoring Wells, WSC-310-91."

2.2.3 Sample Identification, Documentation and Handling

Each sample will be assigned a unique alpha-numeric identifier which is consistent with previous sample identification schemes used at the site. Each sample will be logged in a field notebook at the time of collection along with the following information: date sample was collected; weather conditions; unique sample identification number; field screening results; sample location and depth; verbal description of sample (matrix, color, texture, odor, etc.); and any unusual conditions or incidents during sampling.

Samples sent off-site for laboratory analysis will be accompanied by a Chain of Custody (COC) form completed by sampling personnel which includes the following information: sample identification number, number and volume of containers, preservative, analysis requested, and the date and time samples were relinquished to the laboratory.

2.2.4 Analytical Program

All formal samples collected for reporting purposes are to be analyzed for gross Alpha and gross Beta radioactivity. The USEPA drinking water regulations (40 CFR 141), provide maximum contaminant levels (MCLs) for drinking water. These regulations state that the MCL for gross Alpha is 15 pCi/L and the MCL for gross beta is 50 pCi/L. In the event that any sample exceeds the MCL, isotopic analysis for uranium and thorium will be performed for that sample.

2.2.5 Quality Assurance/Quality Control

All sample containers will be laboratory supplied, pre-cleaned and traceable. Sampping containers will remain closed and sealed until sample containers are needed. Sample containers will remain closed until ready for use and then closed immediately after filling with the sample.

Disposable sampling equipment will be dedicated to one well and properly disposed of after use. Decontamination of non-disposable sampling equipment will be as follows: methanol rinse; scrubbing with soapy water and a soft brush; and a potable water rinse.

Field blanks will be collected at the rate of one per week and will be generated by passing laboratory supplied analyte-free water through decontaminated sampling equipment into empty sample containers. The blanks will be analyzed according to the same analytical protocols selected for this investigation.

2.3 INVESTIGATION RESULTS REPORT

Analytical data will be received from the laboratory approximately 3-4 weeks from the date of sample collection. Once the laboratory data are received, a summary report will be developed. This report will include tables summarizing the potentiometric measurements and analytical results, and it will include attachments containing copies of the raw analytical laboratory data, and the field log sheets.

3. REFERENCES

NUREG/CR-1383. Guidance on the Application of Quality Assurance for Characterizing a Low-Level Waste Disposal Site, NUREG/CR-1383, October 1990.

NUREG/CR-5849. Guidance Manual for Conducting Radiological Surveys in Support of License Termination, draft, NUREG/CR-5849, June 1992.

ORAU, 1990a. Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program, Revision 5, ORAU, February 1990.

ORAU, 1990b. Quality Assurance Manual for the Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program, Revision 3, ORAU, February 1990.

ORAU, 1990c. Survey Procedures Manual for the Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program, Oak Ridge Associated Universities (ORAU), March 1990.

NRC, 1994. Draft Branch Technical Position on Site Characterization for Decommissioning, Division of Waste Management, Office of Nuclear Material, Safety and Safeguards, U.S. Nuclear Regulatory Commission, Nov. 17, 1994.

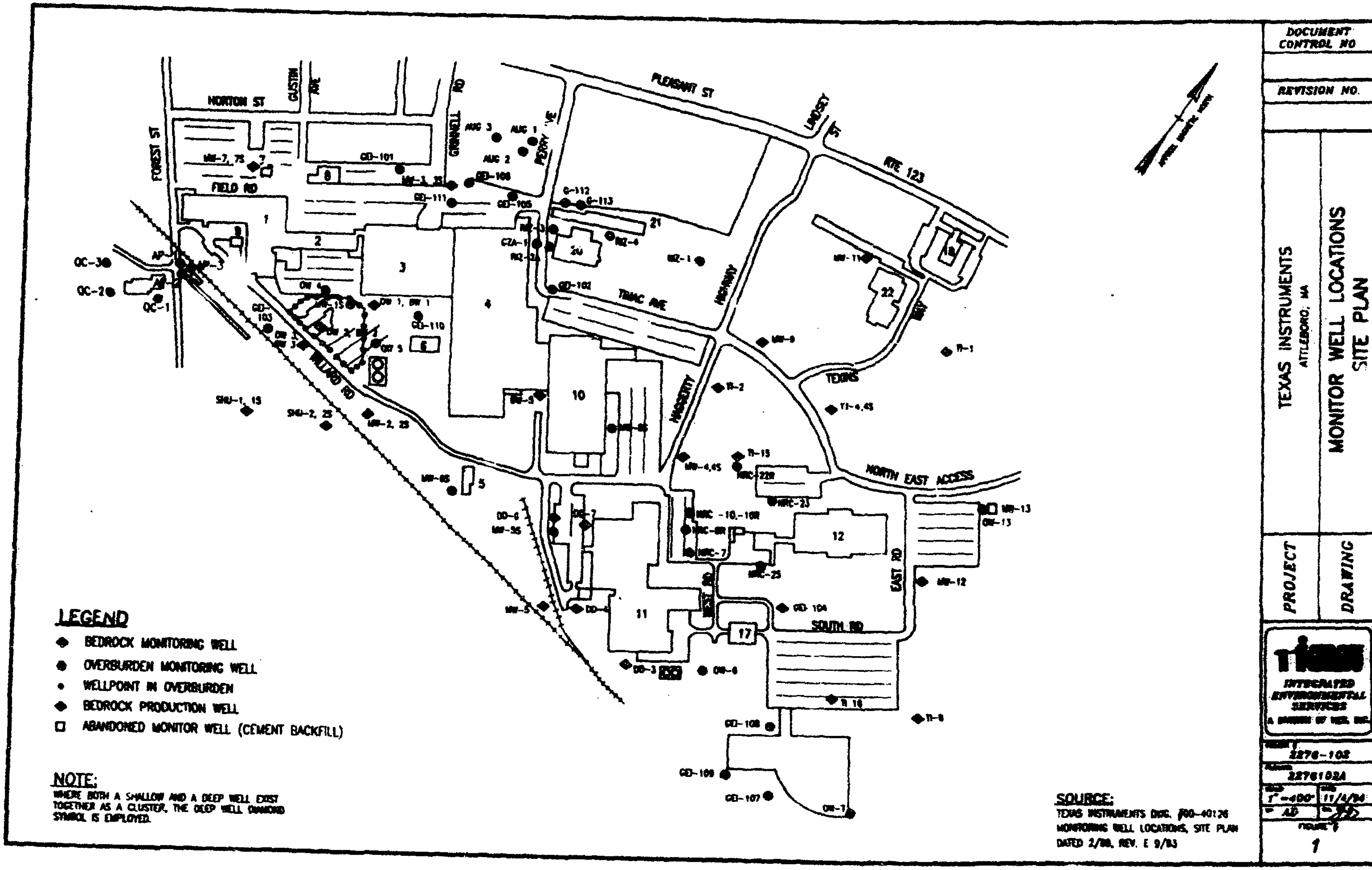
TI, 1993. Monitoring Well Locations Site Plan, Texas Instruments Facility, Attleboro, Massachusetts, Texas Instruments, September 1993.

TI, 1993. Appendix F, Site Hydrogeology of 1993 Burial Site Final Report, Texas Instruments Facility, Attleboro, Massachusetts, Texas Instruments, September 1993.

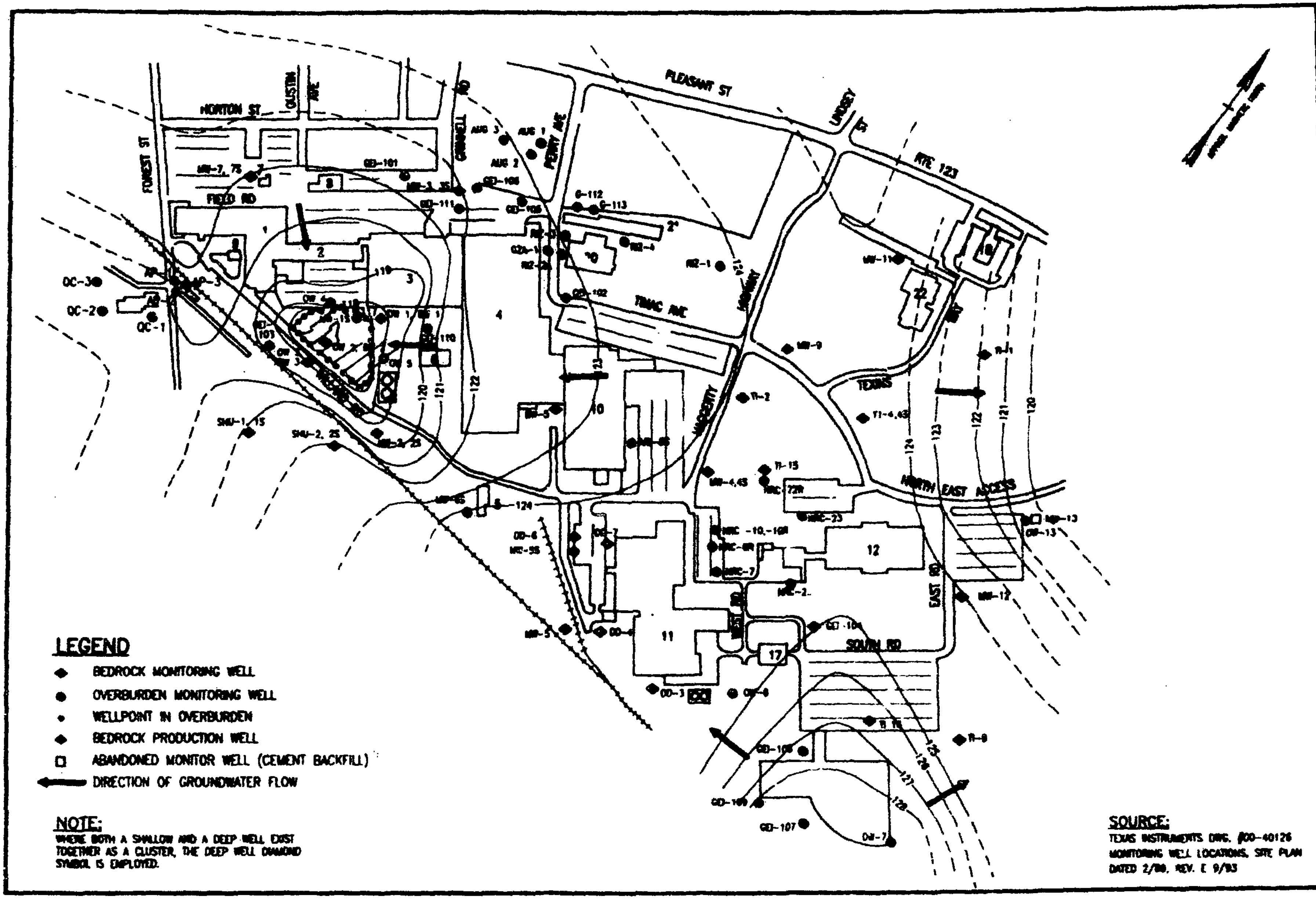
TI, 1990. Potentiometric Map, Overburden Aquifer, May 1990, Texas Instruments Complex, Attleboro, Massachusetts, Texas Instruments, May 1990.

Veale, F.J. 1983. Environmental Report: Radiological Survey and Review of the Texas Instruments Complex, Attleboro, Massachuetts, Texas Instruments, 17 January 1983.

Veale, F.J. 1982. Environmental Report: Radiological Survey of the Texas Instruments Complex, Texas Instruments, 20 July 1982.



DOCUMENT CONTROL NO
REVISION NO.
TEXAS INSTRUMENTS
ATTLEBORO, MA
MONITOR WELL LOCATIONS
SITE PLAN
PROJECT
DRAWING
INTEGRATED ENVIRONMENTAL SERVICES
2276-102
2276102A
1" =400'
11/4/94
FIGURE
1
PLEASANT ST
LINDSEY ST
RTE 123
NORTON ST
FOREST ST
FIELD RD
GRINNELL RD
PERRY AVE
TRIAC AVE
HIGHWAY
HAGGERTY
TEXINS
NORTH EAST ACCESS
EAST RD
SOUTH RD
WILLARD RD
LEGEND
BEDROCK MONITORING WELL
OVERBURDEN MONITORING WELL
WELLPOINT IN OVERBURDEN
BEDROCK PRODUCTION WELL
ABANDONED MONITOR WELL (CEMENT BACKFILL)
NOTE:
WHERE BOTH A SHALLOW AND A DEEP WELL EXIST TOGETHER AS A CLUSTER, THE DEEP WELL DIAMOND SYMBOL IS EMPLOYED.
SOURCE:
TEXAS INSTRUMENTS DWG. #00-40126
MONITORING WELL LOCATIONS, SITE PLAN
DATED 2/88, REV. E 9/93



LEGEND

- ◆ BEDROCK MONITORING WELL
- ● OVERBURDEN MONITORING WELL
- • WELLPOINT IN OVERBURDEN
- ◆ BEDROCK PRODUCTION WELL
- □ ABANDONED MONITOR WELL (CEMENT BACKFILL)
- ⟵ DIRECTION OF GROUNDWATER FLOW

NOTE:
WHERE BOTH A SHALLOW AND A DEEP WELL EXIST TOGETHER AS A CLUSTER, THE DEEP WELL DIAMOND SYMBOL IS EMPLOYED.

SOURCE:
TEXAS INSTRUMENTS DWG. #00-40126 MONITORING WELL LOCATIONS, SITE PLAN DATED 2/88, REV. E 9/93

DOCUMENT CONTROL NO.

REVISION NO.

PROJECT: TEXAS INSTRUMENTS
ATTLEBORO, MA

DRAWING: POTENTIOMETRIC MAP
OVERBURDEN AQUIFER – MAY 1990

INTEGRATED ENVIRONMENTAL SERVICES

2276-102

22761024

1" = 400'

11/4/94

AD

FIGURE 2

APR 13 1995

Docket No. 070-00033
License No. SNM-23
Control No. 121534

Mr. Michael Elliott
Environmental Manager
Texas Instruments, Incorporated
34 Forest Street
Attleboro, MA 02703

SUBJECT: ADDITIONAL INFORMATION REQUIRED REGARDING YOUR DECEMBER 1994 SUPPLEMENT TO THE 1992 REMEDIATION PLAN FOR THE ATTLEBORO SITE

Dear Mr. Elliott:

This is in reference to your letter dated December 19, 1994, that transmited the Supplement to the 1992 Remediation Plan (the Supplement) for your Attleboro, Massachusetts facility (License No. SNM-23). The 1992 Remediation Plan for the Identified Building 12 Burial Area (the Remediation Plan) was also included in our review. This also refers to a telephone conversation between you and Mark Roberts of my staff on April 7, 1995. In order to continue our review, we need the following additional information:

1. The characterization report (discussed in section 9 of the Supplement) is necessary to evaluate the adequacy of the radiological characterization that has been performed at the facility. Provide the date that you will transmit this report to Region I.

2. In Section 3.1 of the Supplement and in Section 7 of Appendix A to the Supplement you discuss surface scans for affected and uraffected exterior areas of the site. At what distance above the ground surface are these measurements performed? What specific follow-up is performed for locations that exceed 1.5 times nominal background?

3. Describe the criteria or method that you have used for determining background for use in the evaluation of the results of exterior surface scans.

4. In Section 3.2 of the Supplement you discuss surface (radiological) scanning for interior surfaces. Describe the methodology and the instrumentation that you are employing. Include a description of the instrumentation and the detection sensitivity for this equipment. You may find it useful to refer to Section 5.2 of NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination", for the calculations of detection sensitivity of a radiation survey meter.

5. Describe the training or instructions provided to individuals working in or near the areas to be remediated, but not directly involved in the decommissioning efforts.

OFFICIAL RECORD COPY ML10

6. In the Remediation Plan you included a description of your gross alpha counting technique for determining total uranium concentrations in soil. In the Remediation Plan and in your September 1993 Final Report of the Remediation of the Former Radioactive Waste Burial Site you included data that validates this technique as sufficiently sensitive to meet the NRC criteria for release for unrestricted use (30 pCi/gram for enriched uranium). Although you describe aspects of a Quality Assurance (QA) program relating to the gross alpha measurements in Section 7.3.4 of Appendix A to the Supplement, provide additional explanation on how your QA program will compare the numbers from alpha and gamma spectrometry results and how differences or anomalies will be resolved.

7. We have no objection to the concurrent survey, remediation, and restoration of interior areas of the building as described in the Supplement. However, we need more detailed plans for this activity so that we may inspect these activities while they are in progress. Please provide the following information:

   a. A map or figure on your proposed segmentation of areas.

   b. A tentative schedule for the resolution of each area.

   c. A commitment that you will provide an updated schedule to Region I approximately once or twice per month.

8. In Section 3.3 of the Supplement you discuss work plans that will be consistent with the 1992 practices. In our review of the Remediation Plan and the Supplement, it is not clear what you define as a work plan. The information provided in Section 3.3.3.2 of the Supplement is not specific enough for us to understand: the preparation of areas; protective clothing requirements for workers; signs and notifications to workers; and controls for the prevention of non-radiation workers from entering the areas under remediation. Please submit a description of a "typical" work plan for the survey, remediation and restoration of an interior area segment that, at a minimum, addresses these items.

9. Briefly describe your system for archiving samples described in Section 3.4 of the Supplement. Approximately how much sample is retained for further analysis?

10. In Attachment C of Appendix C to the Supplement (the Radiological Health and Safety Plan), there appears to be an error in the units for uranium bioassay results. A uranium concentration of 5 g/l in urine (the specified action level) would yield a value that is several times the Annual Limit on Intake in 10 CFR 20, Appendix B (assuming inhalation of a Class Y compound). Please correct this error.

11. In the telephone conversation with Mr. Roberts on April 7, 1995 you stated that your gross alpha counting technique appears to over-estimate low concentrations of total uranium in soil. Describe the methodology that you will use for applying a correction factor to the lower concentration results using this technique.

OFFICIAL RECORD COPY

12. In the telephone conversation with Mr. Roberts on April 7, 1995 you stated that the uranium contaminated soil in some locations appears to be located in sub-surface layers and that you will be removing the clean surface soil and using it to fill excavated areas where contaminated soil was removed. Although we have no objection to this procedure, please include a brief discussion on the mechanics of the operations used to accomplish the removal and disposal.

We will continue our review upon receipt of this information. Please reply in duplicate to the Region I office and refer to Mail Control No. 121534. Please contact Mark Roberts at (610) 337-5094 or me at (610) 337-5252 should you have any questions concerning this letter.

Your cooperation with us is appreciated.

Sincerely,

Original Signed By:
John D. Kinneman

John D. Kinneman, Chief
Site Decommissioning Section
Division of Radiation Safety
and Safeguards

Docket No. 070-00033
License No. SNM-23

OFFICIAL RECORD C

DOCUMENT NAME: S:\FRSSB\TI DEF.LTR

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	RI:DRSS	RI:DRSS C			
NAME	Roberts	Kinn			
DATE	04/10/95	04/10/95			

OFFICIAL RECORD COPY

TELEPHONE CONVERSATION RECORD	Date:4/7/95	Time:4:00
Mail Control No.:121534	License No.: SNM-23	Docket No.: 070-00033
Person Called: Mark Roberts (Returned call)	Organization: Texas Instruments, Inc.	Telephone Number: (508) 236-1809
Person Calling: Michael Elliott, Environmental Manager		
Subject: Clarification of items in the Remediation Plan Supplement for TI Attleboro		
Summary: I requested information to clarify the statistical evaluation of the soil sampling pattern for affected exterior areas. To summarize, due to the relatively large potentially affected area that is being surveyed, TI is using a sampling pattern that calls for less samples than suggested in NUREG/CR-5849. Their statistical analysis indicates that their sampling pattern is sufficiently representative to meet the intent of the NUREG since they have collected and analyzed approximately 6,000 samples. Mr. Elliott also informed me that the results of the surface and sub-surface soil samples indicates that there is a sub-surface layer of uranium-contaminated soil. Their exterior remediation plans will include removal of the clean layer, disposing of the contaminated layer of soil and returning the clean soil to the excavated area. He also discussed that refinements in the gross alpha measurement technique will allow the application of a calibration factor to be applied to results that appear to be close to background. Their sample results for very low concentrations of uranium in soil have over-estimated the total uranium concentration. I informed Mr. Elliott that since we are about to request some additional information concerning their 1994 Supplement to the Remediation Plan, that we will include a request that they summarize these latter two items in their response to our request for additional information.		
Action Required/Taken: Review information upon receipt.		
Signature:	Date:4/9/95	

OFFICIAL RECORD COPY ML 10

Texas Instruments Incorporated

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964

(508) 236-3800

December 19, 1994

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
Article No. Z 074 994 106

070-00033

SNM No. 23
Docket No. 70-33

Mr. Mark Roberts, CHP
Senior Health Physicist
U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

Re: Supplement to the 1992 Remediation Plan

Dear Mr. Roberts:

As you know, Texas Instruments Incorporated (TI), Materials & Controls Group has been decommissioning its facility and site at Attleboro, MA, in accordance with a decommissioning plan, including criteria, previously approved by the NRC.

Enclosed is a "Supplement to the 1992 Remediation Plan" (December 1994) (the Supplement) that TI has prepared in order to document the specific actions that TI is taking to complete the decommissioning of the site and facility, and thus achieve termination of Special Nuclear Materials License No. 23 and release of the entire facility and site for unrestricted use.

We would appreciate the NRC's approval of the Supplement by a license amendment which reaffirms that satisfactory performance of the described activities will complete the decommissioning of the facility and site in accordance with criteria identified in the Site Decommissioning Management Plan Action Plan of April 16, 1992.

Sincerely,

Materials & Controls Group

Michael J. Elliott

Cont'n of 118945

Michael J. Elliott
Environmental Manager
Environmental, Safety & Health Dept.

Encl: "Supplement to the 1992 Remediation Plan" (December 1994)

4/11/95
I
4/4/95

SUPPLEMENT TO THE 1992 REMEDIATION PLAN

TEXAS INSTRUMENTS INCORPORATED
ATTLEBORO, MASSACHUSETTS

SPECIAL NUCLEAR MATERIAL LICENSE No. 23
DOCKET No. 70-33

REV. 0.0

For Submission to:

The U.S. Nuclear Regulatory Commission
Region I - NMSS
475 Allendale Road
King of Prussia, PA 19406

Prepared by:

Texas Instruments Incorporated
Materials & Controls Group
Environmental, Safety & Health Department
P.O. Box 2964
34 Forest Street, MS 10-02
Attleboro, MA 02703-0964

DECEMBER 1994

TABLE OF CONTENTS

LIST OF FIGURES

1.0 PURPOSE OF THE SUPPLEMENT

Texas Instruments Incorporated, Materials & Controls Group (TI), has been decommissioning its facility and site at Attleboro, Massachusetts, under Special Nuclear Material License No. 23 (the License). As described below, these activities have been conducted in accordance with a decommissioning plan, including criteria, previously approved by the U.S. Nuclear Regulatory Commission (NRC).

The purpose of this "Supplement to the 1992 Remediation Plan" (the Supplement) is to document the specific actions that TI is taking to complete the decommissioning of the facility and site, and thus achieve termination of the License and release of the entire facility and site for unrestricted use.

2.0 BACKGROUND

2.1 HISTORICAL OPERATIONS

In 1952, the Atomic Energy Commission (AEC) engaged Metals & Controls Corporation to fabricate uranium fuel elements for experimental research reactors. In these early years between 1952 and 1955, nuclear operations were confined to the "Fissionable and Source Material" (FSM) Manufacturing Area located in the northern portion of Bldg L (which by today's nomenclature, corresponds to a portion of Bldg 4), and a rolling mill within Bldg C, (currently known as Bldg 3).

By 1955, as the nuclear operations expanded, Metals & Controls Corporation formed a wholly owned subsidiary known as M&C Nuclear. In that same time frame, the AEC issued Special Nuclear Material License No. 23 for the fabrication and assembly of uranium fuel elements Again in 1955, Bldg N (currently known as Bldg 10) was constructed as a dedicated facility to house the nuclear manufacturing operations.

Throughout its history, M&C Nuclear manufactured fuel assemblies primarily for the U.S. Naval Reactor Program. In 1959, TI acquired the Metals & Controls Corporation. TI continued fabrication of Naval Reactor fuel elements through 1968.

After 1968, TI manufactured fuel elements exclusively for the High Flux Isotope Reactor (HFIR) Program under a government contract with Oak Ridge National Laboratories. During the HFIR Program, the nuclear manufacturing operations were reduced in size to a small area in the northwest portion of Bldg 10.

By 1981, TI disengaged from the HFIR Program, and by so doing, it permanently concluded its involvement in uranium fuel element manufacturing..

2.2 PAST DECOMMISSIONING ACTIVITIES

2.2.1 Early Decontamination and Decommissioning (D&D) Activities

As nuclear manufacturing activities were discontinued in various buildings or portions thereof in the 1950s and 1960s, D&D efforts were conducted, but the records of such early efforts are either destroyed in accordance with the records retention policy or unavailable.

In 1981, when TI permanently ceased its involvement in nuclear manufacturing activities, TI initiated final D&D efforts in accordance with an NRC-approved Decommissioning Plan contained in its License.

2.2.2 1982 D&D of Building Interiors

In 1982, TI conducted D&D activities within the interior of the portion of Bldg 10 that had housed the HFIR operation. These activities were expanded to include systematic, radiological surveys of the portions of all other buildings (i.e. Bldgs 3, 4, and the remainder of 10) where nuclear operations had previously existed, but for which, there existed little, if any, documentation of past D&D activities.

Subsequent to the 1982 D&D activities, TI submitted two reports to the NRC, dated May 14, 1982 and November 1, 1982, documenting surveys that showed compliance with the applicable decommissioning criteria. The NRC performed confirmatory surveys and released the building interiors for unrestricted use as recorded in inspection reports dated October 14, 1992 and March 8, 1983. License termination, however was withheld, pending further investigations into the former radioactive waste burial site (Bldg 12 Burial Site) between Bldgs 11 and 12.

2.2.3 1982 Radiological Surveys of the Bldg 12 Burial Site Conducted by TI

The Bldg 12 Burial Site is believed to have been in operation from the early to mid 1950s through approximately the early to mid 1960s. Burial practices were conducted for the onsite disposal of contaminated scrap and debris.

In 1982, TI conducted two surface and subsurface radiological surveys primarily addressing the Bldg 12 Burial Site location. Accordingly, TI submitted two reports to the NRC, dated July 20, 1982 and January 17, 1983 documenting the results of its efforts. These reports concluded that residual radiation at the TI site did not pose a significant risk of harm to public health or the environment. Therefore, TI requested that the License be terminated and that the site should be released for unrestricted use.

2.2.4 1983 Confirmatory Survey Conducted by ORAU for NRC

During the summer of 1983, the NRC mobilized Oak Ridge Associated Universities (ORAU) to conduct an independent radiological assessment of the TI site. ORAU surveyed the Bldg 12 Burial Site location and around the perimeter of Bldg 10. ORAU submitted a report to the NRC with its findings in 1984.

The ORAU report contained results that supported TI's position that residual radiation did not pose a significant or immediate health concern. However, the report also documented

the presence of isolated areas of soil contamination in excess of the NRC's guidance policy for unrestricted release, Option 1 of the 1981 Branch Technical Position (1981 BTP) (46 FR 52061, October 23, 1981).

2.2.5 Remediation of Soils Adjacent to the HFIR Loading Ramp

Under the direction of the NRC, TI removed an area of surface soil contamination adjacent to the former HFIR loading ramp along the west side of Bldg 10 in the 1983 time frame. After excavation, this material was packaged and dispositioned to a licensed low level radioactive waste disposal facility in Barnwell, South Carolina.

2.2.6 Remediation of the Building 12 Burial Site

During a meeting in April, 1990, the NRC indicated that the Bldg 12 Burial Site would have to be remediated in order to terminate the License. The NRC asked for and received TI's commitment to remediate the Bldg 12 Burial Site.

The NRC also informed TI at the April, 1990 meeting that TI had been added to a list of sites targeted for accelerated efforts toward decommissioning. On April 16, 1992, the NRC published this list as part of the SDMP Action Plan.

After evaluating a wide range of technical options, and after having performed additional subsurface radiological characterization surveys, TI submitted the "Remedation Plan for the Identified Bldg 12 Burial Area" (the 1992 Remediation Plan) to the NRC in July, 1992. The NRC approved the plan in August, 1992 in Amendment No. 16 to the License.

On August 31, 1992, TI initiated the Burial site remediation. The project spanned the course of a year, reaching completion in July, 1993. During that time, TI transported 63,000 cubic feet of contaminated soil and debris for disposal at a licensed facility in Utah. TI documented the project activities and the final survey results in a final report dated September, 1993.

In December, 1993, the NRC and its contractor, Oak Ridge Institute for Science and Environment (ORISE), formerly known as ORAU, conducted a confirmatory survey of the Bldg 12 Burial Site project. Subsequently, ORISE issued a survey report in February 1994 and concluded that the Bldg 12 Burial Site remediation had achieved the NRC guidance criteria contained in the 1981 BTP for unrestricted release.

2.2.7 Remediation of the Metals Recovery Area

In final preparation for license termination activities, TI investigated the Metals Recovery Area in the vicinity of Bldg 5 because such area had been used for waste processing during the time of the nuclear operations. In late 1993, TI conducted preliminary surveys and

identified the existence of elevated radiation levels on the southwest side of Bldg 5. Subsequent surveys, including subsurface soil measurements (March, 1994) indicated the need to perform remediation activities at this location. TI notified the NRC of its intentions in March, 1994, and received the NRC's approval to proceed with the remediation. Remediation activities commenced on April 28, 1994, and were completed by November 14, 1994. The remediation project generated 115,000 cubic feet of contaminated soil which were also dispositioned to the licensed disposal facility in Utah.

3.0 TI'S CONTINUING ACTIVITIES TOWARD COMPLETION OF DECOMMISSIONING

In addition to the decommissioning activities described in the previous section that were performed in the past, TI has identified several activities that, once completed, will satisfy all the decommissioning requirements for the Attleboro facility and site. As an initial step, TI has reviewed historical documents, including reports and photographs and previous radiological surveys. TI has also interviewed selected employees who had been employed at the time of the nuclear operations or who might know something about past practices. These steps were taken to provide additional assurance that locations of previous nuclear activities were identified, and to assist in the classification of "affected" versus "unaffected" areas as described below.

The additional activities to be completed by TI can be divided into two broad categories: supplemental radiological surveys and remediation activities. With respect to the radiological surveys, the types of surveys, survey unit areas, and sampling protocol, etc. are described in Appendix A, "Supplemental Radiological Surveys".

As regards the remediation activities, though there are no substantive differences from the practices described in the 1992 Remediation Plan, the minor improvements afforded through actual field experience are described in Section 3.3.3, "Refinements to the 1992 Remediation Plan". TI plans to apply these enhancements at any additional areas requiring remediation.

3.1 RADIOLOGICAL SURVEYS OF OPEN LAND AREAS

The activities that are described below, commenced in July, 1994, and all field work will be completed by December, 1994. TI's consultant is in the process of preparing a radiological survey report summarizing the findings of this effort.

At the outset, TI decided to survey 100% of all land areas that were developed at the time of the nuclear operations.

Undeveloped areas (e.g. the dense woods to the east of the site) were excluded, as for all practical purposes, they were inaccessible by any reasonable means. (See Figure A1 in Appendix A.) The only other land areas that were specifically excluded from consideration were the previously remediated locations such as the Bldg 12 Burial Site, the Metals Recovery Area, and the Soils Adjacent to the HFIR Loading Dock.

Within the developed areas, TI further subdivided the land as either "affected" or "unaffected" (See Figures A1 and A2 in Appendix A). As will be described below, the distinction between affected and unaffected influenced the level of radiological survey that was performed for a given land area.

The definition of the different land categories and a description of each of the affected areas are found in Appendix A. TI based its land classification decisions on information collected from numerous sources of data, and logic that was consistent with definitions that appear in NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination" (Draft Report for Comment).

3.1.1 Surveys in the Affected Land Areas

Radiological surveys in affected areas were performed, as described in Sections 7.1 and 7.3 of Appendix A, similar to a "Final Survey" as contained in the 1992 Remediation Plan. A reference grid with 10m X 10m grid cells was established across any given survey unit. Systematic subsurface soil samples and exposure rate measurements were taken within the survey unit. Survey units were centered on suspect locations, and as necessary, they were expanded to a known boundary and/or until the soil concentrations were consistently below the cleanup criteria.

3.1.2 Survey in the Unaffected Land Areas

Radiological surveys were also performed in the unaffected areas according to the protocol described in Sections 7.1 and 7.3 of Appendix A.. TI's protocol exceeds the NUREG guidance with respect to surface scans. TI surveyed 100% of the unaffected open land areas. Additionally, TI is performing soil sampling within the unaffected area which consisted of 30 randomly selected surface soil samples and an unspecified number of biased samples.

3.1.3 Radiological Survey Reports for Open Land Areas

The results of the supplemental radiological surveys (other than for the Metals Recovery Area) will be compiled and submitted to the NRC in a Supplement Survey Report.

Since the Metals Recovery Area was in the process of being actively remediated, the radiological survey data constitutes part of the final survey data. Therefore, the survey data specific to this area will be submitted as part of the Metals Recovery Area Final Report, similar to the 1993 Burial Site Final Report.

3.2 RADIOLOGICAL SURVEYS OF BUILDING INTERIORS

The radiological surveys of the building interiors are in progress. This effort commenced in August, 1994, and is expected to be completed over the winter months in 1995.

The review of historical documents and employee interviews that TI conducted for defining affected and unaffected land areas, also served to classify building interiors. A description of identified building interiors subject to supplemental surveying is contained in Sections 5.0 and 6.0 of Appendix A. Details of the respective survey protocols are found in Sections 7.2 and 7.4 of Appendix A.

3.2.1 Surveys in Previously Decommissioned Building Interiors

TI decided to perform a supplemental survey even for the building interiors that had previously been decommissioned and released for unrestricted use by the NRC (i.e. portions of Bldgs 3 and 4, and most of Bldg 10). In these locations, TI's contractor scanned 100% of the accessible floor and wall space within 10m X 10m grid cells at 30 random locations within each of the original survey units that were defined in TI's 1982 D&D Final Reports.

For Bldg 3, the survey unit area was sufficiently small that the random survey covered the entire amount of accessible floor and wall space within the survey unit. At the same time, overhead areas, including pipes and structural members were also surveyed. At Bldgs 4 and 10, the 30 random locations within each of the survey units identified some elevated radiation levels, thus necessitating further surveying in accordance with the sampling protocol for an affected area.

Additional survey work is being planned for Bldgs 4 and 10 that will include previously inaccessible areas, as well as drains and trenches. Because of the logistical complications of performing such surveys in active manufacturing areas, the foregoing work will take place over an extended period on the order of a month or two.

3.2.2 Surveys in Affected Building Interiors

Bldg 5, part of the Metals Recovery Area, was identified as an affected area. A radiological scan survey was performed on 100% of the accessible space within the area of the original building boundaries that existed during the time of the nuclear operations. A small area of elevated radiation was detected at one of the floor/wall junctures. Similar to Bldgs 4 and 10, expanded surveys are slated for the upcoming winter months.

TI's historical review identified two additional affected areas, one occupying a portion of Bldg 1, and the other occupying a portion of Bldg 11. TI's contractor scanned 100% of the accessible floor and wall areas, and a representative portion of the overhead areas at both locations. Neither area demonstrated any evidence of elevated radiation levels.

3.2.3 Surveys in Unaffected Building Interiors

TI has classified as unaffected areas the floors and wall surfaces of areas where nuclear activities had not been conducted in buildings that contain previously decommissioned areas or affected areas (i.e. Bldgs 1, 3, 4, 5, 10, and 11). As recommended in NUREG/CR 5849, TI plans to perform random scan surveys over 10% of each unaffected area. This will also include random scan surveys on the roofs of the same buildings. This work will occur simultaneously with the additional work described above.

TI determined that no surveys were needed in buildings where no nuclear activities had been conducted.

3.2.4 Radiological Survey Report for Building Interiors

Just as in the case of the open land areas, the results of the building interior supplemental radiological surveys will be documented in a report format. It is TI's intention to complete additional supplemental radiological surveys of Buildings 4, 5 and 10 concurrent with decontamination activities. Therefore, the supplemental survey report for the building interiors will be included in the Final Report for overall remediation.

3.3 REMEDIATION PLAN AND DECOMMISSIONING CRITERIA

Using the results of the supplemental radiological surveys, TI will identify any additional areas requiring remediation pursuant to the criteria listed below. Once the areas requiring remediation have been identified, a separate work plan will be developed specific to each area. The work plans will be consistent with the practices approved in the 1992 Remediation Plan, as refined, see Section 3.3.3, below.

3.3.1 Decommissioning Criteria for Soils

Consistent with the limits specified in Option 1 of the 1981 BTP for unrestricted release of soils containing residual uranium contamination, the applicable criteria for the TI site, as determined through isotopic analysis, correspond to enriched uranium in some locations and depleted uranium at other locations. In the case of enriched uranium, the

concentration, measured as total uranium, shall not exceed 30 pCi/gm on average. For depleted uranium, the concentration, measured as total uranium, shall not exceed 35 pCi/gm on average.

Similarly, the previously approved 1992 Remediation Plan included a criterion of 30 pCi/gm measured as total uranium.

In applying these criteria for defining limits of excavation, TI will be comparing grid cell averages calculated from the radiological survey data against the applicable limit. After soil processing, these criteria will also be used to establish final disposition for soils.

3.3.2 Decommissioning Criteria for Facilities and Equipment

Annex C of TI's License originally established decommissioning criteria for facilities and equipment by referencing Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors" (NRC, 1974). Since the issuance of Reg Guide 1.86, the NRC has on several occasions updated and tailored those criteria for application to holders of material licenses. On May 11, 1994, the NRC provided to TI the most recent version entitled "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted use or Termination of Licenses for Byproduct, Source or Special Nuclear Materials" prepared by the NRC, Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle, Medical, Academic and Commercial Use Safety, dated April 1993. These criteria will be used in completing the work described in this Supplement.

These criteria will be used for two purposes. First, TI will use them to define sections of building interiors requiring remediation. To this end, data collected during the radiological surveys of the building interiors will be compared against the guideline limits. Remediation procedures will be designed to render all surface areas suitable for unrestricted release as defined by the applicable criteria.

TI will also use the guidelines in the field during soil remediation activities when potentially contaminated debris is encountered requiring determination of final disposition. The debris will be surveyed, and decontaminated as necessary, to achieve compliance with the applicable guidelines.

3.3.3 Refinements to the 1992 Remediation Plan

3.3.3.1 Open Land Areas

The remediation of open land areas will proceed as described within the 1992 Remediation Plan. Excavated soils will be processed using conventional methods to

remove bulk aggregate. The extent of excavations will be defined through the systematic supplemental surveys performed as described in Sections 6.0 and 7.0 of Appendix A.

Based on the results of those surveys, areas with soils of highest contamination will be identified for remediation as described in Phase I of the 1992 Remediation Plan. Those excavated soils will be segregated to preclude contamination of soils below the criteria.

The remaining identified soils will then be excavated and processed to remove debris and aggregate and re-sampled to determine disposition as described in Phase II of the 1992 Remediation Plan.

In-process excavation surveys will proceed in the manner described within the 1992 Remediation Plan for both Phase I and Phase II areas.

3.3.3.2 Building Interiors

Building interiors for which decontamination may be required will be identified through the supplemental surveys as described in Sections 6.0 and 7.0 of Appendix A. Preliminary surveys have identified several areas of fixed contamination slightly greater than the release criteria. ("Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Materials," NRC, Office of Nuclear Material Safety and Safeguards, Division of Fuel Cycle, Medical, Academic and Commercial Use Safety, dated April 1993).

The method of decontamination to be used for building interiors may consist of any of the commonly employed destructive and non-destructive techniques such as scrubbing, chemical/strippable coatings, scarification or sand blasting. The particular technique employed will be dependent upon the extent of area to be decontaminated/remediated, the nature of the contaminant, and the results of small area testing of the various techniques. Since the nature of the contaminant is the same as in land areas requiring remediation, the Radiological Health and Safety Plan (Appendix C) remains applicable. Additional controls necessary for performing decontamination work inside building areas will be detailed within the workplan for each area.

3.4 FINAL SURVEY

3.4.1 Remediated Land Areas

For any additional remediated land areas, a final survey will be performed, as described in Section 8.1 of Appendix A, that is similar to the practice described in the approved 1992 Remediation Plan. In-process soil samples that are collected from the floor of the excavation during remediation will serve, in part, as final survey data. These samples will be analyzed in the onsite field laboratory using the gross alpha counting technique. In accordance with QA/QC protocol, 5% of the samples will be sent to an offsite laboratory for confirmatory analysis by gamma spectroscopy. Additionally, 1% of the samples collected which were sent to the offsite laboratory will also be analyzed by alpha spectroscopy.

All of the in-process floor samples and all of the supplemental radiological survey samples on which TI is relying for final survey data at any additional remediated locations will be archived and stored onsite in a locked, protected location. The archived samples will be maintained until the NRC has determined that the site is eligible to be released for unrestricted use.

To the extent that supplemental radiological survey data is used as final survey data, and to the extent that the sampling location pattern deviates from the suggested pattern described in NUREG/CR-5849, Section 8.3 and Attachment A of Appendix A include a conservative statistical evaluation showing that the sampling pattern used in the supplemental radiological survey is adequate to use as the final survey to demonstrate compliance with the applicable criterion and with the necessary 95% level of confidence. Within the remediated areas, where TI is relying, in part, on in-process floor sample data, the sample pattern density generally exceeds the guidelines in NUREG/CR-5849, and therefore easily satisfies the 95% confidence criteria.

3.4.2 Remediated Building Interiors

For any additional remediated building interiors, a final survey will be performed according to the practices described in Section 8.2 of Appendix A. This survey will be performed as an integral part of the D&D activities. Data will be recorded and maintained according to established QA/QC protocol.

The sampling protocol will be consistent with suggested guidelines contained in NUREG/CR-5849.

3.5 FINAL REPORT

Upon completion of the final surveys, TI will compile all the final survey data, for both open land areas and building interiors, into a final report. The final report will be structured similar to the 1993 Burial Site Final Report that was previously submitted to the NRC.

Attached to the final report, TI will include the results of a groundwater radiological monitoring program. This program, described in Appendix B, is modeled on the sampling and analysis protocol performed in 1993 under the direction of the NRC, and reported in Appendix F - "Site Hydrology" of the 1993 Burial Site Final Report. Consistent with the earlier efforts, the monitoring program will address groundwater quality downgradient of areas specifically identified for soil remediation activities. The groundwater samples will be collected, analyzed at an offsite laboratory, and compared against the EPA Drinking Water Criteria for Radionuclides (40 CFR 141), specifically, 15 pCi/l for gross alpha and 50 pCi/l for gross beta in the dissolved aqueous phase. In the event that any sample exceeds the criteria, isotopic analysis for uranium and thorium will be performed for that sample.

In the case of the Metals Recovery Area, and in the event that any other decommissioning activities are completed well in advance (i.e. by three months or more) of the majority of the work, a stand-alone final report for the individual area will be submitted in advance to the NRC separately.

4.0 ORGANIZATION FOR COMPLETING DECOMMISSIONING ACTIVITIES

4.1 HEALTH & SAFETY

The radiological contractor is responsible for maintaining the health physics programs for all activities within the decommissioning process. The "Radiological Health and Safety Plan, Rev. 3.0" which appears in Appendix C of this Supplement is a modified version of the original plan bearing the same title that was submitted to the NRC in July, 1992 as an attachment to the previously approved 1992 Remediation Plan, and later, in September, 1993, as Attachment A of the 1993 Burial Site Final Report. The original plan was modeled on the health & safety plan contained in TI's License. The original 1992 plan was modified for this effort in order to maintain applicability to all on-site decommissioning activities.

4.2 MANAGEMENT STRUCTURE

The organization and structure associated with the activities described in this Supplement will vary dependent upon the particular activity at any given time. In general terms, a project team is established for each activity. The composition of the team is tailored to the particular details of each activity. Figure 2 represents a typical organization chart for a generic activity associated with decommissioning.

TI provides project management and oversight under the direction of the Environmental Manager of the Materials & Controls Group, or his designee.

The radiological contractor provides support services during all phases of the decommissioning process. This contractor offers technical advice and guidance, and physically participates in or supervises the survey and remediation activities within the protocol established in this Supplement.

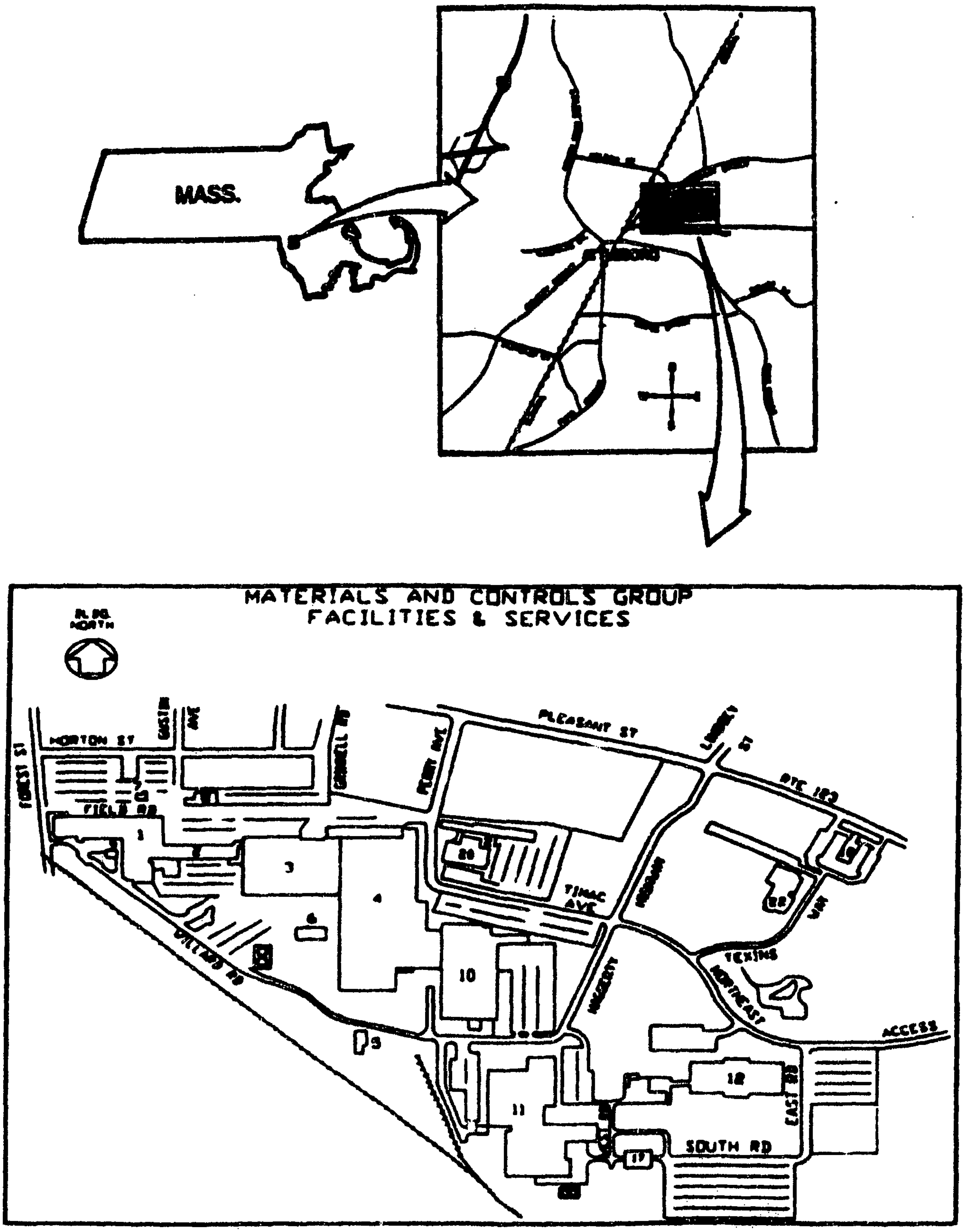
Support contractors are coordinated through the efforts of the project team. Though the meeting frequency varies dependent upon the specific requirements of the activity at hand, this team, chaired by the project manager, meets regularly (usually weekly) to maintain focus toward the desired objective. Minutes of the project meetings are recorded and issued to all team members. In addition, ad-hoc meetings are convened to deal with specific issues as circumstances dictate.

5.0 SCHEDULE

The following schedule outlines significant milestones toward completion of the decommissioning process. While the dates shown are meant to be attained and TI has extended every reasonable effort to scope out the project, the schedule is an aggressive one. Any unforeseen circumstances could adversely impact the currently estimated completion dates. At any time that TI determines that a milestone completion date is not achievable, TI will notify the NRC in advance and will promptly provide a revised schedule to the NRC.

5.1	Submit the Supplement to the 1992 Remediation Plan	12/94
5.2	NRC issues License Amendment	01/95
5.3	Submit Supplemental Radiological Survey Results -complete for open land areas -partial for building interiors	01/95
5.4	Identify any additional areas requiring remediation	01/95
5.5	Develop area specific remediation work plans	02/95
5.6	Submit Metals Recovery Area Final Report	02/95
5.7	Complete remediation activities	09/95
5.8	Complete TI Final Surveys and submit Final Report	10/95
5.9	NRC performs confirmatory surveys	11/95
5.10	NRC terminates license and releases facility and site for unrestricted use	02/96

Figure 1
Site Plan



121534

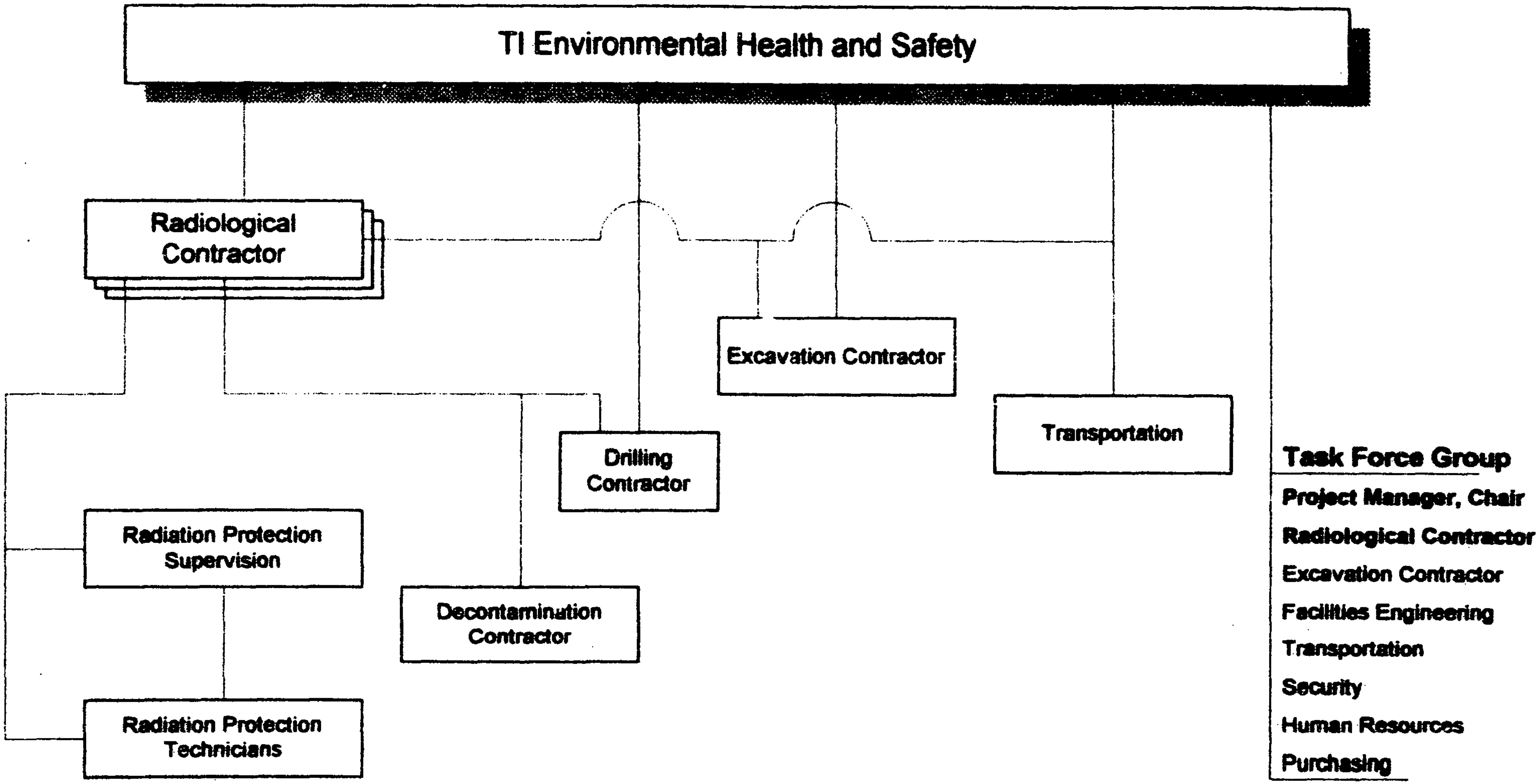
OFFICIAL RECORD COPY ML 10

Figure 2

Texas Instruments Incorporated

Decommissioning Project Organization

(Generic Project Team)



Appendix A:
Supplemental Radiological Survey Plan

Texas Instruments Incorporated
Materials & Controls Group
Environmental, Safety & Health Department
P.O. Box 2964
34 Forest Street
Attleboro, MA 02703-0964

APPENDIX A

SUPPLEMENTAL RADIOLOGICAL SURVEY PLAN IN SUPPORT OF THE SUPPLEMENT TO THE 1992 REMEDIATION PLAN

TEXAS INSTRUMENTS INCORPORATED
ATTLEBORO, MASSACHUSETTS

SPECIAL NUCLEAR MATERIAL LICENSE No. 23
DOCKET No. 70-33

REV. 0.0

For Submission to:

The U.S. Nuclear Regulatory Commission
Region I - NMSS
475 Allendale Road
King of Prussia, PA 19406

Jointly Prepared by:

Texas Instruments Incorporated
Materials & Controls Group
Environmental, Safety & Health Department
P.O. Box 2964
34 Forest Street M/S 10-02
Attleboro, MA 02703-0964

and

Creative Pollution Solutions, Inc.
P.O. Box 9253
Lowell, MA 01853

DECEMBER 1994

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

1.0 PURPOSE

The purpose of this plan is to summarize the methodology and scope of the supplemental radiological surveys that Texas Instruments Incorporated (TI) is conducting, or will conduct, on its facility and site at Attleboro, Massachusetts. These surveys fall into two broad categories; 1) those that augment previously collected information by further defining the facility and site characteristics, and 2) those that serve as a final survey to demonstrate compliance with the decommissioning criteria. The two are not unrelated, and in certain cases, they are the same.

2.0 DOCUMENT AND HISTORY REVIEW

The TI Environmental Department, its consultants, and retained counsel performed a review of historical documents including reports, drawings, maps and photographs, previous radiological surveys, and interviewed selected employees who had knowledge of past nuclear operations in order to identify any open land areas and building interiors that had the potential for residual contamination. Details of this review are contained in TI files. The results of this review are reflected in the supplemental survey design, Sections 3.0 to 7.0, as it influenced the selection of areas and methods for further study.

3.0 DEFINITION OF AREAS

NUREG/CR-5849, "Manual for Conducting Radiological Surveys in support of License Termination" defines "affected areas" and "unaffected areas" as follows:

Affected Areas:

> "Areas that have potential radioactive contamination (based on plant operating history) or known radioactive contamination (based on past or preliminary radiological surveillance)."
>
> Note: At TI, this would normally include areas where radioactive materials were used, processed, stored, handled, and/or buried, and immediately surrounding areas.

Unaffected Areas:

> "All areas not classified as affected. These areas are not expected to contain residual radioactivity, based on a knowledge of site history and previous survey information."

As a subset of "unaffected areas", TI added one more definition for "undeveloped areas" that warrant no radiological surveys.

Undeveloped Areas:

> Areas that have never been developed by TI and have remained intact or untouched since the inception of the site; the category of areas that TI did not own at the time of the nuclear operations; and nearby, offsite areas that TI may have formerly owned or used, but are separated by a public way that would render movement of materials impractical and unlikely.
>
> Typically, such areas include the woodlands east of the site, as well as, developed areas acquired by TI subsequent to the naval reactor program (i.e. post 1968).

4.0 AREAS EXCLUDED FROM SUPPLEMENTAL RADIOLOGICAL SURVEYS

4.1 GENERAL SITE

The TI Attleboro site covers a large area in excess of 250 acres (refer to Figure 1, attached to the supplement). Just over 90 acres has ever been developed. Thus over 60% of the site constitutes undeveloped areas, as shown in attached Figure A1, for which a radiological survey was not performed.

4.2 SPECIFIC LOCATIONS

Contaminated surface soils adjacent to the former HFIR Loading Dock on the west side of Building 10 were identified by the NRC. TI conducted a soil remediation project in the 1983 time frame with the concurrence of the NRC. Contaminated soils were dispositioned to a licensed radioactive waste disposal facility in Barnwell, South Carolina. For this reason, and due to the fact that this location has since been developed, it was excluded from further surveys.

The Former Radioactive Waste Burial Site between Buildings 11 and 12 (Bldg 12 Burial Site) was remediated during 1992 and 1993. TI submitted a Final Report in September, 1993. NRC's contractor, Oak Ridge Institute for Science and Environment (ORISE), performed a confirmatory survey and issued its report in February, 1994. Accordingly, no supplemental radiological survey of the Bldg 12 Burial Site is being performed.

A portion of the Metals Recovery Area had already been remediated when TI commenced the supplemental, systematic radiological surveys in July, 1994. In fact, the performance of additional surveys was, in a large part, motivated by the desire to scope the size of the Metals Recovery Area undergoing active remediation. For the portion of this area not covered by the supplemental, systematic surveys described in Section 7.0, final survey data, as described in Section 8.0, has been collected and will ensure proper coverage of the area.

5.0 AREAS SUBJECT TO SUPPLEMENTAL RADIOLOGICAL SURVEYS

5.1 OPEN LAND AREAS

The remaining land areas at the Attleboro site have been categorized by TI as either affected or unaffected, as shown in Figures A1 and A2, in accordance with NRC guidance.

Supplemental, systematic radiological surveys, of the type described in Section 7.0 below, have been or will be performed for affected and unaffected areas, respectively.

5.2 BUILDING INTERIORS

With respect to building interiors, TI decided to perform a supplemental survey even for building interiors that had previously been decommissioned and released for unrestricted use by the NRC in 1982. Those supplemental surveys are of the type described in Section 7.2.1.

Areas other than previously decommissioned locations where nuclear activities are believed to have been conducted were classified as "affected areas," and supplemental, systematic surveys of the type described in Section 7.2.1 have been or will be performed.

TI has classified as unaffected areas the remaining portions of buildings that contain affected areas or previously decommissioned areas. For unaffected areas, surveys of the type described in Section 7.2.2 will be performed.

TI determined that no surveys were needed in buildings where no nuclear activities had been conducted.

6.0 DESCRIPTION OF AREAS

To help visualize the locations which are referenced below, refer to the attached Figures A1 and A2 for the land areas and Figure A3 for the building interiors.

All compass directions are given according to TI's standard practice in reference to "Building North", which is approximately equivalent to geographic Northwest.

In general the following descriptions will be structured in such a way to provide information about the physical location, the alleged origin of potential contamination, the expected spatial distribution, and actual findings where known.

6.1 AFFECTED LAND AREAS

6.1.1 Stockade Area

Located on the south side of Willard Road between Bldgs 10 and 11.

The origin of the contamination is believed to be the result of staging waste washwater and pickling acid solutions in drums placed on the ground surface within an area enclosed by a stockade fence.

Contaminated soils were found from just below the current ground surface to a maximum depth of 10 feet at the original source area. Elsewhere, the contamination seems to have been spread away from the source, in a southwesterly direction, and mixed with fill that was placed in low lying areas to create Parking Lot "K". Contaminated soils beyond the source penetrate, on average, to a depth of 3 feet, and in a couple of locations, down to 5 - 6 feet.

6.1.2 Railroad Spur

Located on the southern property boundary between the Metals Recovery Area and Parking Lot "K".

Contamination in this area forms a transition zone between the Metals Recovery Area and the Stockade Area. The contamination could have come from either area. It is not known that any nuclear material handling took place here. Contamination was found to be distributed at shallow depths, generally less than 3 feet below the ground surface.

6.1.3 Switchgear Building

Located south of the Metals Recovery Area, almost in the vertex of the angle formed by the junction of the railroad tracks and the railroad spur.

Prior to the construction of the Switchgear Building in the early 1980s, the area was predominantly a low lying wetland. This area was identified as a suspect location as it had received some fill from the ›t of the hill west of Bldg 5.

Based on knowledge of the construction methods and fill operations, systematic sampling at this location was performed to a depth of 10 feet below ground surface in the immediate vicinity of the building. Elsewhere, subsurface samples were driven to the standard three foot depth. This sampling demonstrated that there was no radioactive contaminated soils in excess of the applicable criteria.

6.1.4 Bldg 10 Perimeter

The location, as the title implies, is the open land areas surrounding the perimeter of Bldg 10 out to a distance of approximately 20m. In past surveys, slightly elevated radioactivity measurements were detected in close proximity to the building walls in a few locations. Therefore, the distance of 20m was chosen as a conservative assumption of the limit of potential dispersion had any potential contamination been disturbed.

This area was considered suspect due to a couple of historical facts: Most of the nuclear manufacturing operations occurred in this building, and there had been an earlier remediation activity at the former HFIR loading ramp on the west side. It was also chosen because radiological surveys conducted by ORAU in 1984 had identified some elevated meter readings and evidence of surface soil contamination.

Based on these facts, the majority of potential soil contamination was expected to be present within the top 3 feet of the surface, and in one location on the northwest corner of the building, at a depth of 4 to 6 feet. The systematic sampling conducted substantiated the finding of the surface contamination in only one grid cell south of the Building 10 Lab Wing. As expected, the contamination was found to be within the top 3 feet of the surface.

6.1.5 Bldg 10 Alleged Zirc Burning Area

Located in the southeast portion of the Bldg 10 Parking Lot "M" and of unspecified dimensions.

This area was listed as suspect because of zirconium chip burning on the ground surface that allegedly took place there in about the same time frame as similar activities at the Metals Recovery Area. Since the Metals Recovery Area has been shown to contain extensive soil contamination requiring remediation, TI conservatively decided to perform soil sampling at the Bldg 10 location as well.

Because the potential contaminants were associated with activities on the ground surface, it was anticipated that any contamination would be found within the top 3 feet of soil below the asphalt macadam. Systematic sampling revealed no elevated levels of contamination at this location.

6.1.6 Bldg 12 South Lawn

Located in the landscaped lawn area south of Bldg 12 and of unspecified dimensions.

Elevated surface radiation levels were identified in couple of spots on the lawn by ORAU in 1983. It is believed that final grading at the conclusion of the Bldg 12 construction project in 1968 distributed a thin layer of contaminated material in a southeasterly direction emanating from the source at the former Burial Site location. Since historical photographs show that the former Burial Site remained undisturbed while Bldg 12 was under construction, no contamination is expected to exist under the building.

Based on earlier subsurface investigations, potentially contaminated soils were expected to exist at a depth of 2 to 4 feet below the ground surface. This was confirmed by the systematic sampling.

6.1.7 North and West Sides of Bldg 12 Exclusive of the Burial Site

Located at the lawns, and under parking lots and driveways on the north and west sides of Bldg 12. The northern border extends up to an undeveloped area, and the western border extends as far as the east side of Bldg 11. The footprint of the excavated area at the Bldg 12 Burial Site is excluded from consideration as it has been adequately surveyed as part of the 1993 Final Survey.

Potential contamination in this area is believed to be related to the Bldg 12 Burial Site as is the case for contamination encountered at the South Lawn.

As such, any potential contamination was expected to exist at a depth of 2 to 4 feet below the ground surface. This was confirmed by the systematic sampling. Sampling identified approximately a 3000 sq. ft.area of soil whose average grid cell concentrations marginally exceeded the cleanup criteria

6.1.8 Bldg 11 Drainage Ditch

The location was well defined based on comparing historical site layout drawings and topographic maps to current site layout drawings. The location of this former topographic feature extends from the Bldg 11-C Wing eastward under the South Road, just north of Bldg 17, and then curves in a somewhat northerly direction into the Bldg 12 South Lawn.

The drainage ditch formerly received effluent from a wastewater process in the southwestern extremity of Bldg "O" (currently, the middle of Bldg 11). Since it was alleged that waste processing in Bldg "O" was associated with nuclear operations, sampling was performed on the drainage ditch to detect the possible presence of contaminated sediments.

Due to the likely depth of the drainage ditch, any potential contamination was expected to be confined to shallow depths within 1 to 3 feet of the surface. The systematic sampling revealed no elevated levels of soil contamination at this location.

6.1.9 Hill South of Bldg 17

This area is a gently sloped, elevated surface feature covering approximately half an acre just south of Bldg 17.

Soil and debris found at this location were transported there from various onsite construction projects since the 1985 time frame. One of the projects that generated some portion of the soil volume was the Bldg 4-10 Connector that was built on the west side of Bldg 10 in 1986. Since ORAU had identified some shallow soil contamination on the west side of Bldg 10, any soil contamination that might have been disturbed by the project would have been deposited at the Bldg 17 Hill.

Since the exact vertical and horizontal distribution within the hill where the materials from the Bldg 4-10 Connector had been deposited are unknown, TI sampled the entire hill down to the depth of the original groundsurface, or about 15 feet below grade at the highest point. The systematic sampling identified a small area of contamination approximately 2,000 sq. feet to a maximum depth of six feet below the surface.

6.1.10 Bldg 12 Air-Line Debris

Located on the eastern boundary of the developed portion of the Attleboro site. A small area of approximately 2500 sq. ft. was pinpointed by an employee who was involved in the placement of soils at this location in 1980.

During the installation of a buried, compressed air-line between Bldgs 11 and 12 in 1980, one leg of the excavation cut through a portion of the Bldg 12 Burial Site. After

conferring with the NRC, TI employees sorted through the contaminated excavated material to remove debris with elevated radiation measurements. The material demonstrating elevated radiation levels was packaged and dispositioned to a licensed disposal facility in Barnwell, South Carolina. The remaining soil was re-buried at its current location on the eastern edge of the developed portion of the Attleboro site.

Since the current location is a popular spot for placing construction project and groundskeeping spoils and debris, a low hill with an elevation of approximately 10 to 15 feet above the original ground surface has evolved above the spot where the potentially contaminated soil was buried. Assuming that the 1980 burial would not have extended far below the original ground surface, the sampling depths for this exercise extended down to 25 feet below the existing ground surface. Systematic sampling confirmed our expectations. Elevated soil contamination was found within a narrow stratum at a depth of 15 feet below the existing ground surface.

6.2 UNAFFECTED AREAS

6.2.1 Metal Hydroxide Sludge Lagoons

Located to the south of Bldg 12 Parking Lot "R", and covering a rectangular area of approximately one acre.

An earlier letter to the NRC (June 1994) denoted this area as a suspect location because of its association with past waste operations. Subsequently, TI has determined that this area should not be given any more attention than an unaffected area. A knowledgeable Facilities Department employee has provided information that the sludge lagoons were constructed at the same time that the present-day industrial wastewater treatment plant was installed in 1977. Metal hydroxide sludge generated by TI's industrial wastewater treatment plant had been placed at the lagoons between 1977 and 1980. The metal hydroxide sludge was hard-piped directly from the wastewater treatment plant to the lagoons. In 1981, the lagoons were closed and capped. They were never used for any other purpose. Furthermore, during the active life of the lagoons, TI's only nuclear operations were associated with the HFIR operation. None of the contaminated land areas are believed to have resulted from any activities during the HFIR operation. Therefore, based on engineering controls in place at the time, and due to the nature of the HFIR operation, it seems highly unlikely that the sludge lagoons could have been contaminated with radioactive materials.

6.2.2 Overall Site

For other land areas that fit the category of "developed areas", 100% walkover surveys, random soil samples and biased samples are being performed per the method described in

Sections 7.1 and 7.3. The protocol for the unaffected areas is consistent with the guidance contained in NUREG/CR-5849.

6.3 PREVIOUSLY DECOMMISSIONED BUILDING INTERIORS

6.3.1 Bldg 10

Within Bldg 10 there are four survey units which were surveyed, decommissioned and released as part of the 1982 D&D activities. These four units are:

HFIR - An area in the northwest portion of the building which housed the High Flux Isotope Reactor (HFIR) Program. Uranium oxide powder was processed in this area to produce HFIR fuel elements.

UMA - Unclad Manufacturing Area - This area was also located in the northwest portion of the building, but covered a larger area than HFIR. Exposed uranium oxide associated with the Naval Reactor Program was processed in this area.

CMA - Clad Manufacturing Area - This area encompassed most of the building at that time. Clad fuel material associated with the Naval Reactor Program was assembled into fuel elements.

R&D Labs - This area is located on the first floor, and easternmost extremity of the lab wing in the northeast portion of the building. This operation supported manufacturing during the Naval Reactor Program including R&D, and metallurgical quality control.

6.3.2 Building 4, Bay L, FSM Area

Bldg 4, formerly Bldg L, housed the Fissionable and Source Material (FSM) manufacturing area and the associated laboratory in Bay L prior to 1955. The operations would have been very similar to the Naval Reactor work, but on a smaller scale. The work would not have involved complete fabrication of the fully-assembled fuel elements, but it would have involved cladding fuel material for the Atomic Energy Commission (AEC).

6.3.3 Building 3

Bldg 3, formerly Bldg C, housed a rolling mill that supported the FSM operation. The rolling mill was located in the southwest corner of the original footprint of the building. Currently, that location is be near the center of the existing building.

6.4 AFFECTED BUILDING INTERIORS

6.4.1 Bldg 10 High Bay

High Bay Assembly Area in Bldg 10 - Southernmost extremity of the building. This 67 foot high structure housed the final assembly area for the finished naval reactor fuel elements.

This area is being surveyed as an affected area, since there is no documentation, known to TI, of previous surveys for release for unrestricted use of this area.

6.4.2 Bldg 4, Bays D and K, and the remainder of Bay L

These building bays are adjacent to where the FSM area was housed. The only reason they are being surveyed as affected areas is because it was alleged that nuclear operations were also conducted in these locations. It is not known that any nuclear manufacturing took place in these areas.

6.4.3 Bldg 3, Tumbling

This area, located in the southwest portion of the existing building footprint, was originally believed to be the site of nuclear operations in this building. Subsequently, an interview with a past employee about the rolling mill operation, and a review of the building construction history, revealed that the actual rolling mill was located toward the center of the existing building, but by then, TI's contractor had already surveyed this spot as an affected area.

6.4.4 Building 5

This building is located within the Metals Recovery Area. The original building footprint during the time of the nuclear operations was smaller than it is today. Since it had been associated with nuclear waste processing operations in the past, it was treated as an affected area. According to a 1961 insurance report, the area housed a water evaporation process and an incinerator.

OFFICIAL RECORD COPY

6.4.5 Building 11 Former Wastewater Processing Area

This area was listed was because it was alleged that the former wastewater processing area was associated with the nuclear operations. TI has no other reason to believe there were any nuclear materials handled in this location.

6.4.6 Bldg 1 Alleged Former Incinerator

A former employee indicated that "in the early days", before the incinerator was located in Bldg 5, incineration of contaminated rags, boots, and paper, etc., was performed in the former boiler that was then located in Building 1. Today the former boiler room has been converted into the current mail room.

6.5 UNAFFECTED BUILDING INTERIORS

The remaining portions of buildings where some portion has been classified as previously decommissioned or affected, have been classified as unaffected (as shown in Figure A3). This includes the roofs as well as the interiors.

7.0 SUPPLEMENTAL SURVEY METHODS AND REPORT

This section describes the survey methods used for the supplemental radiological surveys. The methods described in this section are applicable for supplemental surveys, in-process surveys conducted during remediation, and final surveys. All supplemental surveys, including in-process surveys will be conducted such that the results of the surveys can be used, in part, for the final survey.

7.1 SURVEY DESCRIPTION OF THE OPEN LAND AREAS

7.1.1 Affected Open Land Areas

Reference grids are established in part to facilitate the selection of sampling/measurement locations, to provide a mechanism for referencing a sample/measurement back to a specific location, and to provide a convenient means for averaging activity/activity concentration levels. The grid system that is used during this supplemental survey is a system of intersecting lines established at 10 meter intervals and referenced to a convenient benchmark, such as a corner of a building that is tied into the Massachusetts Grid Coordinates. The coordinate system for this reference grid is based on compass direction and distance.

Within the grid system identified for each affected area, 100% surface scans are performed. Elevated readings are referenced to a facility map and surface soil samples are collected at these locations. Direct measurements are obtained as static measurements at locations chosen for the subsurface soil samples.

Due to shielding from overburden (if present) and self shielding provided by soils, activity deposited at depths is not readily identified by surface scans or static measurements. Therefore, systematic subsurface soil samples are collected within the affected area at grid line intersections and grid cell center points. The use of systematic subsurface soil samples provides greater sensitivity than surface soil samples.

7.1.2 Unaffected Open Land Areas

Within the unaffected areas, 100% surface scans are performed. The methodology is identical to the method described for the affected areas except grids are not established. Locations of elevated readings are identified and located on a facility map and referenced

to a convenient bench mark that is tied into the Massachusetts Grid Coordinates. Surface and subsurface soil samples are collected at each location.

A minimum of 30 random subsurface samples are collected throughout the unaffected area. In addition to the random samples, biased sample locations are chosen for further sampling. Biased sampling include, but will not be limited to, surface soil sampling, subsurface soil sampling, and catch basin drains. The basis for biasing samples is predicated on results obtained from the normal survey methods, path of travel considerations, proximity to and distance between affected areas.

7.2 SURVEY DESCRIPTION OF THE BUILDING INTERIORS

7.2.1 Affected Areas / Previously Decommissioned Areas

Preliminary surveys have identified some elevated radiation levels within Building 4 and Building 10 which necessitated further surveys within these areas in accordance with the protocol for affected areas. In addition, the previously decommissioned area within Building 3 was a relatively small area and therefore was also treated as an affected area for survey purposes. Therefore, all previously decommissioned areas are being treated as affected areas and are being surveyed in accordance with the criteria described within this section.

A one meter by one meter grid system is established on the horizontal surfaces within the affected areas. This grid system provides reference locations for the conduct of supplemental surveys, site decontamination activities, and final survey. Vertical surfaces to an elevation of 2 meters are likewise defined.

Survey measurements consist of the following: walkover direct scans, direct measurements (static), and removable surface activity measurements. Affected areas include 100% surface scans of the floors and lower wall surfaces (2 meters). Static measurements are obtained at grid intersections. Upper walls, ceilings, and overhead structures are each surveyed with a minimum of 30 (1 per 20 m^2) measurement locations on vertical and horizontal structures where radioactive material may have accumulated. The collection of 30 samples for overhead areas is considered adquate since these areas were generally previously decommissioned or are unlikely to have residual activity in excess of 25% of the guideline. For any area in which measurements demonstrate levels in excess of 25% of guidelines, the sampling density is increased.

7.2.2 Unaffected Areas

Unaffected areas are scanned for 10% of the floor and lower wall surface area with at least 30 randomly selected measurement locations or an average measurement of 1 per 50 m^2

of building surface area whichever is greater. Measurements with results in excess of 25% of the guideline require a reclassification to an affected area protocol.

7.3 SURVEY METHOD FOR OPEN LAND AREAS

7.3.1 Walkover Scans

These scans are performed using a standard 1" by 1" NaI(Tl) detector coupled to a rate meter with an audio output. The use of head phones provides a sensitive method to determine the presence of elevated readings. Scanning proceeds at a rate not to exceed 0.5 m/s. Elevated readings are identified as values exceeding approximately 1.5 times nominal background readings and located on a facility map and referenced to a common bench mark.

7.3.2 Static Measurements

Static Measurements are performed using a standard 1" by 1" NaI(Tl) detector coupled to a rate meter and/or scaler. Static measurements are recorded as count rate or total counts integrated over a fixed integrating time period. Static measurements are generally obtained at reference grid coordinates as described above.

7.3.3 Surface Soil Measurements

Surface soil measurements are obtained at locations exhibiting elevated NaI(Tl) readings (7.3.1 and 7.3.2). Surface Soil Samples may also be collected on a random or biased sampling scheme. These samples are obtained by removing the immediate vegetation layer and sampling the soil to a nominal depth of six inches with a nominal diameter of 2-4 inches. The locations of the samples are identified on a facility map and referenced to a common bench mark.

7.3.4 Subsurface Soil Samples

Subsurface soil samples are obtained using spilt spoon sampling methods. Split spoon samples are collected at each grid intersection and grid center. Samples are obtained in one foot or two foot increments depending on the area surveyed and the expectation of soil contamination at a given depth. NUREG guidance specifies that split spoon samples shall not exceed 1 meter increments. At each subsequent increment, smaller diameter spoons are used in an attempt to avoid cross contamination of soils from the shallower depth to the underlying depths. Each spoon is also decontaminated to preclude potential

for cross contamination. The total depth of each sample also varies, depending upon the maximum depth of suspected contamination. If contamination is identified at the maximum depth of the split spoon sample then the general area is re-sampled to determine the relative depth of contamination. Typical depths for split spoon sampling generally range from 3 to 6 feet and the maximum depth extends to 25 feet.

The soil samples obtained are analyzed for total uranium using the gross alpha screening technique (TI 1992 Remediation Plan). Within each affected area, 5% of the samples collected will be sent to an off-site laboratory for gamma spectroscopy analysis. In addition, 1% of the samples collected, which were sent to the off-site laboratory, will be analyzed by alpha spectroscopy. The off-site laboratory analysis will be performed for two primary purposes: (1) as a quality assurance measure for the alpha screening technique and (2) to determine the isotopic distribution represented in each affected area.

7.3.5 Bore Hole Measurements

During the conduct of split spoon sampling, NaI(Tl) measurements are obtained at various depths within the drill hole location. These measurements are made in an attempt to better identify the depth of contamination should it exist at levels readily detected using a NaI(Tl) detector arrangement. The results are recorded on the daily activity logs. Typical responses must be compared to the anticipated background and geometry affects presented. A transition of 2Π to 4Π geometry is made and therefore will result in background results that approach twice that of surface readings.

7.3.6 Exposure Rate Measurements

Exposure rate measurements are obtained at 1 meter elevations at grid intersections within the affected area and at locations defined by elevated readings obtained during the scanning procedure. These measurements may be made using a Bicron microrem meter, a Ludlum micro-R meter, a NaI(Tl) ratemeter, or a high pressure ionization chamber. Those instruments demonstrating a strong energy dependence, such as those incorporating NaI(Tl) detectors, will be referenced to an exposure rate obtained for the spectra distribution encountered in field. Reference may be made to established exposure rate locations or to an instrument depicting minimal energy dependence. The energy dependence of NaI(Tl) is very pronounced and will over respond to lower energy photon spectral distributions (approximately a factor of 1.5), as encountered with uranium contaminated sites, when calibrated to ^{137}Cs photons. The reference guideline is 15 μR/h above background.

7.4 SURVEY METHODS FOR BUILDING INTERIOR

7.4.1 Surface Scans and Direct Measurements

Surface scans are conducted using a pancake type GM probe over the areas of interest in close proximity to the surface at a rate not greater than 0.1 m/s. Direct measurements are conducted (also using a pancake GM probe) at grid intersections in a static condition. The scans and direct measurements also included lower wall surfaces at 1 and 2 meter elevations.

Surface scans and direct static measurements will be performed using GM pancake type meters (Ludlum model 44-88 and model 44-9). These instruments were calibrated against traceable sources. Nominal calibration factors of 260 cpm (gross counts) per 5000 dpm /100 cm^2 and 630 cpm (gross counts) per 15,000 dpm /100 cm^2 were obtained.

7.4.2 Removable Contamination

Removable contamination measurements will be conducted using a filter paper smear over a 100 cm^2 area. The filter paper is then analyzed in a laboratory environment using a Ludlum Model 43-10-1 coupled to a Ludlum Model 2200 Scaler. Removable contamination surveys will be conducted with a minimum of five measurements per 100 square meter area within the floor area, overhead area, and walls within the building.

7.4.3 Exposure Rate Measurements

In accordance with NUREG guidance, no gamma emitting radionuclides of significant yield are present due to the nature of the contaminant being Uranium in a surface geometry and therefore exposure rate measurements are not required.

7.5 SUPPLEMENTAL SURVEY REPORT

7.5.1 Open Land Areas

The results of the supplemental radiological surveys for all open land areas (except for the Metals Recovery Area) will be compiled and submitted to the NRC in a report format.

The Metals Recovery Area is treated separately as it was an area of active remediation during radiolaogical survey activities. All radiological survey results for this area will be

included in the Metals Recovery Area Final Report, similar to the 1993 Burial Site Final Report.

7.5.2 Building Interiors

The results of the building interior supplemental radiological surveys will be documented in a report format. Since the additional building interior supplemental surveys will occur concurrently with remediation activities, all supplemental survey reports for building interiors will be included in the Final Report for the overal decontamination activities as described in Section 9.0.

8.0 FINAL SURVEY PLAN

Final surveys are conducted subsequent to remediation and decontamination activities to determine final status as compared to acceptance criteria used for final decommissioning and license termination. As stated within NUREG/CR-5849, the final status survey may incorporate other surveys such as the supplemental surveys and in-process excavation surveys. The supplemental surveys have been designed so that they may be readily incorporated as acceptable final survey data. Those areas which have been remediated or decontaminated will be subject to the same surveys, however, in process excavation surveys will be used as part of the data base.

8.1 ' AND AREA FINAL SURVEYS

8.1.1 Affected Areas

Post excavation surveys, will include walk over scans and static measurements. Fill material, used for backfilling operations will be sampled and assayed. All soil samples used for final status survey, whether they were from supplemental surveys, in-process remediation surveys, or final status surveys will be archived and retained until NRC determines that the facility and site is eligible to be released for free release.

Subsurface soil sampling data is used to verify that the remediated area was appropriately extended. These subsurface soil samples are taken within 10 m x 10 m grids at each grid intersection and the center of each grid (see section 7.3.4). The subsurface soil sampling data collected during the supplemental surveys is used for final survey data as appropriate. A statistical evaluation of this sampling pattern is included within section 8.3.

In addition to subsurface soil sampling, in-process surface soil samples are performed during the excavation on the floor of the excavated area. The sample pattern used for these samples is a more dense pattern than described for the subsurface soil sampling (for example, samples on every grid intersection within approximate 10 ft x 10 ft grids rather than on the larger 10 m x 10 m grids).

8.1.2 Unaffected Areas

Final surveys for the unaffected open land areas will be solely based on the data collected during the supplemental radiological surveys described in Section 7.1.2.

8.2 BUILDING INTERIOR FINAL SURVEYS

8.2.1 Affected Areas / Previously Decommissioned Areas

Building interior surveys conducted during the supplemental surveys are performed in accordance with NUREG/CR-5849 for final surveys. Those areas requiring remediation will be surveyed during remediation and this data may be used in part, for final survey data. Once remediation efforts have been completed, those areas will be subject to full final radiological surveys. Areas immediately adjacent to the remediated areas will also be re-surveyed to ensure that no cross contamination had occurred during the remediation efforts.

8.2.2 Unaffected Areas

All surveys conducted for unaffected areas during the supplemental radiological surveys are acceptable for final survey status.

8.3 STATISTICAL EVALUATION OF THE FINAL SURVEY SAMPLING PATTERN

8.3.1 Open Land Areas

Subsurface soil sampling data is used to verify that the remediated area is appropriately extended. The sampling scheme for subsurface soil sampling is chosen based on a typical sample unit size whereby the total number of subsurface soil samples obtained is sufficient to allow for a 95% confidence interval for each sample unit. The method selected differs from NUREG-CR5849 largely due to the extent of the affected areas. Over 1700 split spoon sample locations were identified resulting in approximately 6000 samples for analyses.

For application to the final survey a minimum sample unit size must be determined for the sample scheme chosen. This may be best determined by application of the Chi-Square statistic for a normally distributed population. The probability that the chi-square statistic distribution is less than the variable, x, at 95% confidence for a variance of 37 is 7.4 meters (see Attachment A). This variance was obtained through analysis of a large sample population of samples obtained in the field. This radius, would allow for a minimum of eight samples spaced at a distance no greater than 7.4 meters within a 20m x20m survey unit and will also satisfy the student t-test.

With regard to sampling for the purpose of grid cell averaging, for any grid exceeding the criteria, increased sample density is performed as suggested in the NUREG guidance (i.e., 13 locations within a 10m x 10m grid cell).

Attachment A includes the summary statistical evaluation that demonstrates the analytical model in support of the above-stated assertions. In practical terms, the statistical evaluation provides justification for TI's sampling pattern. For a typical survey unit sized at TI, TI's sampling pattern assures a 95% confidence level that the decommissioning criteria has been achieved.

In addition to the subsurface soil samples surface soil samples are taken from the excavation floor during the remediation to be used for final survey data. This sampling pattern (approximately 100 square foot grids) exceeds that defined within the NUREG/CR-5849 and therefore is within the desired 95% confidence limit.

8.3.2 Building Interiors

The final surveys for building interiors are performed in accordance with NUREG/CR-5849 guidance. The sampling pattern is based on a one square meter grid pattern. As specified in NUREG-CR5849, this sampling pattern will fall within the desired 95% confidence limit.

9.0 FINAL REPORT

Upon completion of the final surveys, TI will compile all the final survey data, for both open land areas and building interiors, into a final report. The final report will be structured similar to the 1993 Burial Site Final Report that was previously submitted to the NRC.

Attachment A to Appendix A

Summary Statistical Model for x-y Grid System

Developed for

Texas Instruments Incorporated
Materials and Controls Group

By

Laura Schulman
Applied Mathematician and Statistician
179 Woods Hole Road
Falmouth, MA 02540

Attachment A: Summary Statistical Model for x-y Grid System

In this model, the goal is to estimate a radius within which 95% of the uranium will be detected. Suppose X and Y are normally distributed with mean zero and variance 37. This is a feasible assumption because the probability that uranium will be detected increases closer to the source and decreases the greater the distance from the source. The variance is an estimate based on the large number of samples taken over a large area. The following calculations show how the radius of 95% detection was found:

$X \sim N(0,37)$
$Y \sim N(0,37)$

(X^2)/37+(Y^2)/37 < R) = .95

Here, P stands for 'the probability that'

P(X^2+Y^2/37 < R) = .95

P(X^2+Y^2 < 37(.1)) = .95

So the radius has chi squared distribution with 2 degrees of freedom. Therefore, if the radius is less than 3.7 meters, then 95% accuracy will be achieved.

In conclusion, to have 95% confidence that any uranium over the limit will be detected, it is ncessary to take a sample about every 7.4 meters. In a grid pattern, it is sufficient to test 8 points in a 20 meter x 20 meter area with no more than 7.4 meters between any two nearest points.

Figure A1
Map of Open Land Areas Depicting Undeveloped and Unaffected Land Areas

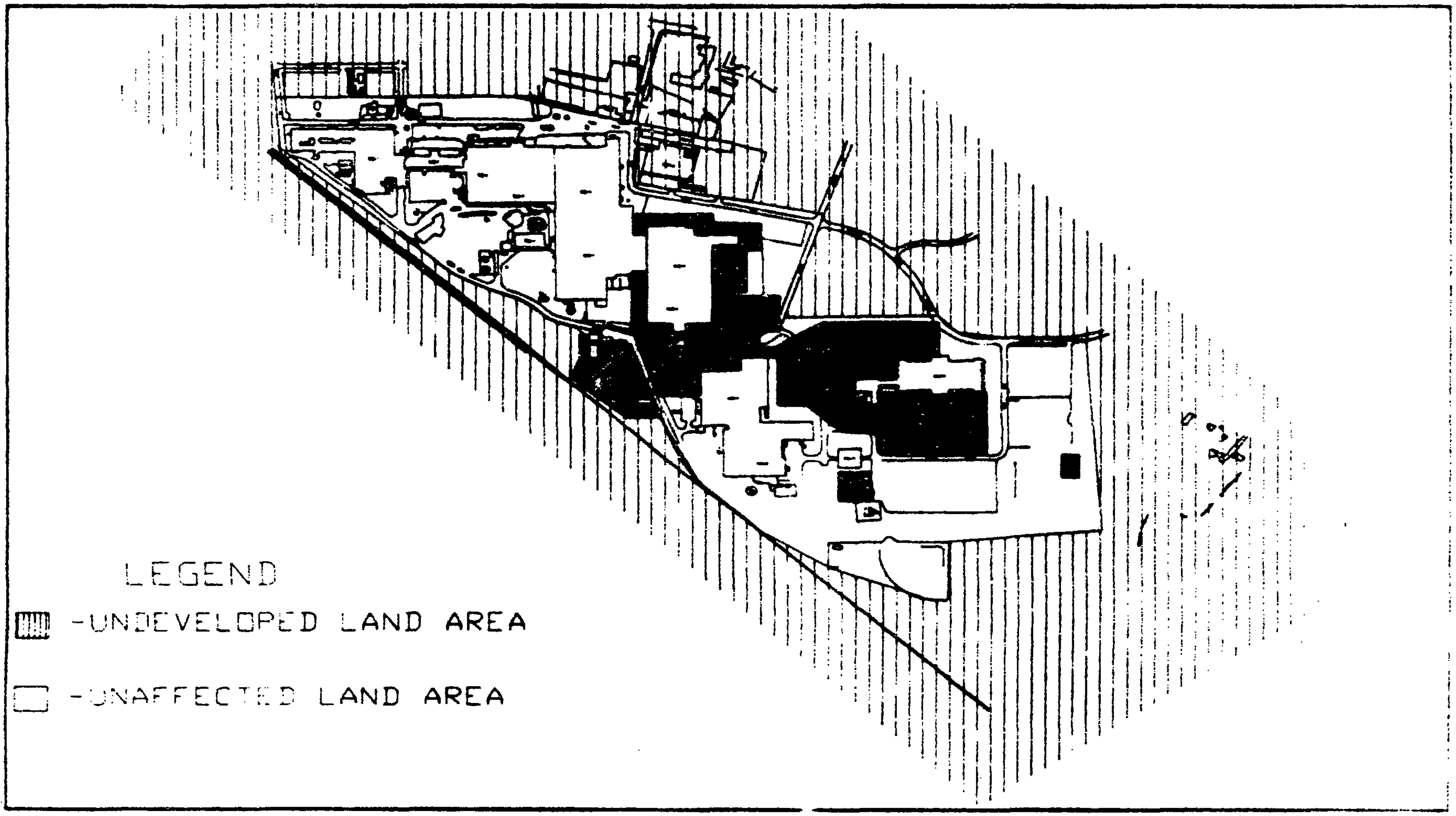


Figure A2
Map of Open Land Areas Depicting Affected and Previously Remediated Areas

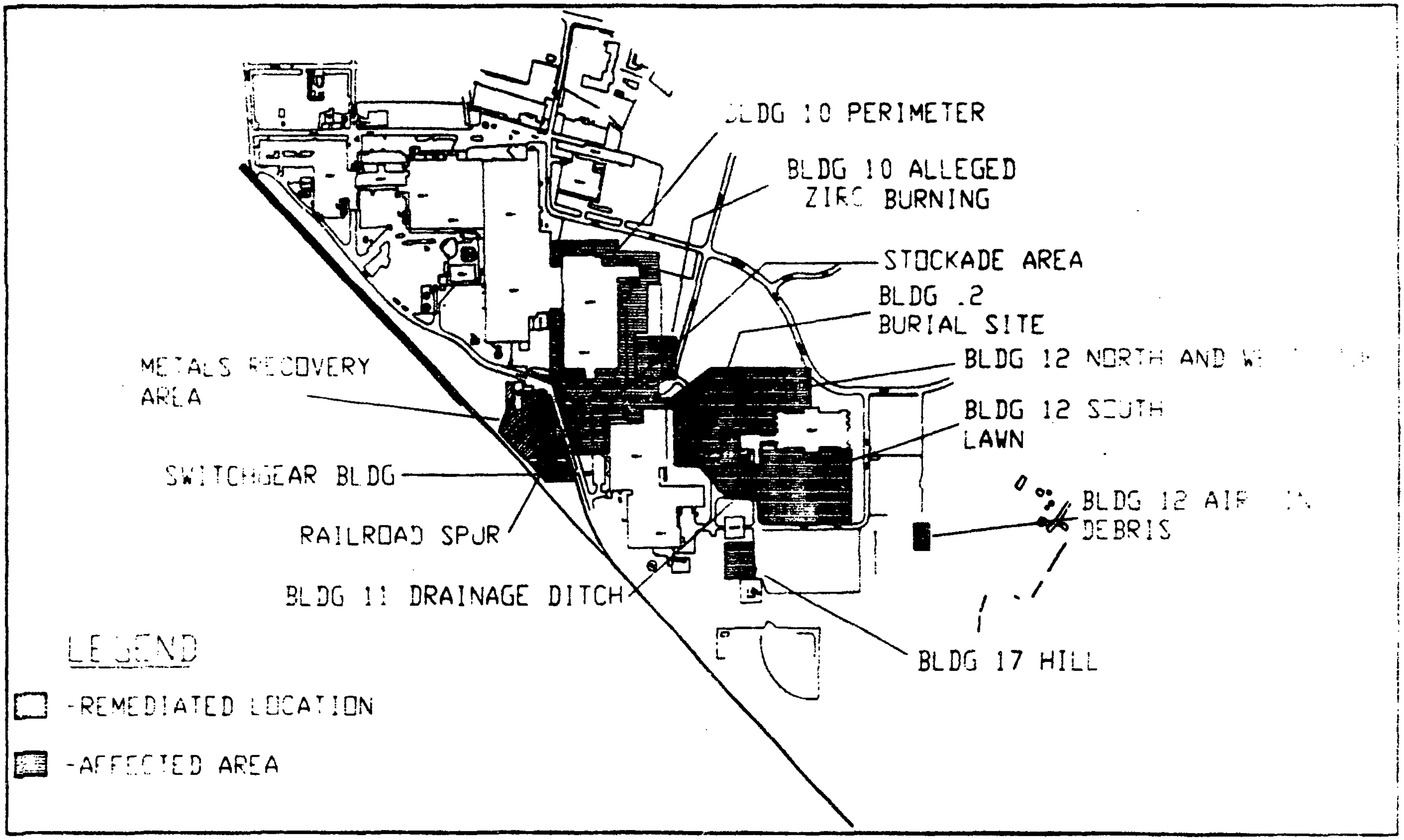
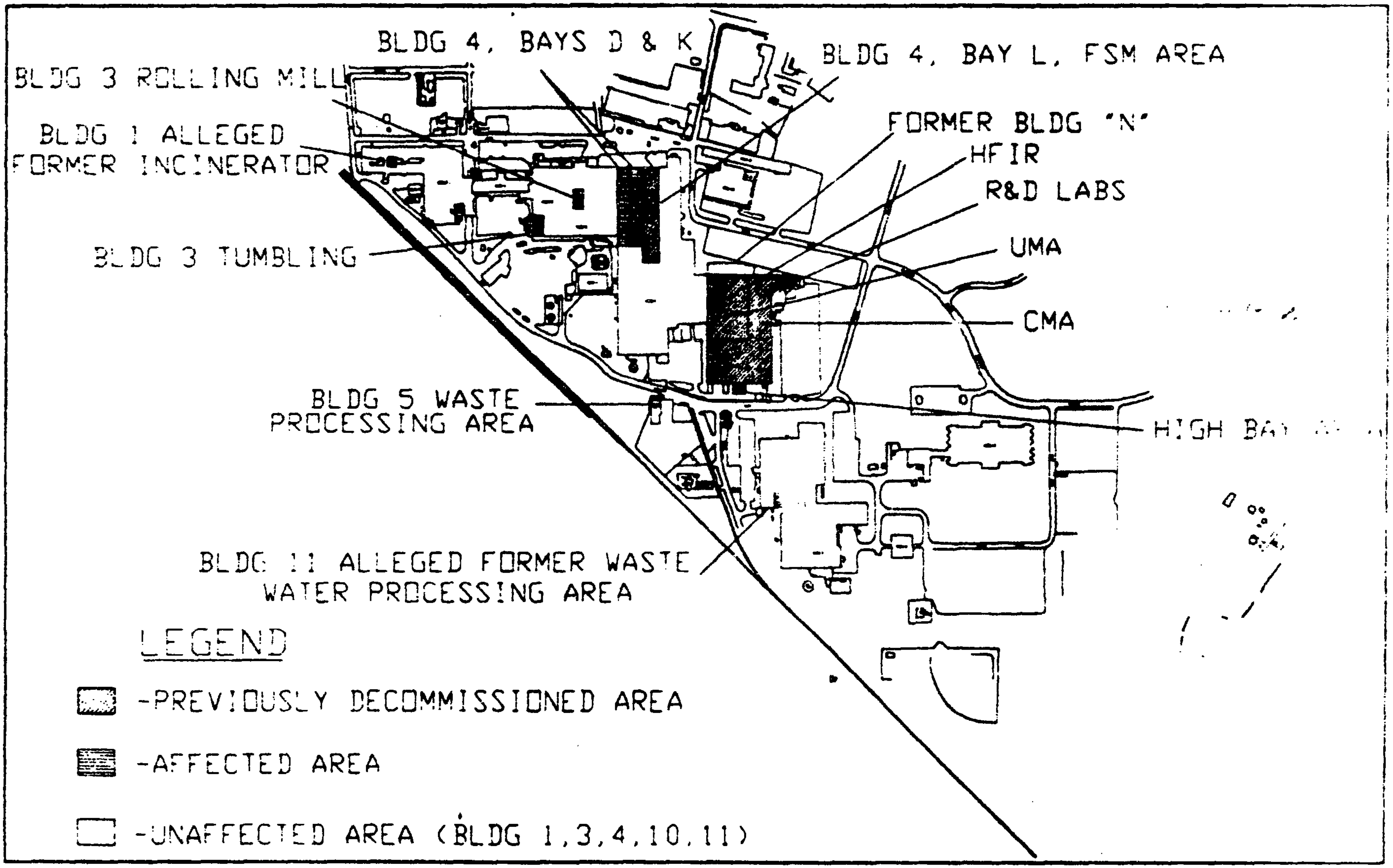


Figure A3
Map of Building Areas Depicting Affected, Unaffected, and Previously Decommissioned Areas



Appendix B:
Groundwater Radiological Monitoring
Work Plan

Texas Instruments Incorporated
Materials & Controls Group
Environmental, Safety & Health Department
P.O. Box 2964
34 Forest Street
Attleboro, MA 02703-0964

APPENDIX B

GROUNDWATER RADIOLOGICAL MONITORING WORK PLAN

TEXAS INSTRUMENTS FACILITY
ATTLEBORO, MASSACHUSETTS

Prepared for:

TEXAS INSTRUMENTS INCORPORATED
MATERIALS & CONTROLS GROUP
ENVIRONMENTAL, SAEFTY AND HEALTH DEPARTMENT
P.O. BOX 2964
34 FOREST STREET
ATTLEBORO, MASSACHUSETTS 02703-0964

Prepared by:

INTEGRATED ENVIRONMENTAL SERVICES
A DIVISION OF NES, INC.
44 SHELTER ROCK ROAD
DANBURY, CONNECTICUT

December 19, 1994

NES DOCUMENT #82A8594, REV. 1

Document Authorization Form

Groundwater Radiological Monitoring Workplan
Texas Instruments Facility
Attleboro, Massachusetts

Prepared for:

Texas Instruments Incorporated
34 Forest Street
Attleboro, Massachusetts

Prepared by:

Integrated Environmental Services
a Division of NES, Inc.
44 Shelter Rock Road
Danbury, CT 06810

December 16, 1994

NES DOCUMENT #82A8594, REV. 1

Stuart S. Manley — 12/16/94
Stuart S. Manley
Senior Environmental Scientist
Date

Todd L. Bachand/RJW — 12.16.94
Todd L. Bachand
Section Manager
Technical Services
Date

Robert J. Weireter — 12.16.94
Robert J. Weireter
Senior Department Manager
Geosciences and Technical Services
Date

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1. INTRODUCTION

This document was prepared by Integrated Environmental Services, a division of NES, Inc. (NES/IES) for Texas Instruments Incorporated (TI) to present a plan for radiological monitoring of groundwater at the TI facility in Attleboro, Massachusetts (the "Site"). TI has proposed to remediate several areas where radiologically contaminated soil has been documented. Subsequent to the remediation of these areas, herein described as a Remediated Area (RA), groundwater monitoring will be performed to determine whether radiological constituents are contained in the groundwater. Identification and discussion of each RA is not included in this report.

1.1 PURPOSE

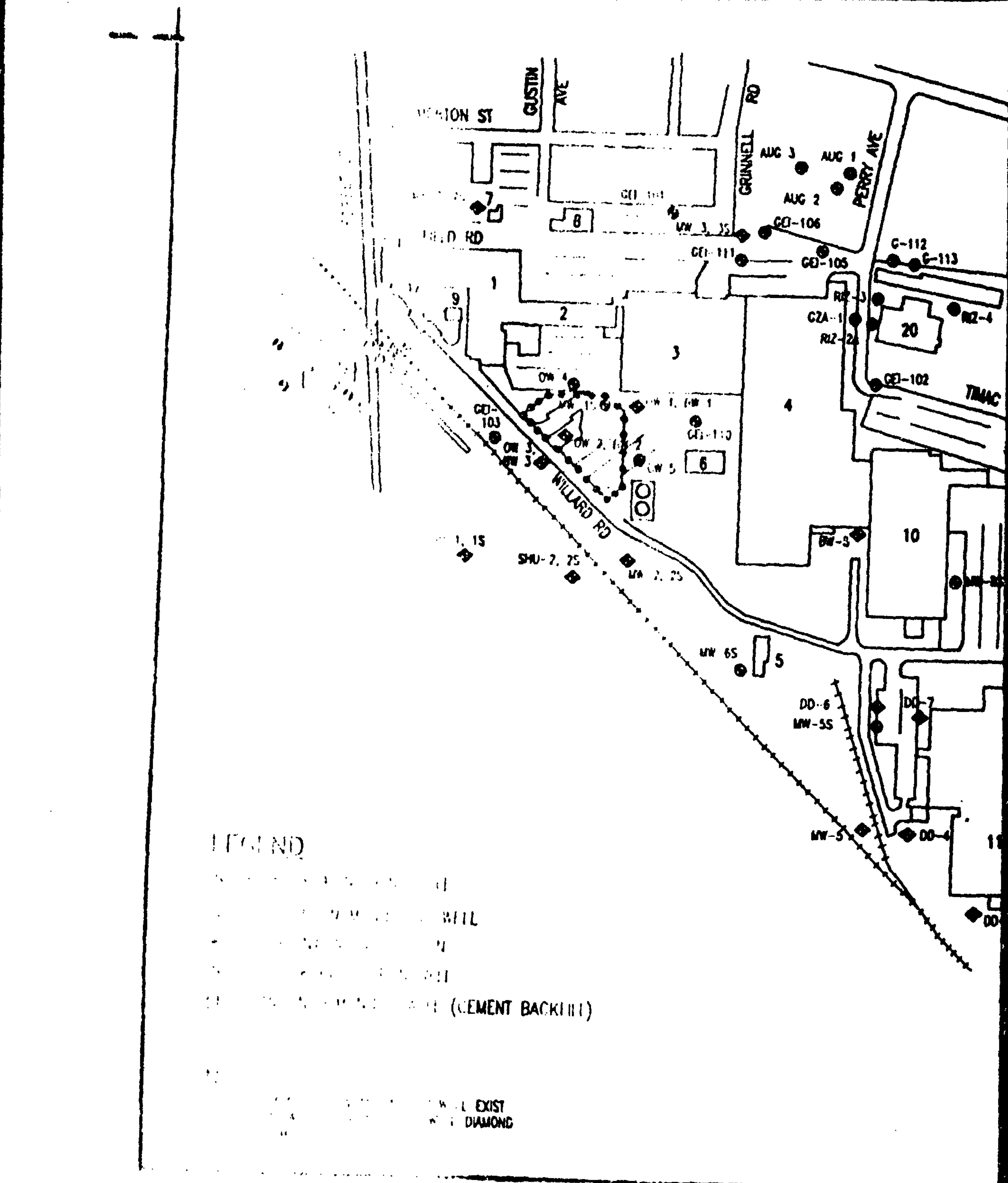
The purpose of this workplan is to describe the methodology and logic of the monitoring program to ascertain the presence of radionuclides in the groundwater at each RA. The results of this investigation are intended to be used in support of the completion of decommissioning efforts at the Site and termination of TI's Special Nuclear Materials License No. 23.

1.2 SITE HYDROGEOLOGY

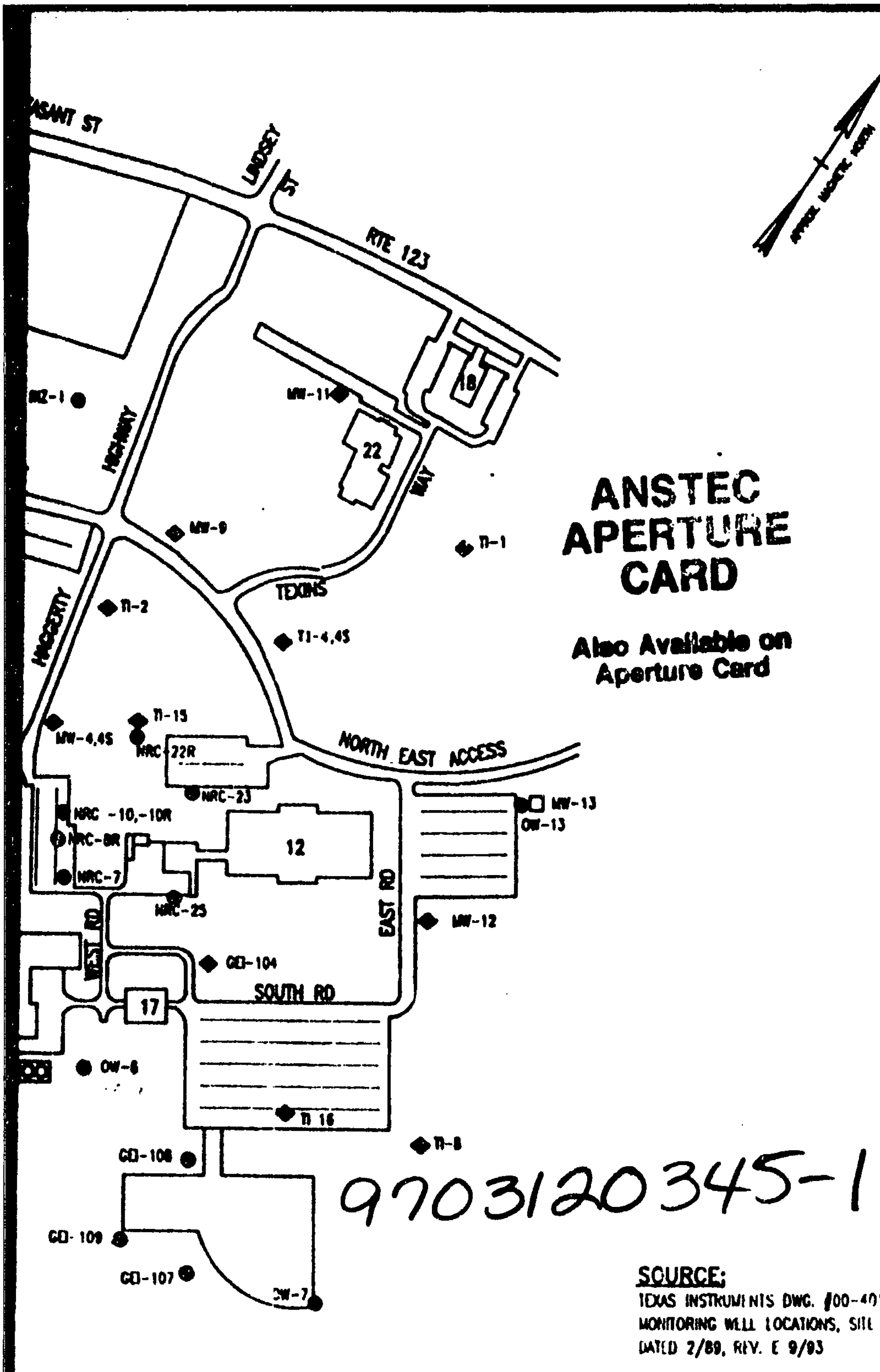
The following description of Site hydrogeology was summarized from Appendix F, Site Hydrogeology in the 1993 Burial Site Final Report submitted by TI to the NRC in September 1993. The site is located within the bounds of the Narraganset basin. Bedrock consists of folded metasediments of the Rhode Island Formation containing fractures parallel to the northeast-southwest trending folds.

Bedrock is overlain by 10 to 40 feet of unconsolidated overburden which includes glacio-alluvial sediments consisting of a poorly sorted basal till (hydraulic conductivity 10E-5 to 10E-6 cm/s) overlain by interbedded silts, sands, and gravels (hydraulic conductivity 10E-2 to 10E-5 cm/s), with peat and other organic deposits near the surface representing a pre-development wetland in some locations.

Both the bedrock and overburden are waterbearing zones with some degree of hydraulic connection between them as indicated by pump test results. The water table is generally 4 to 5 feet below grade and a northwest-southeast trending divide is observed in the overburden aquifer. Shallow groundwater to the west of the divide flows towards the Ten Mile River Watershed and shallow groundwater east of the divide flows towards Cooper's Pond and the Taunton River Watershed.



GUSTIN
AVE
GRINNELL RD
PERRY AVE
TIMAC
WILLARD RD
AUG 3
AUG 1
AUG 2
MW 3, 3S
GEI-106
GEI-111
GEI-105
G-112
G-113
RIZ-3
RIZ-4
CZA-1
RIZ-2A
GEI-102
OW 4
GEI-103
OW 3
MW 3
GEI-110
OW 5
SHU-2, 2S
BW-3
MW 6S
DD-6
MW-5S
DD-7
MW-5
DD-4
1
2
3
4
5
6
7
8
9
10
20
LEGEND
(CEMENT BACKFILL)
EXIST
DIAMOND



121534

ANSTEC APERTURE CARD

Also Available on Aperture Card

OFFICIAL RECORD COPY ML 10

9703120345-1

SOURCE:
TEXAS INSTRUMENTS DWG. #00-40126
MONITORING WELL LOCATIONS, SITE PLAN
DATED 2/89, REV. E 9/93

DOCUMENT CONTROL NO

REVISION NO.

PROJECT: TEXAS INSTRUMENTS
ATTLEBORO, MA

DRAWING: MONITOR WELL LOCATIONS
SITE PLAN

IES
INTEGRATED ENVIRONMENTAL SERVICES
A DIVISION OF NEX, INC

PROJECT # 2276-102
FILENAME 2276102A
SCALE 1" = 400'
DATE 11/4/94
BY AD
FIGURE 1

2. GROUNDWATER MONITORING PROGRAM

The following sampling program is designed to investigate the potential presence of radionuclides in groundwater at each of the RAs utilizing the existing groundwater monitoring network to the greatest extent possible. NES/IES proposes to sample the existing monitoring wells located in the immediate vicinity and on the downgradient side of each RA, if possible. If no overburden wells are immediately adjacent to and downgradient from the RA, an overburden well will be installed within a short distance downgradient of the area. Bedrock wells in the immediate vicinity will also be sampled to provide information on this aquifer; however, no additional bedrock wells are proposed in this scope of work.

2.1 EXISTING MONITORING WELL NETWORK

According to information provided by TI, there are a total of 63 monitoring wells that currently exist on-site and one that has been abandoned. In addition, there are 13 monitoring wells off-site North and South of the Western half of the Site (See Figure 1). Twenty five of these wells extend into the bedrock, two of which are production wells used for the on-site manufacturing and two are located off-site, to the South of the Site. The balance of the wells, a total of 51, are completed in the overburden and 11 of these are located off-site. A potentiometric map, generated in May 1990, of the overburden aquifer was provided by TI (TI, 1990), and shows the hydraulic gradient of the Site (See Figure 2).

TI is presently conducting a groundwater remediation program in the area where 24 wellpoints have been completed in the overburden South of Building #3. However, that program is not relevant to this investigation, since that area is not an RA.

2.2 INVESTIGATION PROCEDURES, METHODS AND PROTOCOLS

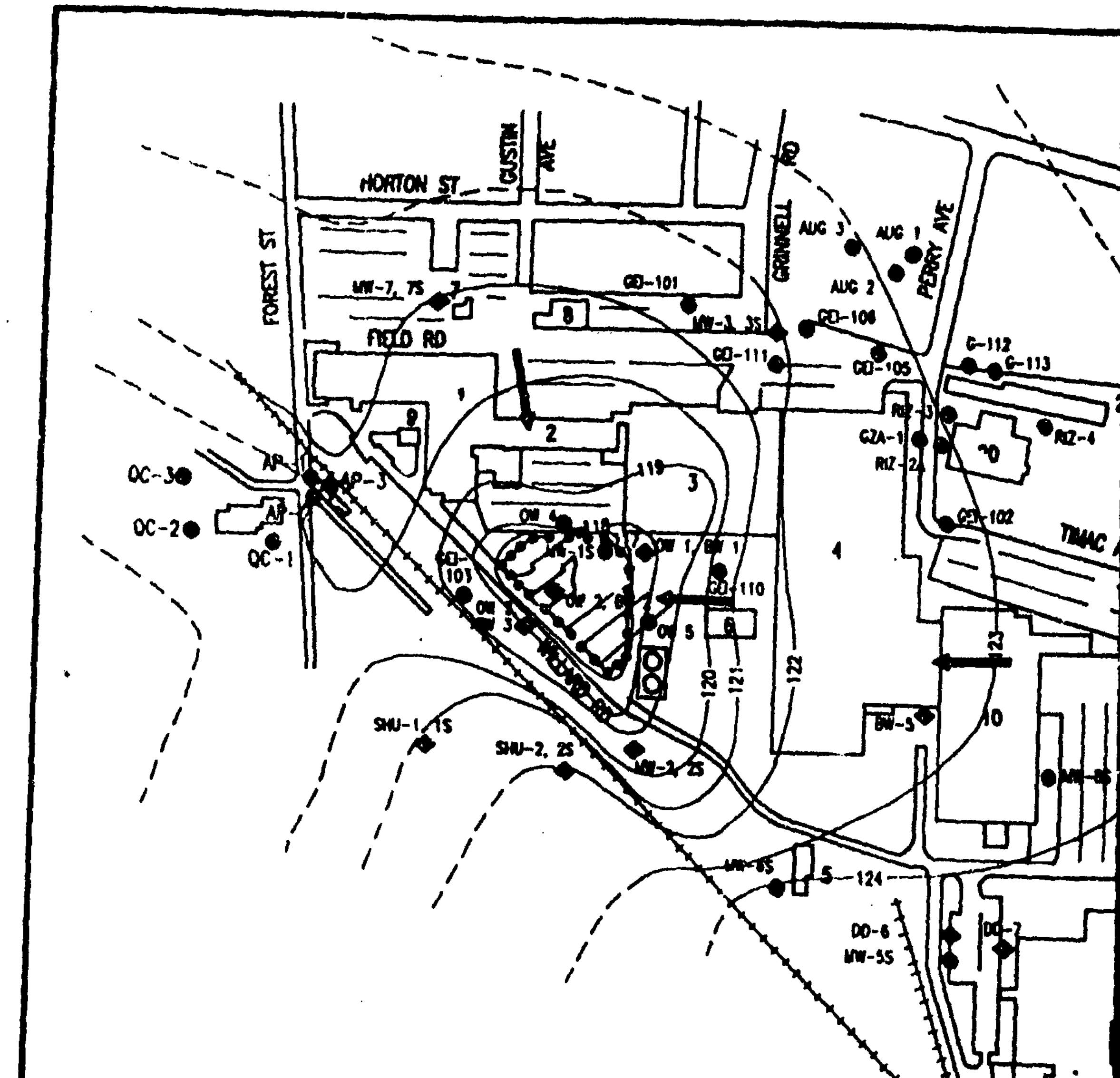
2.2.1 Groundwater Flow Mapping

Prior to beginning the well installation and sampling activities in any individual RA, NES/IES proposes to measure the groundwater elevations of all wells and use this information to generate a current groundwater flow map. This information will then be used to confirm the location or to re-position the proposed wells in the downgradient direction.

2.2.2 Sample Collection Procedures

Groundwater samples will be collected from identified wells adjacent to each individual RA according to the following procedures, as stated in the NES/IES SOP-017-010, Sampling a Well. Groundwater will be sampled as remediation of each RA is completed. The following equipment will be used for well sampling:

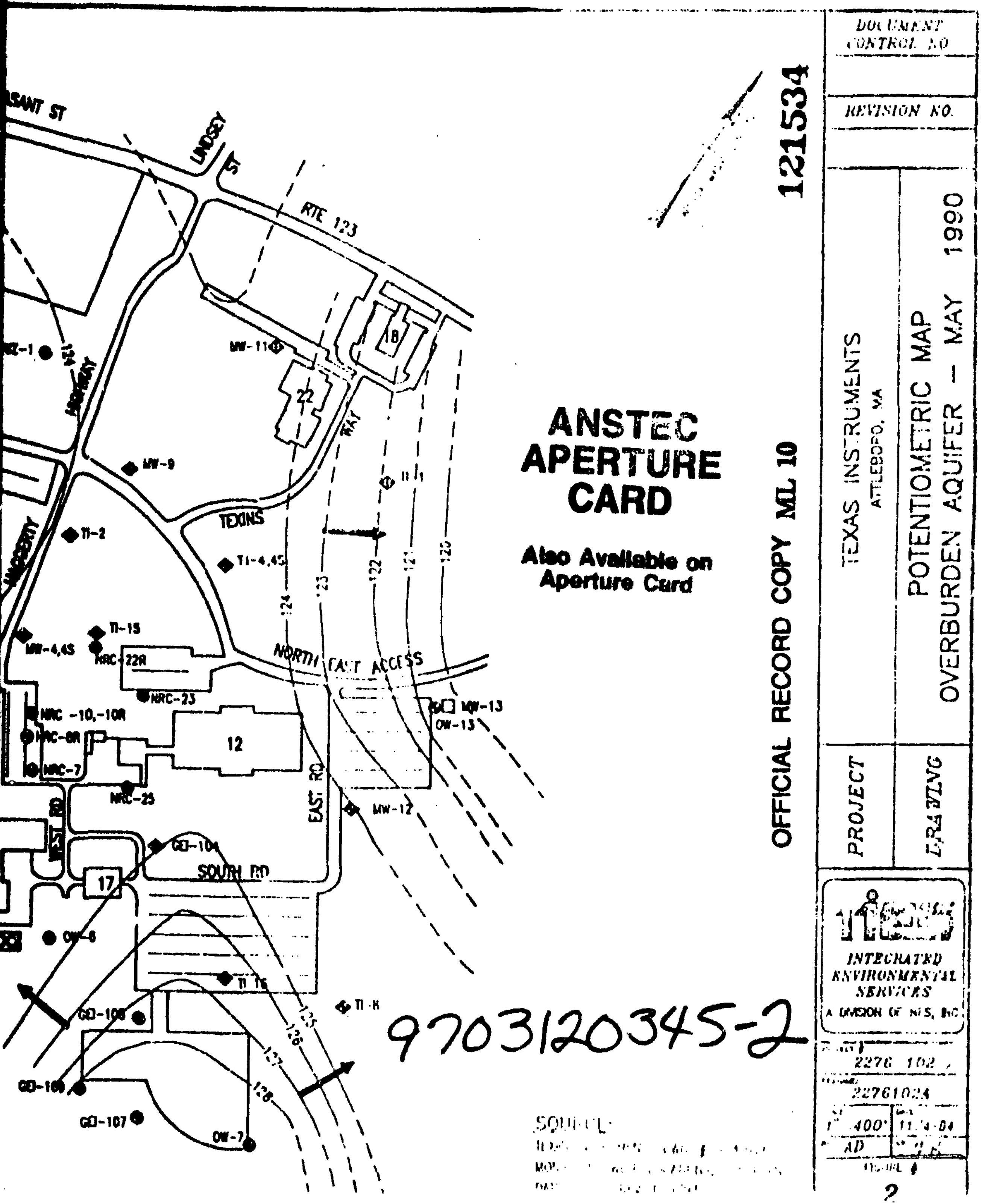
Disposable Teflon™ Bailer	Electric submersible pump
Appropriate discharge tubing	Non-absorbent cord



LEGEND

- ◆ BEDROCK MONITORING WELL
- ● OVERBURDEN MONITORING WELL
- • WELLPOINT IN OVERBURDEN
- BEDROCK PRODUCTION WELL
- □ ABANDONED MONITOR WELL (CEMENT BACKFILL)
- ← DIRECTION OF GROUNDWATER FLOW

NOTE:
WHERE BOTH A SHALLOW AND A DEEP WELL EXIST TOGETHER AS A CLUSTER, THE DEEP WELL DIAMOND SYMBOL IS EMPLOYED.



121534

ANSTEC APERTURE CARD

Also Available on Aperture Card

OFFICIAL RECORD COPY ML 10

9703120345-2

IES' field forms
Well location and site map
Stop watch or equivalent
Misc. tools
Appropriate Health and Safety Equipment (as specified in the H&S Plan)
Site Sampling Plan and Site Health and Safety Plan (H&S Plan)

Equipment decontamination will be according to the procedures stated in Section 2.3.5 - Quality Assurance/Quality Control. The depth of standing water will be measured as described in SOP-017-003 or SOP-017-004. At this time there is no indication that explosive gases would be present in the well; however, the well gases will be screened for organic contamination with a photoionization detector (PID).

The volume of water standing in the well will be calculated and three to five well volumes of water will be purged prior to sampling to ensure the collection of a representative groundwater sample. The purging of the well will be according to the procedures specified in SOP-017-012 - Standard Operating Procedure for Purging a Well. All purge water will be containerized until receipt of the analytical data. Upon receipt of the data, a determination will be made regarding the disposal of the purge water.

Any new monitoring wells will be installed according to NES/IES SOP-017-017, Construction, Development and Abandonment of Monitoring Wells in Unconsolidated Formations.

2.2.3 Sample Identification, Documentation and Handling

Each sample will be assigned a unique alpha-numeric identifier which is consistent with previous sample identification schemes used at the site. Each sample will be logged in a field notebook at the time of collection along with the following information: date sample was collected; weather conditions; unique sample identification number; field screening results; sample location and depth; verbal description of sample (matrix, color, texture, odor, etc.); and any unusual conditions or incidents during sampling.

Samples sent off-site for laboratory analysis will be accompanied by a Chain of Custody (COC) form completed by sampling personnel which includes the following information: sample identification number, number and volume of containers, preservative, analysis requested, and the date and time samples were relinquished to the laboratory.

2.2.4 Analytical Program

All samples collected are to be analyzed for gross Alpha and gross Beta radioactivity. The USEPA drinking water regulations (40 CFR 141), provide maximum contaminant levels (MCLs) for drinking water. These regulations state that the MCL for gross Alpha is 15 pCi/L and the MCL for gross beta is 50 pCi/L. In the event that any sample exceeds the MCL, isotopic analysis for uranium and thorium will be performed for that sample.

2.2.5 Quality Assurance/Quality Control

All sample containers will be laboratory supplied, pre-cleaned and traceable. Shipping containers will remain closed and sealed until sample containers are needed. Sample containers will remain closed until ready for use and then closed immediately after filling with the sample.

Hand held sampling equipment will be constructed of inert materials (e.g. stainless steel) and will be decontaminated prior to each sampling event according to the protocols stated in NES/IES SOP-017-008, Decontamination of Field Sampling Equipment. Disposable sampling equipment will be dedicated to one well and properly disposed of after use. Decontamination of non-disposable sampling equipment will be as follows: potable water rinse; scrubbing with a potable water soap solution; potable water rinse, and deionized water rinse.

Field blanks will be collected at the rate of one per day and will be generated by passing laboratory supplied analyte-free water through decontaminated sampling equipment into empty sample containers. The blanks will be analyzed according to the same analytical protocols selected for this investigation.

Relevant NES/IES SOPs to be used in this program are listed in Attachment 1 at the end of this report.

2.3 INVESTIGATION RESULTS REPORT

Analytical data will be received from the laboratory approximately 3-4 weeks from the date of sample collection. Once the laboratory data are received, a draft results report will be submitted to TI for review and approval. This report will include a site plan showing monitoring well locations, a current potentiometric map, the analytical results summarized in tables and discussion of the analytical data relative to the applicable MCLs, including the results of any isotopic analyses that were performed.

3. REFERENCES

NUREG/CR-1383. Guidance on the Application of Quality Assurance for Characterizing a Low-Level Waste Disposal Site, NUREG/CR-1383, October 1990.

NUREG/CR-5849. Guidance Manual for Conducting Radiological Surveys in Support of License Termination, draft, NUREG/CR-5849, June 1992.

ORAU, 1990a. Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program, Revision 5, ORAU, February 1990.

ORAU, 1990b. Quality Assurance Manual for the Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program, Revision 3, ORAU, February 1990.

ORAU, 1990c. Survey Procedures Manual for the Oak Ridge Associated Universities' Environmental Survey and Site Assessment Program, Oak Ridge Associated Universities (ORAU), March 1990.

NRC, 1994. Draft Branch Technical Position on Site Characterization for Decommissioning, Division of Waste Management, Office of Nuclear Material, Safety and Safeguards, U.S. Nuclear Regulatory Commission, Nov. 17, 1994.

TI, 1993. Monitoring Well Locations Site Plan, Texas Instruments Facility, Attleboro, Massachusetts, Texas Instruments, September 1993.

TI, 1993. Appendix F, Site Hydrogeology of 1993 Burial Site Final Report, Texas Instruments Facility, Attleboro, Massachusetts, Texas Instruments, September 1993.

TI, 1990. Potentiometric Map, Overburden Aquifer, May 1990, Texas Instruments Complex, Attleboro, Massachusetts, Texas Instruments, May 1990

Veal, F.J. 1983. Environmental Report: Radiological Survey and Review of the Texas Instruments Complex, Attleboro, Massachuetts, Texas Instruments, 17 January 1983.

Veal, F.J. 1982. Environmental Report: Radiological Survey of the Texas Instruments Complex, Texas Instruments, 20 July 1982.

ATTACHMENT 1

List of Relevant NES/IES Standard Operating Procedures

SOP-017-001	Checking Data Tables
SOP-017-003	Measuring Water Levels and Sounding a Well with a Steel Tape
SOP-017-004	Measuring Water Levels and Sounding a Well with and Electronic Indicator
SOP-017-008	Decontamination of Field Sampling Equipment
SOP-017-010	Sampling a Well
SOP-017-017	Construction, Development and Abandonment of Monitoring Wells in Unconsolidated Formations
SOP-017-012	Standard Operating Procedure for Purging a Well.

Appendix C:
Radiological Health and Safety Plan

Texas Instruments Incorporated
Materials & Controls Group
Environmental, Safety & Health Department
P.O. Box 2964
34 Forest Street
Attleboro, MA 02703-0964

APPENDIX C

RADIOLOGICAL HEALTH AND SAFETY PLAN

TEXAS INSTRUMENTS FACILITY
ATTLEBORO, MASSACHUSETTS

Prepared for:

TEXAS INSTRUMENTS INCORPORATED
MATERIALS & CONTROLS GROUP
ENVIRONMENTAL, SAEFTY AND HEALTH DEPARTMENT
P.O. BOX 2964
34 FOREST STREET
ATTLEBORO, MASSACHUSETTS 02703-0964

Prepared by:

Creative Pollution Sollutions, Inc.

November 1994
Version 3.0

RADIOLOGICAL HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

I. Scope

This health and safety plan is established for the radiological health and safety aspects of any future decommissioning work, associated with USNRC license SNM-23, to be performed at the Texas Instruments Incorporated facility in Attleboro, Massachusetts. In part, this plan will be based, when applicable, to the USNRC license SNM-23 Health and Safety Plan. If additional remediation activities are necessary, a general health and safety plan will be developed which will address all aspects of health and safety including any physical or chemical hazards.

This radiation health and safety plan details the site specific requirements for radiation protection purposes only. Since the anticipated radiation hazards are believed to be similar throughout the Texas Instruments site, this plan should require few modifications for any future remediation work. This plan, and the radiation protocols outlined within this plan, will also be applicable during all supplemental radiological surveys (drilling, walkover surveys, etc.).

II. Site Description

The Texas Instruments Incorporated, Materials and Control Group, Attleboro, MA, site is located in Attleboro, approximately 48 kilometers south of Boston on Route 123. The site covers approximately 250 acres (see Attachment A "Site Maps"). Attachment A also includes maps identifying the affected land areas and the affected buidling interior areas. These areas are described in detail within the main body of this report.

III. Responsible Organizations and Key Personnel

Individuals specified within the organizations shall be identified by the site access log detailed in appendix B.

A. Organizations

1. Texas Instruments Incorporated

Texas Instruments Incorporated by virtue of ownership is responsible for all aspects of the project scope. Departments involved include: Environmental,

Health and Safety, Security, Facilities, Purchasing, Human Resources, Transportation, and affected bussiness operations.

2. Remediation Contractor(s)

The remediation contractor is responsible for the physical excavation and/or decontamination of the identified areas and the preparation and packaging of materials for disposition. Personnel involved include operations and health and safety.

3. Creative Pollution Solutions, Inc.

Creative Pollution Solutions, Inc. will provide the Site Specific Radiological Health and Safety Plan, radiation protection and controls during site activity, and recommendations to Texas Instruments Incorporated regarding radiation protection.

B. Key Personnel

1. Texas Instruments Incorporated

Environmental
Health and Safety
Site Security
Facilities
Transportation
Medical
Human Resources
Purchasing
Affected Bussiness Operations personnel

2. Remediation Contractor(s)
   - Operations Manager
   - Safety and Compliance Officer
   - Machine Operator(s)
   - Laborers

3. Creative Pollution Solutions, Inc.
   - Field Supervisor
   - Health Physicist
   - Health Physics Technicians
   - Health Physics Analytical Support

A telephone contact list of key personnel will be included within this plan and made available on site during remediation operations.

IV. Work Stop Authority

Any individual or organization has the right to shut down the operations on the site. In the event of a disagreement, the most conservative approach shall be taken. A meeting shall be convened by identified representatives of each organization to assess the decision at hand.

V. Site Radiological Characteristics

Radiological hazards associated with this site are the result of previous NRC licesened activities which involved the manufacturing and processing of uranium. Hence, site radiological hazards are those associated with this material. The supplemental radiological surveys will allow for more precise determination of the level of contamination however, previous surveys indicate that the levels which may be encountered will most likely be consistent with the profile shown below. Modifications will be made to this plan as necessary based on future radiological surveys.

Concentrations of Radionuclides in Surface Soil

The concentration of U-238 in soil ranges from < 0.38 - 250 pCi/g. U-235 concentrations ranged from < 0.11 to 230 pCi/g.

Concentrations of Radionuclides Surface Soil

The concentration of U-238 in sub-surface soil ranged from < .38 - 410 pCi/g; U-235 ranged from <.11 - 440 pCi/g.

External Exposure Rates

External Exposure Rates ranged from 12 - 20 μR/h.

VI. Personnel Training Requirements

All site personnel will have received training consistent with that required under the general health and safety plan developed by the remediation contractor. Site specific training regarding radiation protection and control will be conducted by CPS. An outline of the radiolgocial control training is as follows:

1. Organization
2. Health and Safety Plan
3. Responsibilities
4. Site Characterization
5. Radiation Properties (site specific)
6. Contamination Controls
7. Frisking Procedures
8. Dose Control
9. Personnel Access
10. Work Stop Authority

A training log will be established to keep a record of the site specific radiation training (see Attachment D).

VII. Site Control

Site Controls will be established in accordance with standard practices for hazardous waste activities. Generally work zones will be established and broken down into three primary zones: the Exclusion Zone, the Contamination Reduction Zone and the Support Zone. These zones are all to be considered part of the larger Restricted Area. Only authorized personnel will be allowed within the Restricted Area.

Exclusion Zone -- Exclusion zone is the area within the Restricted Area where remediation activities will be performed. Th[illegible]usion zone will require level D protective clothing unless characterization data dictates an upgrade in protective equipment.

Contamination Reduction Zone -- Within the contamination reduction zone a control point will be established to control access to the Exclusion Zone. A personnel decontamination area and an equipment decontamination area will be established within this zone.

Support Zone --- The support zone will include a command center and a field radiation laboratory.

Security check points may be necessary in order to control access to the Restricted Area.

VIII. Personnel Protective Equipment

Personnel in the Exclusion Area will maintain, as a minimum, level D protective equipment. The minimum protective equipment required includes: hard hat and steel toed safety shoes. In many situations shoe covers and gloves will be required. Additional protective equipment may be required as conditions warrant. Decisions to upgrade or downgrade protective equipment at any time during the site operation will be made jointly by Texas Instruments Incorporated, Materials and Control Group personnel and Creative Pollution Solutions, Inc. personnel.

IX. Monitoring and Sampling

This section describes the radiological sampling and monitoring to be performed during site operations in order to protect site personnel and the community. Action Levels have been established for certain aspects of sampling and monitoring (Attachment D).

Area Air Sampling

Area air sampling will be performed, as needed, during site operations at perimeter locations and work areas. Perimeter locations will be based on prevailing conditions.

Personnel Breathing Zone Air Samples

Personnel BZA's may be provided to a representative number of workers based on job task.

Bioassay Measurements

In-vitro bioassay monitoring consisting of baseline and post-work urinalysis will be performed on all personnel working in the exclusion zone. Urinalysis samples will be analyzed for total uranium via flourometric techniques by an identified outside laboratory.

Personnel Contamination Monitoring

Frisking of personnel and equipment shall be performed prior to exit from the contamination reduction zone. Frisking will be done to assure personnel and equipment are not contaminated.

X. Decontamination

Personnel Decontamination

Personnel decontamination will be performed in accordance with standard decontamination practices as outlined in the "Occupational Safety and Health Manual for Hazardous Waste Site Activities". In addition to standard waste site procedures frisking out of all personnel will take place prior to exiting the exclusion zone.

Equipment Decontamination

All equipment shall be surveyed to determine disposition. Disposition shall include decontamination for free release (see Appendix C) or disposed of as appropriate.

XI. Medical Surveillance

Medical surveillance shall be performed for all personnel working in the exclusion zone. Medical surveillance shall be in accordance with the general health and safety plan developed by the remediation contractor. In addition, for this site, a bioassay analysis for the assessment of intakes of radionuclides shall be performed pre and post site work.

XII. Informational Programs

Informational programs are the responsibility of Texas Instruments Incorporated, Materials and Control Group. These programs will inform TI employees and the community of the site work as necessary.

XIII. Record Keeping

Site records will be kept including but not limited to : Site log, site training records, air sampling results, site sampling and monitoring results, and bioassay results.

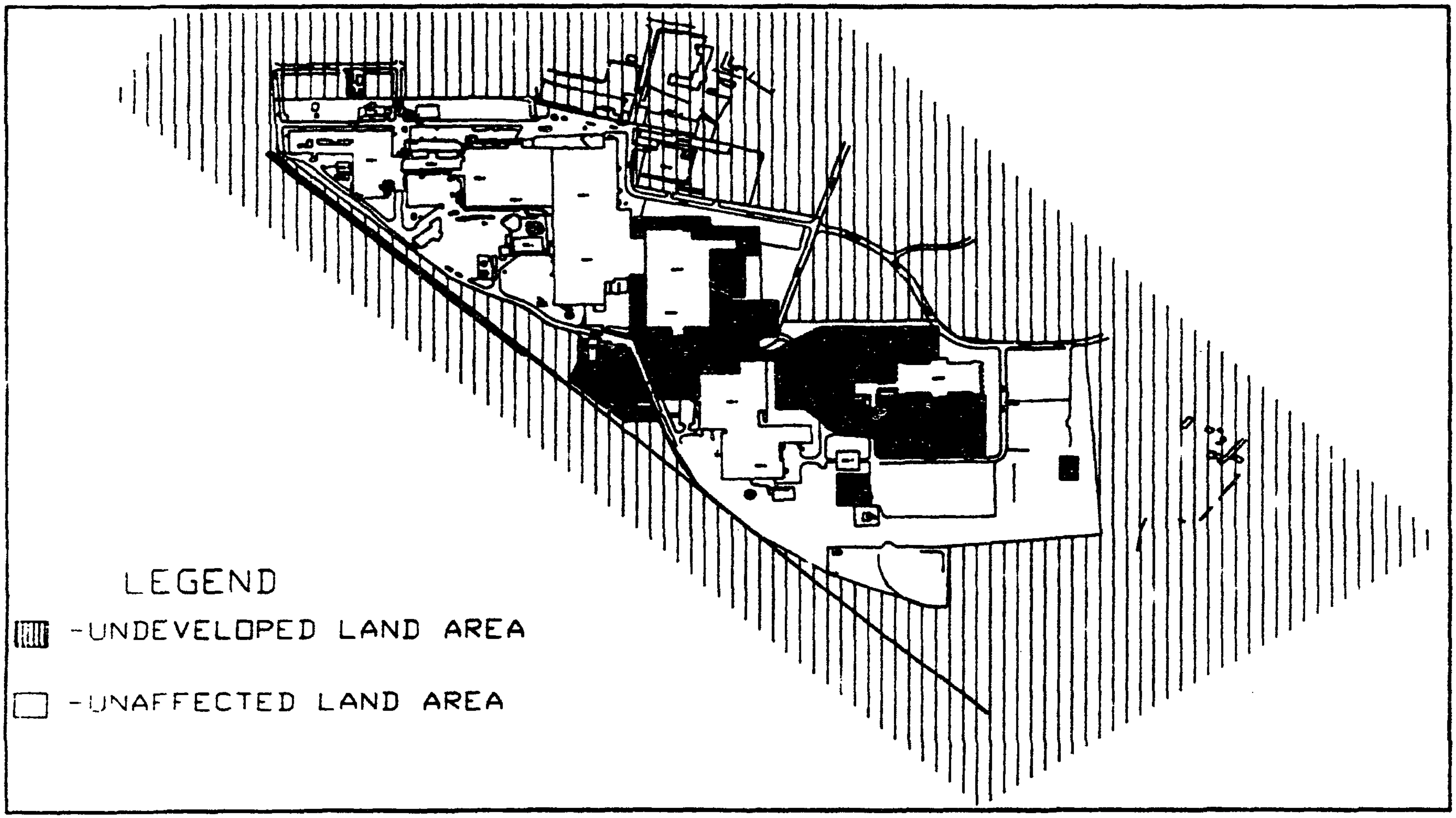
XIV. Emergency Response Contingency Plan

Emergency procedures will be consistent with those outlined in the general health and safety plan developed by the remediation contractor and Texas Instruments Incorporated, Materials and Control Group Disaster Emergency Management Plan.

Attachment A

Site Maps

Figure A1
Map of Open Land Areas Depicting Undeveloped and Unaffected Land Areas



OFFICIAL RECORD COPY
121534

Figure A2
Map of Open Land Areas Depicting Affected and Previously Remediated Areas

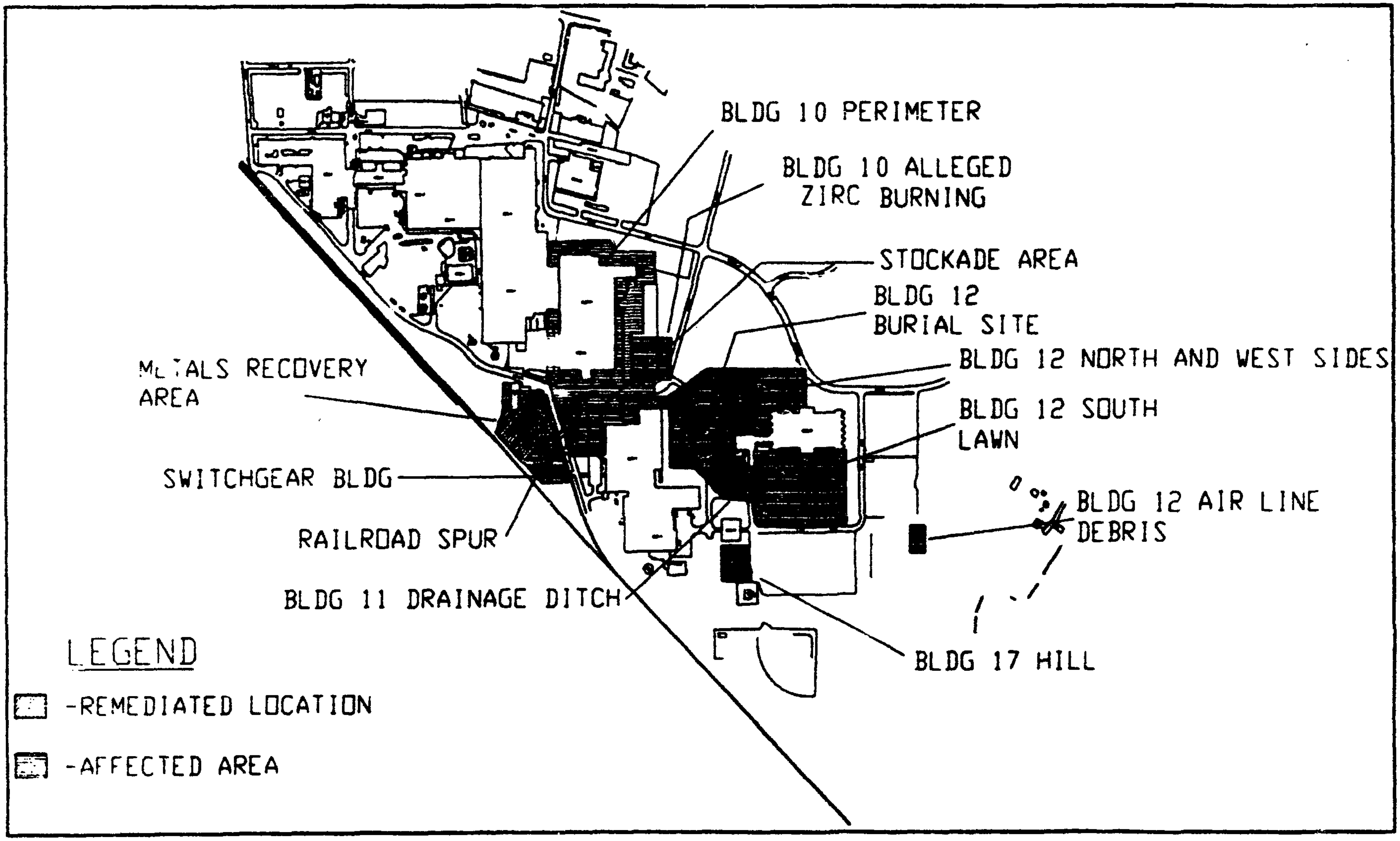
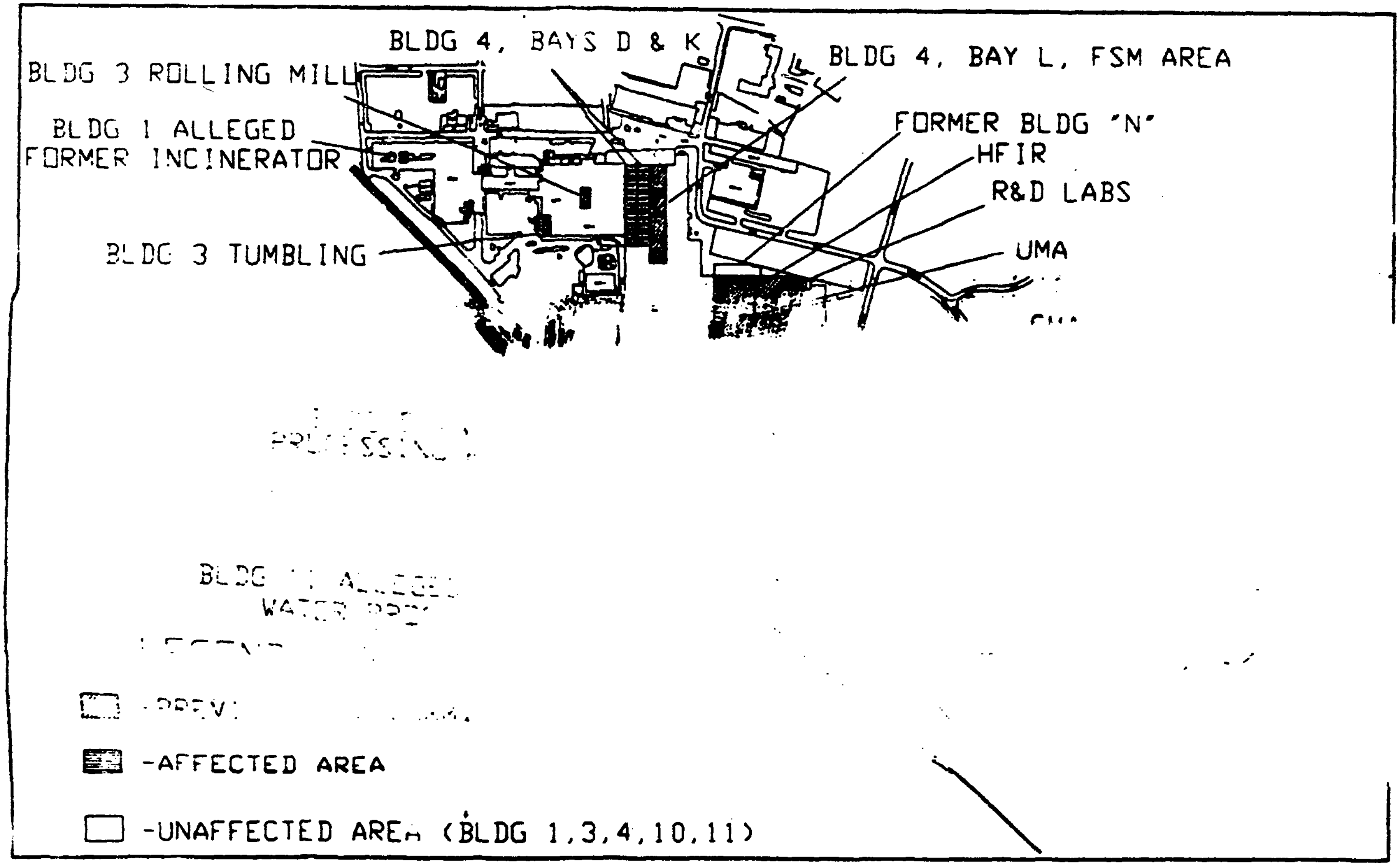


Figure A3
Map of Building Areas Depicting Affected, Unaffected, and Previously Decommissioned Areas



Attachment B

Site Access Log

Site Access Log

Name	Date	Company	Position/Purpose

Attachment C

Action Limits

Air Sample (General Area)

General Area Air Sampling is performed to assess airborne concentrations of radionuclides. Action Limits are established in accordance with NRC published concentration limits (Derived Air Concentrations, DACs).

Concentration	Action
< 25%	No Action
25% < X < 75 %	Investigate and notify radiation protection supervision
75% < X < 100%	Stop work. Notify radiation protection supervision.

Personnel Exposure

External Dose

Thermoluminescent Dosimetry (TLDs) shall be the dose of record for those issued. Self reading pocket dosimeters are for exposure control purposes, dose of record for those not issued TLDs, and to serve as a backup to TLDs. Action limits are established for dose control purposes using the self reading pocket dosimeters.

SRD Reading	Action
< 20 mR	No Action
20 mR < X < 100 mR	Notify Radiation Protection Supervision for Investigation
> 100 mR	Remove worker from area and notify and notify Radiation Protection Supervision.

Breathing Zone Air Samples (BZA)

BZAs are worn by a representative group of workers based on job function. BZAs are used to assess potential intakes of radionuclides. Action Limits are as follows:

< 150 dpm	No action
> 150 dpm	Investigation level. Verify by bioassay

Bioassay (Urine analysis)

Urine samples are obtained to assess intakes and verify the effectiveness of the respiratory protection. Bioassay results are reported in the units of g/l. The results are compared to baseline values and to Investigation/Action levels.

Bioassay results	Action
< 5 g/l	No action
> 5 g/l	Investigation

Contamination Levels

In accordance with USNRC guidelines for "Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material", Dated April 1993, the following is established:

Acceptable Surface Contamination Levels

Nuclide (Note a)	Average (Note b,c,f)	Maximum (Note b,d,f)	Removable (note b,e,f)
U-Natural, ^{235}U, ^{238}U, and associated decay products	5,000 dpm /100 cm^2	15,000 dpm /100cm^2	1,000 dpm /100cm^2
Transuranics, ^{226}Ra, ^{228}Ra, ^{230}Th, ^{228}Th, ^{231}Pa, ^{227}Ac, ^{125}I, ^{129}I	100 dpm/100cm^2	300 dpm/100cm^2	20 dpm/100cm^2
Th-nat., ^{232}Th, ^{90}Sr, ^{223}Ra, ^{224}Ra, ^{232}U, ^{126}I, ^{131}I, ^{133}I	1,000 dpm/100cm^2	3,000 dpm/100cm^2	200 dpm/100cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except ^{90}Sr and others noted above. Includes mixed fission products containing ^{90}Sr and others noted above.	5,000 dpm /100cm^2	15,000 dpm /100cm^2	1,000 dpm /100cm^2

Notes:

a. Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently

b. As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrument.

c. Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

d. The maximum contamination level applies to an area of not more than 100 cm^2.

e. The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbant paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface area should be wiped.

f. The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad at 1 cm, respectively, measured through not more than 7 mg/100 cm^2 of total absorber.

Exposure Rates

Action Limits for external exposure rates are specified as follows:

Exposure Rate	Action
Background < X < 1 mR/h	No Action
1 mR/h < X < 10mR/h	Stop work and Radiation Protection Supervision Notified for Investigation
10 mR/h < X < 100 mR/h	Stop Work. Personnel retire to area of exposure rate less than 1 mR/h. Radiation protection supervision notified for investigation.
> 100 mR/h	Stop work. evacuate to control point and exit to command center. Radiation Protection supervision notified.

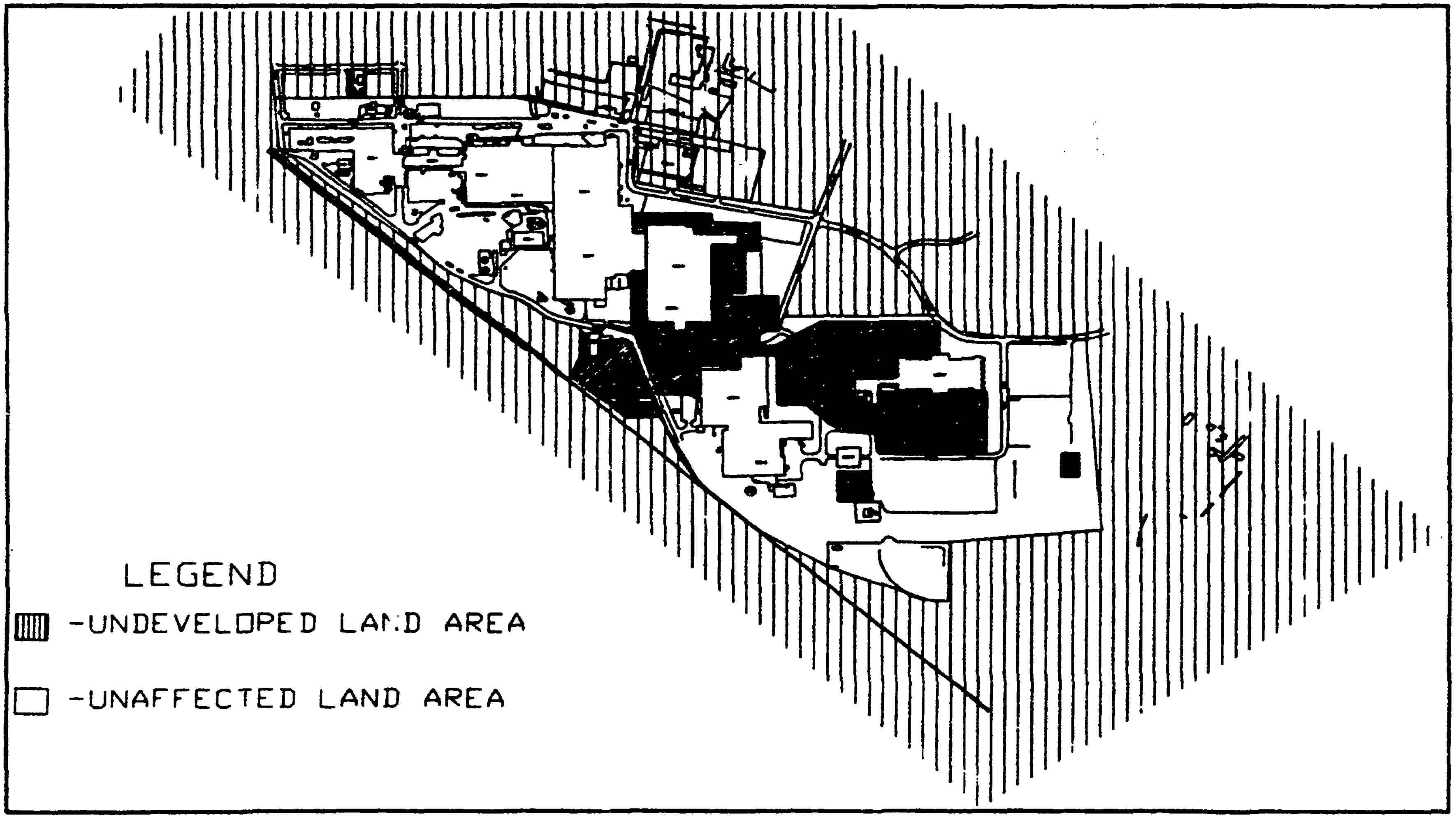
Training Log

Description of Training:

Date:

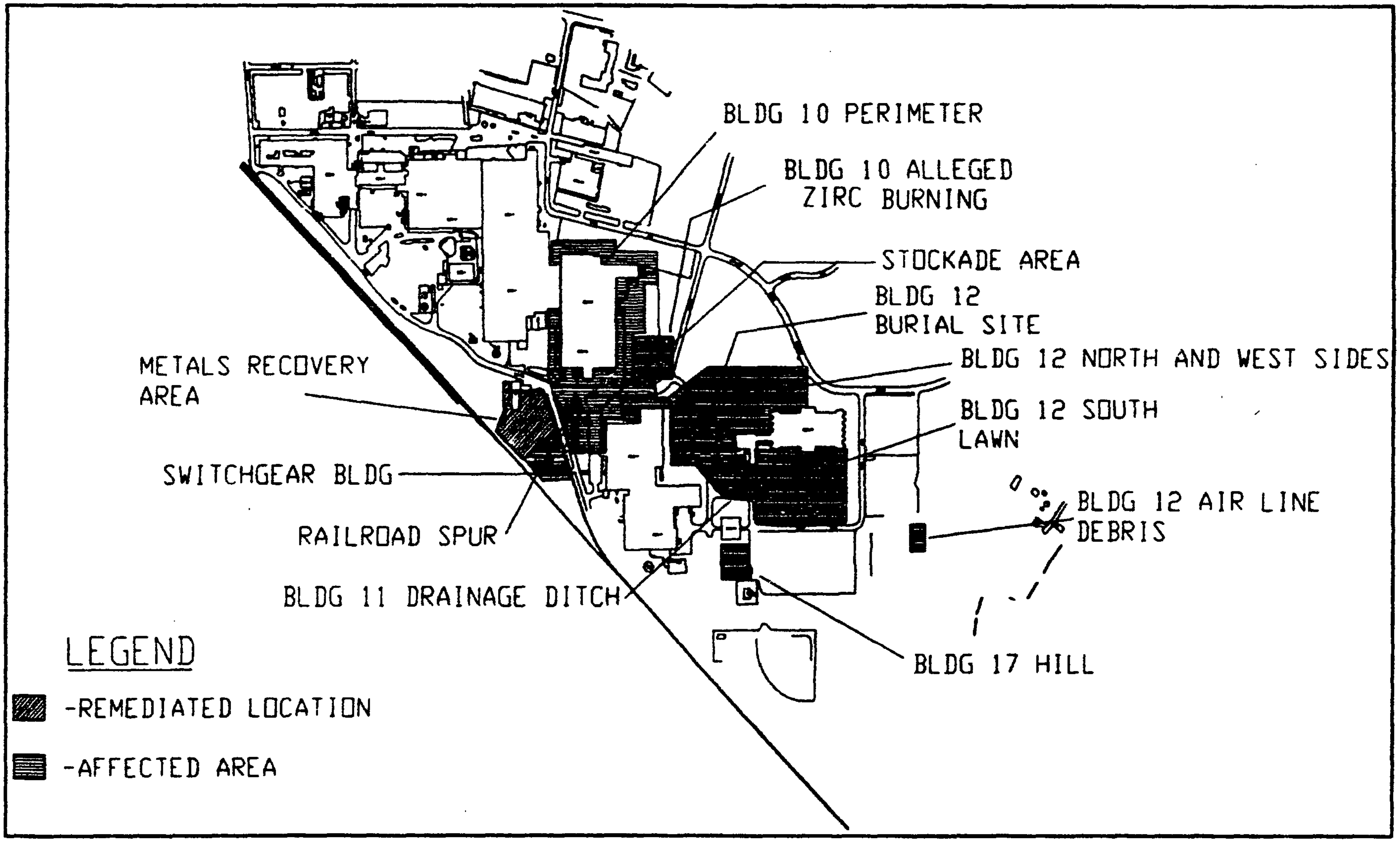
Attendees:

Figure A1
Map of Open Land Areas Depicting Undeveloped and Unaffected Land Areas



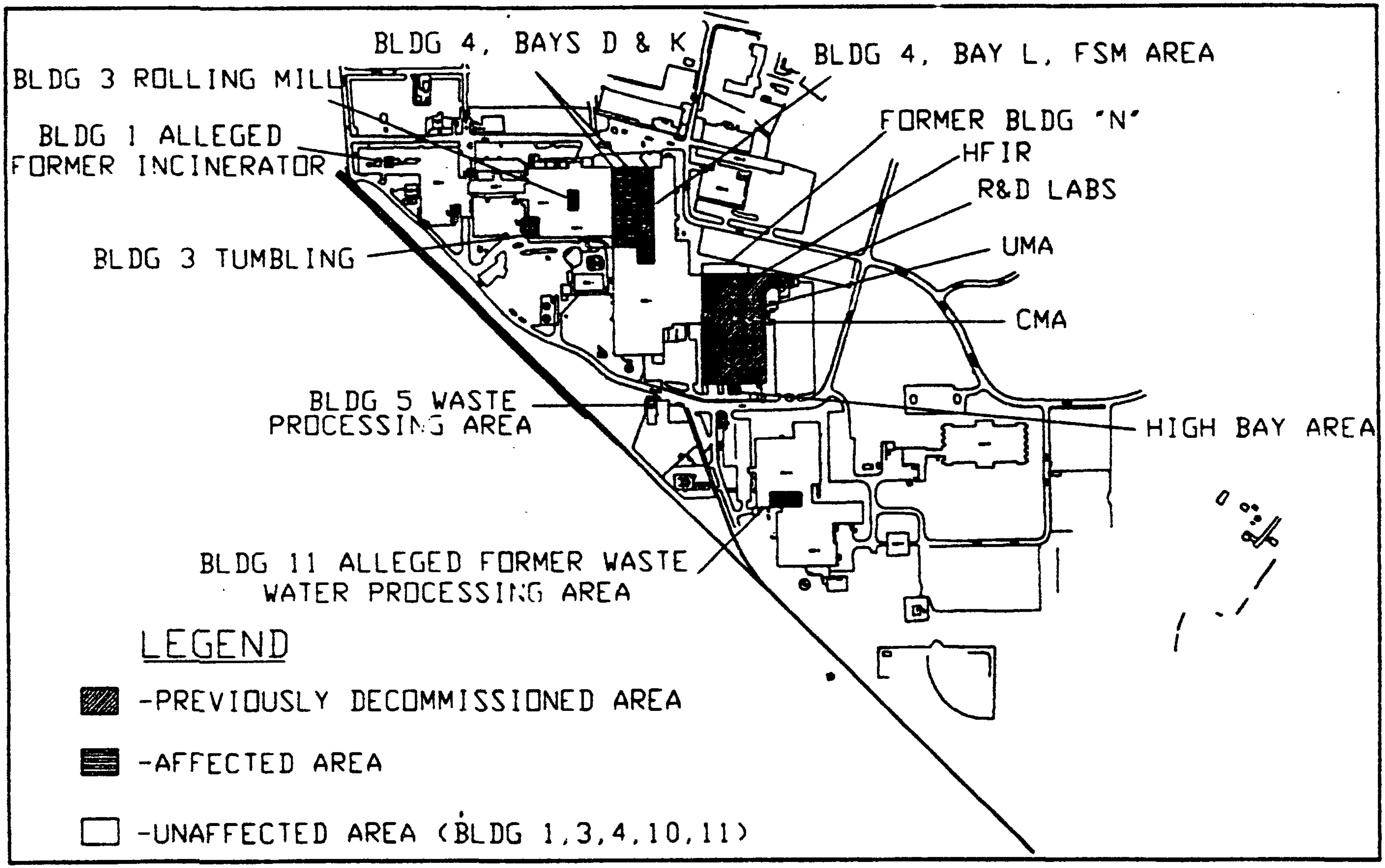
121534

Figure A2
Map of Open Land Areas Depicting Affected and Previously Remediated Areas



121534

Figure A3
Map of Building Areas Depicting Affected, Unaffected, and Previously Decommissioned Areas



121534

Attachment D

Training Log

121534

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

(FOR LFMS USE)
INFORMATION FROM LTS

PROGRAM CODE: 21215
STATUS CODE: 0
FEE CATEGORY: 14
EXP. DATE: 20111111
FEE COMMENTS: V
DECOM FIN ASSUR REQD: Y

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
   APPLICANT/LICENSEE: TEXAS INSTRUMENTS, INC.
   RECEIVED DATE: 950406
   DOCKET NO: 7000033
   CONTROL NO.: 121534
   LICENSE NO.: SNM-23
   ACTION TYPE: AMENDMENT

2. FEE ATTACHED
   AMOUNT: ---------
   CHECK NO.: ---------

3. COMMENTS
   SDMP
   Reference 118945
   U00750

SIGNED R. J. Brown
DATE 4/6/95

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED / ✓ /)

1. FEE CATEGORY AND AMOUNT: 14 Cont'n of 118945

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:
   AMENDMENT ------------
   RENEWAL ------------
   LICENSE ------------

3. OTHER ------------------------------

SIGNED [signature]
DATE 4/4/95

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO 2
PLANT OPERATING MANUAL

VOLUME 2

PART 5

EMERGENCY PROCEDURE

EPPRO-00

EMERGENCY PREPAREDNESS PROGRAM AND TESTING

REVISION 2

EFFECTIVE DATE
2·7·97

SELECT

CONTROLLED
COPY NO.

Approval Michael D. ... For 2/5/97
Supervisor - Emergency Preparedness Date

9703060404 970303

LIST OF EFFECTIVE PAGES

Page(s)	Revision
1	2
LEP	2
Table of Contents	1
4	1
5 through 9	2
10	1

Revision 2 Summary:

1. Correct coversheet revision.

2. Reflect new relief shift policy.

3. Clarify "ON-CALL" requirements for JIC staff and non-beeper staff.

4. Clarify Fire Brigade and offsite Fire Department training process.

3. Responding to the site in the event of a drill/exercise or a real emergency.

   a. Response to real emergencies is required even when not "ON CALL".

4. Keeping Emergency Preparedness (EP) informed of any changes (i.e., change of home phone number, moving to new location, etc.) which will effect their ability to respond to an emergency.

5. Maintaining Respirator Qualification as designated.

6. Becoming familiar with, and proficient in, the implementation of applicable procedures.

3.1.2 ERO members who are assigned a pager (beeper), individual or rotational, are responsible for the following functions:

1. Compliance with Fitness for Duty regulations during the period the ERO member is "ON CALL". "On Call" is generally rotated by Team and the specific position and time period assigned is documented by the "ON CALL" roster maintained by EP.

2. Arranging a relief for any period when the "ON CALL" position holder will not be able to respond to the applicable facility within the required time.

   a. When a relief is arranged, the requesting individual is responsible for ensuring that relief personnel obtain an ERO beeper for the period of relief.

   b. If the relief period is less than one week it is not necessary to notify Emergency Preparedness or the Control Room.

   c. If the relief period exceeds a week then the requesting individual is responsible for notifying EP during normal working hours and the Control Room at other times.

      - A week was chosen to approximate a complete "ON-CALL" cycle.

3.1 EMERGENCY RESPONSE ORGANIZATION MEMBER

3. After being contacted by the dialogic system, ERO members are required to respond to computer requests and report to the applicable facility.

4. During real emergencies, ERO personnel who carry a pager are required to call Dialogic upon arrival at their facility unless directed by beeper code to do so prior to departure for the facility.

   a. This practice may be modified for conduct of drills and exercises.

5. Maintaining the beeper in close proximity and turned on at all times regardless of "ON-CALL" status, and responding to Beeper activation unless unfit for duty.

6. In the event that a beeper is lost by an on call person during non-working hours, the individual should:

   a. Obtain the spare beeper from Security or,

   b. Arrange for a qualified individual, with a beeper, to be on call or,

   c. Remain near your phone until a new beeper is obtained.

7. When notified of a real emergency, ERO members on vacation or not fit for duty should call their position and make themselves available for relief.

3.1.3 Individuals who are "ON-CALL" and **DO NOT** hold a beeper must:

1. Remain fit for duty during their "ON-CALL" period and stay within 60-75 minutes of their facility.

   a. Joint Information Center (JIC) personnel are required to report to the applicable facility within 2 hours following notification to activate.

   b. Personnel assigned to teams are considered "ON-CALL" the week their designated team has coverage.

3.2 EMERGENCY PREPAREDNESS (EP) STAFF

3.2.1 The EP Staff is responsible for the following:

1. Ensuring an ERO is staffed and prepared to respond to and mitigate any postulated emergency at H. B. Robinson Steam Electric Plant, Unit No. 2.

2. Develop and maintain the Robinson Emergency Plan and all required implementing procedures.

3. Tracking ERO Qualifications by maintaining a computer database.

4. Maintaining a roster of all qualified ERO personnel.

5. Planning, scheduling, and administration of drills and exercises (except fire drills).

6. Coordination of the public education and information program.

7. Assuring the annual dissemination of safety information in the possible plume exposure Emergency Planning Zone (EPZ).

3.3 EP TRAINING STAFF

3.3.1 EP staff personnel are responsible for the following:

1. Ensuring EP lesson plans are current based on changes made to procedures.

2. Coordinating initial and continuing training needs.

3. Maintaining ERO position task lists.

4. Coordinating training of onsite Fire Brigade and offsite Fire Department personnel as required.

    a. Normally, this is accomplished through regular fire brigade training which is arranged by Fire Protection or Fire Protection Training staff.

5. Evaluate training feedback reports for improvements to the training program.

3.3 EP TRAINING STAFF

6. Perform a needs or job analysis as required.

3.4 LINE MANAGEMENT

3.4.1 Line Management of assigned ERO members are responsible for the following functions:

1. Coaching of personnel assigned an ERO position on proper performance of that position.

2. Selection of personnel to staff the ERO positions and obtai ı EP concurrence on the selection.

   a. Alternately, selecting personnel to fill ERO positions at the request of EP.

   b. Notifying personnel selected for the ERO of their selection and the expectations for completion of qualification and ERO participation.

3. Ensuring the personnel in their area of responsibility maintain a current CP&L security badge.

4. Ensuring that personnel under their supervision are technically qualified for their ERO position.

5. Submitting request for additions or changes of personnel on the ERO.

6. Ensuring EP is notified of personnel changes that may affect their ability to respond to an emergency.

3.4.2 During a site or local Evacuation, management personnel are responsible for the following:

1. Ensuring that Contractors or offsite personnel reporting to them know where to assemble during the evacuation.

2. Ensuring that designees accounting for personnel during an evacuation are briefed on ensuring safe passage from one location to another.

3.4 LINE MANAGEMENT

3. Ensuring that personnel participate in the site wide (owner controlled area) evacuation drills unless specifically exempted by EP Management for critical work.

3.5 EP TRAINING PROGRAM COMMITTEE (TPC)

3.5.1 The EP TPC is responsible for the following:

1. Identify ERO continuing training needs.

2. Review Drill/Exercise critiques and EP related operating experience feeuback items to identify ERO training needs.

3. Evaluate the effectiveness of ERO initial and continuing training.

4. Review/establish ERO training schedules.

4.0 PREREQUISITES

N/A

5.0 PRECAUTIONS AND LIMITATIONS

N/A

6.0 SPECIAL TOOLS AND EQUIPMENT

N/A

7.0 ACCEPTANCE CRITERIA

N/A

8.0 INSTRUCTIONS

See Individual Sections

CAROLINA POWER & LIGHT COMPANY
H.B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO 2
PLANT OPERATING MANUAL

VOLUME 2
BOOK 5

EMERGENCY PROCEDURE

EPPRO-01

PROGRAM AND RESPONSIBILITIES

REVISION 2

EFFECTIVE DATE
2·7·97

SELECT
CONTROLLED

Approval Michael D. Gyn for — 2/5/97
Supervisor - Emergency Preparedness — Date

LIST OF EFFECTIVE PAGES

Page(s)	Revision
1-1	2
LEP	2
Table of Contents	1
1-4 through 1-14	1
1-15	2
1-16 through 1-32	1

Revision 2 Summary:

1. Delete references to JIC Technical Specialist and E&RC Team Leader.

ERO BEEPER DISTRIBUTION

All Team Members in the following positions.

SEC
POD
TAD
ERD
RCD/RCM
ESTL
DPTL
AERM

OSC Leader
ERM
A&LM
TAM
POA
EC
Company Spokesperson
JIC Director

Shift Supervisor Desk
NRC
EP
En Mon TL
Reactor Engineer
Computer Support

Rotational Beepers (number of beepers)

NRC Communicator (1)
State/County Communicator (1)
Electrical Engineer (1)
Mechanical Engineer (1)
Damage Control Leaders (2)
Mechanics (4)
I&C/Electricians (4)

Chemistry/Environmental Monitoring (2)
PI Communicator (1)
Security Lieutenant (1)
JIC Technical Spokesperson (1)
HPs (4)

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO 2
PLANT OPERATING MANUAL

VOLUME 2
BOOK 5

EMERGENCY PROCEDURE

EPPRO-02

MAINTENANCE AND TESTING

REVISION 2

EFFECTIVE DATE
2·7·97

SELECT

CONTROLLED
RPRT ID

Approval Michael D. [signature] for 2/5/97
Supervisor - Emergency Preparedness Date

LIST OF EFFECTIVE PAGES

Page(s)	Revision
2-1	2
LEP	2
Table of Contents	2
2-4 through 2-46	2

Revision 2 Summary:

1. Incorporate new siren feedback system capabilities into testing program.
2. Procedure enhancements.
3. Correct typographical error.
4. Clarify acceptance criteria for selected tests.

TABLE OF CONTENTS

8.2 MAINTENANCE AND TESTING

8.2.1 PURPOSE

1. To ensure periodic testing commitments of the Emergency Plan and 10 CFR 50 Appendix E are being met and properly documented.

8.2.2 RESPONSIBILITIES

1. The EP Staff is responsible for performance of tne following periodic tests in this procedure as follows:

   a. Monthly Selective Signaling System Communications Drill - Once per 28 days + 10 days

   b. Monthly Local Government Radio Test - Once per 28 days + 10 days

   c. Monthly FTS 2000/ESSX/SSS Phone Tests - Once per 28 days + 10 days

   d. Monthly Siren Testing Including Growl Testing - Once per 31 days + 7 days

   e. Quarterly IPZ State Communications Drill - Once per 92 days + 23 days

   f. Quarterly ERO Phone Book Review - Once per 92 days + 23 days

   g. Quarterly Beeper test - Once per 92 days + 23 days

   h. Quarterly TSC/EOF Inventories - Once per 92 days + 23 days and after each drill

   i. Semi-Annual Health Physics and PASS Drills - Once per 184 days + 46 days

   j. Contributions to Emergency Support Organizations -Once per 364 days + 91 days, and each Quarter as required

   k. Annual Siren Full Volume Test - Once per 364 days + 91 days

   l. Annual Siren Adequacy Review - Once per 364 days + 91 days

   m. Annual EAL Review - Once per 364 days + 91 days

8.2.2 RESPONSIBILITIES

n. Annual PNSC review of Emergency Plan - Once per 364 days + 91 days

o. Annual Medical Emergency Drill - Once per 364 days + 91 days

p. Annual Environmental Team Communications - Once per 364 days + 91 days

q. Annual Lake Sign Verification - Once per 364 days + 91 days

r. Annual Audit Required by 10CFR50.54T - Once per 364 days + 91 days

s. Annual Letters of Agreement - Once per 364 days + 91 days

t. Hospital and Rescue Squad Training - Once per 364 days + 91 days

u. NRC Evaluated Exercise - Per 10 CFR, Part 50, Appendix E

v. Augmentation Drill - Once per 24 months + 182 days

w. Public Safety Information - Once per 364 days + 91 days and Once per 92 days + 23 days

8.2.3 GENERAL

1. Periodic test scheduling will be as follows:

   a. When a periodic test is completed prior to the scheduled date the next scheduled date will be the early completion date plus the frequency.

   b. When a periodic test is completed on or after the scheduled date but before the overdue date the next scheduled date will be the last scheduled date plus the frequency.

2. Emergency Preparedness (EP) personnel or Emergency Communicators may be used for communications drills.

8.2.3 GENERAL

3. A drill or exercise that uses the Selective Signaling System (SSS) to contact the State and Counties may be used to fulfill the requirements of the monthly communications test.

    a. The Superintendent - Shift Operations (SSO) is responsible for providing an emergency communicator for the off hours monthly communications drill.

4. If while performing a test or drill an offsite agency is involved in an actual emergency perform the following:

    a. If the agency is a State or County Warning Point or EOC, excuse the agency from the remainder of the test or drill, and annotate the situation in the test or drill documentation.

    b. If the agency is the NRC, perform that part of the test at a later time.

5. A drill or exercise that begins between 6 p.m. and 4 a.m. or a weekend, that includes in the objectives, the conduct of an off hours augmentation of the ERO, may be used to satisfy the requirements of the Augmentation Drill.

6. Attachment 8.2.28.1, Certification Test and Review Form, may be used to document completion of any test or other periodic Emergency Preparedness (EP) requirement unless other documentation is specified in the procedure.

7. When contacting the Control Room in the following procedure steps, it is desirable to contact the SSO, but not required.

8.2.4 MONTHLY SELECTIVE SIGNALING SYSTEM COMMUNICATIONS DRILL

1. The monthly communications drill is normally performed by EP personnel. Every third monthly drill, as resources are available, should be performed off hours by Operations personnel.

2. Contact the Control Room and inform them that a Selective Signaling System (SSS) Communications Drill will be performed.

3. Provide a scenario to the Emergency Communicator of sufficient detail to allow two Emergency Notification Forms to be completed.

   a. One form will be the initial notification and one form will be the termination notification.

4. The Emergency Communicator uses the scenario information provided to fill out a notification form (EPNOT-01, CR/EOF Communicator).

5. Review the completed notification form to ensure that "THIS IS A DRILL" is checked, and that all required elements of the form are completed per EPNOT-00 Notification and Emergency Communications.

6. If the form is correct, approve the notification form and instruct the Emergency Communicator to begin the notification.

7. The Emergency Communicator implements EPNOT-00 to notify Warning Points and EOCs.

8. If all parties responded to the communications drill skip to Step 8.2.4.13.

9. If any Warning Points or Emergency Operations Centers fail to respond verify that the nonresponding agencies can be contacted by commercial telephone using the phone number from the ERO Phone Book. During this call, attempt to determine why they did not answer the Selective Signaling System telephone.

10. Contact the nonresponding agency again using a Selective Signaling Telephone by dialing the specific dialing code for that agency. See Attachment 8.2.28.2, Selective Signaling System Dialing Codes.

11. If the agency called picks up, and communications can be established, consider the test successful.

12. If no agency can be contacted using the Selective Signaling System from any site location, via any method (including ESSX, Bell, etc.), inform the SSO that a 1 hour reportable event to the NRC has occurred. Consult AP-030, NRC Reporting Requirements. Assist the SSO in making the notification.

13. Notify the Control Room that the Selective Signaling System Communications Drill is concluded. State that the Selective Signaling System is returned to operational status.

14. Arrange for repair of any Selective Signaling System problems by calling the Telecommunications Help Desk. Notify Site Telecommunications of the problem for information purposes.

NOTE:	Chesterfield, Darlington, and Lee Counties have locations named, "Warning Point" and "Emergency Operating Center" The State chose not to have a phone in the EOC. Therefore, they have a Warning Point, and a Backup Warning Point.

15. Acceptance Criteria:

The monthly Selective Signaling System Communications drill is acceptable when:

a. Contact has been made with the Warning Point and EOC for each of the Counties and both of the State Warning Points.

b. An initial and termination message has been read to at least one of the locations for each of the agencies.

16. Documentation of the drill will consist of the notification forms used and a completed Attachment 8.2.28.1, Certification and Test Review Form.

17. Transmit the completed forms, to Records Storage in accordance with RMP-001. A copy of the record may be maintained in the EP files for the convenience of auditors.

8.2.5 MONTHLY LOCAL GOVERNMENT RADIO TEST

1. The State of South Carolina tests radio communications with various agencies and nuclear plants every Thursday starting at about 0900. Therefore, at approximately 0900 on the scheduled Thursday, or other prearranged day during the grace period, listen to the Local Government Radio (LGR) set in the EP office.

2. The LGR Instruction Manual lists "10" codes on Page 33. The only "10" codes necessary for the radio test are "10-1" (signal weak), "10-2" (signal good), and "10-97" (radio test).

3. Listen for the call from the State of South Carolina stating, "KNBD414 ROBINSON THIS IS WBS264."

4. Pick up the handset, press the button on the handset, and acknowledge the transmission by saying:

   "THIS IS KNBD414 ROBINSON, I READ YOU 10-2", if the transmission is clear, *OR* "I READ YOU 10-1" if the transmission is weak, and inform the operator that two more radio sets need to be tested.

5. After your transmission is acknowledged, state:

   "WBS 264 THIS IS KNBD414 SIGNING OFF."

6. After radio traffic on the channel has stopped, test the radio set in Rooms 425 TSC and 434 EOF as follows:
   "WBS 264 THIS IS KNBD414 ROBINSON FOR A 10-97 ON THE BACKUP RADIO", after the State operator responds answer with "THIS IS KNBD414 ROBINSON, I READ YOU 10-1 or 10-2" as appropriate.

7. After your transmission is acknowledged, state:

   "WBS 264 THIS IS KNBD414 SIGNING OFF."

8. Complete the third radio set per steps 8.2.5.6 and 8.2.5.7 above and inform the State operator that testing is complete.

9. If the radio communication is weak or not working, notify the Telecommunications Help Desk, Site Telecommunications, and the South Carolina Emergency Preparedness Division. Following repairs retest the radio sets.

10. Acceptance Criteria:

The monthly LGR test is acceptable when satisfactory communication has been completed with the State of South Carolina using the handsets at the TSC, EOF, and EP office.

11. Document the monthly test on Attachment 8.2.28.1, Certification and Test Review Form.

12. Transmit the completed form to Records Storage in accordance with RMP-001. A copy of the record may be maintained in the EP files for the convenience of auditors.

8.2.6 MONTHLY FTS 2000/ESSX/SELECTIVE SIGNALING SYSTEM PHONE TESTS

1. Contact the Control Room and inform them that a test of the FTS 2000/ESSX/Selecting Signaling System will be performed. Request that the Control Room not answer the FTS 2000 telephone until notified again at the conclusion of this test.

2. From an available FTS-2000 telephone in the TSC or EOF, dial one of the 10 digit telephone numbers listed in the ERO telephone book to contact the NRC Operations Center.

3. When the NRC Duty officer answers, inform him of your name, state that you are calling from Robinson Plant, and that this is the monthly test of the Emergency Notification System (ENS). Request that the Duty Officer call back at (700) 256-0213.

4. When the ENS telephone rings, answer the telephone by identifying "ROBINSON NUCLEAR PLANT."

    a. Record the name of the Duty Officer contacted.

        - No other calls to the NRC Operations Center are required.

5. Use each of the ENS telephones listed on Attachment 8.2.28.3, FTS-2000/ESSX/SSS Monthly Telephone Test, to receive and originate a call.

    a. This will verify that a dial tone is present and that each ringer, handset, and dial keypad is operational.

    b. The Control Room FTS phone is tested daily and will not be included in this test.

6. To test the ERDS Link to the NRC take a telephone to Room 426 and open the first louvered door on the back of the ERFIS panel.

    a. Locate and disconnect the ERDS jack and connect the telephone in its place.

    b. Ensure the telephone has a dial tone.

    c. Disconnect the telephone and reconnect the ERDS jack previously disconnected.

7. If any problems are noted during the test:

   a. Contact the NRC Operations Center by FTS-2000, if available, or bell telephone at one of the numbers listed in the ERO telephone book.

   b. If no means of contacting the NRC Operations Center is available, contact the SSO and inform him that a 1 hour reportable event to the NRC has occurred.

      - Consult AP-030.

      - Assist the SSO in making the notification.

8. Use each of the ESSX telephones listed on Attachment 8.2.28.3, FTS-2000/ESSX/SSS Monthly Telephone Test, to receive and originate a call.

   a. This will verify that a dial tone is present and that each ringer, handset, and dial keypad is operational.

9. If any problems are identified with the ESSX telephones notify the Telecommunications Help Desk and onsite personnel to have the telephones repaired.

10. Notify the Control Room of the "Out of Service" condition. When the telephones are repaired and tested notify the Control Room that the telephones are returned to service.

    a. This condition above is not reportable to the NRC.

11. Use each of the SSS telephones listed on Attachment 8.2.28.3, FTS-2000/ESSX/SSS Monthly Telephone Test, to receive and originate a call.

    a. This will verify that each ringer, handset, and dial keypad is operational.

       - There is no dial tone on the SSS telephones.

12. If any problems are identified with the SSS telephones notify the Telecommunications Help Desk and onsite personnel to have the telephones repaired.

8.2.6 MONTHLY FTS 2000/ESSX/SELECTIVE SIGNALING SYSTEM PHONE TESTS

13. Notify the Control Room of the "Out of Service" condition.

    a. When the telephones are repaired the tested, notify the Control Room that the telephones are returned to service.

        - This condition is not reportable to the NRC provided a backup communications system (Site PBX, ESSX, etc.) is available.

14. Notify the Control Room that the phone test is complete.

15. <u>Acceptance Criteria</u>:

    The FTS-2000, ESSX, and SSS phone tests are satisfactory when:

    a. It has been verified that the dial tone (except SSS), ringer, handset, and keypad function for each FTS-2000, ESSX, and SSS telephones.

    b. A dial tone was obtained on the ERDS jack.

16. Documentation of the test will consist of Completed Attachment 8.2.28.3, FTS-2000/ESSX/SSS Monthly Telephone Test, and Attachment 8.2.28.1, Certification Test and Review Form.

17. Transmit the completed forms to Records Storage in accordance with RMP-001. A copy of the record may be maintained in the EP files for the convenience of auditors.

8.2.7 MONTHLY SIRENS TESTING INCLUDING GROWL TESTING

NOTE:	Sirens are rotated each week, typically this automatically initiated early Monday morning. Once each quarter each siren is growl tested.

1. Obtain system records documenting the weekly rotation tests.

   a. On a weekly basis, if the automatic report has not been generated, perform a manual rotation. Guidance is available in the system technical manual.

NOTE:	The siren feedback system provides real time information on siren status. This data is routinely reviewed each work day by a member of the EP staff.

2. If failures are [illegible]ed which have not previously been reported:

   a. Enter the required information on Attachment 8.2.28.4, Siren Out of Service Notification.

   b. Notify appropriate Telecommunications personnel.

   c. Notify the Control Room that the siren is out of service.

   d. Inform the County Emergency Management Director about the siren(s) out of service using the telephone number in the ERO Phone Book.

   e. Notify the Telecommunications help desk to make repairs.

3. When notified by Transmission Maintenance or Telecommunications Help Desk that the siren has returned to service, perform the following:

   a. Log the notification on Attachment 8.2.28.4, Siren Out of Service Notification.

   b. Notify the Control Room that the siren is back in service.

   c. Inform the County Emergency Management Director about the siren(s) back in service.

4. If at any time 9 or more of the sirens are out of service, or all of the sirens in one county become out of service, inform the SSO that a 1 hour reportable event to the NRC has occurred.

   a. Consult AP-030 NRC Reporting requirements. Assist the SSO in making the notification.

5. Review siren test records to compare rotation and alarm data against the notifications logged on Attachment 8.2.28.4, Siren Out of Service Notification, and incoming repair records (Form 2000, Telecommunications Service Order Report or equivalent).

   a. If the records do not compare with the notification log, contact Telecommunications or Transmission Maintenance to resolve the differences.

6. On a monthly test basis, verify that there has been 1 rotation test each week since the last monthly verification.

   a. Also verify that a Form 2000, Telecommunications Service Order Report or equivalent has been received for each failed test or that a siren is listed as out of service for each failed test.

7. On a quarterly basis, Growl Test the sirens, note any failures on the notification logs and document any subsequent Form 2000, Telecommunications Service Order Reports or equivalent.

   a. Emergency Preparedness will establish a schedule for growl and full volume siren testing.

   b. The testing schedule will be entered into the site surveillance tracking system, or similar system, to provide prompts to interested parties such as Site Communications.

8. Include the Growl Test Forms 2000, Telecommunications Service Order Reports or equivalent as attachments to the test documentation.

9. <u>Acceptance Criteria</u>

   This test is satisfactory when:

   a. Each of the sirens has been rotated weekly or any sirens that failed to rotate have been repaired and successfully retested or listed as out of service. In all cases, sirens out of service must be less than criteria for an NRC report.

9. Transmit the completed records to Records Storage in accordance with RMP-001. A copy of the form may be maintained in the EP files for the convenience of auditors.

SIREN OUT OF SERVICE NOTIFICATIONS

Date	Notification	Name	Time	Siren(s)	County	IN/OUT Service	Initial
	Noted By Telecom County Control Rm	____ ____ ____ ____	____ ____ ____ ____			IN/OUT (Circle)	
	Noted By Telecom County Control Rm	____ ____ ____ ____	____ ____ ____ ____			IN/OUT (Circle)	
	Noted By Telecom County Control Rm	____ ____ ____ ____	____ ____ ____ ____			IN/OUT (Circle)	
	Noted By Telecom County Control Rm	____ ____ ____ ____	____ ____ ____ ____			IN/OUT (Circle)	
	Noted By Telecom County Control Rm	____ ____ ____ ____	____ ____ ____ ____			IN/OUT (Circle)	
	Noted By Telecom County Control Rm	____ ____ ____ ____	____ ____ ____ ____			IN/OUT (Circle)	

David Lederer
U.S. Environmental Protection Agency
Region I
J. F. Kennedy Federal Building, HBO
Boston, Massachusetts 02203

SUBJECT: REMOVAL OF THE TEXAS INSTRUMENTS, INC., ATTLEBORO, MASSACHUSETTS SITE FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND TERMINATION OF USNRC LICENSE NO. SNM-23

Dear Mr. Lederer:

In 1990, the NRC staff identified approximately 50 sites that warranted special Nuclear Regulatory Commission oversight and created the Site Decommissioning Management Plan (SDMP). This action was taken for these sites to ensure timely and safe remediation of residual radioactive material in excess of the current NRC criteria for release for unrestricted use. One of the sites on the SDMP is the Texas Instruments, Inc., facility in Attleboro, Massachusetts.

The staff added this site to the SDMP because an on-site disposal of radioactive material had been made, but the location and extent of the disposal was not well-known, and the extent and location of soil contamination on this site was also not well-known. Although measurements taken in the 1980's had not indicated any contamination in groundwater, the staff was also concerned about potential radioactive contamination of the groundwater due to the presence of the buried radioactive material on the site.

Remediation of the on-site burial area was completed in the fall of 1993. Confirmatory measurements by an NRC contractor did not identify any residual radioactive contamination in this area in excess of the NRC criteria for release for unrestricted use. In the summer and early fall of 1994, Texas Instruments completed comprehensive characterization of the remainder of the exterior areas of the site. Radiological surveys of the building interiors were also performed at this time. Radiological contamination was identified in both interior and exterior areas of the site. Texas Instruments remediated the contamination in these areas in accordance with their 1992 remediation plan for the burial area and a 1994 supplement to the 1992 remediation plan.

Texas Instruments completed remediation of all exterior and interior areas in September 1996. Final radiological surveys were conducted by Texas Instruments' contractors and the reports were submitted to the NRC for review. Texas Instruments also submitted the results of the analysis of groundwater samples collected from monitoring wells on the site from 1993 through 1997. The NRC, accompanied by a representative of the

210014
RETURN ORIGINAL TO
REGION I

IE07

9703210181 970312
PDR ADOCK 07000033
C PDR

Commonwealth of Massachusetts, conducted confirmatory measurements at the site during the week of February 4-7, 1997.

Also, as you are aware, in approximately 1978, the NRC confirmed the presence of radioactive contamination at the Shpack landfill in nearby Norton, Massachusetts. Although the source of this contamination may have been the result of work performed at the Texas Instruments' Attleboro facility, the company has not acknowledged that their facility was the source of the material in the landfill. Texas Instruments and several other companies have entered into a consent order with EPA regarding the landfill. The landfill was listed on the U.S. Department of Energy (DOE) Formerly Utilized Site Remedial Action Program (FUSRAP) in 1980. Because the landfill is a DOE FUSRAP site and Texas Instruments is a party to the consent order with EPA, NRC believes that there is adequate regulatory consideration of any remaining radioactive material in the landfill.

Based on the actions taken by the licensee, our review of the surveys performed, and the results of the NRC confirmatory survey, the staff concludes that the site now meets the NRC criteria for release for unrestricted use. The staff plans to terminate NRC License No. SNM-23, issued to Texas Instruments. Inc. for the Attleboro, Massachusetts site, and to remove this site from the SDMP. The NRC intends to formally notify the licensee, by letter, and plans no further action on this site. The Commonwealth of Massachusetts is cognizant of the NRC plans and also plans no further action regarding the NRC licensed materials at the site. Mark Roberts of my staff discussed these issues with you on March 5, 1997.

If you have any questions concerning this letter, please contact Mr. Roberts at (610) 337-5094, or me at (610) 337-5200. Your cooperation with us is appreciated.

Sincerely,

Ronald R. Bellamy, Ph. D., Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

License No. SNM-23
Docket No. 070-00033

OFFICIAL RECORD COPY

cc:
Commonwealth of Massachusetts

Francis Veale
Environmental Safety & Health Department Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703

James Wagoner
U.S. Department of Energy
Office of Restoration
12800 Middlebrook Road
Germantown, MD 20874

Distribution:
PUBLIC
Nuclear Safety Information Center (NSIC)
RI Docket Room (w/concurrences)

DOCUMENT NAME: S:\PENDING\TI_EPA.LTR

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	DNMS/RI	DNMS/RI			
NAME	MRoberts	RBellamy			
DATE	03/12/97	03/12/97			

OFFICIAL RECORD COPY

POLICY ISSUE

(NEGATIVE CONSENT)

March 13, 1997 SECY-97-061

FOR: The Commissioners

FROM: L. Joseph Callan
Executive Director for Operations

SUBJECT: REMOVAL OF TEXAS INSTRUMENTS, INC. FROM SITE DECOMMISSIONING MANAGEMENT PLAN

PURPOSE:

To inform the Commission that remedial action has been completed at the Texas Instruments, Inc. (TI) site in Attleboro, Massachusetts. The staff plans to approve release of the site for unrestricted use, terminate the current Nuclear Regulatory Commission license, and remove the site from the Site Decommis' ning Management Plan (SDMP).

SUMMARY:

TI conducted uranium operations from 1952 to 1981. The licensee has now satisfactorily remediated the site. Based on the actions taken by the licensee, staff review of the surveys performed, and the results of the confirmatory survey, the staff plans to terminate the license before Massachusetts becomes an Agreement State on March 21, 1997. A representative of the Commonwealth of Massachusetts, Department of Public Health - Radiation Control Program accompanied and assisted Region I staff during the final confirmatory survey. Massachusetts representatives indicate they have no unresolved concerns about the NRC-regulated radiological material at the site and have confirmed in a letter to Region I that documentation provided by the licensee is sufficient to demonstrate compliance with Massachusetts'

Contact: M. Roberts, RI
(610) 337-5094

NOTE: TO BE MADE PUBLICLY AVAILABLE WHEN THE FINAL SRM IS MADE AVAILABLE

9703250105 970313
CF SUBJ

requirements for release of the site.

BACKGROUND:

In SECY-90-121, the original SDMP, and in subsequent revisions to the SDMP (SECY-91-096, -92-200, -93-179, -95-209, and 96-207), the staff identified approximately 50 sites that warranted special NRC oversight, to ensure timely and safe remediation of residual radioactive material in excess of the current NRC criteria for release for unrestricted use. One of these sites is the Texas Instruments, Inc., facility in Attleboro, Massachusetts. The staff added this site to the SDMP list because on-site disposals had been made, and the location and extent of the disposals were not well-known.

The TI facility is located in Attleboro, Massachusetts, approximately 16 kilometers (10 miles) northeast of Providence, Rhode Island and 48 kilometers (30 miles) southwest of Boston. The site currently comprises eighteen buildings owned by TI on approximately 40 hectares (100 acres). Operations with radioactive materials began at the site in 1952 when Metals and Controls, Inc., began to fabricate enriched uranium foils. Metals and Controls, Inc., merged with TI in 1959 and eventually was operated as a corporate division of TI. From 1952 through 1965, Metals and Controls (and later TI), under a variety of Government contracts, fabricated enriched uranium fuel elements for the U.S. Naval Reactors Program, Air Force, other U.S. Government-funded research, and a few commercial customers. From 1965 through 1981, TI fabricated fuel for the High Flux Isotope Reactor at Oak Ridge National Laboratory and other Government-owned research reactors. Depleted uranium and processed natural uranium were also used at the facility for research and development. The facility remains operational in a variety of metallurgical production activities; however, radioactive material is no longer used in the company's manufacturing operations.

Operations with radioactive materials were initially conducted in portions of what is now Building 4, with very limited operations conducted in Building 3. In 1956, Metals and Controls constructed Building 10 on the site to house all manufacturing work with radioactive materials. By 1957, all manufacturing operations with radioactive material were moved to Building 10. Waste handling, processing of scrap metal and residues, and treatment of waste acids and water were conducted in Building 5 and outside Building 5 in areas known as the Metals Recovery Area and the Stockade. A waste evaporator and an incinerator were operated in Building 5 and the adjacent Metals Recovery Area. Scrap and waste generated in the manufacturing processes were returned to the U.S. Government; however, some materials contaminated with low levels of radioactivity were disposed in an on-site burial adjacent to Building 11.

Following cessation of fuel fabrication operations in 1981, TI initiated remediation of uranium contamination in the buildings and surrounding exterior locations. Remediation and final surveys of contaminated portions of Buildings 4 and 10 were completed in 1985, and the NRC staff approved release of these buildings for unrestricted use. Residual radioactive contamination remained in the burial area east of Building 11 and west of the relatively recently constructed Building 12. In 1990, NRC listed the TI facility on the

NRC SDMP because of the presence of the residual contamination in the burial area. Region I staff approved a remediation plan for the burial area in 1992 and initial remediation was completed in December 1992. A confirmatory survey conducted by the Oak Ridge Institute for Science and Education (ORISE) in December 1992 identified some remaining contamination on the walls of the excavation. In July 1993, the licensee completed additional remediation activities. An ORISE confirmatory survey in December 1993 did not identify any remaining residual contamination in this burial area in excess of the NRC criteria for release for unrestricted use.

After completion of the remediation and survey of the burial area, TI identified soil contamination in three locations within the Metals Recovery Area. Remediation and sampling in this area during 1994 led to the determination that the three distinct contaminated areas were actually part of a single, larger contaminated area. Remediation of this area was completed in November 1994. After identification of the additional contamination in the Metals Recovery Area, Region I staff requested that TI perform a comprehensive radiological survey of all potentially affected areas on the site. These comprehensive radiological surveys, performed in 1994 and 1995, and discussions with long-term employees, led to the identification of additional areas of contaminated soil, primarily in the Stockade and Building 12 south lawn areas. The contamination in the Stockade Area was likely due to the past handling and storage operations in the area. Contamination on the lawn of Building 12 was likely the result of intrusion into the burial area and the spread of contamination during final grading around the building. Residual contamination was also identified in Buildings 4, 5, and 10, primarily where unclad uranium operations had been conducted. This contamination was generally limited to cracks and joints in the concrete floor, areas around equipment installed in the concrete floor, and drain lines buried in or beneath the concrete floor. Remediation was performed in accordance with the 1992 plan for remediation of the burial area and a 1994 addendum.

Also, in approximately 1978, NRC confirmed the presence of radioactive contamination at the Shpack landfill in nearby Norton, Massachusetts. The source of this contamination may have been the result of work performed at the TI Attleboro facility, but the company has not acknowledged that its facility was the source of the material in the landfill. Although some residual radioactive material was removed from the closed landfi l, further remediation for both radiological and chemical contaminants may still be required. In 1980, the landfill was listed on the U.S. Department of Energy (DOE) Formerly Utilized Site Remedial Action Program (FUSRAP), which will manage any remediation of radioactive materials. In addition, TI and several other companies have entered into a consent order with the U.S. Environmental Protection Agency (EPA) regarding the landfill.

DISCUSSION:

In response to the staff's request, TI performed comprehensive radiological surveys of all potentially affected areas on the site. These surveys, performed in 1994 and 1995, included a 100 percent walkover survey of both affected and unaffected areas using a sodium odide detector, and systematic

surface and sub-surface soil sampling with a split-spoon sampling apparatus and drill rig. Sampling was conducted at 1600 locations resulting in the collection of 5865 surface and sub-surface soil samples. Sample locations in affected areas were defined on a 10 meter x 10 meter (100 m^2) grid plan to ensure complete coverage of the affected area. Sampling in the Stockade Area was complicated by the presence of numerous underground electrical, communication, and water utilities and concrete supports for overhead structures. Designated sample points within some of the grid cells were moved short distances to avoid these obstacles. Unaffected areas were not sampled on a defined grid; however, 30 random sub-surface samples were collected in the unaffected areas. All soil samples were evaluated for total uranium concentrations. The soil sampling in the affected area identified eighty-five 100 m^2 grid cells where soil contamination exceeded NRC guidelines for release for unrestricted use (30 pCi/gram total uranium), as stated in the Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites (57 FR 13389). One anomaly was found in the unaffected area survey. This area bordered the Stockade Area and resulted in the extension of the Stockade Area to include it; this area was subsequently remediated. Discussions with long-term employees provided additional information concerning the use and possible disposal of licensed material on the site.

Radiological surveys were also conducted inside the buildings where there was a history of use of licensed material. Residual uranium contamination was identified in Buildings 4, 5, and 10. In Building 1, surveys identified a small amount of radium-226. The Commonwealth of Massachusetts has oversight for this material, and it is evaluating possible courses of action. Remediation activities in Buildings 4 and 5 primarily involved scabbling concrete floor surfaces. In a few cases, portions of the concrete slab and some underlying soil were removed. Building 10 required more extensive remediation work to remove contamination because unclad uranium operations had been conducted in portions of this building. Activities included scabbling approximately 75 m^2 (800 ft^2) of the floor and lower wall surfaces. Approximately 1400 m^2 (15,000 ft^2) of the concrete slab were removed to provide access to contaminated drain lines and soil. In most cases, the concrete was not contaminated or was only contaminated on the surface. Approximately 460 meters (1500 feet) of contaminated drain lines were removed from Building 10, and another 180 meters (600 feet) were decontaminated using a high-pressure wash. Approximately 6 m^3 (200 ft^3) of sludge were collected and disposed. All wash water was collected, filtered, and analyzed prior to release. All water released from the site in both the interior and exterior remediation projects, met NRC regulations for release.

The volume of uranium-contaminated waste generated in the interior remediation project was 980 m^3 (34,600 ft^3) of soil and concrete rubble. The exterior remediation projects generated primarily contaminated soil totaling 15,100 m^3 (532,000 ft^3). Initial waste shipments were sent via truck; however, most of the waste was shipped via covered rail cars. Waste was disposed of at the Envirocare facility in Clive, Utah.

NRC Region I staff conducted periodic inspections of the remediation activities during the various phases of the remediation projects. Three

representatives from the Region I staff, accompanied and assisted by a representative from the Commonwealth of Massachusetts, conducted confirmatory measurements at the site in February 1997. These surveys confirmed the licensee's survey results

The licensee's survey results indicated small areas of residual contamination exceeding unrestricted release limits in a few inaccessible locations. These areas are beneath vital structures or utilities and cannot be further remediated without adversely affecting the integrity of buildings and structures on the site. Based on the limited volume and activity of the material and averaging the residual contamination with the volume of other material present, the staff concludes that these areas are acceptable for release for unrestricted use. TI's contractor also performed a series of dose evaluations to estimate the impact of intrusion into any of these areas. The two scenarios that were evaluated were the exposure of a maintenance worker digging and working in a trench in Building 10 and exposure of a resident after conversion of the site to residential use. Using conservative assumptions in both cases, dose equivalents of 1.3 millirem/year and 7.9 millirem/year were calculated for the maintenance worker and residential scenarios, respectively, for maximally exposed individuals. The staff has reviewed the dose assessments and finds them to be conservative and acceptable.

The chemical forms of uranium used at the site were primarily uranium oxides, uranium metal, and uranium metal alloys. These forms of uranium are generally not soluble. Groundwater monitoring data from samples collected from on-site monitoring wells from March 1993 through February 1997 show only occasional values in excess of the gross alpha screening level of 15 pCi/liter. Specific uranium analyses have not exceeded 0.4 pCi/liter. These concentrations are well below the EPA proposed primary drinking water limit of 30 pCi/liter for uranium, and are acceptable for releasing the site for unrestricted use.

CONCLUSIONS:

Based on the actions taken by the licensee, our review of the surveys performed, and the results of the NRC confirmatory survey, the staff concludes that decommissioning has been satisfactorily completed at the TI Attleboro, Massachusetts site and the site now meets the NRC criteria described in the Action Plan for release for unrestricted use.

The staff has notified EPA and the Commonwealth of Massachusetts of its intent to terminate the license. Because the Shpack landfill is a DOE FUSRAP site and TI is a party to the consent order with EPA, the staff believes that there is adequate Federal regulatory oversight of any radioactive material that may remain in the former landfill. The Commonwealth of Massachusetts plans no further action regarding the NRC-licensed materials at the site. Massachusetts is expected to become an Agreement State on March 21, 1997.

The staff previously placed a notice in the Federal Register (60 FR 27146, dated May 22, 1995) that acknowledged the receipt of the amended remediation plan and that TI was working toward complete remediation of the site. The

staff will place a notice in the Federal Register stating that the areas of concern now meet NRC guidelines for release for unrestricted use, and NRC is removing this site from the SDMP and terminating the license.

It is the staff's intention, unless otherwise directed by the Commission, before March 21, 1997, to send a letter to TI (attachment) stating that the Attleboro site meets current NRC requirements for release for unrestricted use, that the license is terminated, and that NRC intends to remove the site from the SDMP.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection.

L. Joseph Callan
Executive Director
for Operations

Attachment:
Draft letter to Texas Instruments

DISTRIBUTION:
Commissioners
OGC
OCAA
OIG
OPA
OCA
ACNW
CIO
CFO
EDO
REGION I
SECY

staff will place a notice in the Federal Register stating that the areas of concern now meet NRC guidelines for release for unrestricted use. and NRC is removing this site from the SDMP and terminating the license.

It is the staff's intention. unless otherwise directed by the Commission. before March 21. 1997. to send a letter to TI (attachment) stating that the Attleboro site meets current NRC requirements for release for unrestricted use. that the license is terminated. and that NRC intends to remove the site from the SDMP.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection.

Original Signed by
L. J. Callan

L. Joseph Callan
Executive Director
for Operations

Attachment: Draft letter to Texas Instruments
TICKET:
DOCUMENT NAME: S:\DWM\LLDP\TI SECY.LDP

OFC	R-I*	R-1*	LLDP*	LLDP*	TEd. *	LLDP	OGC*
NAME	MRoberts	RBellamy	JShepherd	TCJohnson	EKraus	JHickey	RFonner
DATE	3/13/97	3/13/97	3/13/97	3/13/97	3/12/97	3/ /97	3/12/97
OFC	DWM	NMSS	DEDR	EDO			
NAME	JGreeves	CPaperiello	HLThompson	LJCallan			
DATE	3/13/97	3/13/97	3/13/97	3/13/97			

OFFICIAL RECORD COPY

NRC FILE CENTER COPY

250024

further action regarding the NRC licensed materials at the site. Massachusetts is expected to become an Agreement State on March 21, 1997.

The staff previously placed a notice in the Federal Register (60 FR 27146, dated May 22, 1995) that acknowledged the receipt of the amended remediation plan and that TI was working toward complete remediation of the site. The staff will place a notice in the Federal Register stating that the areas of concern now meet NRC guidelines for release for unrestricted use, and NRC is removing this site from the SDMP and terminating the license.

It is the staff's intention, unless otherwise directed by the Commission, before March 21, 1997, to send a letter to TI (attachment) stating that the Attleboro site meets current NRC requirements for release for unrestricted use, that the license is terminated, and that NRC intends to remove the site from the SDMP.

COORDINATION:

The Office of the General Counsel has reviewed this paper and has no legal objection.

L. Joseph Callan
Executive Director
for Operations

Attachment: Draft letter to Texas Instruments
TICKET:
DOCUMENT NAME: S:\DWM\LLDP\TI_SECY.LDP

OFC	R-I	R-I	LLDP	LLDP	TEd.	LLDP	OGC
NAME	JCS for MRoberts	FBC by JCS RBellamy	JShepherd	TCJohnson	JCS for EKraus	JHickey	NLO RFonner by email
DATE	3/13/97	3/13/97	3/13/97	3/13/97	3/12/97	3/ /97	3/12/97

OFC	DWM	NMSS	DEDR	EDO			
NAME	JGreeves	CPaperiello	HLThompson	LJCallan			
DATE	3/ /97	3/ /97	3/ /97	3/ /97			

OFFICIAL RECORD COPY

ATTACHMENT

DRAFT

Francis J. Veale Jr.
Environmental Safety and Health Department Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703-0964

SUBJECT: REMOVAL OF THE TEXAS INSTRUMENTS, INC., ATTLEBORO, MASSACHUSETTS FACILITY FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND TERMINATION OF NRC LICENSE

Dear Mr. Veale:

I am responding to your letter dated October 29, 1996, requesting that NRC release the Texas Instruments, Inc., Attleboro, Massachusetts, site for unrestricted use, terminate the current NRC license, and remove the site from the Site Decommissioning Management Plan (SDMP). We have reviewed your reports from the radiological surveys and analysis of soil samples and conducted our own confirmatory radiological survey. We conclude that the facility has been remediated to meet the criteria for release for unrestricted use as discussed in the "Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites" (the Action Plan) (57 FR 13389-13392) and NRC's current criteria for residual contamination in soil.

In accordance with your request, NRC License No. SNM-23, issued to Texas Instruments, Inc., is hereby terminated, and we are removing your Attleboro, Massachusetts site from the SDMP list.

As noted in the Action Plan, this is the Commission's final action on the referenced license. NRC will not require any additional decommissioning in response to future NRC criteria or standards, unless additional contamination, or noncompliance with your July, 1992 Remediation Plan or the December 1994 Supplement to the Remediation Plan, is found, and there is a significant threat to public health and safety.

If you have any questions concerning our action, please contact Mark Roberts of my staff at (610) 337-5094 or me at (610) 337-5200. Thank you for your cooperation in this matter.

Sincerely,

Ronald R. Bellamy, Ph. D., Chief
Decommissioning & Laboratory Branch
Division of Nuclear Materials Safety

OFFICIAL RECORD COPY

License No. SNM-23
Docket No. 070-00033

cc:
Commonwealth of Massachusetts

David Lederer
Remediation Manager
U.S. Environmental Protection Agency, Region I
J. F. Kennedy Federal Building, HBO
Boston, Massachusetts 02203

James Wagoner
U.S. Department of Energy
Office of Restoration
12800 Middlebrook, Road
Germantown, Maryland 20874

James P. Mooney, Health Agent
City of Attleboro
77 Park Street
Attleboro, Massachusetts 02703

Michael Elliott
Environmental Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703-0964

March 20, 1997

Michael Elliott
Environmental Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703

SUBJECT: INSPECTION NO. 070-00033/97-001

Dear Mr. Elliott:

On February 3-6, 1997, Anthony Dimitriadis and Mark Roberts of this office conducted a safety inspection at the Texas Instruments, Inc. facility in Attleboro, Massachusetts of activities authorized by the NRC license listed below. The inspection was limited to observations by the inspectors, interviews with personnel, selective examination of records and confirmatory surveys inside Buildings 4, 5, and 10 and in exterior areas of the site. A copy of the NRC inspection report is enclosed. In addition, our inspection examined the activities covered in survey reports dated May 1995, August 1996, two from October 1996, January 1997, February 1997, February 11, 1997, February 24, 1997, and March 10, 1997. The findings of the inspection were discussed with James Armstrong, Francis Veale, Jr., your consultant Steve Shafer from Roy F. Weston, and you, at the conclusion of the inspection. Thomas O'Connell from the Commonwealth of Massachusetts, Department of Public Health - Radiation Control Program, assisted the inspectors and attended the exit meeting.

Within the scope of this inspection, no violations were identified.

Please note that the enclosed inspection report does not constitute approval by the NRC for release of your facility for unrestricted use. The results of this inspection report, and all other applicable information available to the NRC, will be examined to determine if your facility may be released for unrestricted use by the reviewer who is responsible for amending your license.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the Public Document Room. No reply to this letter is required.

9704010558 970320
PDR ADOCK 07000033
C PDR

RETURN ORIGINAL TO
REGION I

IE07

Your cooperation with us is appreciated.

Sincerely,

Original Signed by:
J. J. Kottan

Ronald R. Bellamy, Ph. D., Chief
Decommissioning and Laboratory Branch
sion of Nuclear Materials Safety

Docket No.: 070-00033
License No.: SNM-23

Enclosure:
Inspection Report No. 070-00033/97-001

cc w/enclosure:

Commonwealth of Massachusetts

M. Elliott
Texas Instruments, Inc.

Distribution: w/encl
PUBLIC
Nuclear Safety Information Center (NSIC)
Region I Docket Room (w/concurrences)
M. Roberts, RI

DOCUMENT NAME: P:\TI_CONF

To receive a copy of this document, indicate in the box: "C" = Copy w/o attach/encl "E" = Copy w/ attach/encl "N" = No copy

OFFICE	DNMS/RI	N	DNMS/RI	N				
NAME	MRoberts		RBellamy					
DATE	03/20/97		03/20/97					

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No.	070-00033/97-001
Docket No.	070-00033
License No.	SNM-23
Licensee:	Texas Instruments, Inc. 34 Forest Avenue Attleboro, Massachusetts 02703
Inspection At:	Texas Instruments, Inc. Attleboro, Massachusetts
Inspection Conducted:	February 3-6, 1997

Inspectors: Anthony Dimitriadis, Health Physicist — date: March 20, 1997

Mark C. Roberts, CHP, Senior Health Physicist — date: March 20, 1997

Approved By: Ronald R. Bellamy, Ph. D., Chief, Decommissioning and Laboratory Branch, Division of Nuclear Materials Safety — date: 3-20-97

Inspe~tion Summary: Announced, confirmatory survey at the licensee's Attleboro, Massachusetts facility (Inspection Report No. 070-00033/97-001)

Areas Inspected: Organization and scope of remediation project, confirmatory measurements in interior areas, confirmatory measurements in exterior areas, results of sample analysis, review of radiological survey and remediation documents.

Results: Radiological measurements did not identify any residual levels in excess of the criteria for release for unrestricted use. Sample results from 40 soil samples analyzed in the NRC regional laboratory confirmed the licensee's results. A small amount of contaminated soil or contamination on below-ground concrete surfaces was left in place in inaccessible areas that could not be further remediated because of their proximity to vital structures or utilities. Measurements in each of these areas were not different than ambient background measurements. Based on volume averaging, the inspectors determined that the average total uranium concentration in each of these areas is less than 30 picocuries per gram.

9704010569 970320

DETAILS

1. Individuals Contacted

   * Michael Elliott, Environmental Manager, Texas Instruments, Inc. (TI)
   * Francis Veale, Environmental Safety and Health Department Manager, TI
   * James Armstrong, Operational Excellence Manager, TI
   * Steve Shafer, Health Physicist (Exterior Remediation Project Manager), Roy F. Weston, Inc. (Weston)

   Michael Madonia, Health Physicist (Interior Remediation Project Manager), Weston (via telephone on February 5, 1997)

   * Thomas O'Connell, Health Physicist, Commonwealth of Massachusetts

   * Denotes those present at exit meeting

2. Background

   The TI facility is located in Attleboro, Massachusetts, approximately 16 kilometers (10 Miles) northeast of Providence, Rhode Island and 48 kilometers (30 miles) southwest of Boston. The site currently comprises eighteen buildings owned by TI on approximately 40 hectares (100 acres). Operations with radioactive material began at the site in 1952 when Metals and Controls, Inc. began to fabricate enriched uranium foils. Metals and Controls, Inc., merged with TI in 1959 and eventually was operated as a corporate division of TI. From 1952 through 1965, Metals and Controls (and later TI), under a variety of government contracts, fabricated enriched uranium fuel elements for the U.S. Naval Reactors Program, U.S. Air Force, other U.S. Government-funded research, and a few commercial customers. From 1965 through 1981, TI fabricated fuel for the High Flux Isotope Reactor at Oak Ridge National Laboratory and other government-owned research reactors. Depleted uranium and processed natural uranium were also used at the facility in research and development of the production methodologies. The facility remains operational in a variety of metallurgical production activities; however, radioactive material is no longer used in the company's manufacturing operations.

   Operations with radioactive materials were initially conducted in portions of what is now Building 4, with very limited operations conducted in Building 3. In 1956, Metals and Controls constructed Building 10 on the site to house all work with radioactive materials. By 1957, all manufacturing operations were moved to Building 10. Waste handling, processing of scrap metal and residues, and treatment of waste acids and water were conducted in Building 5 and outside Building 5 in areas known as the Metals Recovery Area and the Stockade. A waste evaporator and an incinerator were operated in Building 5/Metals Recovery Area. Scrap and waste generated in the manufacturing processes were returned to the U. S. Government; however, some materials contaminated with low levels of radioactivity were disposed in a burial site adjacent to Building 11.
   Following cessation of operations with radioactive materials in 1981, TI initiated remediation of uranium contamination in the buildings and surrounding exterior locations. Remediation and final surveys of contaminated portions of Buildings 4

and 10 were completed in 1985 and the NRC staff approved release of these buildings for unrestricted use. Residual radioactive contamination remained in the burial area east of Building 11 and west of the recently constructed Building 12. In 1990, the NRC listed the TI Attleboro, Massachusetts facility on the NRC Site Decommissioning Management Plan (SDMP) because of the presence of the residual contamination in the burial area. Region I staff approved a remediation plan for the burial area in 1992 and initial remediation was completed in December 1992. A confirmatory survey conducted by the Oak Ridge Institute for Science and Education (ORISE) in December 1992 identified some remaining contamination on the walls of the excavation. In July 1993, the licensee completed additional remediation activities. An ORISE confirmatory survey performed in December 1993 did not identify any remaining residual contamination in this burial area in excess of the current criteria for release for unrestricted use.

After completion of the remediation and survey of the burial area, TI identified soil contamination in three locations within the Metals Recovery Area. Remediation and sampling in this area during 1994 led to the determination that the three distinct contaminated areas were actually part of a single, larger contaminated area. Remediation of this area was completed in November 1994. After identification of the additional contamination in the Metals Recovery Area, Region I staff requested that TI perform a comprehensive survey of all potentially affected areas on the site. These comprehensive radiological surveys, performed in 1994 and 1995, and discussions with long-term employees, led to the identification of additional contaminated soil, primarily in the Stockade and Building 12 south lawn area. The contamination in the stockade area was likely due to the past handling and storage operations in the area. Contamination on the lawn of Building 12 was likely the result of intrusion into the burial area and the spread of contamination during final grading around the building. Residual contamination was identified in Buildings 4, 5, and 10, primaril· where unclad uranium operations had been conducted. The contamination was primarily limited to cracks and joints in the concrete floor, areas around equipment installed in the concrete floor, and drain lines buried in or beneath the concrete floor. Remediation was performed in accordance with the 1992 plan for remediation of the burial area and a 1994 addendum.

Also, in approximately 1978, NRC confirmed the presence of radioactive contamination at the Shpack landfill in nearby Norton, Massachusetts The source of 'is contamination may have been the result of work performed at the TI Attleboro facility, but the company has not acknowledged that its facility was the source of the material in the landfill. Although some residual radioactive material was removed from the closed landfill, further remediation for both radiological and chemical contaminants may still be required. In 1980, the landfill was listed on the U.S. Department of Energy (DOE) Formerly Utilized Site Remedial Action Program (FUSRAP), which will manage any remediation of radioactive materials. In addition, TI and several other companies have entered into a consent order with the U.S. Environmental Protection Agency (EPA) regarding the landfill.

3. Organization and Scope of Remediation Project

The site remediation project was coordinated by the Environmental Manager. This individual reports to the Environmental Safety and Health Manager who reports to the Site Manager. The remediation of the Metals Recovery Area was handled as one sep rate project and the remediation of the remainder of the exterior areas and all of the interior areas was handled as a second separate project. CPS Environmental, Inc. provided contractor health physics technical support and directed the excavation and drilling contractors based on the results of the radiation surveys and sample analysis. CPS, Environmental also performed the radiological characterization of the site. Roy F. Weston, Inc. provided project management for the remainder of the exterior remediation and the interior remediation. Two Weston project managers provided direct supervision of the support services including health physics, construction, transportation, and analytical services.

No safety concerns were identified.

4. Instrumentation Used in Confirmatory Surveys

The inspectors used a series of portable radiation survey meters and laboratory equipment to make confirmatory measurements. Ambient gamma radiation levels were measured with Ludlum Micro-R meters (NRC # 033513 and NRC # 019634, calibrated on December 5, 1996 and March 14, 1996, respectively). Unless otherwise indicated, these measurements were made at a distance of one meter above the ground or from the surface that was measured. Ambient exterior gamma radiation in the vicinity of the site ranged from 8 - 12 μR/hour. Background measurements inside Building 10 in unaffected areas ranged from 10 - 15 μR/hour. The higher range of values was generally measured in locations with newer concrete. Direct measurements for radioactive contamination were made at near contact with floor and wall surfaces using Ludlum Model 43-68 100 cm^2 gas-flow proportional detectors (NRC # 054810 and NRC # 057023) with Ludlum Model 18 rate-meters (NRC # 054822 and NRC # 054825, both calibrated March 4, 1996). Floor surfaces were scanned with Ludlum Model 239-1F floor monitors (NRC # 054976 and NRC # 054975 equipped with Ludlum Model 2221 scaler/rate-meters (NRC # 054826 and NRC # 054828, both calibrated March 14, 1996). The inspectors determined the operating voltages and detector efficiencies prior to the inspection and confirmed the efficiency and measured the background, for each detector, daily prior to initiating confirmatory measurements. The inspectors also measured higher background counts with the gas proportional detectors on the newer concrete. A 2" x 2" sodium iodide detector (Ludlum Model 44-10), coupled to one of the Ludlum Model 18 rate-meters, was used to make gross gamma measurements.

Soil samples from interior and exterior remediated areas were selected from archived samples in storage. Two additional soil samples were obtained directly from areas where characterization measurements indicated that the total uranium

concentration did not exceed the NRC guidelines for release for unrestricted use. Each soil sample was prepared for analysis in the Region I radioanalytical laboratory by drying and then milling the dried sample. An aliquot of each sample was weighed and transferred into a Marinelli beaker for gamma counting. Gamma counting was performed using a high-purity germanium detector (HpGe) that can quantify specific gamma emission energies from the sample. Analysis of the gamma spectrum and identification of radioactive isotopes is performed with a commercial software program. Results of the analysis of the soil samples were reported in units of picocuries/gram (pCi/g) with an uncertainty of one standard deviation for each radionuclide reported.

5. Confirmatory Measurements in Interior Areas

5.1. Measurements in Building 4

Building 4 is the largest of the manufacturing buildings on the site. A small portion of the building was used for uranium milling prior to the construction of Building 10. Approximately 12,000 ft^2 of this 295,000 ft^2 building required remediation. Gamma exposure rate measurements in the remediated area and in the area adjacent to the remediated area ranged from 6 - 12 μR/hour. With the exception of one area, these values were not distinguishable from background measurements in the building. The exposure rate measured along a stone walkway adjacent to the remediated area was as high as 18 μR/hour. The source of these slightly elevated readings appeared to be the natural stone used in the walkway. Scanning and direct measurements were performed with the gas-proportional detectors over approximately 100 percent of the accessible floor area in the remediated area. A large portion of the area adjacent to the remediated area was also scanned with the same instrumentation. With the exception of the stone walkway, all results were less than approximately 2000 dpm/100 cm^2. The area of the walkway exhibited elevated surface measurements, but appeared to be caused by naturally-occurring radioactive material in the rock.

The inspectors also performed gamma exposure rate measurements directly above drain pipes buried in or beneath the floor. These pipes had either been remediated by pressure washing or characterization readings indicated that contamination levels met the NRC guidance for release. All measurements were not different than the background measurements.

No safety concerns were identified.

5.2. Measurements in Building 5

Building 5 is a small building adjacent to the Metals Recovery Area. Remediation in Building 5 consisted of removal of approximately one third of the concrete floor of the building and removing contaminated soil

beneath the floor. Gamma exposure rate measurements in Building 5 ranged from 12 - 16 μR/hour. All scanning and direct measurements on the floor and lower wall surfaces were not distinguishable from background. Areas that had been remediated and areas where characterization data indicated that the surface criteria for release for unrestricted use was met were both included in the survey of this building. Because this is a small building, the entire floor surface was subject to the scanning measurements.

No safety concerns were identified.

5.3. Measurements in Building 10

Building 10 was the primary location for work with both clad and unclad licensed materials. The principle area within the building where the unclad material was used was the northern end of the building. Licensed material use in the remainder of the building was limited to storage and transportation support for the finished products. Following the remediation of contamination in 1981 and 1982, the building was converted to a number of other manufacturing uses. The recent decommissioning activities required remediation of approximately 40,000 ft^2 of the 168,000 ft^2 building. Most of the remediation performed required the removal and replacement of portions of the concrete slab, excavation and disposal of contaminated soil, and pressure washing or removal of contaminated drain lines.

Gamma exposure rates measured throughout the building ranged from 6 - 16 μR/hour. The higher values were generally measured in areas where there was newer concrete. The inspectors made scanning measurements throughout the remediated area and in the areas bordering the remediated area with the floor monitor. All areas were well below the release criterion of 5000 dpm/100 cm^2. The inspectors also performed gamma exposure rate measurements above the concrete slab where drain pipes are buried in the floor. The pipes had either been cleaned or characterization measurements indicated that remediation was not required. The gamma exposure rate measurements in these areas were not different than those measured throughout the remainder of the building.

The licensee left residual contamination in place in eight inaccessible locations within the building. These areas are under or adjacent to vital structures or heavy equipment and consist of either contaminated soil or contamination on concrete surfaces. The depth of these locations ranges from one to 2.5 meters beneath the floor surface. Direct gamma measurements with the 2" x 2" NaI detector at the soil surface and exposure rate measurements with the Micro R-meter in each of these areas were also indistinguishable from background measurements.

Because Building 10 required the most significant remediation, the inspectors selected a number of archived, post-remediation samples for analysis in the NRC regional laboratory. The results of these analyses are discussed in section 7 of this inspection report.

No safety concerns were identified.

6. Confirmatory Measurements in Exterior Areas

The inspectors reviewed the characterization and post-remediation radiological survey data for the exterior areas of the TI site. The affected exterior area of the site was divided into approximately 300 grid cells, 10 meters x 10 meters. A total of 93 of the grid cells required remediation by removal of uranium contaminated soil in excess of the NRC criteria for release for unrestricted use. The inspectors made measurements with the 2" x 2" NaI gamma detector and the micro-R meter throughout the remediated area and in areas where the characterization data indicated that no remediation was required. All readings were not different than the background measurements on the site.

In thirteen of the remediated grid cells, at least one post-remediation sample from the grid cell exceeds the NRC unrestricted use criterion of 30 pCi/g total uranium. In all cases, the residual contamination is inaccessible due to the presence of critical utilities or structures that prevented complete removal of contaminated soil. This residual contamination is located from one to three meters below the surface of the soil. The inspectors made measurements with the 2" x 2" NaI gamma detector and the micro-R meter in each of these grid cells. Measured exposure rates ranged from 10 to 17 μR/hour. The highest reading was measured in the vicinity of a large sub-surface concrete structure which appeared to have contributed to the exposure rate. All other readings were not significantly different than local background levels.

No safety concerns were identified.

7. Results of Sample Analyses

As discussed in section 4 of this report, selected soil samples, primarily post-remediation samples, were analyzed by gamma spectrometry in the Region I analytical laboratory. Concentrations of uranium-235 and U-238 (reported as the concentrations of the thorium-234 and protactinium-234m decay progeny) for the forty soil samples are presented in Table 1. Because the gamma spectrometry analysis can not be used to quantify the uranium-234 concentration in a sample, some of the soil samples were submitted to ORISE, the NRC's contractor laboratory, for alpha spectrometry analysis. The alpha spectrometry analysis provided a quantitative measure of the U-235 and U-238 concentrations, as well as, the U-234 concentration. Results of the nine alpha spectrometry analyses are presented in Table 2. Licensee contractor data for these samples is also presented in Table 2.

The results of the gamma spectrometry analyses confirm that the facility meets the criteria for release for unrestricted use. The average total uranium concentration of the thirty-nine post remediation samples is approximately 11 pCi/g. The inspectors estimated the U-234 concentrations using ratios of U-238 to U-235 for each sample. One pre-remediation sample indicated a total uranium concentration of approximately 180 pCi/g. This value was in good agreement with the licensee contractor value of approximately 200 pCi/g. The area was later remediated to levels less than 30 pCi/g. Only two samples indicated estimated total uranium concentrations above 30 pCi/g. One sample from the Metals Recovery Area was approximately 31 pCi/g and appeared to be depleted uranium (the NRC guideline for depleted uranium is 35 pCi/g). A sample from the stockade area indicated an estimated concentration of 38 pCi/g. This value was in good agreement with the licensee's contractor values of 36, 15 and 45 pCi/g for this location. Although this value exceeded 30 pCi/g, volume averaging indicates that the total uranium concentration in this area meets the 30 pCi/g guideline.

The alpha spectrometry results in Table 2 show very good agreement with data from the licensee's contractors. Except for one sample from the Metals Recovery Area, the data also show very good agreement with the gamma spectrometry data. The disagreement in the sample data from the Metals Recovery Area was likely caused by a non-homogenous sample, because neither the U-235 nor the U-238 results are in agreement, and the alpha spectrometry analysis use a very small sample compared to the gamma spectrometry analysis. One sample from the Stockade Area slightly exceeded 30 pCi/g; however, this area also meets the NRC criteria based upon volume averaging for the grid cell.

No safety concerns were identified.

8. Review of Radiological Survey and Remediation Documents

8.1 Surveys of Open Land Areas

Because of the discovery of soil contamination in the burial area between Buildings 11 and 12 and the subsequent identification of soil contamination in the Metals Recovery Area adjacent to Building 5, TI conducted a comprehensive survey of exterior areas of the site. This systematic characterization survey of the affected and unaffected exterior areas of the site was conducted from July through September 1994 and was documented in a May 1995 report (Radiological Surveys of Open Land Areas, Texas Instruments Incorporated, Attleboro, Massachusetts). The survey included a 100 percent walkover survey of both the affected and unaffected areas of the site using a 2" x 2" NaI detector and rate-meter. The surveys were conducted by CPS, a contractor for TI. Undeveloped portions of the site were not surveyed.

Systematic surface and sub-surface soil samples were taken by a split spoon sampling apparatus and drill rig. Sampling was conducted at 1600

locations resulting in the collection of 5865 surface and sub-surface soil samples. Sample locations in affected areas were defined on a 10 meter x 10 meter (100 m^2) grid plan to ensure complete coverage of the affected area. Sampling in the Stockade Area was complicated by the presence of numerous underground electrical, communication, and water utilities and concrete supports for overhead structures. Designated sample points within some of the grid cells were moved short distances to avoid these obstacles. Unaffected areas were not sampled on a defined grid; however, thirty random sub-surface samples were collected in the unaffected areas. Samples were evaluated by the gross alpha soil analysis technique to identify total uranium concentrations. The soil sampling in the affected area identified eighty-five 100 $meter^2$ grid cells where soil contamination exceeded NRC guidelines for release for unrestricted use. One additional contaminated area was found in the unaffected area survey. This area, which bordered the Stockade Area, was remediated as part of the exterior remediation project in the Stockade Area.

Based on a review of the data in the characterization report, knowledge of the physical layout of the site obtained in previous inspections, and a prior review of the gross alpha counting technique (including the analysis of samples split with the NRC), the site was adequately characterized to identify locations where licensed material was used or may have been inadvertently disposed. TI's contractors and environmental staff interviewed a number of long-time employees to assist in determining the areas that were defined as affected.

No safety concerns were identified.

8.2 Remediation of the Metals Recovery Area

Radiological surveys in late 1993 and early 1994 identified soil contamination in the Metals Recovery Area. This area was formerly a waste handling area where an incinerator and a liquid waste evaporator were operated. Three initial areas were identified in this area and the contaminated soil volume was estimated to be approximately 425 m^3 (15,000 ft^3). The remediation activities conducted in this area led eventually to the disposal of 3300 m^3 (115,000 ft^3) of contaminated soil. Contamination was primarily limited to the top 15 cm of soil; however, excavation of contaminated soil down to approximately 2 meters was required in the area immediately adjacent to Building 5. The highest concentration of uranium identified in characterization and remediation samples was 17,000 pCi/g. Remediation activities were conducted from April 1994 through November 1994. A report summarizing the results of the remediation of the Metals Recovery Area was transmitted to the NRC in October 1996 (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of the Metals Recovery Area, Final Report).

The results from the analysis of systematic surface and sub-surface soil samples from the excavated area and the perimeter of the excavated area; and exposure rate measurements indicate that the criterion for residual uranium concentration in soil (30 pCi/g) and the exposure rate criterion were both met. In one 9 meter x 9 meter grid cell, contaminated soil averaging 49 pCi/g total uranium was left in place around an electrical duct bank. Using a volumetric averaging method, the inspectors determined that this area was below the 30 pCi/g total uranium criterion when averaged over a one-meter thick vertical plain. Rain water that collected in the excavation was confirmed to be well below effluent criteria and was released. Contaminated soil was disposed at the Envirocare facility in Utah.

No safety concerns were identified.

8.3 Remediation of Exterior Areas Adjacent to Buildings 11 & 12

TI's contractor, Weston, coordinated the remediation of the exterior areas adjacent to Buildings 11 and 12 that were identified in the report on the Survey of the Open Land Areas. The burial area between Buildings 11 and 12 and the Metals Recovery Area were not included in this remediation project because they had been previously remediated by CPS and the results provided to Region I. Characterization data generated by CPS was used to identify the initial 77, 10 meter x 10 meter grid cells, requiring remediation. An additional 16 cells, adjacent to remediated cells, were eventually included in the remediation. The depth of the contaminated material ranged from the surface to approximately three meters (ten feet). Remediation activities on these exterior areas were conducted from June 1995 through December 1995. The results of the remediation activities were documented in an August 1996 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of Exterior Areas Adjacent to Buildings 11 and 12, Final Report).

Remediation of contaminated soil in grid cells was accomplished by removing soil in approximately 30-centimeter (one-foot) sections within the grid cell. In areas where the surface soil was less than the criteria for release for unrestricted use, the soil was reserved for backfilling excavated areas where contaminated soil was removed. Contaminated soil was excavated and segregated for eventual disposal. Excavation continued until field measurements indicated that the unrestricted guidelines had been met. Thirteen check samples were then analyzed using a gross alpha screening technique. If the results of those analyses were acceptable, five verification samples (one from each quadrant of the cell and one from the center of the cell) were collected and analyzed and reported as the final verification sample. A composite of these samples was then sent to an off-site vendor for alpha spectrometry analysis.

Contaminated soil in excess of the NRC guidelines for release for unrestricted use was left in place in a few inaccessible locations. These areas are beneath vital structures or utilities and can not be further remediated without adversely affecting the structures. In all but three areas, the average total uranium soil concentration on the surface of the excavation met the averaging criteria for unrestricted use. In the other three locations, using a volumetric averaging method, the inspectors determined that these areas also met the 30 pCi/g release criteria.

No safety concerns were identified.

8.4 Surveys of Interior Areas in Buildings 4, 5, and 10

TI's contractor, Weston, also coordinated the remediation of the contaminated interior portions of Buildings 4, 5, and 10. Remediation activities on these interior areas were conducted from June 1995 through September 1996. The results of the remediation activities are documented in an October 1996 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of Building Interiors, Buildings 4, 5, and 10).

The contaminated portions of the buildings were divided into eighteen (decontamination) areas based upon physical barriers and historical operations. The decontamination areas were further divided into 100 m^2 grids. A contaminated portion of the roof was similarly divided. Remediation activities primarily included scabbling contaminated concrete floors and removing portions of the concrete slab to excavate contaminated soil and remove contaminated drain lines. The total volume of waste disposed from the interior remediation project was 980 m^3 (34,600 ft^3). Final remediation soil samples were analyzed by an off-site laboratory for total uranium or isotopic uranium. Surface contamination measurements were performed with properly calibrated detectors with sufficient sensitivity to meet the NRC guidelines for surface contamination measurements.

Contaminated soil or surface contamination in excess of the NRC guidelines for release for unrestricted use was left in place in a few inaccessible locations. These areas are beneath structural column footings or under vital machinery and can not be further remediated without adversely affecting the building structure or some of the machinery in the building. In these locations, using a volumetric averaging method, the inspectors determined that these areas meet the 30 pCi/g release criteria. All other areas were also sufficiently remediated to meet the NRC criteria for release for unrestricted use.

Based on their review of this document, the inspectors requested additional information concerning the remediation activities for pipes left in

place and the evaluation of residual contamination. The inspector also requested that the licensee perform a dose evaluation of the residual contamination in the remediated drain lines. Based on the review of three documents prepared by Weston (Texas Instruments Incorporated Attleboro Facility - Building Interiors Remediation, Drainage System Characterization, January 1996; Drainage System Unrestricted Release Information - Supplemental Analyses, February 11, 1997; and SNM License Termination Hypothetical Radiological Dose and Exposure Rate Assessment, Priority 2 Drain Lines), the inspectors concluded that the residual activity in the priority 2 drain lines (drain lines that were cleaned by pressure washing) met the NRC guidelines for release for unrestricted use.

No safety concerns were identified.

8.5 Surveys of Building Interiors, Overhead Structures, and Upper Walls

As part of the characterization of the affected buildings, surveys of the building interiors, overhead structures, and upper walls were performed. Although data from these surveys were recorded, the surveys were not initially documented in a report. The results of the surveys were used to guide the remediation of contaminated portions of Buildings 4 and 10. The surveys were subsequently documented in a February 1997 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Supplemental Surveys of Building Interiors, Overhead Structures and Upper Walls). Measurements included both direct measurements to evaluate non-removable contamination and smears to evaluate removable contamination. A review of this document confirmed that the upper portions of Buildings 3, 4, 10, and 11 meet the NRC guidelines for release for unrestricted use.

No safety concerns were identified.

8.6 Groundwater Radiological Monitoring Data Report

The chemical forms of uranium used at the site were primarily uranium oxides, uranium metal, and uranium metal alloys. These forms of uranium are generally not soluble. Groundwater monitoring data for the Texas Instrument site is summarized in a letter report (February 24, 1997 letter and four attachments to M. Roberts, NRC Region I from M. Elliott, Texas Instruments). Groundwater samples were collected from a series of representative monitoring wells on the site during January-March 1993, August-September 1995, and December-February 1996-1997. Gross alpha concentrations for the most recent samples ranged from less than detectable to 11 pCi/liter and gross beta concentrations ranged from less than detectable to 25 pCi/liter. These values are below the EPA groundwater screening criteria for gross alpha and gross beta activity of 15 and 50 pCi/liter, respectively. Results from the earlier samples were

less than the most recent samples. A specific uranium analysis was performed on selected samples in the recent sampling period. Measured total uranium concentrations ranged from 0.22 to 0.39 pCi/liter. These concentrations are below the EPA proposed primary drinking water limit of 30 pCi/liter for uranium, and are acceptable for releasing the site for unrestricted use.

No safety concerns were identified.

8.7 Dose Assessment

As discussed in sections 8.4 and 8.5, residual contamination was left in place in areas that were inaccessible because the remaining material was beneath critical utilities and structures. In order to conclude that there is no significant dose impact in leaving this material in place, and in order to satisfy the Commonwealth of Massachusetts requirement that the residual dose impact be less than 10 millirem per year, TI's contractor (Weston) performed a supplementary Radiological Dose Assessment of the interior and exterior areas. The results of this assessment are reported in a February 20, 1997 report (Texas Instruments, Incorporated - SNM License Termination, Radiological Dose Assessment). The assessment considered both a current exposure scenario and a future exposure scenario for members of the public. In each case, a maximum population group is considered.

The current exposure scenario was intrusion of a Texas Instruments' maintenance worker into any of the five primary source areas to perform maintenance in a trench. This scenario considers multiple exposure pathways including direct radiation exposure, inhalation of resuspended dusts and ingestion of contaminated soils. For conservatism, the area of highest residual contamination was used as the source term. The maintenance worker intrusion scenario resulted in an annual total effective dose equivalent of 1.3 millirem. The dose calculation was performed using a series of hand calculations. The contractor considered using the RESRAD-BUILD computer code for the calculations, but determined that the program was not readily applicable to the scenario.

The future use scenario considered closure of the site, removal of the industrial buildings and construction of a residence. The computer code RESRAD (version 5.62) was used to model the exposure pathways and calculate the dose from the scenario. The area with the highest average residual activity was selected for the calculations. The annual total effective dose equivalent for the future use residential scenario is 7.3 millirem for the first year, with the projected dose declining in future years.

No safety concerns were identified.

9. <u>Exit Meeting</u>

The results of the inspection were discussed with the individuals identified in Section 1 of this report.

TABLE 1

GAMMA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SOIL SAMPLES

[Results in Units of pCi/g dry ± 1σ]

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
40S 130E 120195,VER-0092C	Building 11 West Lawn	1.33 ± 0.10	1.0 ± 0.6	0.38 ± 0.02
30S 130E 120195, VER-0077C	Building 11 West Lawn	1.45 ± 0.09	1.0 ± 0.6	1.13 ± 0.03
20S '0E 112995, VER-0103	Stockade Area	7.4 ± 0.3	9.1 ± 0.9	1.05 ± 0.04
0110-06-6C-SS-01-00 TI 287	Building 10, Area 6	2.0 ± 0.3	4.4 ± 1.0	0.43 ± 0.04
0110-06-SC-SS-02-06-00 TI-278	Building 10, Area 6	4.88 ± 0.12	5.0 ± 0.8	0.39 ± 0.02
1214-12-6D-BSS(substation) TI-359 [1]	Building 10, Area 12	101.8 ± 0.7	111 ± 2	3.21 ± 0.06
01222-13-2C-SS-01-06-00 TI-359	Building 4, Area 13	0.4 ± 0.3	< 2	< 0.1
0110-06-5C-SS-03-06-00 TI-279	Building 10, Area 6	5.99 ± 0.11	6.7 ± 0.6	0.58 ± 0.03
0110-06-6(?)-SS-01-06-00 TI-289	Building 10, Area 6	<0.5	1.2 ± 0.7	0.04 ± 0.02
1026-08-6B-SS-02-06-00 TI-06?	Stockade Area	0.67 ± 0.09	1.3 ± 0.8	0.12 ± 0.02
120N21OE-09089S-VER-0022C	Adjacent to Building 12, Loading Dock	3.0 ± 0.2	2.5 ± 0.7	0.13 ± 0.03
60S 70E-10209S-VER-0041-C	Stockade Area	11.55 ± 0.11	11.3 ± 0.8	0.29 ± 0.02
100N 150E-092695-VER-0015-Ca	Building 11, East Lawn	2.1 ± 0.3	3.6 ± 0.9	0.08 ± 0.03
2050-112195-VER-0076-C	Stockade Area, near metals p	2.16 ± 0.08	?.3 ± 0.6	0.73 ± 0.02
200N 150E-073195-VER-0001-C	Building 12, Northwest Lawn	10.7 ± 0.4	12.1 ± 0.8	0.49 ± 0.03
110N 270E-082845-VER-0019-C	Building 12, South Lawn	1.54 ± 0.11	1.3 ± 0.7	0.10 ± 0.02
60S 40E-112895-VER-0061-C	Stockade Area	4.3 ± 0.3	5.7 0.8	0.25 ± 0.03
40S 140E 120195-VER-0093-C	Building 11, Lawn	1.45 ± 0.14	2.0 ± 1.0	0.48 ± 0.03
30S 40E 111495-VER-0064-C	Stockade Area	1.1 ± 0.3	2.3 ± 0.6	0.14 ± 0.03
110N 220E-091295-VER-0027-C	Adjacent to Building 12 Loading Dock	5.55 ± 0.09	5.2 ± 0.7	0.26 ± 0.02
30S 90E 1200195-VER-0052	Stockade Area	17.61 ± 0.13	18.7 ± 0.8	0.64 ± 0.03
40S 130E-120492 VER-0092-C13	Building 11, West Lawn	1.0 ± 0.3	1.4 ± 0.7	0.16 ± 0.03
20S 90E-120295-VER-0053-C	Stockade Area	13.60 ± 0.12	13.7 ± 0.9	0.58 ± 0.03
FGS 20S X90W TI-B5-FGC-0719-1676	Metals Recovery Area	2.54 ± 0.10	2.3 ± 0.6	0.16 ± 0.02
FSG 75SX0 1' TI-B5-FGC-0805-1744	Metals Recovery Area	6.76 ± 0.13	4.6 ± 0.7	0.45 ± 0.03

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
70N X110W 7-2-94 TI-B5-FGC-0702-1670	Metals Recovery Area	0.16 ± 0.13	1.3 ± 1.2	0.44 ± 0.04
68N X105W 7/1/94 TI-B5-FGC-0701-1659	Metals Recovery Area	< 1	< 4	0.22 ± 0.08
40S X35W 6" FGS TI-B5-FGC-0805-1764	Metals Recovery Area	1.04 ± 0.11	2.2 ± 0.6	0.06 ± 0.02
0119-14A-3F-SS-03-06-00 TI-330	Building 4, Area 14	0.5±0.3	<2	0.07±0.03
1130-12-6E-SS-01-06-00 TI-191	Building 10, Area 12	0.9 ± 0.3	1.8 ± 0.7	0.10 ± 0.03
1211-12-5F-BSS South Composite	Building 10, Area 12	0.8 ± 0.3	< 2	0.11 ± 0.03
0227-BLDG5-SS-02-06-00 TI-465	Building 5	1.67±0.12	1.9±0.7	0.36±0.03
0111-05-5B-SS-03-06-00 TI-293	Building 10, Area 5	2.61 ± 0.11	2.2 ± 0.7	0.33 ± 0.02
0111-05-6B-SS-04-06-00 TI-292	Building 10, Area 5	5.9±0.3	6.9±0.9	1.10±0.04
0104-12-5D-SS-03-06-00 TI-273	Building 10, Area 12	4.34 ± 0.08	4.2 ± 0.7	0.42 ± 0.03
0104-12-5E-SS-02-06-00 TI-272	Building 10, Area 12	17.63±0.13	18.4±0.9	0.54±0.02
0110-06-6C-SS-04-06-00 TI-288	Building 10, Area 6	5.88±0.09	5.9±0.7	0.61±0.02
1026-08-7B-SS-01-06-00	Building 10, Area 8	0.4±0.3	< 2	0.08±0.03
Building 12	Building 12 Lawn	1.21±0.11	1.0±0.7	0.06±0.02
Site Background	East of Building 12	0.72±0.08	1.1±0.8	0.09±0.02

(1) Pre-remediation sample

TABLE 2

COMPARISON OF ALPHA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SAMPLES

[Results in Units of pCi/g dry ± 2σ]

Sample Identification No.	Texas Inst. In-house Results (Total Uranium)	Licensee Contractor Results			NRC Contractor Results		
		U-234	U-235	U-238	U-234	U-235	U-238
20S 40E 112995, VER-0103	24 (1)	27.71 ± 6.52	1.12 ± 0.46	7.16 ± 1.54	29.1 ± 2.1	1.3 ± 0.2	8.6 ± 0.7
0110-06-6C-SS-01-00 TI 287	(2)	5.79 ± 1.22	0.29 ± 0.20	2.69 ± 0.69	8.3 ± 0.5	0.3 ± 0.06	2.1 ± 0.2
0110-06-SC-SS-02-06-00 TI-278	(2)	4.97 ± 1.25	0.33 ± 0.27	2.76 ± 0.83	10.4 ± 0.6	0.52 ± 0.07	5.1 ± 0.3
0110-06-5C-SS-03-06-00 TI-279	(2)	10.34 ± 2.11	0.34 ± 0.21	6.06 ± 1.33	16.2 ± 0.9	0.67 ± 0.08	6.9 ± 0.4
60S 70E-102095-VER-0041-C	9	5.2 ± 1.6	0.51 ± 0.28	12.2 ± 3.4	5.2 ± 0.3	0.42 ± 0.07	13.3 ± 0.8
100N 150E-092695-VER-0015-Ca	26	2.5 ± 0.89	0.07 ± 0.10	2.10 ± 0.76	2.8 ± 0.2	0.14 ± 0.04	2.3 ± 0.2
20S0-112195-VER-0076-C	21	8.7 ± 0.33	0.40 ± 0.22	8.5 ± 0.32	14.3 ± 0.8	0.56 ± 0.08	1.6 ± 0.1
FSG [illegible] SX0 1' TI-B5-FGC-0805-1744	30	(3)	(3)	(3)	16.7 ± 1.0	0.77 ± 0.09	8.1 ± 0.5
70[illegible] .0W 7-2-94 TI-B5-FGC-0702-1670	10	(3)	(3)	(3)	11.0 ± 0.7	0.42 ± 0.07	0.33 ± 0.06

(1) Uncertainty for In-house result not calculated
(2) Only alpha spectrometry analysis performed on these samples by the licensee
(3) Alpha spectrometry analysis not performed on these samples by the licensee contractor

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No. 070-00033/97-001

Docket No. 070-00033

License No. SNM-23

Licensee: Texas Instruments, Inc.
34 Forest Avenue
Attleboro, Massachusetts 02703

Inspection At: Texas Instruments, Inc.
Attleboro, Massachusetts

Inspection Conducted: February 3-6, 1997

Inspectors: ______________________ March 20, 1997
Anthony Dimitriadis — date
Health Physicist

Mark C Roberts ______________________ March 20, 1997
Mark C. Roberts, CHP — date
Senior Health Physicist

Approved By: ______________________ 3-20-97
Ronald R. Bellamy, Ph. D., Chief — date
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

Inspection Summary: Announced, confirmatory survey at the licensee's Attleboro, Massachusetts facility (Inspection Report No. 070-00033/97-001)

Areas Inspected: Organization and scope of remediation project, confirmatory measurements in interior areas, confirmatory measurements in exterior areas, results of sample analysis, review of radiological survey and remediation documents.

Results: Radiological measurements did not identify any residual levels in excess of the criteria for release for unrestricted use. Sample results from 40 soil samples analyzed in the NRC regional laboratory confirmed the licensee's results. A small amount of contaminated soil or contamination on below-ground concrete surfaces was left in place in inaccessible areas that could not be further remediated because of their proximity to vital structures or utilities. Measurements in each of these areas were not different than ambient background measurements. Based on volume averaging, the inspectors determined that the average total uranium concentration in each of these areas is less than 30 picocuries per gram.

9704010569 970320

DETAILS

1. Individuals Contacted

* Michael Elliott, Environmental Manager, Texas Instruments, Inc. (TI)
* Francis Veale, Environmental Safety and Health Department Manager, TI
* James Armstrong, Operational Excellence Manager, TI
* Steve Shafer, Health Physicist (Exterior Remediation Project Manager), Roy F. Weston, Inc. (Weston)

Michael Madonia, Health Physicist (Interior Remediation Project Manager), Weston (via telephone on February 5, 1997)

* Thomas O'Connell, Health Physicist, Commonwealth of Massachusetts

* Denotes those present at exit meeting

2. Background

The TI facility is located in Attleboro, Massachusetts, approximately 16 kilometers (10 Miles) northeast of Providence, Rhode Island and 48 kilometers (30 miles) southwest of Boston. The site currently comprises eighteen buildings owned by TI on approximately 40 hectares (100 acres). Operations with radioactive material began at the site in 1952 when Metals and Controls, Inc. began to fabricate enriched uranium foils. Metals and Controls, Inc., merged with TI in 1959 and eventually was operated as a corporate division of TI. From 1952 through 1965, Metals and Controls (and later TI), under a variety of government contracts, fabricated enriched uranium fuel elements for the U.S. Naval Reactors Program, U.S. Air Force, other U.S. Government-funded research, and a few commercial customers. From 1965 through 1981, TI fabricated fuel for the High Flux Isotope Reactor at Oak Ridge National Laboratory and other government-owned research reactors. Depleted uranium and processed natural uranium were also used at the facility in research and development of the production methodologies. The facility remains operational in a variety of metallurgical production activities; however, radioactive material is no longer used in the company's manufacturing operations.

Operations with radioactive materials were initially conducted in portions of what is now Building 4, with very limited operations conducted in Building 3. In 1956, Metals and Controls constructed Building 10 on the site to house all work with radioactive materials. By 1957, all manufacturing operations were moved to Building 10. Waste handling, processing of scrap metal and residues, and treatment of waste acids and water were conducted in Building 5 and outside Building 5 in areas known as the Metals Recovery Area and the Stockade. A waste evaporator and an incinerator were operated in Building 5/Metals Recovery Area. Scrap and waste generated in the manufacturing processes were returned to the U. S. Government; however, some materials contaminated with low levels of radioactivity were disposed in a burial site adjacent to Building 11.
Following cessation of operations with radioactive materials in 1981, TI initiated remediation of uranium contamination in the buildings and surrounding exterior locations. Remediation and final surveys of contaminated portions of Buildings 4

and 10 were completed in 1985 and the NRC staff approved release of these buildings for unrestricted use. Residual radioactive contamination remained in the burial area east of Building 11 and west of the recently constructed Building 12. In 1990, the NRC listed the TI Attleboro, Massachusetts facility on the NRC Site Decommissioning Management Plan (SDMP) because of the presence of the residual contamination in the burial area. Region I staff approved a remediation plan for the burial area in 1992 and initial remediation was completed in December 1992. A confirmatory survey conducted by the Oak Ridge Institute for Science and Education (ORISE) in December 1992 identified some remaining contamination on the walls of the excavation. In July 1993, the licensee completed additional remediation activities. An ORISE confirmatory survey performed in December 1993 did not identify any remaining residual contamination in this burial area in excess of the current criteria for release for unrestricted use.

After completion of the remediation and survey of the burial area, TI identified soil contamination in three locations within the Metals Recovery Area. Remediation and sampling in this area during 1994 led to the determination that the three distinct contaminated areas were actually part of a single, larger contaminated area. Remediation of this area was completed in November 1994. After identification of the additional contamination in the Metals Recovery Area, Region I staff requested that TI perform a comprehensive survey of all potentially affected areas on the site. These comprehensive radiological surveys, performed in 1994 and 1995, and discussions with long-term employees, led to the identification of additional contaminated soil, primarily in the Stockade and Building 12 south lawn area. The contamination in the stockade area was likely due to the past handling and storage operations in the area. Contamination on the lawn of Building 12 was likely the result of intrusion into the burial area and the spread of contamination during final grading around the building. Residual contamination was identified in Buildings 4, 5, and 10, primarily where unclad uranium operations had been conducted. The contamination was primarily limited to cracks and joints in the concrete floor, areas around equipment installed in the concrete floor, and drain lines buried in or beneath the concrete floor. Remediation was performed in accordance with the 1992 plan for remediation of the burial area and a 1994 addendum.

Also, in approximately 1978, NRC confirmed the presence of radioactive contamination at the Shpack landfill in nearby Norton, Massachusetts The source of this contamination may have been the result of work performed at the TI Attleboro facility, but the company has not acknowledged that its facility was the source of the material in the landfill. Although some residual radioactive material was removed from the closed landfill, further remediation for both radiological and chemical contaminants may still be required. In 1980, the landfill was listed on the U.S. Department of Energy (DOE) Formerly Utilized Site Remedial Action Program (FUSRAP), which will manage any remediation of radioactive materials. In addition, TI and several other companies have entered into a consent order with the U.S. Environmental Protection Agency (EPA) regarding the landfill.

3. Organization and Scope of Remediation Project

The site remediation project was coordinated by the Environmental Manager. This individual reports to the Environmental Safety and Health Manager who reports to the Site Manager. The remediation of the Metals Recovery Area was handled as one sep ·ate project and the remediation of the remainder of the exterior areas and all of the interior areas was handled as a second separate project. CPS Environmental, Inc. provided contractor health physics technical support and directed the excavation and drilling contractors based on the results of the radiation surveys and sample analysis. CPS, Environmental also performed the radiological characterization of the site. Roy F. Weston, Inc. provided project management for the remainder of the exterior remediation and the interior remediation. Two Weston project managers provided direct supervision of the support services including health physics, construction, transportation, and analytical services.

No safety concerns were identified.

4. Instrumentation Used in Confirmatory Surveys

The inspectors used a series of portable radiation survey meters and laboratory equipment to make confirmatory measurements. Ambient gamma radiation levels were measured with Ludlum Micro-R meters (NRC # 033513 and NRC # 019634, calibrated on December 5, 1996 and March 14, 1996, respectively). Unless otherwise indicated, these measurements were made at a distance of one meter above the ground or from the surface that was measured. Ambient exterior gamma radiation in the vicinity of the site ranged from 8 - 12 μR/hour. Background measurements inside Building 10 in unaffected areas ranged from 10 - 15 μR/hour. The higher range of values was generally measured in locations with newer concrete. Direct measurements for radioactive contamination were made at near contact with floor and wall surfaces using Ludlum Model 43-68 100 cm^2 gas-flow proportional detectors (NRC # 054810 and NRC # 057023) with Ludlum Model 18 rate-meters (NRC # 054822 and NRC # 054825, both calibrated March 4, 1996). Floor surfaces were scanned with Ludlum Model 239-1F floor monitors (NRC # 054976 and NRC # 054975 equipped with Ludlum Model 2221 scaler/rate-meters (NRC # 054826 and NRC # 054828, both calibrated March 14, 1996). The inspectors determined the operating voltages and detector efficiencies prior to the inspection and confirmed the efficiency and measured the background, for each detector, daily prior to initiating confirmatory measurements. The inspectors also measured higher background counts with the gas proportional detectors on the newer concrete. A 2" x 2" sodium iodide detector (Ludlum Model 44-10), coupled to one of the Ludlum Model 18 rate-meters, was used to make gross gamma measurements.

Soil samples from interior and exterior remediated areas were selected from archived samples in storage. Two additional soil samples were obtained directly from areas where characterization measurements indicated that the total uranium

concentration did not exceed the NRC guidelines for release for unrestricted use. Each soil sample was prepared for analysis in the Region I radioanalytical laboratory by drying and then milling the dried sample. An aliquot of each sample was weighed and transferred into a Marinelli beaker for gamma counting. Gamma counting was performed using a high-purity germanium detector (HpGe) that can quantify specific gamma emission energies from the sample. Analysis of the gamma spectrum and identification of radioactive isotopes is performed with a commercial software program. Results of the analysis of the soil samples were reported in units of picocuries/gram (pCi/g) with an uncertainty of one standard deviation for each radionuclide reported.

5. Confirmatory Measurements in Interior Areas

5.1. Measurements in Building 4

Building 4 is the largest of the manufacturing buildings on the site. A small portion of the building was used for uranium milling prior to the construction of Building 10. Approximately 12,000 ft^2 of this 295,000 ft^2 building required remediation. Gamma exposure rate measurements in the remediated area and in the area adjacent to the remediated area ranged from 6 - 12 μR/hour. With the exception of one area, these values were not distinguishable from background measurements in the building. The exposure rate measured along a stone walkway adjacent to the remediated area was as high as 18 μR/hour. The source of these slightly elevated readings appeared to be the natural stone used in the walkway. Scanning and direct measurements were performed with the gas-proportional detectors over approximately 100 percent of the accessible floor area in the remediated area. A large portion of the area adjacent to the remediated area was also scanned with the same instrumentation. With the exception of the stone walkway, all results were less than approximately 2000 dpm/100 cm^2. The area of the walkway exhibited elevated surface measurements, but appeared to be caused by naturally-occurring radioactive material in the rock.

The inspectors also performed gamma exposure rate measurements directly above drain pipes buried in or beneath the floor. These pipes had either been remediated by pressure washing or characterization readings indicated that contamination levels met the NRC guidance for release. All measurements were not different than the background measurements.

No safety concerns were identified.

5.2. Measurements in Building 5

Building 5 is a small building adjacent to the Metals Recovery Area. Remediation in Building 5 consisted of removal of approximately one third of the concrete floor of the building and removing contaminated soil

beneath the floor. Gamma exposure rate measurements in Building 5 ranged from 12 - 16 μR/hour. All scanning and direct measurements on the floor and lower wall surfaces were not distinguishable from background. Areas that had been remediated and areas where characterization data indicated that the surface criteria for release for unrestricted use was met were both included in the survey of this building. Because this is a small building, the entire floor surface was subject to the scanning measurements.

No safety concerns were identified.

5.3. Measurements in Building 10

Building 10 was the primary location for work with both clad and unclad licensed materials. The principle area within the building where the unclad material was used was the northern end of the building. Licensed material use in the remainder of the building was limited to storage and transportation support for the finished products. Following the remediation of contamination in 1981 and 1982, the building was converted to a number of other manufacturing uses. The recent decommissioning activities required remediation of approximately 40,000 ft^2 of the 168,000 ft^2 building. Most of the remediation performed required the removal and replacement of portions of the concrete slab, excavation and disposal of contaminated soil, and pressure washing or removal of contaminated drain lines.

Gamma exposure rates measured throughout the building ranged from 6 - 16 μR/hour. The higher values were generally measured in areas where there was newer concrete. The inspectors made scanning measurements throughout the remediated area and in the areas bordering the remediated area with the floor monitor. All areas were well below the release criterion of 5000 dpm/100 cm^2. The inspectors also performed gamma exposure rate measurements above the concrete slab where drain pipes are buried in the floor. The pipes had either been cleaned or characterization measurements indicated that remediation was not required. The gamma exposure rate measurements in these areas were not different than those measured throughout the remainder of the building.

The licensee left residual contamination in place in eight inaccessible locations within the building. These areas are under or adjacent to vital structures or heavy equipment and consist of either contaminated soil or contamination on concrete surfaces. The depth of these locations ranges from one to 2.5 meters beneath the floor surface. Direct gamma measurements with the 2" x 2" NaI detector at the soil surface and exposure rate measurements with the Micro R-meter in each of these areas were also indistinguishable from background measurements.

Because Building 10 required the most significant remediation, the inspectors selected a number of archived, post-remediation samples for analysis in the NRC regional laboratory. The results of these analyses are discussed in section 7 of this inspection report.

No safety concerns were identified.

6. Confirmatory Measurements in Exterior Areas

The inspectors reviewed the characterization and post-remediation radiological survey data for the exterior areas of the TI site. The affected exterior area of the site was divided into approximately 300 grid cells, 10 meters x 10 meters. A total of 93 of the grid cells required remediation by removal of uranium contaminated soil in excess of the NRC criteria for release for unrestricted use. The inspectors made measurements with the 2" x 2" NaI gamma detector and the micro-R meter throughout the remediated area and in areas where the characterization data indicated that no remediation was required. All readings were not different than the background measurements on the site.

In thirteen of the remediated grid cells, at least one post-remediation sample from the grid cell exceeds the NRC unrestricted use criterion of 30 pCi/g total uranium. In all cases, the residual contamination is inaccessible due to the presence of critical utilities or structures that prevented complete removal of contaminated soil. This residual contamination is located from one to three meters below the surface of the soil. The inspectors made measurements with the 2" x 2" NaI gamma detector and the micro-R meter in each of these grid cells. Measured exposure rates ranged from 10 to 17 μR/hour. The highest reading was measured in the vicinity of a large sub-surface concrete structure which appeared to have contributed to the exposure rate. All other readings were not significantly different than local background levels.

No safety concerns were identified.

7. Results of Sample Analyses

As discussed in section 4 of this report, selected soil samples, primarily post-remediation samples, were analyzed by gamma spectrometry in the Region I analytical laboratory. Concentrations of uranium-235 and U-238 (reported as the concentrations of the thorium-234 and protactinium-234m decay progeny) for the forty soil samples are presented in Table 1. Because the gamma spectrometry analysis can not be used to quantify the uranium-234 concentration in a sample, some of the soil samples were submitted to ORISE, the NRC's contractor laboratory, for alpha spectrometry analysis. The alpha spectrometry analysis provided a quantitative measure of the U-235 and U-238 concentrations, as well as, the U-234 concentration. Results of the nine alpha spectrometry analyses are presented in Table 2. Licensee contractor data for these samples is also presented in Table 2.

The results of the gamma spectrometry analyses confirm that the facility meets the criteria for release for unrestricted use. The average total uranium concentration of the thirty-nine post remediation samples is approximately 11 pCi/g. The inspectors estimated the U-234 concentrations using ratios of U-238 to U-235 for each sample. One pre-remediation sample indicated a total uranium concentration of approximately 180 pCi/g. This value was in good agreement with the licensee contractor value of approximately 200 pCi/g. The area was later remediated to levels less than 30 pCi/g. Only two samples indicated estimated total uranium concentrations above 30 pCi/g. One sample from the Metals Recovery Area was approximately 31 pCi/g and appeared to be depleted uranium (the NRC guideline for depleted uranium is 35 pCi/g). A sample from the stockade area indicated an estimated concentration of 38 pCi/g. This value was in good agreement with the licensee's contractor values of 36, 15 and 45 pCi/g for this location. Although this value exceeded 30 pCi/g, volume averaging indicates that the total uranium concentration in this area meets the 30 pCi/g guideline.

The alpha spectrometry results in Table 2 show very good agreement with data from the licensee's contractors. Except for one sample from the Metals Recovery Area, the data also show very good agreement with the gamma spectrometry data. The disagreement in the sample data from the Metals Recovery Area was likely caused by a non-homogenous sample, because neither the U-235 nor the U-238 results are in agreement, and the alpha spectrometry analysis use a very small sample compared to the gamma spectrometry analysis. One sample from the Stockade Area slightly exceeded 30 pCi/g; however, this area also meets the NRC criteria based upon volume averaging for the grid cell.

No safety concerns were identified.

8. Review of Radiological Survey and Remediation Documents

8.1 Surveys of Open Land Areas

Because of the discovery of soil contamination in the burial area between Buildings 11 and 12 and the subsequent identification of soil contamination in the Metals Recovery Area adjacent to Building 5, TI conducted a comprehensive survey of exterior areas of the site. This systematic characterization survey of the affected and unaffected exterior areas of the site was conducted from July through September 1994 and was documented in a May 1995 report (Radiological Surveys of Open Land Areas, Texas Instruments Incorporated, Attleboro, Massachusetts). The survey included a 100 percent walkover survey of both the affected and unaffected areas of the site using a 2" x 2" NaI detector and rate-meter. The surveys were conducted by CPS, a contractor for TI. Undeveloped portions of the site were not surveyed.

Systematic surface and sub-surface soil samples were taken by a split spoon sampling apparatus and drill rig. Sampling was conducted at 1600

locations resulting in the collection of 5865 surface and sub-surface soil samples. Sample locations in affected areas were defined on a 10 meter x 10 meter (100 m^2) grid plan to ensure complete coverage of the affected area. Sampling in the Stockade Area was complicated by the presence of numerous underground electrical, communication, and water utilities and concrete supports for overhead structures. Designated sample points within some of the grid cells were moved short distances to avoid these obstacles. Unaffected areas were not sampled on a defined grid; however, thirty random sub-surface samples were collected in the unaffected areas. Samples were evaluated by the gross alpha soil analysis technique to identify total uranium concentrations. The soil sampling in the affected area identified eighty-five 100 $meter^2$ grid cells where soil contamination exceeded NRC guidelines for release for unrestricted use. One additional contaminated area was found in the unaffected area survey. This area, which bordered the Stockade Area, was remediated as part of the exterior remediation project in the Stockade Area.

Based on a review of the data in the characterization report, knowledge of the physical layout of the site obtained in previous inspections, and a prior review of the gross alpha counting technique (including the analysis of samples split with the NRC), the site was adequately characterized to identify locations where licensed material was used or may have been inadvertently disposed. TI's contractors and environmental staff interviewed a number of long-time employees to assist in determining the areas that were defined as affected.

No safety concerns were identified.

8.2 <u>Remediation of the Metals Recovery Area</u>

Radiological surveys in late 1993 and early 1994 identified soil contamination in the Metals Recovery Area. This area was formerly a waste handling area where an incinerator and a liquid waste evaporator were operated. Three initial areas were identified in this area and the contaminated soil volume was estimated to be approximately 425 m^3 (15,000 ft^3). The remediation activities conducted in this area led eventually to the disposal of 3300 m^3 (115,000 ft^3) of contaminated soil. Contamination was primarily limited to the top 15 cm of soil; however, excavation of contaminated soil down to approximately 2 meters was required in the area immediately adjacent to Building 5. The highest concentration of uranium identified in characterization and remediation samples was 17,000 pCi/g. Remediation activities were conducted from April 1994 through November 1994. A report summarizing the results of the remediation of the Metals Recovery Area was transmitted to the NRC in October 1996 (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of the Metals Recovery Area, Final Report).

The results from the analysis of systematic surface and sub-surface soil samples from the excavated area and the perimeter of the excavated area; and exposure rate measurements indicate that the criterion for residual uranium concentration in soil (30 pCi/g) and the exposure rate criterion were both met. In one 9 meter x 9 meter grid cell, contaminated soil averaging 49 pCi/g total uranium was left in place around an electrical duct bank. Using a volumetric averaging method, the inspectors determined that this area was below the 30 pCi/g total uranium criterion when averaged over a one-meter thick vertical plain. Rain water that collected in the excavation was confirmed to be well below effluent criteria and was released. Contaminated soil was disposed at the Envirocare facility in Utah.

No safety concerns were identified.

8.3 Remediation of Exterior Areas Adjacent to Buildings 11 & 12

TI's contractor, Weston, coordinated the remediation of the exterior areas adjacent to Buildings 11 and 12 that were identified in the report on the Survey of the Open Land Areas. The burial area between Buildings 11 and 12 and the Metals Recovery Area were not included in this remediation project because they had been previously remediated by CPS and the results provided to Region I. Characterization data generated by CPS was used to identify the initial 77, 10 meter x 10 meter grid cells, requiring remediation. An additional 16 cells, adjacent to remediated cells, were eventually included in the remediation. The depth of the contaminated material ranged from the surface to approximately three meters (ten feet). Remediation activities on these exterior areas were conducted from June 1995 through December 1995. The results of the remediation activities were documented in an August 1996 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of Exterior Areas Adjacent to Buildings 11 and 12, Final Report).

Remediation of contaminated soil in grid cells was accomplished by removing soil in approximately 30-centimeter (one-foot) sections within the grid cell. In areas where the surface soil was less than the criteria for release for unrestricted use, the soil was reserved for backfilling excavated areas where contaminated soil was removed. Contaminated soil was excavated and segregated for eventual disposal. Excavation continued until field measurements indicated that the unrestricted guidelines had been met. Thirteen check samples were then analyzed using a gross alpha screening technique. If the results of those analyses were acceptable, five verification samples (one from each quadrant of the cell and one from the center of the cell) were collected and analyzed and reported as the final verification sample. A composite of these samples was then sent to an off-site vendor for alpha spectrometry analysis.

Contaminated soil in excess of the NRC guidelines for release for unrestricted use was left in place in a few inaccessible locations. These areas are beneath vital structures or utilities and can not be further remediated without adversely affecting the structures. In all but three areas, the average total uranium soil concentration on the surface of the excavation met the averaging criteria for unrestricted use. In the other three locations, using a volumetric averaging method, the inspectors determined that these areas also met the 30 pCi/g release criteria.

No safety concerns were identified.

8.4 Surveys of Interior Areas in Buildings 4, 5, and 10

TI's contractor, Weston, also coordinated the remediation of the contaminated interior portions of Buildings 4, 5, and 10. Remediation activities on these interior areas were conducted from June 1995 through September 1996. The results of the remediation activities are documented in an October 1996 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of Building Interiors, Buildings 4, 5, and 10).

The contaminated portions of the buildings were divided into eighteen (decontamination) areas based upon physical barriers and historical operations. The decontamination areas were further divided into 100 m^2 grids. A contaminated portion of the roof was similarly divided. Remediation activities primarily included scabbling contaminated concrete floors and removing portions of the concrete slab to excavate contaminated soil and remove contaminated drain lines. The total volume of waste disposed from the interior remediation project was 980 m^3 (34,600 ft^3). Final remediation soil samples were analyzed by an off-site laboratory for total uranium or isotopic uranium. Surface contamination measurements were performed with properly calibrated detectors with sufficient sensitivity to meet the NRC guidelines for surface contamination measurements.

Contaminated soil or surface contamination in excess of the NRC guidelines for release for unrestricted use was left in place in a few inaccessible locations. These areas are beneath structural column footings or under vital machinery and can not be further remediated without adversely affecting the building structure or some of the machinery in the building. In these locations, using a volumetric averaging method, the inspectors determined that these areas meet the 30 pCi/g release criteria. All other areas were also sufficiently remediated to meet the NRC criteria for release for unrestricted use.

Based on their review of this document, the inspectors requested additional information concerning the remediation activities for pipes left in

place and the evaluation of residual contamination. The inspector also requested that the licensee perform a dose evaluation of the residual contamination in the remediated drain lines. Based on the review of three documents prepared by Weston (Texas Instruments Incorporated Attleboro Facility - Building Interiors Remediation, Drainage System Characterization, January 1996; Drainage System Unrestricted Release Information - Supplemental Analyses, February 11, 1997; and SNM License Termination Hypothetical Radiological Dose and Exposure Rate Assessment, Priority 2 Drain Lines), the inspectors concluded that the residual activity in the priority 2 drain lines (drain lines that were cleaned by pressure washing) met the NRC guidelines for release for unrestricted use.

No safety concerns were identified.

8.5 <u>Surveys of Building Interiors, Overhead Structures, and Upper Walls</u>

As part of the characterization of the affected buildings, surveys of the building interiors, overhead structures, and upper walls were performed. Although data from these surveys were recorded, the surveys were not initially documented in a report. The results of the surveys were used to guide the remediation of contaminated portions of Buildings 4 and 10. The surveys were subsequently documented in a February 1997 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Supplemental Surveys of Building Interiors, Overhead Structures and Upper Walls). Measurements included both direct measurements to evaluate non-removable contamination and smears to evaluate removable contamination. A review of this document confirmed that the upper portions of Buildings 3, 4, 10, and 11 meet the NRC guidelines for release for unrestricted use.

No safety concerns were identified.

8.6 <u>Groundwater Radiological Monitoring Data Report</u>

The chemical forms of uranium used at the site were primarily uranium oxides, uranium metal, and uranium metal alloys. These forms of uranium are generally not soluble. Groundwater monitoring data for the Texas Instrument site is summarized in a letter report (February 24, 1997 letter and four attachments to M. Roberts, NRC Region I from M. Elliott, Texas Instruments). Groundwater samples were collected from a series of representative monitoring wells on the site during January-March 1993, August-September 1995, and December-February 1996-1997. Gross alpha concentrations for the most recent samples ranged from less than detectable to 11 pCi/liter and gross beta concentrations ranged from less than detectable to 25 pCi/liter. These values are below the EPA groundwater screening criteria for gross alpha and gross beta activity of 15 and 50 pCi/liter, respectively. Results from the earlier samples were

less than the most recent samples. A specific uranium analysis was performed on selected samples in the recent sampling period. Measured total uranium concentrations ranged from 0.22 to 0.39 pCi/liter. These concentrations are below the EPA proposed primary drinking water limit of 30 pCi/liter for uranium, and are acceptable for releasing the site for unrestricted use.

No safety concerns were identified.

8.7 Dose Assessment

As discussed in sections 8.4 and 8.5, residual contamination was left in place in areas that were inaccessible because the remaining material was beneath critical utilities and structures. In order to conclude that there is no significant dose impact in leaving this material in place, and in order to satisfy the Commonwealth of Massachusetts requirement that the residual dose impact be less than 10 millirem per year, TI's contractor (Weston) performed a supplementary Radiological Dose Assessment of the interior and exterior areas. The results of this assessment are reported in a February 20, 1997 report (Texas Instruments, Incorporated - SNM License Termination, Radiological Dose Assessment). The assessment considered both a current exposure scenario and a future exposure scenario for members of the public. In each case, a maximum population group is considered.

The current exposure scenario was intrusion of a Texas Instruments' maintenance worker into any of the five primary source areas to perform maintenance in a trench. This scenario considers multiple exposure pathways including direct radiation exposure, inhalation of resuspended dusts and ingestion of contaminated soils. For conservatism, the area of highest residual contamination was used as the source term. The maintenance worker intrusion scenario resulted in an annual total effective dose equivalent of 1.3 millirem. The dose calculation was performed using a series of hand calculations. The contractor considered using the RESRAD-BUILD computer code for the calculations, but determined that the program was not readily applicable to the scenario.

The future use scenario considered closure of the site, removal of the industrial buildings and construction of a residence. The computer code RESRAD (version 5.62) was used to model the exposure pathways and calculate the dose from the scenario. The area with the highest average residual activity was selected for the calculations. The annual total effective dose equivalent for the future use residential scenario is 7.3 millirem for the first year, with the projected dose declining in future years.

No safety concerns were identified.

9. Exit Meeting

The results of the inspection were discussed with the individuals identified in Section 1 of this report.

TABLE 1

GAMMA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SOIL SAMPLES

[Results in Units of pCi/g dry ± 1σ]

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
40S 130E 120195,VER-0092C	Building 11 West Lawn	1.33 ± 0.10	1.0 ± 0.6	0.38 ± 0.02
30S 130E 120195, VER-0077C	Building 11 West Lawn	1.45 ± 0.09	1.0 ± 0.6	1.13 ± 0.03
20S '0E 112995, VER-0103	Stockade Area	7.4 ± 0.3	9.1 ± 0.9	1.05 ± 0.04
0110-06-6C-SS-01-00 TI ?87	Building 10, Area 6	2.0 ± 0.3	4.4 ± 1.0	0.43 ± 0.04
0110-06-SC-SS-02-06-00 TI-278	Building 10, Area 6	4.88 ± 0.12	5.0 ± 0.8	0.39 ± 0.02
1214-12-6D-BSS(substation) TI-359 (1)	Building 10, Area 12	101.8 ± 0.7	111 ± 2	3.21 ± 0.06
01222-13-2C-SS-01-06-00 TI-359	Building 4, Area 13	0.4 ± 0.3	< 2	< 0.1
0110-06-5C-SS-03-06-00 TI-279	Building 10, Area 6	5.99 ± 0.11	6.7 ± 0.6	0.58 ± 0.03
0110-06-6(·SS-01-06-00 TI-289	Building 10, Area 6	<0.5	1.2 ± 0.7	0.04 ± 0.02
1026-08-6B-SS-02-06-00 TI-06?	Stockade Area	0.67 ± 0.09	1.3 ± 0.8	0.12 ± 0.02
120N21OE-09089S-VER-0022C	Adjacent to Building 12, Loading Dock	3.0 ± 0.2	2.5 ± 0.7	0.13 ± 0.03
60S 70E-10209S-VER-0041-C	Stockade Area	11.55 ± 0.11	11.3 ± 0.8	0.29 ± 0.02
100N 150E-092695-VER-0015-Ca	Building 11, East Lawn	2.1 ± 0.3	3.6 ± 0.9	0.08 ± 0.03
2050-112195-VER-0076-C	Stockade Area, near metals p	2.16 ± 0.08	?.3 ± 0.6	0.73 ± 0.02
200N 150E-073195-VER-0001-C	Building 12, Northwest Lawn	10.7 ± 0.4	12.1 ± 0.8	0.49 ± 0.03
110N 270E-082845-VER-0019-C	Building 12, South Lawn	1.54 ± 0.11	1.3 ± 0.7	0.10 ± 0.02
60S 40E-112895-VER-0061-C	Stockade Area	4.3 ± 0.3	5.7 0.8	0.25 ± 0.03
40S 140E 120195-VER-0093-C	Building 11, Lawn	1.45 ± 0.14	2.0 ± 1.0	0.48 ± 0.03
30S 40E 111495-VER-0064-C	Stockade Area	1.1 ± 0.3	2.3 ± 0.6	0.14 ± 0.03
110N 220E-091295-VER-0027-C	Adjacent to Building 12 Loading Dock	5.55 ± 0.09	5.2 ± 0.7	0.26 ± 0.02
30S 90E 1200195-VER-0052	Stockade Area	17.61 ± 0.13	18.7 ± 0.8	0.64 ± 0.03
40S 130E-120492 VER-0092-C13	Building 11, West Lawn	1.0 ± 0.3	1.4 ± 0.7	0.16 ± 0.03
20S 90E-120295-VER-0053-C	Stockade Area	13.60 ± 0.12	13.7 ± 0.9	0.58 ± 0.03
FGS 20S X90W TI-B5-FGC-0719-1676	Metals Recovery Area	2.54 ± 0.10	2.3 ± 0.6	0.16 ± 0.02
FSG 75SX0 1' TI-B5-FGC-0805-1744	Metals Recovery Area	6.76 ± 0.13	4.6 ± 0.7	0.45 ± 0.03

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
70N X110W 7-2-94 TI-B5-FGC-0702-1670	Metals Recovery Area	0.16 ± 0.13	1.3 ± 1.2	0.44 ± 0.04
68N X105W 7/1/94 TI-B5-FGC-0701-1659	Metals Recovery Area	< 1	< 4	0.22 ± 0.08
40S X35W 6" FGS TI-B5-FGC-0805-1764	Metals Recovery Area	1.04 ± 0.11	2.2 ± 0.6	0.06 ± 0.02
0119-14A-3F-SS-03-06-00 TI-330	Building 4, Area 14	0.5±0.3	<2	0.07±0.03
1130-12-6E-SS-01-06-00 TI-191	Building 10, Area 12	0.9 ± 0.3	1.8 ± 0.7	0.10 ± 0.03
1211-12-5F-BSS South Composite	Building 10, Area 12	0.8 ± 0.3	< 2	0.11 ± 0.03
0227-BLDG5-SS-02-06-00 TI-465	Building 5	1.67±0.12	1.9±0.7	0.36±0.03
0111-05-5B-SS-03-06-00 TI-293	Building 10, Area 5	2.61 ± 0.11	2.2 ± 0.7	0.33 ± 0.02
0111-05-6B-SS-04-06-00 TI-292	Building 10, Area 5	5.9±0.3	6.9±0.9	1.10±0.04
0104-12-5D-SS-03-06-00 TI-273	Building 10, Area 12	4.34 ± 0.08	4.2 ± 0.7	0.42 ± 0.03
0104-12-5E-SS-02-06-00 TI-272	Building 10, Area 12	17.63±0.13	18.4±0.9	0.54±0.02
0110-06-6C-SS-04-06-00 TI-288	Building 10, Area 6	5.88±0.09	5.9±0.7	0.61±0.02
1026-08-7B-SS-01-06-00	Building 10, Area 8	0.4±0.3	< 2	0.08±0.03
Building 12	Building 12 Lawn	1.21±0.11	1.0±0.7	0.06±0.02
Site Background	East of Building 12	0.72±0.08	1.1±0.8	0.09±0.02

(1) Pre-remediation sample

TABLE 2

COMPARISON OF ALPHA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SAMPLES

[Results in Units of pCi/g dry ± 2σ]

Sample Identification No.	Texas Inst. In-house Results (Total Uranium)	Licensee Contractor Results			NRC Contractor Results		
		U-234	U-235	U-238	U-234	U-235	U-238
20S 40E 112995, VER-0103	24 (1)	27.71 ± 6.52	1.12 ± 0.46	7.16 ± 1.54	29.1 ± 2.1	1.3 ± 0.2	8.6 ± 0.7
0110-06-6C-SS-01-00 TI 287	(2)	5.79 ± 1.22	0.29 ± 0.20	2.69 ± 0.69	8.3 ± 0.5	0.3 ± 0.06	2.1 ± 0.2
0110-06-SC-SS-02-06-00 TI-278	(2)	4.97 ± 1.25	0.33 ± 0.27	2.76 ± 0.83	10.4 ± 0.6	0.52 ± 0.07	5.1 ± 0.3
0110-06-5C-SS-03-06-00 TI-279	(2)	10.34 ± 2.11	0.34 ± 0.21	6.06 ± 1.33	16.2 ± 0.9	0.67 ± 0.08	6.9 ± 0.4
60S 70E-102095-VER-0041-C	9	5.2 ± 1.6	0.51 ± 0.28	12.2 ± 3.4	5.2 ± 0.3	0.42 ± 0.07	13.3 ± 0.8
100N 150E-092695-VER-0015-Ca	26	2.5 ± 0.89	0.07 ± 0.10	2.10 ± 0.76	2.8 ± 0.2	0.14 ± 0.04	2.3 ± 0.2
20S0-112195-VER-0076-C	21	8.7 ± 0.33	0.40 ± 0.22	8.5 ± 0.32	14.3 ± 0.8	0.56 ± 0.08	1.6 ± 0.1
FSG [illegible] SX0 1' TI-B5-FGC-0805-1744	30	(3)	(3)	(3)	16.7 ± 1.0	0.77 ± 0.09	8.1 ± 0.5
70[illegible] 0W 7-2-94 TI-B5-FGC-0702-1670	10	(3)	(3)	(3)	11.0 ± 0.7	0.42 ± 0.07	0.33 ± 0.06

(1) Uncertainty for In-house result not calculated
(2) Only alpha spectrometry analysis performed on these samples by the licensee
(3) Alpha spectrometry analysis not performed on these samples by the licensee contractor

April 7, 1997

MEMORANDUM FOR: David L. Meyer, Chief
Rules Review and Directives Branch
Division of Freedom of Information
and Publications Services, ADM

FROM: John W. N. Hickey, Chief [ORIGINAL SIGNED BY:]
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management, NMSS

SUBJECT: FEDERAL REGISTER NOTICE ON REMOVAL OF TEXAS INSTRUMENTS, INC. ATTLEBORO, MA. SITE FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND LICENSE TERMINATION

Attached please find one signed original of the subject Federal Register notice for your transmittal to the Office of the Federal Register for publication. Also, attached are five copies of the signed Notice and a 3.5" diskette with the notice in WordPerfect.

Docket No. 70-33
License No. SNM-23

Attachments: As stated

Contact: James Shepherd, NMSS/DWM
415-6712

NRC FILE CENTER COPY

DISTRIBUTION: **Central File** LLDP r/f NMSS r/f PUBLIC PSobel

Path & File Name: s:\dwm\lldp\jcs\ti-frn.mem

OFC	LLDP	LLDP	LLDP	LLDP		
NAME	JShepherd/cv	TCJohnson	JHickey	JCopeland		
DATE	4/2/97	4/3/97	4/ /97	4/3/97		

OFFICIAL RECORD COPY

ACNW: YES X__ NO ___ Category: Proprietary ___ or CF Only ___
IG : YES ___ NO ___
LSS : YES ___ NO ___ Delete file after distribution: Yes ___ No ___

9705290209 970407
PDR ADOCK 07000033
C PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 7, 1997

MEMORANDUM FOR: David L. Meyer, Chief
Rules Review and Directives Branch
Division of Freedom of Information
and Publications Services, ADM

FROM: John W. N. Hickey, Chief
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management, NMSS

SUBJECT: FEDERAL REGISTER NOTICE ON REMOVAL OF TEXAS INSTRUMENTS, INC. ATTLEBORO, MA. SITE FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND LICENSE TERMINATION

Attached please find one signed original of the subject Federal Register notice for your transmittal to the Office of the Federal Register for publication. Also, attached are five copies of the signed Notice and a 3.5" diskette with the notice in WordPerfect.

Docket No. 70-33
License No. SNM-23

Attachments: As stated

Contact: James Shepherd, NMSS/DWM
415-6712

NUCLEAR REGULATORY COMMISSION

AGENCY: Nuclear Regulatory Commission

ACTION: Notice of Removal of the Texas Instruments Incorporated, Attleboro, Massachusetts Site from the NRC Site Decommissioning Management Plan and Termination of the NRC License for the Facility

---

SUMMARY:

This notice is to inform the public that the U.S. Nuclear Regulatory Commission is removing the Texas Instruments, Incorporated, Attleboro, Massachusetts site from the NRC Site Decommissioning Management Plan (SDMP). NRC has determined that remediation of residual radioactive contamination, as a result of past operations with NRC licensed material in buildings and in exterior areas on the site, has successfully been completed and the facility meets the current NRC criteria for release for unrestricted use

FOR FURTHER INFORMATION CONTACT:

Mark Roberts, Division of Radiation Safety and Safeguards, Region I, 475 Allendale Road, King of Prussia, PA 19406, Telephone: (610) 337-5094.

SUPPLEMENTARY INFORMATION:

The Texas Instruments, Incorporated site in Attleboro, Massachusetts was identified in 1990 by NRC as a site where residual radioactive contamination was present, as a result of past operations. Radioactive contamination was identified by Texas Instruments in a former burial area on the site. In order to ensure that remediation of the burial area was accomplished in a timely manner, NRC added this site to its SDMP. Contamination in three of the site buildings, as well as additional exterior contamination, was subsequently identified. Texas Instruments has remediated residual contamination in all of these areas, performed radiological surveys throughout the entire site and site buildings, where radioactive materials may have been used, and requested,

9705290211 970407
PDR ADOCK 07000033
C PDR

by letter dated October 29, 1996, that NRC remove the Attleboro, Massachusetts site from the SDMP and terminate the license.

NRC staff has periodically inspected the site remediation activities, reviewed final radiological surveys performed by the licensee's contractors, and performed confirmatory measurements at the site. NRC staff has determined that the facility meets the requirements for release for unrestricted use and has removed the site from the SDMP and terminated the NRC license.

For further details with respect to this action, documents are available for inspection at NRC's Region I office located at 475 Allendale Road, King of Prussia, PA 19406. Persons desiring to review documents at the Region I office should call Ms. Cheryl Buracker at (610) 337-5093 several days in advance to assure that the documents will be readily available for review.

Dated at Rockville, Maryland this 2nd day of April 1997.

FOR THE NUCLEAR REGULATORY COMMISSION

John W. N. Hickey, Chief
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

NUCLEAR REGULATORY COMMISSION

AGENCY: Nuclear Regulatory Commission

ACTION: Notice of Removal of the Texas Instruments Incorporated, Attleboro, Massachusetts Site from the NRC Site Decommissioning Management Plan and Termination of the NRC License for the Facility

---

SUMMARY:

This notice is to inform the public that the U.S. Nuclear Regulatory Commission is removing the Texas Instruments, Incorporated, Attleboro, Massachusetts site from the NRC Site Decommissioning Management Plan (SDMP). NRC has determined that remediation of residual radioactive contamination, as a result of past operations with NRC licensed material in buildings and in exterior areas on the site, has successfully been completed and the facility meets the current NRC criteria for release for unrestricted use

FOR FURTHER INFORMATION CONTACT:

Mark Roberts, Division of Radiation Safety and Safeguards, Region I, 475 Allendale Road, King of Prussia, PA 19406, Telephone: (610) 337-5094.

SUPPLEMENTARY INFORMATION

The Texas Instruments, Incorporated site in Attleboro, Massachusetts was identified in 1990 by NRC as a site where residual radioactive contamination was present, as a result of past operations. Radioactive contamination was identified by Texas Instruments in a former burial area on the site. In order to ensure that remediation of the burial area was accomplished in a timely manner, NRC added this site to its SDMP. Contamination in three of the site buildings, as well as additional exterior contamination, was subsequently identified. Texas Instruments has remediated residual contamination in all of these areas, performed radiological surveys throughout the entire site and site buildings, where radioactive materials may have been used, and requested,

9705290211 970407
PDR ADOCK 07000033
C PDR

by letter dated October 29, 1996, that NRC remove the Attleboro, Massachusetts site from the SDMP and terminate the license

NRC staff has periodically inspected the site remediation activities, reviewed final radiological surveys performed by the licensee's contractors, and performed confirmatory measurements at the site. NRC staff has determined that the facility meets the requirements for release for unrestricted use and has removed the site from the SDMP and terminated the NRC license.

For further details with respect to this action, documents are available for inspection at NRC's Region I office located at 475 Allendale Road, King of Prussia PA 19406. Persons desiring to review documents at the Region I office should call Ms Cheryl Buracker at (610) 337 5093 several days in advance to assure that the documents will be readily available for review.

Dated at Rockville, Maryland this 2th day of April 1997.

FOR THE NUCLEAR REGULATORY COMMISSION

John W. N. Hickey, Chief
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

License Number
SNM-23
Docket or Reference Number
070-00033
Amendment No. 18

MATERIALS LICENSE
SUPPLEMENTARY SHEET

OFFICIAL RECORD COPY

Texas Instruments, Incorporated
34 Forest Street
Attleboro, Massachusetts 02703-0964

In accordance with your letter dated October 29, 1996, License Number SNM-23 is hereby terminated.

9709160168 970321
PDR ADOCK 07000033
B PDR

For the U.S. Nuclear Regulatory Commission

Date MAR 21 1997

By Original Signed By:
Ronald R. Bellamy

Nuclear Materials Safety Branch
Region I
King of Prussia, Pennsylvania 19406

NRC FORM 197C Part 1 (11-88)

U.S. NUCLEAR REGULATORY COMMISSION

TECHNICAL ASSIGNMENT CONTROL

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

TACS NUMBER *: U 0 0 7 5 0

X NEW ASSIGNMENT

NEW INFORMATION

SECTION I. REQUEST DATA

PREPARED BY (Name)	MAIL STOP	DATE PREPARED * MONTH	DAY	YEAR
Sheryl Villar / Mark Roberts	RI/DNMS	05	14	97

FACILITY NAME AND ASSIGNMENT TITLE * (Limit to 120 characters)

Texas Instruments, Inc. mc # 118945

DOCKET NUMBER *: 070-00033

PLANNED ACCOMPLISHMENT:

RECEIPT DATE: MONTH / DAY / YEAR

REQUESTING TARGET DATE: MONTH / DAY / YEAR

REQUEST CONTACT	REQUESTER'S INITIALS *
Mark Roberts	MYR

REQUESTING ORGANIZATION *: RI/DNMS (SDMP)

LICENSE REVIEW NO. *:

REVIEW BY REGION: X 1 | 2 | 3 | 4 | 5

ACCESSION NUMBER:

OR COPY OF INCOMING ATTACHED

SECTION II. SYSTEMS CONTROL DATA

FACILITY TYPE	CASE TYPE	FEE RECOVERABLE	AMENDMENT NUMBER	REVIEW DATE MONTH	DAY	YEAR	TAC COMPLETION DATE MONTH	DAY	YEAR	APPLICATION DATE * MONTH	DAY	YEAR
B	A	X YES / NO	18 (WITHDRAWN / CANCELLED)				03	21	97	11	05	93

TOPICAL REPORT REVIEWS

NAME VENDOR

REPORT DATE: MONTH / DAY / YEAR

REPORT IDENTIFICATION SYMBOL

ADDL INFO REQUEST DATE: MONTH / DAY / YEAR

P - PROPRIETARY VERSION

SUBMIT DATE: MONTH / DAY / YEAR

NP - NONPROPRIETARY VERSION

STATUS

ACCEPTED

NOT ACCEPTED

WITHDRAWN

DATE LETTER TO VENDOR: MONTH / DAY / YEAR

NONPROPRIETARY REPORT

REQUESTING REMARKS (Limit to 120 characters)

License Terminated.

SECTION III. REVIEW DATA

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE ESTIMATED MONTH	DAY	YEAR	ACTUAL MONTH	DAY	YEAR
Mark Roberts	MYR							
Tony Dimitriadis	ARD							

NRC FORM 197C Part 2
(11-[illegible])

U.S. NUCLEAR REGULATORY COMMISSION

TECHNICAL ASSIGNMENT CONTROL

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

TACS NUMBER *	FACILITY NAME AND ASSIGNMENT TITLE * *(Limit to 120 characters)*
☐ NEW ASSIGNMENT	
☐ NEW INFORMATION	

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE					
			ESTIMATED			ACTUAL		
			MONTH	DAY	YEAR	MONTH	DAY	YEAR

TACS NUMBER *	FACILITY NAME AND ASSIGNMENT TITLE * *(Limit to 120 characters)*
☐ NEW ASSIGNMENT	
☐ NEW INFORMATION	

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE					
			ESTIMATED			ACTUAL		
			MONTH	DAY	YEAR	MONTH	DAY	YEAR

TACS NUMBER *	FACILITY NAME AND ASSIGNMENT TITLE * *(Limit to 120 characters)*
☐ NEW ASSIGNMENT	
☐ NEW INFORMATION	

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE					
			ESTIMATED			ACTUAL		
			MONTH	DAY	YEAR	MONTH	DAY	YEAR

NRC FORM 197C Part 1
(11-82)

U.S. NUCLEAR REGULATORY COMMISSION

TECHNICAL ASSIGNMENT CONTROL
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

TACS NUMBER *: U 0 0 7 5 0

X NEW ASSIGNMENT
NEW INFORMATION

SECTION I. REQUEST DATA

PREPARED BY (Name): Sheryl Villar / Mark Roberts

MAIL STOP: RI/DNMS

DATE PREPARED *: MONTH 03 DAY 14 YEAR 97

FACILITY NAME AND ASSIGNMENT TITLE * (Limit to 120 characters): Texas Instruments, Inc. mc # 118945

DOCKET NUMBER *: 070-00033

PLANNED ACCOMPLISHMENT:

RECEIPT DATE: MONTH DAY YEAR

REQUEST CONTACT: Mark Roberts

REQUESTER'S INITIALS *: MYR

REQUESTING TARGET DATE: MONTH DAY YEAR

REQUESTING ORGANIZATION *: RI/DNMS (SDMP)

LICENSE REVIEW NO *:

REVIEW BY REGION: X 1 | 2 | 3 | 4 | 5

ACCESSION NUMBER:

OR COPY OF INCOMING ATTACHED

SECTION II. SYSTEMS CONTROL DATA

FACILITY TYPE	CASE TYPE	FEE RECOVERABLE	AMENDMENT NUMBER: 18	REVIEW DATE (MONTH / DAY / YEAR)	TAC COMPLETION DATE (MONTH / DAY / YEAR)	APPLICATION DATE * (MONTH / DAY / YEAR)
B	A	X YES / NO	WITHDRAWN / CANCELLED		03 / 21 / 97	11 / 05 / 93

TOPICAL REPORT REVIEWS

NAME - VENDOR:

REPORT DATE: MONTH DAY YEAR

REPORT IDENTIFICATION SYMBOL

ADDL. INFO. REQUEST DATE: MONTH DAY YEAR

P - PROPRIETARY VERSION

SUBMIT DATE: MONTH DAY YEAR

NP - NONPROPRIETARY VERSION

STATUS: ACCEPTED / NOT ACCEPTED / WITHDRAWN

DATE LETTER TO VENDOR: MONTH DAY YEAR

NONPROPRIETARY REPORT

REQUESTING REMARKS (Limit to 120 characters): License Terminated.

SECTION III. REVIEW DATA

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE ESTIMATED MONTH	ESTIMATED DAY	ESTIMATED YEAR	ACTUAL MONTH	ACTUAL DAY	ACTUAL YEAR
Mark Roberts	MYR							
Tony Dimitriadis	ARD							

NRC FORM 197C Part 2
(11-82)

U.S. NUCLEAR REGULATORY COMMISSION

TECHNICAL ASSIGNMENT CONTROL

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

TACS NUMBER *	FACILITY NAME AND ASSIGNMENT TITLE * *(Limit to 120 characters)*
NEW ASSIGNMENT	
NEW INFORMATION	

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE					
			ESTIMATED			ACTUAL		
			MONTH	DAY	YEAR	MONTH	DAY	YEAR

TACS NUMBER *	FACILITY NAME AND ASSIGNMENT TITLE * *(Limit to 120 characters)*
NEW ASSIGNMENT	
NEW INFORMATION	

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE					
			ESTIMATED			ACTUAL		
			MONTH	DAY	YEAR	MONTH	DAY	YEAR

TACS NUMBER *	FACILITY NAME AND ASSIGNMENT TITLE * *(Limit to 120 characters)*
NEW ASSIGNMENT	
NEW INFORMATION	

REVIEWER'S SURNAME	REVIEWER'S INITIALS *	ESTIMATED HOURS	COMPLETION DATE					
			ESTIMATED			ACTUAL		
			MONTH	DAY	YEAR	MONTH	DAY	YEAR

MAR 21 1997

Francis J. Veale, Jr.
Environmental Safety and Health Department Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703-0964

SUBJECT: REMOVAL OF THE TEXAS INSTRUMENTS, INC., ATTLEBORO, MASSACHUSETTS FACILITY FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND TERMINATION OF NRC LICENSE

Dear Mr. Veale:

I am responding to your letter dated October 29, 1996, requesting that NRC release the Texas Instruments, Inc., Attleboro, Massachusetts, site for unrestricted use, terminate the current NRC license, and remove the site from the Site Decommissioning Management Plan (SDMP). We have reviewed your reports from the radiological surveys and analysis of soil samples and conducted our own confirmatory radiological survey. We conclude that the facility has been remediated to meet the criteria for release for unrestricted use as discussed in the "Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites" (the Action Plan) (57 FR 13389-13392) and NRC's current criteria for residual contamination in soil.

In accordance with your request, NRC License No. SNM-23, issued to Texas Instruments, Inc., is hereby terminated, and we are removing your Attleboro, Massachusetts site from the SDMP list. Enclosed is Amendment 18 to NRC License No. SNM-23.

As noted in the Action Plan, this is the Commission's final action on the referenced license. NRC will not require any additional decommissioning in response to future NRC criteria or standards, unless additional contamination, or noncompliance with your July, 1992 Remediation Plan or the December 1994 Supplement to the Remediation Plan, is found, and there is a significant threat to public health and safety.

If you have any questions concerning our action, please contact Mark Roberts of my staff at (610) 337-5094 or me at (610) 337-5200. Thank you for your cooperation in this matter.

Sincerely,

Original Signed By:

Ronald R. Bellamy, Ph. D., Chief
Decommissioning & Laboratory Branch
Division of Nuclear Materials Safety

OFFICIAL RECORD COPY ML 10

MAR 2 1 1997

Francis J. Veale, Jr.
Environmental Safety and Health Department Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703-0964

SUBJECT: REMOVAL OF THE TEXAS INSTRUMENTS, INC., ATTLEBORO, MASSACHUSETTS FACILITY FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND TERMINATION OF NRC LICENSE

Dear Mr. Veale:

I am responding to your letter dated October 29, 1996, requesting that NRC release the Texas Instruments, Inc., Attleboro, Massachusetts, site for unrestricted use, terminate the current NRC license, and remove the site from the Site Decommissioning Management Plan (SDMP). We have reviewed your reports from the radiological surveys and analysis of soil samples and conducted our own confirmatory radiological survey. We conclude that the facility has been remediated to meet the criteria for release for unrestricted use as discussed in the "Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites" (the Action Plan) (57 FR 13389-13392) and NRC's current criteria for residual contamination in soil.

In accordance with your request, NRC License No. SNM-23, issued to Texas Instruments, Inc., is hereby terminated, and we are removing your Attleboro, Massachusetts site from the SDMP list. Enclosed is Amendment 18 to NRC License No. SNM-23.

As noted in the Action Plan, this is the Commission's final action on the referenced license. NRC will not require any additional decommissioning in response to future NRC criteria or standards, unless additional contamination, or noncompliance with your July, 1992 Remediation Plan or the December 1994 Supplement to the Remediation Plan, is found, and there is a significant threat to public health and safety.

If you have any questions concerning our action, please contact Mark Roberts of my staff at (610) 337-5094 or me at (610) 337-5200. Thank you for your cooperation in this matter.

Sincerely,

Original Signed By:

Ronald R. Bellamy, Ph. D., Chief
Decommissioning & Laboratory Branch
Division of Nuclear Materials Safety

OFFICIAL RECORD COPY ML 10

License No. SNM-23
Docket No. 070-00033
Mail Control No. 118945

Enclosure: Amendment 13 to NRC License No. SNM-23

cc:
Commonwealth of Massachusetts

David Lederer
Remediation Manager
U.S. Environmental Protection Agency, Region I
J. F. Kennedy Federal Building, HBO
Boston, Massachusetts 02203

James Wagoner
U.S. Department of Energy
Office of Restoration
12800 Middlebrook, Road
Germantown, Maryland 20874

James P. Mooney, Health Agent
City of Attleboro
77 Park Street
Attleboro, Massachusetts 02703

Michael Elliott
Environmental Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703-0964

Distribution:

PUBLIC
Nuclear Safety Information Center (NSIC)
Region I Docket Room (w/concurrences)

DOCUMENT NAME: S:\PENDING\TI_SDMP.LTR

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	DNMS/RI	E	DNMS/RI							
NAME	MRoberts m/[illegible]		RBellamy							
DATE	03/18/97		03/ /97							

OFFICIAL RECORD COPY

090-00833

MEMORANDUM

DATE: January 23, 1997

TO: Frank Veale
Dean Chapman
John O'Donnell
Rick Joosten

FROM: Mike Elliott

RE: Meeting with Tom O'Connell

CC: Henry Morton
Dr. Bertrand Brill
Mark Griffon
Mike Madonia
Tom O'Connell
Mark Roberts

I am meeting with Tom O'Connell from the MDPH Radiation Safety Office on Friday, January 31. Samantha has reserved the Arrow conference room in building 20 from 8:30 am - 12:00 pm. You are all welcome to attend the meeting.

In preparation for the upcoming transfer of authority from the NRC to the MDPH, Tom wants to further familiarize himself with the history of the Nuclear Remediation project and the Building 1 Radium Policy.

Regards,
Mike

118945

OFFICIAL RECORD COPY ML 10

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

March 20, 1997

Michael Elliott
Environmental Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703

SUBJECT: INSPECTION NO. 070-00033/97-001

Dear Mr. Elliott:

On February 3-6, 1997, Anthony Dimitriadis and Mark Roberts of this office conducted a safety inspection at the Texas Instruments, Inc. facility in Attleboro, Massachusetts of activities authorized by the NRC license listed below. The inspection was limited to observations by the inspectors, interviews with personnel, selective examination of records and confirmatory surveys inside Buildings 4, 5, and 10 and in exterior areas of the site. A copy of the NRC inspection report is enclosed. In addition, our inspection examined the activities covered in survey reports dated May 1995, August 1996, two from October 1996, January 1997, February 1997, February 11, 1997, February 24, 1997, and March 10, 1997. The findings of the inspection were discussed with James Armstrong, Francis Veale, Jr., your consultant Steve Shafer from Roy F. Weston, and you, at the conclusion of the inspection. Thomas O'Connell from the Commonwealth of Massachusetts, Department of Public Health - Radiation Control Program, assisted the inspectors and attended the exit meeting.

Within the scope of this inspection, no violations were identified.

Please note that the enclosed inspection report does not constitute approval by the NRC for release of your facility for unrestricted use. The results of this inspection report, and all other applicable information available to the NRC, will be examined to determine if your facility may be released for unrestricted use by the reviewer who is responsible for amending your license.

In accordance with Section 2.790 of the NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the Public Document Room. No reply to this letter is required.

118945

Your cooperation with us is appreciated.

Sincerely,

for Ronald R. Bellamy, Ph. D., Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

Docket No.: 070-00033
License No.: SNM-23

Enclosure:
Inspection Report No. 070-00033/97-001

cc w/enclosure:

Commonwealth of Massachusetts

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

INSPECTION REPORT

Report No.	070-00033/97-001
Docket No.	070-00033
License No.	SNM-23
Licensee:	Texas Instruments, Inc. 34 Forest Avenue Attleboro, Massachusetts 02703
Inspection At:	Texas Instruments, Inc. Attleboro, Massachusetts
Inspection Conducted:	February 3-6, 1997

Inspectors: Anthony Dimitriadis, Health Physicist — date: March 20, 1997

Mark C. Roberts, CHP, Senior Health Physicist — date: March 20, 1997

Approved By: Ronald R. Bellamy, Ph. D., Chief, Decommissioning and Laboratory Branch, Division of Nuclear Materials Safety — date: 3-20-97

Inspection Summary: Announced, confirmatory survey at the licensee's Attleboro, Massachusetts facility (Inspection Report No. 070-00033/97-001)

Areas Inspected: Organization and scope of remediation project, confirmatory measurements in interior areas, confirmatory measurements in exterior areas, results of sample analysis, review of radiological survey and remediation documents.

Results: Radiological measurements did not identify any residual levels in excess of the criteria for release for unrestricted use. Sample results from 40 soil samples analyzed in the NRC regional laboratory confirmed the licensee's results. A small amount of contaminated soil or contamination on below-ground concrete surfaces was left in place in inaccessible areas that could not be further remediated because of their proximity to vital structures or utilities. Measurements in each of these areas were not different than ambient background measurements. Based on volume averaging, the inspectors determined that the average total uranium concentration in each of these areas is less than 30 picocuries per gram.

1. Individuals Contacted

* Michael Elliott, Environmental Manager, Texas Instruments, Inc. (TI)
* Francis Veale, Environmental Safety and Health Department Manager, TI
* James Armstrong, Operational Excellence Manager, TI
* Steve Shafer, Health Physicist (Exterior Remediation Project Manager), Roy F. Weston, Inc. (Weston)

Michael Madonia, Health Physicist (Interior Remediation Project Manager), Weston (via telephone on February 5, 1997)
* Thomas O'Connell, Health Physicist, Commonwealth of Massachusetts

* Denotes those present at exit meeting

2. Background

The TI facility is located in Attleboro, Massachusetts, approximately 16 kilometers (10 Miles) northeast of Providence, Rhode Island and 48 kilometers (30 miles) southwest of Boston. The site currently comprises eighteen buildings owned by TI on approximately 40 hectares (100 acres). Operations with radioactive material began at the site in 1952 when Metals and Controls, Inc. began to fabricate enriched uranium foils. Metals and Controls, Inc., merged with TI in 1959 and eventually was operated as a corporate division of TI. From 1952 through 1965, Metals and Controls (and later TI), under a variety of government contracts, fabricated enriched uranium fuel elements for the U.S. Naval Reactors Program, U.S. Air Force, other U.S. Government-funded research, and a few commercial customers. From 1965 through 1981, TI fabricated fuel for the High Flux Isotope Reactor at Oak Ridge National Laboratory and other government-owned research reactors. Depleted uranium and processed natural uranium were also used at the facility in research and development of the production methodologies. The facility remains operational in a variety of metallurgical production activities; however, radioactive material is no longer used in the company's manufacturing operations.

Operations with radioactive materials were initially conducted in portions of what is now Building 4, with very limited operations conducted in Building 3. In 1956, Metals and Controls constructed Building 10 on the site to house all work with radioactive materials. By 1957, all manufacturing operations were moved to Building 10. Waste handling, processing of scrap metal and residues, and treatment of waste acids and water were conducted in Building 5 and outside Building 5 in areas known as the Metals Recovery Area and the Stockade. A waste evaporator and an incinerator were operated in Building 5/Metals Recovery Area. Scrap and waste generated in the manufacturing processes were returned to the U. S. Government; however, some materials contaminated with low levels of radioactivity were disposed in a burial site adjacent to Building 11.
Following cessation of operations with radioactive materials in 1981, TI initiated remediation of uranium contamination in the buildings and surrounding exterior locations. Remediation and final surveys of contaminated portions of Buildings 4

and 10 were completed in 1985 and the NRC staff approved release of these buildings for unrestricted use. Residual radioactive contamination remained in the burial area east of Building 11 and west of the recently constructed Building 12. In 1990, the NRC listed the TI Attleboro, Massachusetts facility on the NRC Site Decommissioning Management Plan (SDMP) because of the presence of the residual contamination in the burial area. Region I staff approved a remediation plan for the burial area in 1992 and initial remediation was completed in December 1992. A confirmatory survey conducted by the Oak Ridge Institute for Science and Education (ORISE) in December 1992 identified some remaining contamination on the walls of the excavation. In July 1993, the licensee completed additional remediation activities. An ORISE confirmatory survey performed in December 1993 did not identify any remaining residual contamination in this burial area in excess of the current criteria for release for unrestricted use.

After completion of the remediation and survey of the burial area, TI identified soil contamination in three locations within the Metals Recovery Area. Remediation and sampling in this area during 1994 led to the determination that the three distinct contaminated areas were actually part of a single, larger contaminated area. Remediation of this area was completed in November 1994. After identification of the additional contamination in the Metals Recovery Area, Region I staff requested that TI perform a comprehensive survey of all potentially affected areas on the site. These comprehensive radiological surveys, performed in 1994 and 1995, and discussions with long-term employees, led to the identification of additional contaminated soil, primarily in the Stockade and Building 12 south lawn area. The contamination in the stockade area was likely due to the past handling and storage operations in the area. Contamination on the lawn of Building 12 was likely the result of intrusion into the burial area and the spread of contamination during final grading around the building. Residual contamination was identified in Buildings 4, 5, and 10, primarily where unclad uranium operations had been conducted. The contamination was primarily limited to cracks and joints in the concrete floor, areas around equipment installed in the concrete floor, and drain lines buried in or beneath the concrete floor. Remediation was performed in accordance with the 1992 plan for remediation of the burial area and a 1994 addendum.

Also, in approximately 1978, NRC confirmed the presence of radioactive contamination at the Shpack landfill in nearby Norton, Massachusetts. The source of this contamination may have been the result of work performed at the TI Attleboro facility, but the company has not acknowledged that its facility was the source of the material in the landfill. Although some residual radioactive material was removed from the closed landfill, further remediation for both radiological and chemical contaminants may still be required. In 1980, the landfill was listed on the U.S. Department of Energy (DOE) Formerly Utilized Site Remedial Action Program (FUSRAP), which will manage any remediation of radioactive materials. In addition, TI and several other companies have entered into a consent order with the U.S. Environmental Protection Agency (EPA) regarding the landfill.

3. Organization and Scope of Remediation Project

The site remediation project was coordinated by the Environmental Manager. This individual reports to the Environmental Safety and Health Manager who reports to the Site Manager. The remediation of the Metals Recovery Area was handled as one separate project and the remediation of the remainder of the exterior areas and all of the interior areas was handled as a second separate project. CPS Environmental, Inc. provided contractor health physics technical support and directed the excavation and drilling contractors based on the results of the radiation surveys and sample analysis. CPS, Environmental also performed the radiological characterization of the site. Roy F. Weston, Inc. provided project management for the remainder of the exterior remediation and the interior remediation. Two Weston project managers provided direct supervision of the support services including health physics, construction, transportation, and analytical services.

No safety concerns were identified.

4. Instrumentation Used in Confirmatory Surveys

The inspectors used a series of portable radiation survey meters and laboratory equipment to make confirmatory measurements. Ambient gamma radiation levels were measured with Ludlum Micro-R meters (NRC # 033513 and NRC # 019634, calibrated on December 5, 1996 and March 14, 1996, respectively). Unless otherwise indicated, these measurements were made at a distance of one meter above the ground or from the surface that was measured. Ambient exterior gamma radiation in the vicinity of the site ranged from 8 - 12 μR/hour. Background measurements inside Building 10 in unaffected areas ranged from 10 - 15 μR/hour. The higher range of values was generally measured in locations with newer concrete. Direct measurements for radioactive contamination were made at near contact with floor and wall surfaces using Ludlum Model 43-68 100 cm^2 gas-flow proportional detectors (NRC # 054810 and NRC # 057023) with Ludlum Model 18 rate-meters (NRC # 054822 and NRC # 054825, both calibrated March 4, 1996). Floor surfaces were scanned with Ludlum Model 239-1F floor monitors (NRC # 054976 and NRC # 054975 equipped with Ludlum Model 2221 scaler/rate-meters (NRC # 054826 and NRC # 054828, both calibrated March 14, 1996). The inspectors determined the operating voltages and detector efficiencies prior to the inspection and confirmed the efficiency and measured the background, for each detector, daily prior to initiating confirmatory measurements. The inspectors also measured higher background counts with the gas proportional detectors on the newer concrete. A 2" x 2" sodium iodide detector (Ludlum Model 44-10), coupled to one of the Ludlum Model 18 rate-meters, was used to make gross gamma measurements.

Soil samples from interior and exterior remediated areas were selected from archived samples in storage. Two additional soil samples were obtained directly from areas where characterization measurements indicated that the total uranium

concentration did not exceed the NRC guidelines for release for unrestricted use. Each soil sample was prepared for analysis in the Region I radioanalytical laboratory by drying and then milling the dried sample. An aliquot of each sample was weighed and transferred into a Marinelli beaker for gamma counting. Gamma counting was performed using a high-purity germanium detector (HpGe) that can quantify specific gamma emission energies from the sample. Analysis of the gamma spectrum and identification of radioactive isotopes is performed with a commercial software program. Results of the analysis of the soil samples were reported in units of picocuries/gram (pCi/g) with an uncertainty of one standard deviation for each radionuclide reported.

5. Confirmatory Measurements in Interior Areas

5.1. Measurements in Building 4

Building 4 is the largest of the manufacturing buildings on the site. A small portion of the building was used for uranium milling prior to the construction of Building 10. Approximately 12,000 ft^2 of this 295,000 ft^2 building required remediation. Gamma exposure rate measurements in the remediated area and in the area adjacent to the remediated area ranged from 6 - 12 μR/hour. With the exception of one area, these values were not distinguishable from background measurements in the building. The exposure rate measured along a stone walkway adjacent to the remediated area was as high as 18 μR/hour. The source of these slightly elevated readings appeared to be the natural stone used in the walkway. Scanning and direct measurements were performed with the gas-proportional detectors over approximately 100 percent of the accessible floor area in the remediated area. A large portion of the area adjacent to the remediated area was also scanned with the same instrumentation. With the exception of the stone walkway, all results were less than approximately 2000 dpm/100 cm^2. The area of the walkway exhibited elevated surface measurements, but appeared to be caused by naturally-occurring radioactive material in the rock.

The inspectors also performed gamma exposure rate measurements directly above drain pipes buried in or beneath the floor. These pipes had either been remediated by pressure washing or characterization readings indicated that contamination levels met the NRC guidance for release. All measurements were not different than the background measurements.

No safety concerns were identified.

5.2. Measurements in Building 5

Building 5 is a small building adjacent to the Metals Recovery Area. Remediation in Building 5 consisted of removal of approximately one third of the concrete floor of the building and removing contaminated soil

beneath the floor. Gamma exposure rate measurements in Building 5 ranged from 12 - 16 μR/hour. All scanning and direct measurements on the floor and lower wall surfaces were not distinguishable from background. Areas that had been remediated and areas where characterization data indicated that the surface criteria for release for unrestricted use was met were both included in the survey of this building. Because this is a small building, the entire floor surface was subject to the scanning measurements.

No safety concerns were identified.

5.3. Measurements in Building 10

Building 10 was the primary location for work with both clad and unclad licensed materials. The principle area within the building where the unclad material was used was the northern end of the building. Licensed material use in the remainder of the building was limited to storage and transportation support for the finished products. Following the remediation of contamination in 1981 and 1982, the building was converted to a number of other manufacturing uses. The recent decommissioning activities required remediation of approximately 40,000 ft^2 of the 168,000 ft^2 building. Most of the remediation performed required the removal and replacement of portions of the concrete slab, excavation and disposal of contaminated soil, and pressure washing or removal of contaminated drain lines.

Gamma exposure rates measured throughout the building ranged from 6 - 16 μR/hour. The higher values were generally measured in areas where there was newer concrete. The inspectors made scanning measurements throughout the remediated area and in the areas bordering the remediated area with the floor monitor. All areas were well below the release criterion of 5000 dpm/100 cm^2. The inspectors also performed gamma exposure rate measurements above the concrete slab where drain pipes are buried in the floor. The pipes had either been cleaned or characterization measurements indicated that remediation was not required. The gamma exposure rate measurements in these areas were not different than those measured throughout the remainder of the building.

The licensee left residual contamination in place in eight inaccessible locations within the building. These areas are under or adjacent to vital structures or heavy equipment and consist of either contaminated soil or contamination on concrete surfaces. The depth of these locations ranges from one to 2.5 meters beneath the floor surface. Direct gamma measurements with the 2" x 2" NaI detector at the soil surface and exposure rate measurements with the Micro R-meter in each of these areas were also indistinguishable from background measurements.

Because Building 10 required the most significant remediation, the inspectors selected a number of archived, post-remediation samples for analysis in the NRC regional laboratory. The results of these analyses are discussed in section 7 of this inspection report.

No safety concerns were identified.

6. Confirmatory Measurements in Exterior Areas

The inspectors reviewed the characterization and post-remediation radiological survey data for the exterior areas of the TI site. The affected exterior area of the site was divided into approximately 300 grid cells, 10 meters x 10 meters. A total of 93 of the grid cells required remediation by removal of uranium contaminated soil in excess of the NRC criteria for release for unrestricted use. The inspectors made measurements with the 2" x 2" NaI gamma detector and the micro-R meter throughout the remediated area and in areas where the characterization data indicated that no remediation was required. All readings were not different than the background measurements on the site.

In thirteen of the remediated grid cells, at least one post-remediation sample from the grid cell exceeds the NRC unrestricted use criterion of 30 pCi/g total uranium. In all cases, the residual contamination is inaccessible due to the presence of critical utilities or structures that prevented complete removal of contaminated soil. This residual contamination is located from one to three meters below the surface of the soil. The inspectors made measurements with the 2" x 2" NaI gamma detector and the micro-R meter in each of these grid cells. Measured exposure rates ranged from 10 to 17 μR/hour. The highest reading was measured in the vicinity of a large sub-surface concrete structure which appeared to have contributed to the exposure rate. All other readings were not significantly different than local background levels.

No safety concerns were identified.

7. Results of Sample Analyses

As discussed in section 4 of this report, selected soil samples, primarily post-remediation samples, were analyzed by gamma spectrometry in the Region I analytical laboratory. Concentrations of uranium-235 and U-238 (reported as the concentrations of the thorium-234 and protactinium-234m decay progeny) for the forty soil samples are presented in Table 1. Because the gamma spectrometry analysis can not be used to quantify the uranium-234 concentration in a sample, some of the soil samples were submitted to ORISE, the NRC's contractor laboratory, for alpha spectrometry analysis. The alpha spectrometry analysis provided a quantitative measure of the U-235 and U-238 concentrations, as well as, the U-234 concentration. Results of the nine alpha spectrometry analyses are presented in Table 2. Licensee contractor data for these samples is also presented in Table 2.

The results of the gamma spectrometry analyses confirm that the facility meets the criteria for release for unrestricted use. The average total uranium concentration of the thirty-nine post remediation samples is approximately 11 pCi/g. The inspectors estimated the U-234 concentrations using ratios of U-238 to U-235 for each sample. One pre-remediation sample indicated a total uranium concentration of approximately 180 pCi/g. This value was in good agreement with the licensee contractor value of approximately 200 pCi/g. The area was later remediated to levels less than 30 pCi/g. Only two samples indicated estimated total uranium concentrations above 30 pCi/g. One sample from the Metals Recovery Area was approximately 31 pCi/g and appeared to be depleted uranium (the NRC guideline for depleted uranium is 35 pCi/g). A sample from the stockade area indicated an estimated concentration of 38 pCi/g. This value was in good agreement with the licensee's contractor values of 36, 15 and 45 pCi/g for this location. Although this value exceeded 30 pCi/g, volume averaging indicates that the total uranium concentration in this area meets the 30 pCi/g guideline.

The alpha spectrometry results in Table 2 show very good agreement with data from the licensee's contractors. Except for one sample from the Metals Recovery Area, the data also show very good agreement with the gamma spectrometry data. The disagreement in the sample data from the Metals Recovery Area was likely caused by a non-homogenous sample, because neither the U-235 nor the U-238 results are in agreement, and the alpha spectrometry analysis use a very small sample compared to the gamma spectrometry analysis. One sample from the Stockade Area slightly exceeded 30 pCi/g; however, this area also meets the NRC criteria based upon volume averaging for the grid cell.

No safety concerns were identified.

8. Review of Radiological Survey and Remediation Documents

8.1 Surveys of Open Land Areas

Because of the discovery of soil contamination in the burial area between Buildings 11 and 12 and the subsequent identification of soil contamination in the Metals Recovery Area adjacent to Building 5, TI conducted a comprehensive survey of exterior areas of the site. This systematic characterization survey of the affected and unaffected exterior areas of the site was conducted from July through September 1994 and was documented in a May 1995 report (Radiological Surveys of Open Land Areas, Texas Instruments Incorporated, Attleboro, Massachusetts). The survey included a 100 percent walkover survey of both the affected and unaffected areas of the site using a 2" x 2" NaI detector and rate-meter. The surveys were conducted by CPS, a contractor for TI. Undeveloped portions of the site were not surveyed.

Systematic surface and sub-surface soil samples were taken by a split spoon sampling apparatus and drill rig. Sampling was conducted at 1600

locations resulting in the collection of 5865 surface and sub-surface soil samples. Sample locations in affected areas were defined on a 10 meter x 10 meter (100 m^2) grid plan to ensure complete coverage of the affected area. Sampling in the Stockade Area was complicated by the presence of numerous underground electrical, communication, and water utilities and concrete supports for overhead structures. Designated sample points within some of the grid cells were moved short distances to avoid these obstacles. Unaffected areas were not sampled on a defined grid; however, thirty random sub-surface samples were collected in the unaffected areas. Samples were evaluated by the gross alpha soil analysis technique to identify total uranium concentrations. The soil sampling in the affected area identified eighty-five 100 $meter^2$ grid cells where soil contamination exceeded NRC guidelines for release for unrestricted use. One additional contaminated area was found in the unaffected area survey. This area, which bordered the Stockade Area, was remediated as part of the exterior remediation project in the Stockade Area.

Based on a review of the data in the characterization report, knowledge of the physical layout of the site obtained in previous inspections, and a prior review of the gross alpha counting technique (including the analysis of samples split with the NRC), the site was adequately characterized to identify locations where licensed material was used or may have been inadvertently disposed. TI's contractors and environmental staff interviewed a number of long-time employees to assist in determining the areas that were defined as affected.

No safety concerns were identified.

8.2 Remediation of the Metals Recovery Area

Radiological surveys in late 1993 and early 1994 identified soil contamination in the Metals Recovery Area. This area was formerly a waste handling area where an incinerator and a liquid waste evaporator were operated. Three initial areas were identified in this area and the contaminated soil volume was estimated to be approximately 425 m^3 (15,000 ft^3). The remediation activities conducted in this area led eventually to the disposal of 3300 m^3 (115,000 ft^3) of contaminated soil. Contamination was primarily limited to the top 15 cm of soil; however, excavation of contaminated soil down to approximately 2 meters was required in the area immediately adjacent to Building 5. The highest concentration of uranium identified in characterization and remediation samples was 17,000 pCi/g. Remediation activities were conducted from April 1994 through November 1994. A report summarizing the results of the remediation of the Metals Recovery Area was transmitted to the NRC in October 1996 (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of the Metals Recovery Area, Final Report).

The results from the analysis of systematic surface and sub-surface soil samples from the excavated area and the perimeter of the excavated area; and exposure rate measurements indicate that the criterion for residual uranium concentration in soil (30 pCi/g) and the exposure rate criterion were both met. In one 9 meter x 9 meter grid cell, contaminated soil averaging 49 pCi/g total uranium was left in place around an electrical duct bank. Using a volumetric averaging method, the inspectors determined that this area was below the 30 pCi/g total uranium criterion when averaged over a one-meter thick vertical plain. Rain water that collected in the excavation was confirmed to be well below effluent criteria and was released. Contaminated soil was disposed at the Envirocare facility in Utah.

No safety concerns were identified.

8.3 Remediation of Exterior Areas Adjacent to Buildings 11 & 12

TI's contractor, Weston, coordinated the remediation of the exterior areas adjacent to Buildings 11 and 12 that were identified in the report on the Survey of the Open Land Areas. The burial area between Buildings 11 and 12 and the Metals Recovery Area were not included in this remediation project because they had been previously remediated by CPS and the results provided to Region I. Characterization data generated by CPS was used to identify the initial 77, 10 meter x 10 meter grid cells, requiring remediation. An additional 16 cells, adjacent to remediated cells, were eventually included in the remediation. The depth of the contaminated material ranged from the surface to approximately three meters (ten feet). Remediation activities on these exterior areas were conducted from June 1995 through December 1995. The results of the remediation activities were documented in an August 1996 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of Exterior Areas Adjacent to Buildings 11 and 12, Final Report).

Remediation of contaminated soil in grid cells was accomplished by removing soil in approximately 30-centimeter (one-foot) sections within the grid cell. In areas where the surface soil was less than the criteria for release for unrestricted use, the soil was reserved for backfilling excavated areas where contaminated soil was removed. Contaminated soil was excavated and segregated for eventual disposal. Excavation continued until field measurements indicated that the unrestricted guidelines had been met. Thirteen check samples were then analyzed using a gross alpha screening technique. If the results of those analyses were acceptable, five verification samples (one from each quadrant of the cell and one from the center of the cell) were collected and analyzed and reported as the final verification sample. A composite of these samples was then sent to an off-site vendor for alpha spectrometry analysis.

Contaminated soil in excess of the NRC guidelines for release for unrestricted use was left in place in a few inaccessible locations. These areas are beneath vital structures or utilities and can not be further remediated without adversely affecting the structures. In all but three areas, the average total uranium soil concentration on the surface of the excavation met the averaging criteria for unrestricted use. In the other three locations, using a volumetric averaging method, the inspectors determined that these areas also met the 30 pCi/g release criteria.

No safety concerns were identified.

8.4 Surveys of Interior Areas in Buildings 4, 5, and 10

TI's contractor, Weston, also coordinated the remediation of the contaminated interior portions of Buildings 4, 5, and 10. Remediation activities on these interior areas were conducted from June 1995 through September 1996. The results of the remediation activities are documented in an October 1996 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Remediation of Building Interiors, Buildings 4, 5, and 10).

The contaminated portions of the buildings were divided into eighteen (decontamination) areas based upon physical barriers and historical operations. The decontamination areas were further divided into 100 m^2 grids. A contaminated portion of the roof was similarly divided. Remediation activities primarily included scabbling contaminated concrete floors and removing portions of the concrete slab to excavate contaminated soil and remove contaminated drain lines. The total volume of waste disposed from the interior remediation project was 980 m^3 (34,600 ft^3). Final remediation soil samples were analyzed by an off-site laboratory for total uranium or isotopic uranium. Surface contamination measurements were performed with properly calibrated detectors with sufficient sensitivity to meet the NRC guidelines for surface contamination measurements.

Contaminated soil or surface contamination in excess of the NRC guidelines for release for unrestricted use was left in place in a few inaccessible locations. These areas are beneath structural column footings or under vital machinery and can not be further remediated without adversely affecting the building structure or some of the machinery in the building. In these locations, using a volumetric averaging method, the inspectors determined that these areas meet the 30 pCi/g release criteria. All other areas were also sufficiently remediated to meet the NRC criteria for release for unrestricted use.

Based on their review of this document, the inspectors requested additional information concerning the remediation activities for pipes left in

place and the evaluation of residual contamination. The inspector also requested that the licensee perform a dose evaluation of the residual contamination in the remediated drain lines. Based on the review of three documents prepared by Weston (Texas Instruments Incorporated Attleboro Facility - Building Interiors Remediation, Drainage System Characterization, January 1996; Drainage System Unrestricted Release Information - Supplemental Analyses, February 11, 1997; and SNM License Termination Hypothetical Radiological Dose and Exposure Rate Assessment, Priority 2 Drain Lines), the inspectors concluded that the residual activity in the priority 2 drain lines (drain lines that were cleaned by pressure washing) met the NRC guidelines for release for unrestricted use.

No safety concerns were identified.

8.5 Surveys of Building Interiors, Overhead Structures, and Upper Walls

As part of the characterization of the affected buildings, surveys of the building interiors, overhead structures, and upper walls were performed. Although data from these surveys were recorded, the surveys were not initially documented in a report. The results of the surveys were used to guide the remediation of contaminated portions of Buildings 4 and 10. The surveys were subsequently documented in a February 1997 report (Texas Instruments Incorporated, Attleboro, Massachusetts - Supplemental Surveys of Building Interiors, Overhead Structures and Upper Walls). Measurements included both direct measurements to evaluate non-removable contamination and smears to evaluate removable contamination. A review of this document confirmed that the upper portions of Buildings 3, 4, 10, and 11 meet the NRC guidelines for release for unrestricted use.

No safety concerns were identified.

8.6 Groundwater Radiological Monitoring Data Report

The chemical forms of uranium used at the site were primarily uranium oxides, uranium metal, and uranium metal alloys. These forms of uranium are generally not soluble. Groundwater monitoring data for the Texas Instrument site is summarized in a letter report (February 24, 1997 letter and four attachments to M. Roberts, NRC Region I from M. Elliott, Texas Instruments). Groundwater samples were collected from a series of representative monitoring wells on the site during January-March 1993, August-September 1995, and December-February 1996-1997. Gross alpha concentrations for the most recent samples ranged from less than detectable to 11 pCi/liter and gross beta concentrations ranged from less than detectable to 25 pCi/liter. These values are below the EPA groundwater screening criteria for gross alpha and gross beta activity of 15 and 50 pCi/liter, respectively. Results from the earlier samples were

less than the most recent samples. A specific uranium analysis was performed on selected samples in the recent sampling period. Measured total uranium concentrations ranged from 0.22 to 0.39 pCi/liter. These concentrations are below the EPA proposed primary drinking water limit of 30 pCi/liter for uranium, and are acceptable for releasing the site for unrestricted use.

No safety concerns were identified.

8.7 Dose Assessment

As discussed in sections 8.4 and 8.5, residual contamination was left in place in areas that were inaccessible because the remaining material was beneath critical utilities and structures. In order to conclude that there is no significant dose impact in leaving this material in place, and in order to satisfy the Commonwealth of Massachusetts requirement that the residual dose impact be less than 10 millirem per year, TI's contractor (Weston) performed a supplementary Radiological Dose Assessment of the interior and exterior areas. The results of this assessment are reported in a February 20, 1997 report (Texas Instruments, Incorporated - SNM License Termination, Radiological Dose Assessment). The assessment considered both a current exposure scenario and a future exposure scenario for members of the public. In each case, a maximum population group is considered.

The current exposure scenario was intrusion of a Texas Instruments' maintenance worker into any of the five primary source areas to perform maintenance in a trench. This scenario considers multiple exposure pathways including direct radiation exposure, inhalation of resuspended dusts and ingestion of contaminated soils. For conservatism, the area of highest residual contamination was used as the source term. The maintenance worker intrusion scenario resulted in an annual total effective dose equivalent of 1.3 millirem. The dose calculation was performed using a series of hand calculations. The contractor considered using the RESRAD-BUILD computer code for the calculations, but determined that the program was not readily applicable to the scenario.

The future use scenario considered closure of the site, removal of the industrial buildings and construction of a residence. The computer code RESRAD (version 5.62) was used to model the exposure pathways and calculate the dose from the scenario. The area with the highest average residual activity was selected for the calculations. The annual total effective dose equivalent for the future use residential scenario is 7.3 millirem for the first year, with the projected dose declining in future years.

No safety concerns were identified.

9. Exit Meeting

The results of the inspection were discussed with the individuals identified in Section 1 of this report.

TABLE 1

GAMMA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SOIL SAMPLES

[Results in Units of pCi/g dry ± 1σ]

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
40S 130E 120195,VER-0092C	Building 11 West Lawn	1.33 ± 0.10	1.0 ± 0.6	0.38 ± 0.02
30S 130E 120195, VER-0077C	Building 11 West Lawn	1.45 ± 0.09	1.0 ± 0.6	1.13 ± 0.03
20S 40E 112995, VER-0103	Stockade Area	7.4 ± 0.3	9.1 ± 0.9	1.05 ± 0.04
0110-06-6C-SS-01-00 TI 287	Building 10, Area 6	2.0 ± 0.3	4.4 ± 1.0	0.43 ± 0.04
0110-06-SC-SS-02-06-00 TI-278	Building 10, Area 6	4.88 ± 0.12	5.0 ± 0.8	0.39 ± 0.02
1214-12-6D-BSS(substation) TI-359 (1)	Building 10, Area 12	101.8 ± 0.7	111 ± 2	3.21 ± 0.06
01222-13-2C-SS-01-06-00 TI-359	Building 4, Area 13	0.4 ± 0.3	< 2	< 0.1
0110-06-5C-SS-03-06-00 TI-279	Building 10, Area 6	5.99 ± 0.11	6.7 ± 0.6	0.58 ± 0.03
0110-06-60-SS-01-06-00 TI-289	Building 10, Area 6	<0.5	1.2 ± 0.7	0.04 ± 0.02
1026-08-6B-SS-02-06-00 TI-062	Stockade Area	0.67 ± 0.09	1.3 ± 0.8	0.12 ± 0.02
120N21OE-09089S-VER-0022C	Adjacent to Building 12, Loading Dock	3.0 ± 0.2	2.5 ± 0.7	0.13 ± 0.03
60S 70E-10209S-VER-0041-C	Stockade Area	11.55 ± 0.11	11.3 ± 0.8	0.29 ± 0.02
100N 150E-092695-VER-0015-Ca	Building 11, East Lawn	2.1 ± 0.3	3.6 ± 0.9	0.08 ± 0.03
2050-112195-VER-0076-C	Stockade Area, near metals p	2.16 ± 0.08	2.3 ± 0.6	0.73 ± 0.02
200N 150E-073195-VER-0001-C	Building 12, Northwest Lawn	10.7 ± 0.4	12.1 ± 0.8	0.49 ± 0.03
110N 270E-082845-VER-0019-C	Building 12, South Lawn	1.54 ± 0.11	1.3 ± 0.7	0.10 ± 0.02
60S 40E-112895-VER-0061-C	Stockade Area	4.3 ± 0.3	5.7 0.8	0.25 ± 0.03
40S 140E 120195-VER-0093-C	Building 11, Lawn	1.45 ± 0.14	2.0 ± 1.0	0.48 ± 0.03
30S 40E 111495-VER-0064-C	Stockade Area	1.1 ± 0.3	2.3 ± 0.6	0.14 ± 0.03
110N 220E-091295-VER-0027-C	Adjacent to Building 12 Loading Dock	5.55 ± 0.09	5.2 ± 0.7	0.26 ± 0.02
30S 90E 1200195-VER-0052	Stockade Area	17.61 ± 0.13	18.7 ± 0.8	0.64 ± 0.03
40S 130E-120492-VER-0092-C13	Building 11, West Lawn	1.0 ± 0.3	1.4 ± 0.7	0.16 ± 0.03
[illegible] 90E-120295-VER-0053-C	Stockade Area	13.60 ± 0.12	13.7 ± 0.9	0.58 ± 0.03
[illegible] 20S X90W TI-B5-FGC-[illegible]-1676	Metals Recovery Area	2.54 ± 0.10	2.3 ± 0.6	0.16 ± 0.02
[illegible] [illegible]SX0 1' TI-B5-FGC-0805-[illegible]	Metals Recovery Area	6.76 ± 0.13	4.6 ± 0.7	0.45 ± 0.03

TABLE 1

GAMMA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SOIL SAMPLES

[Results in Units of pCi/g dry ± 1σ]

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
40S 130E 120195,VER-0092C	Building 11 West Lawn	1.33 ± 0.10	1.0 ± 0.6	0.38 ± 0.02
30S 130E 120195, VER-0077C	Building 11 West Lawn	1.45 ± 0.09	1.0 ± 0.6	1.13 ± 0.03
20S 40E 112995, VER-0103	Stockade Area	7.4 ± 0.3	9.1 ± 0.9	1.05 ± 0.04
0110-06-6C-SS-01-00 TI 287	Building 10, Area 6	2.0 ± 0.3	4.4 ± 1.0	0.43 ± 0.04
0110-06-5C-SS-02-06-00 TI-278	Building 10, Area 6	4.88 ± 0.12	5.0 ± 0.8	0.39 ± 0.02
1214-12-6D-BSS(substation) TI-359 (a)	Building 10, Area 12	101.8 ± 0.7	111 ± 2	3.21 ± 0.06
01222-13-2C-SS-01-06-00 TI-359	Building 4, Area 13	0.4 ± 0.3	< 2	< 0.1
0110-06-5C-SS-03-06-00 TI-279	Building 10, Area 6	5.99 ± 0.11	6.7 ± 0.6	0.58 ± 0.03
0110-06-60-SS-01-06-00 TI-289	Building 10, Area 6	<0.5	1.2 ± 0.7	0.04 ± 0.02
1026-08-6B-SS-02-06-00 TI-062	Stockade Area	0.67 ± 0.09	1.3 ± 0.8	0.12 ± 0.02
120N210E-09089S-VER-0022C	Adjacent to Building 12, Loading Dock	3.0 ± 0.2	2.5 ± 0.7	0.13 ± 0.03
60S 70E-10209S-VER-0041-C	Stockade Area	11.55 ± 0.11	11.3 ± 0.8	0.29 ± 0.02
100N 150E-092695-VER-0015-Ca	Building 11, East Lawn	2.1 ± 0.3	3.6 ± 0.9	0.08 ± 0.03
2050-112195-VER-0076-C	Stockade Area, near metals p	2.16 ± 0.08	2.3 ± 0.6	0.73 ± 0.02
200N 150E-073195-VER-0001-C	Building 12, Northwest Lawn	10.7 ± 0.4	12.1 ± 0.8	0.49 ± 0.03
110N 270E-082845-VER-0019-C	Building 12, South Lawn	1.54 ± 0.11	1.3 ± 0.7	0.10 ± 0.02
60S 40E-112895-VER-0061-C	Stockade Area	4.3 ± 0.3	5.7 0.8	0.25 ± 0.03
40S 140E 120195-VER-0093-C	Building 11, Lawn	1.45 ± 0.14	2.0 ± 1.0	0.48 ± 0.03
30S 40E 111495-VER-0064-C	Stockade Area	1.1 ± 0.3	2.3 ± 0.6	0.14 ± 0.03
110N 220E-091295-VER-0027-C	Adjacent to Building 12 Loading Dock	5.55 ± 0.09	5.2 ± 0.7	0.26 ± 0.02
30S 90E 1200195-VER-0052	Stockade Area	17.61 ± 0.13	18.7 ± 0.8	0.64 ± 0.03
40S 130E-120492-VER-0092-C13	Building 11, West Lawn	1.0 ± 0.3	1.4 ± 0.7	0.16 ± 0.03
20S 90E-120295-VER-0053-C	Stockade Area	13.60 ± 0.12	13.7 ± 0.9	0.58 ± 0.03
FGS 20S X90W TI-B5-FGC-0719-1676	Metals Recovery Area	2.54 ± 0.10	2.3 ± 0.6	0.16 ± 0.02
FSG 75SX0 1' TI-B5-FGC-0805-1744	Metals Recovery Area	6.76 ± 0.13	4.6 ± 0.7	0.45 ± 0.03

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
70N X110W 7-2-94 TI-B5-FGC-0702-1670	Metals Recovery Area	0.16 ± 0.13	1.3 ± 1.2	0.44 ± 0.04
68N X105W 7/1/94 TI-B5-FGC-0701-1659	Metals Recovery Area	< 1	< 4	0.22 ± 0.08
40S X35W 6" FGS TI-B5-FGC-0805-1764	Metals Recovery Area	1.04 ± 0.11	2.2 ± 0.6	0.06 ± 0.02
0119-14A-3F-SS-03-06-00 TI-330	Building 4, Area 14	0.5±0.3	<2	0.07±0.03
1130-12-6E-SS-01-06-00 TI-191	Building 10, Area 12	0.9 ± 0.3	1.8 ± 0.7	0.10 ± 0.03
1211-12-5F-BSS South Composite	Building 10, Area 12	0.8 ± 0.3	< 2	0.11 ± 0.03
0227-BLDG5-SS-02-06-00 TI-465	Building 5	1.67±0.12	1.9±0.7	0.36±0.03
0111-05-5B-SS-03-06-00 TI-293	Building 10, Area 5	2.61 ± 0.11	2.2 ± 0.7	0.33 ± 0.02
0111-05-6B-SS-04-06-00 TI-292	Building 10, Area 5	5.9±0.3	6.9±0.9	1.10±0.04
0104-12-5D-SS-03-06-00 TI-273	Building 10, Area 12	4.34 ± 0.08	4.2 ± 0.7	0.42 ± 0.03
0104-12-5E-SS-02-06-00 TI-272	Building 10, Area 12	17.63±0.13	18.4±0.9	0.54±0.02
0110-06-6C-SS-04-06-00 TI-288	Building 10, Area 6	5.88±0.09	5.9±0.7	0.61±0.02
1026-08-7B-SS-01-06-00	Building 10, Area 8	0.4±0.3	< 2	0.08±0.03
Building 12	Building 12 Lawn	1.21±0.11	1.0±0.7	0.06±0.02
Site Background	East of Building 12	0.72±0.08	1.1±0.8	0.09±0.02

(1) Pre-remediation sample

TABLE 2

COMPARISON OF ALPHA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SAMPLES

[Results in Units of pCi/g dry ± 2σ]

Sample Identification No.	Texas Inst. In-house Results (Total Uranium)	Licensee Contractor Results			NRC Contractor Results		
		U-234	U-235	U-238	U-234	U-235	U-238
20S 40E 112995, VER-0103	24 (1)	27.71 ± 6.62	1.12 ± 0.46	7.16 ± 1.54	29.1 ± 2.1	1.3 ± 0.2	8.6 ± 0.7
0110-06-6C-SS-01-00 TI 287	(2)	5.79 ± 1.22	0.29 ± 0.20	2.69 ± 0.69	8.3 ± 0.5	0.3 ± 0.06	2.1 ± 0.2
0110-06-SC-SS-02-06-00 TI-278	(2)	4.97 ± 1.25	0.33 ± 0.27	2.76 ± 0.83	10.4 ± 0.6	0.52 ± 0.07	5.1 ± 0.3
0110-06-5C-SS-03-06-00 TI-279	(2)	10.34 ± 2.11	0.34 ± 0.21	6.06 ± 1.33	16.2 ± 0.9	0.67 ± 0.08	6.9 ± 0.4
60S 70E-102095-VER-0041-C	9	5.2 ± 1.6	0.51 ± 0.28	12.2 ± 3.4	5.2 ± 0.3	0.42 ± 0.07	13.3 ± 0.8
100N 150E-092695-VER-0015-Ca	26	2.5 ± 0.89	0.07 ± 0.10	2.10 ± 0.76	2.8 ± 0.2	0.14 ± 0.04	2.3 ± 0.2
20S0-112195-VER-0076-C	21	8.7 ± 0.33	0.40 ± 0.22	8.5 ± 0.32	14.3 ± 0.8	0.56 ± 0.08	1.6 ± 0.1
FSG 75SX0 1' TI-B5-FGC-0805-1744	30	(3)	(3)	(3)	16.7 ± 1.0	0.77 ± 0.09	8.1 ± 0.5
70N X110W 7-2-94 TI-B5-FGC-0702-1670	10	(3)	(3)	(3)	11.0 ± 0.7	0.42 ± 0.07	0.33 ± 0.06

(1) Uncertainty for In-house result not calculated
(2) Only alpha spectrometry analysis performed on these samples by the licensee
(3) Alpha spectrometry analysis not performed on these samples by the licensee contractor

on I FORM 304
(8)

U.S. NUCLEAR REGULATORY COMMISSION

SAMPLE RECORD SHEET
REGION I LABORATORY

LAB CONTROL NUMBER 301893

✓	ROUTINE	DATE NEEDED
	URGENT	

PLE LOCATION	DATE ANALYSIS BEGAN	DATE COMPLETED	ANALYZED BY	DATE
[illegible]			[illegible]	

LECTED BY	DIVISION	PHONE	CONTACT NOTIFIED	DATE	APPROVED BY	DATE
[illegible]	[illegible]	[illegible]			[illegible]	[illegible]

SAMPLE NO.	DATE	HOUR	DESCRIPTION	ANALYZE FOR	INSTRUMENT USED	QUANTITY USED	DATE COUNTED	COUNT TIME	GROSS COUNT	BACK GROUND	NET COUNT		RESULT ±1σ *
	[illegible]	[illegible]	[illegible]	[illegible]	# [illegible]	[illegible]	[illegible]						[illegible]
					# [illegible]	[illegible]	[illegible]						[illegible] table
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	2/[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	2/[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						
					# [illegible]	[illegible]	[illegible]						

*Random uncertainties reported are 1 standard deviation, 1σ, small negative and other results ≤ 2σ are interpreted as including "zero" or as not detected. If appropriate, estimates of possible systematic errors are reported in parenthesis.

(pink) 2. INSPECTOR

Region I FORM 304
(88)

U.S. NUCLEAR REGULATORY COMMISSION

SAMPLE RECORD SHEET
REGION I LABORATORY

LAB CONTROL NUMBER 301883

	ROUTINE	DATE NEEDED
	URGENT	

SAMPLE LOCATION			DATE ANALYSIS BEGAN	DATE COMPLETED	ANALYZED BY	DATE
COLLECTED BY	DIVISION	PHONE	CONTACT NOTIFIED	DATE	APPROVED BY	DATE

SAMPLE NO.	SAMPLE DATE	SAMPLE HOUR	SAMPLE DESCRIPTION	ANALYZE FOR	INSTRUMENT USED	QUANTITY USED	DATE COUNTED	COUNT TIME	GROSS COUNT	BACKGROUND	NET COUNT		RESULT ±1σ *
[illegible]	2/[illegible]	[illegible]	[illegible]	[illegible]	# 2	[illegible]	2/7	[illegible]					See attached
[illegible]	↓	↓	↓	↓	# 1	[illegible]	[illegible]	↓					data table
[illegible]					# 2	423.1	[illegible]						↓
[illegible]					# 2	[illegible]	[illegible]/27						
[illegible]					# 4	[illegible]	[illegible]						
[illegible]			↓		# 2	[illegible]	[illegible]						
[illegible]			[illegible]		~~# 4~~	~~[illegible]~~	~~[illegible]~~						
5			[illegible]		# 2	[illegible]	2/17						
[illegible]					# 2	[illegible]	[illegible]						
7					# 2	[illegible]	[illegible]						
[illegible]					# 1	[illegible].5	2/21						
[illegible]					# 2	[illegible]	2/2[illegible]						
[illegible]					# 1	[illegible]	3/1						
1					# 1	426.8	2/2[illegible]						
2					# 4	[illegible]	3/2						
3					# 2	[illegible].1	3/3						
4	↓	↓	↓	↓	# 2	[illegible]	[illegible]/2	↓					↓

*Random uncertainties reported are 1 standard deviation, 1σ, small negative and other results ≤ 2σ are interpreted as including "zero" or as not detected. If appropriate, estimates of possible systematic errors are reported in parentheses.

Region I FORM 304 (8)

U.S. NUCLEAR REGULATORY COMMISSION

SAMPLE RECORD SHEET

REGION I LABORATORY

LAB CONTROL NUMBER: 301893

ROUTINE / URGENT — DATE NEEDED

SAMPLE LOCATION | DATE ANALYSIS BEGAN | DATE COMPLETED | ANALYZED BY | DATE

COLLECTED BY | DIVISION | PHONE | CONTACT NOTIFIED | DATE | APPROVED BY | DATE

NO.	DATE	HOUR	DESCRIPTION	ANALYZE FOR	INSTRUMENT USED	QUANTITY USED	DATE COUNTED	COUNT TIME	GROSS COUNT	BACKGROUND	NET COUNT		RESULT ±1σ *
[illegible]	2/6	[illegible]	Soil	[illegible]	#1	551.7	3/6	[illegible]					See attached
	↓	↓	↓	↓	#2	[illegible]	3/7	↓					data table
[illegible]					#2	[illegible]	3/6						
[illegible]					#2	443.1	3/5						
[illegible]			↓		#1	[illegible]	[illegible]						
			Soil Blank #12		#2	[illegible]	[illegible]						
	↓	↓	Soil [illegible]	↓	#2	[illegible]	[illegible]	↓					

*Random uncertainties reported are 1 standard deviation, 1σ, small negative and other results ≤ 2σ are interpreted as including "zero" or as not detected. If appropriate, estimates of possible systematic errors are reported in parentheses.

(pink) 2 INSPECTOR

(8-88)

REQUEST FOR ANALYSIS
Region I Laboratory

LABORATORY USE ONLY

CONTROL NUMBER: 30783

SAMPLE LOCATION (LICENSEE)	LICENSE NO.	DOCKET NO.
[illegible] INSTRUMENTS INC		

SAMPLES SUBMITTED

#(TOTAL)	TYPE	VOLUME	WEIGHT
	SOIL [illegible]	[illegible]	[illegible]
	[illegible]		

DATE SAMPLES SUBMITTED	PRIORITY	
		ROUTINE
		URGENT ***

SAMPLE COLLECTION INTERVAL

	MONTH	DAY	YEAR	TIME
START	2	6	[illegible]	[illegible]
STOP	[illegible]	6	[illegible]	[illegible]

INSPECTOR RESPONSIBLE: MARK [illegible] PHONE EXT.: [illegible]094

	ANALYSIS TO BE PERFORMED	LIST DESIRED LLD *(Optional)*		OTHER TYPE OF ANALYSIS *(Specify)*	LIST DESIRED LLD *(Optional)*
	GROSS ALPHA				
	GROSS BETA				
X	GAMMA SPEC				
	TRITIUM				
	CARBON-14				
	IODINE-125				

REMARKS

[illegible]

NOTE: Samples will be discarded after analysis unless reasons are noted above in Remarks.

*** **FOR URGENT USE ONLY**— Signature Blocks below must be filled out by the Inspector's appropriate Section Chief and by the Chief, Effluents Radiation Protection Section BEFORE submitting this form to the Region I Laboratory.

SIGNATURE – APPROPRIATE NUCLEAR MATERIALS SAFETY SECTION CHIEF	DATE

SIGNATURE – CHIEF, EFFLUENTS RADIATION PROTECTION SECTION	DATE

TABLE NO. 1

GAMMA SPECTROMETRY RESULTS OF SELECTED TEXAS INSTRUMENTS, INC., SAMPLES

[Results in Units of pCi/g dry]

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
40S 130E 120195,VCR-0092C	Building 11 West Lawn	1.33 ± 0.10	1.0 ± 0.6	0.38 ± 0.02
30S 130E 120195, VER-0077C	Building 11 West Lawn	1.45 ± 0.09	1.0 ± 0.6	1.13 ± 0.03
20S 40E 112995, VER-0103	Stockade Area	7.4 ± 0.3	9.1 ± 0.9	1.05 ± 0.04
0110-06-6C-SS-01-00 TI 287	Building 10, Area 6	2.0 ± 0.3	4.4 ± 1.0	0.43 ± 0.04
0110-06-SC-SS-02-06-00 TI-278	Building 10, Area 6	4.88 ± 0.12	5.0 ± 0.8	0.39 ± 0.02
1214-12-6D-BSS(substation) TI-359	Building 10, Area 12	101.8 ± 0.7	111 ± 2	3.21 ± 0.06
01222-13-2C-SS-01-06-00 TI-359	Building 4, Area 13	0.4 ± 0.3	< 2	< 0.1
0110-06-5C-SS-03-06-00 TI-279	Building 10, Area 6	5.99 ± 0.11	6.7 ± 0.6	0.58 ± 0.03
0110-06-60-SS-01-06-00 TI-289	Building 10, Area 6	<0.5	1.2 ± 0.7	0.04 ± 0.02
1026-08-6B-SS-02-06-00 TI-062	Stockade Area	0.67 ± 0.09	1.3 ± 0.8	0.12 ± 0.02
120N21OE-090o9S-VER-0022C	Adjacent to Building 12, Loading Dock	3.0 ± 0.2	2.5 ± 0.7	0.13 ± 0.03
60S 70E-10209S-VER-0041-C	Stockade Area	11.55 ± 0.11	11.3 ± 0.8	0.29 ± 0.02
100N 150E-092695-VER-0015-Ca	Building 11, East Lawn	2.1 ± 0.3	3.6 ± 0.9	0.08 ± 0.03
2050-112195-VER-0076-C	Stockade Area, near metals p	2.16 ± 0.08	2.3 ± 0.6	0.73 ± 0.02
200N 150E-073195-VER-0001-C	Building 12, Northwest Lawn	10.7 ± 0.4	12.1 ± 0.8	0.49 ± 0.03
110N 270E-082845-VER-0019-C	Building 12, South Lawn	1.54 ± 0.11	1.3 ± 0.7	0.10 ± 0.02
60S 40E-112895-VER-0061-C	Stockade Area	4.3 ± 0.3	5.7 0.8	0.25 ± 0.03
40S 140E 120195-VER-0093-C	Building 11, Lawn	1.45 ± 0.14	2.0 ± 1.0	0.48 ± 0.03
30S 40E 111495-VER-0064-C	Stockade Area	1.1 ± 0.3	2.3 ± 0.6	0.14 ± 0.03
110N 220E-091295-VER-0027-C	Adjacent to Building 12 Loading Dock	5.55 ± 0.09	5.2 ± 0.7	0.26 ± 0.02
30S 90E 1200195-VER-0052	Stockade Area	17.61 ± 0.13	18.7 ± 0.8	0.64 ± 0.03
40S 130E-120492-VER-0092-C13	Building 11, West Lawn	1.0 ± 0.3	1.4 ± 0.7	0.16 ± 0.03
20S 90E-120295-VER-0053-C	Stockade Area	13.60 ± 0.12	13.7 ± 0.9	0.58 ± 0.03
FGS 20S X90W TI-B5-FGC-0719-1676	Metals Recovery Area	2.54 ± 0.10	2.3 ± 0.6	0.16 ± 0.02
FSG 75SX0 1' TI-B5-FGC-0805-1744	Metals Recovery Area	6.76 ± 0.13	4.6 ± 0.7	0.45 ± 0.03

Sample Identification Number	Location Description	Th-234	Pa-234m	U-235
70N X110W 7-2-94 TI-B5-FGC-0702-1670	Metals Recovery Area	0.16 ± 0.13	1.3 ± 1.2	0.44 ± 0.04
68N X105W 7/1/94 TI-B5-FGC-0701-1659	Metals Recovery Area	< 1	< 4	0.22 ± 0.08
40S X35W 6" FGS TI-B5-FGC-0805-1764	Metals Recovery Area	1.04 ± 0.11	2.2 ± 0.6	0.06 ± 0.02
0119-14A-3F-SS-03-06-00 TI-330	Building 4, Area 14	0.5±0.3	<2	0.07±0.03
1130-12-6E-SS-01-06-00 TI-191	Building 10, Area 12	0.9 ± 0.3	1.8 ± 0.7	0.10 ± 0.03
1211-12-5F-BSS South Composite	Building 10, Area 12	0.8 ± 0.3	< 2	0.11 ± 0.03
0227-BLDG5-SS-02-06-00 TI-465	Building 5	1.67±0.12	1.9±0.7	0.36±0.03
0111-05-5B-SS-03-06-00 TI-293	Building 10, Area 5	2.61 ± 0.11	2.2 ± 0.7	0.33 ± 0.02
0111-05-6B-SS-04-06-00 TI-292	Building 10, Area 5	5.9±0.3	6.9±0.9	1.10±0.04
0104-12-5D-SS-03-06-00 TI-273	Building 10, Area 12	4.34 ± 0.08	4.2 ± 0.7	0.42 ± 0.03
0104-12-5E-SS-02-06-00 TI-272	Building 10, Area 12	17.63±0.13	18.4±0.9	0.54±0.02
0110-06-6C-SS-04-06-00 TI-288	Building 10, Area 6	5.88±0.09	5.9±0.7	0.61±0.02
1026-08-7B-SS-01-06-00	Building 10, Area 8	0.4±0.3	<2	0.08±0.03
Building 12	Building 12 Lawn	1.21±0.11	1.0±0.7	0.06±0.02
Site Background	East of Building 12	0.72±0.08	1.1±0.8	0.09±0.02

OFFICIAL RECORD COPY MT. 1A

118945

Texas Instruments Incorporated
Materials and Controls Group

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964

(508) 236-3800

March 14, 1997

Mr. Mark Roberts
US Nuclear Regulatory Commission
Region I, Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406-1415

SNM No. 23
Docket No. 70-33
Control No. 118945
10 CFR 70.38 (c)(1)(iv)

RE: Certificate of Disposition of Materials - NRC Form 314

Dear Mr. Roberts,

Texas Instruments Incorporated, Materials & Controls Group (TI) is submitting a "Certificate of Disposition of Materials - NRC Form 314" to document the disposition of the final remaining materials subject to the United States Nuclear Regulatory (NRC) Special Nuclear Materials (SNM) License No. 23. The final remaining materials consisted of a fragment of uranium-zirconium alloy scrap metal, and approximately 37 cubic feet of archived soil samples and residual debris generated during the decommissioning project that were in excess of the release criteria. The former was transferred on March 10, 1997 to NFS, a licensed facility in Erwin, Tennessee, where it was assayed as scrap and managed in the NFS scrap program. The latter material was transferred for disposal on March 14, 1997 to Envirocare of Utah, Inc., a licensed disposal facility in Clive, Utah.

Having thus submitted the Certificate of Disposition for the final remaining materials, TI has completed all decommissioning activities identified in its approved decommissioning plan. Accordingly, the site has completed all decommissioning activities and achieved compliance with the NRC guideline criteria for unrestricted release. Therefore, TI is respectfully requesting that the NRC terminate TI's special nuclear materials license number SNM-23 thus releasing the entire facility and site for unrestricted use, and that the NRC remove TI from the Site Decommissioning Management Plan.

Sincerely yours,

Materials & Controls Group

Michael J. Elliott
Environmental Manager

cc: Mr. Thomas O'Connell, MDPH- Radiation Control Program
Mr. Francis J. Veale Jr., Esq. - TI Attleboro

118945

Attachments:

OFFICIAL RECORD COPY

MAR 17 1997

Texas Instruments Incorporated
Materials and Controls Group

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964

(508) 236-3800

March 14, 1997

Mr. Mark Roberts
US Nuclear Regulatory Commission
Region I, Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406-1415

SNM No. 23
Docket No. 70-33
Control No. 118945
10 CFR 70.38 (c)(1)(iv)

RE: Certificate of Disposition of Materials - NRC Form 314

Dear Mr. Roberts,

Texas Instruments Incorporated, Materials & Controls Group (TI) is submitting a "Certificate of Disposition of Materials - NRC Form 314" to document the disposition of the final remaining materials subject to the United States Nuclear Regulatory (NRC) Special Nuclear Materials (SNM) License No. 23. The final remaining materials consisted of a fragment of uranium-zirconium alloy scrap metal, and approximately 37 cubic feet of archived soil samples and residual debris generated during the decommissioning project that were in excess of the release criteria. The former was transferred on March 10, 1997 to NFS, a licensed facility in Erwin, Tennessee, where it was assayed as scrap and managed in the NFS scrap program. The latter material was transferred for disposal on March 14, 1997 to Envirocare of Utah, Inc., a licensed disposal facility in Clive, Utah.

Having thus submitted the Certificate of Disposition for the final remaining materials, TI has completed all decommissioning activities identified in its approved decommissioning plan. Accordingly, the site has completed all decommissioning activities and achieved compliance with the NRC guideline criteria for unrestricted release. Therefore, TI is respectfully requesting that the NRC terminate TI's special nuclear materials license number SNM-23 thus releasing the entire facility and site for unrestricted use, and that the NRC remove TI from the Site Decommissioning Management Plan.

Sincerely yours,

Materials & Controls Group

M. J. Elliott

Michael J. Elliott
Environmental Manager

cc: Mr. Thomas O'Connell, MDPH- Radiation Control Program
Mr. Francis J. Veale Jr., Esq. - TI Attleboro

118945

Attachments:

OFFICIAL RECORD COPY MI 10 MAR 17 1997

NRC FORM 314 (6-95) 10 CFR 30.36(c)(1)(iv) 10 CFR 40.42(c)(1)(iv) 10 CFR 70.38(c)(1)(iv) — U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0028 EXPIRES: 06/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 30 MINUTES. THIS SUBMITTAL IS USED BY NRC AS PART OF THE BASIS FOR ITS DETERMINATION THAT THE FACILITY HAS BEEN CLEARED OF RADIOACTIVE MATERIAL BEFORE THE FACILITY IS RELEASED FOR UNRESTRICTED USE. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0028), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503. AN AGENCY MAY NOT CONDUCT OR SPONSOR, AND A PERSON IS NOT REQUIRED TO RESPOND TO, A COLLECTION OF INFORMATION UNLESS IT DISPLAYS A CURRENTLY VALID OMB CONTROL NUMBER.

CERTIFICATE OF DISPOSITION OF MATERIALS

INSTRUCTIONS. ALL ITEMS MUST BE COMPLETED -- PRINT OR TYPE
SEND THE COMPLETED CERTIFICATE TO THE NRC OFFICE SPECIFIED ON THE REVERSE

LICENSEE NAME AND ADDRESS

Texas Instruments Incorporated
Materials & Controls Group
34 Forest Street
Attleboro, MA 02703

LICENSE NUMBER: SNM-23

LICENSE EXPIRATION DATE: Open

A. MATERIALS DATA *(Check one and complete as necessary)*

THE LICENSEE OR ANY INDIVIDUAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE LICENSEE CERTIFIES THAT:
(Check and/or complete the appropriate item(s) below.)

[ ] 1 NO MATERIALS HAVE EVER BEEN PROCURED OR POSSESSED BY THE LICENSEE UNDER THIS LICENSE.

OR

[X] 2 ALL ACTIVITIES AUTHORIZED BY THE LICENSE HAVE CEASED AND ALL MATERIALS PROCURED AND/OR POSSESSED BY THE LICENSE NUMBER CITED ABOVE HAVE BEEN DISPOSED OF IN THE FOLLOWING MANNER. *(If additional space is needed, use the reverse side or provide attachments.)*

Describe specific material transfer actions and, if there were radioactive wastes generated in terminating this license, the disposal actions including the disposition of low-level radioactive waste, mixed waste, Greater-than Class-C waste, and sealed sources, if applicable.

193 gram fragment of uranium/zirconium scrap metal transferred to NFS, Inc. in Erwin, Tennessee.

For transfers, specify the date of the transfer, the name of the license recipient, and the recipient's NRC license number or Agreement State name and license number.

March 10, 1997; transfer of uranium/zirconium scrap to NFS, NRC License No. SNM-124

If materials were disposed of directly by the licensee rather than transferred to another licensee, licensed disposal site or waste contractor, describe the specific disposal procedures *(e.g., decay in storage)*

See attached continuation sheet.

B. OTHER DATA

[X] 1 OUR LICENSE HAS NOT YET EXPIRED; PLEASE TERMINATE IT.

2 A RADIATION SURVEY WAS CONDUCTED BY THE LICENSEE TO CONFIRM THE ABSENCE OF LICENSED RADIOACTIVE MATERIALS AND TO DETERMINE WHETHER ANY CONTAMINATION REMAINS ON THE PREMISES COVERED BY THE LICENSE. *(Check one)*

[ ] NO *(Attach explanation)*
[X] YES, THE RESULTS *(Check one)*
[ ] ARE ATTACHED, or
[X] WERE FORWARDED TO NRC ON *(Date)* see attached continuation sheet

3 THE PERSON TO BE CONTACTED REGARDING THE INFORMATION PROVIDED ON THIS FORM	NAME	TELEPHONE NUMBER *(Include Area Code)*
	Michael J. Elliott	508-236-1809

4 MAIL ALL FUTURE CORRESPONDENCE REGARDING THIS LICENSE TO

Michael J. Elliott, MS 10-02
Texas Instruments Incorporated, Materials & Controls Group
34 Forest Street, P.O. Box 2964, Attleboro, MA 02703-0964

CERTIFYING OFFICIAL

I CERTIFY UNDER PENALTY OF PERJURY THAT THE FOREGOING IS TRUE AND CORRECT

PRINTED NAME AND TITLE	SIGNATURE	DATE
Michael J. Elliott Environmental Manager	[signature]	March 14, 1997

WARNING: FALSE STATEMENTS IN THIS CERTIFICATE MAY BE SUBJECT TO CIVIL AND/OR CRIMINAL PENALTIES. NRC REGULATIONS REQUIRE THAT SUBMISSIONS TO THE NRC BE COMPLETE AND ACCURATE IN ALL MATERIAL RESPECTS. 18 U.S.C SECTION 1001 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY

118945

FILE CERTIFICATES AS FOLLOWS:

IF YOU ARE A DISTRIBUTOR OF EXEMPT PRODUCTS, SEND TO:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHERS, IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANCE SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

NUCLEAR MATERIALS SAFETY SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET NW, SUITE 2900
ATLANTA, GA 30323-0199

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
801 WARRENVILLE ROAD
LISLE, IL 60532-4351

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

MATERIAL RADIATION PROTECTION SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

CERTIFICATE OF DISPOSITION OF MATERIALS
NRC FORM 314
CONTINUATION SHEET

Texas Instruments Incorporated
Materials & Controls Group
10 CFR 70.38(c)(1)(iv)
SNM-23/Docket No. 70-33
Control No. 118945

A. MATERIALS DATA

2. *Materials disposed directly to another disposal site*:

In addition to earlier shipments of 583,000 cubic feet of soil and debris from the site decommissioning project that were documented in previous submittals, another 36.8 cubic feet of soil samples and residual debris from the same decommissioning project was transferred for disposal at the Envirocare of Utah, Inc. licensed facility in Clive, Utah on March 14, 1997. Envirocare operates under a State of Utah Radioactive Material License No. UT 2300249.

Previous shipments to Envirocare were documented in final reports submitted to the United States Nuclear Regulatory Commission - Region I as follows:

- Remediation of the Former Radioactive Waste Burial Site Final Report, Appendix B - Waste Characterization, Manifesting and Disposal, prepared by CPS Environmental, Inc. (September 1993).
- Remediation of the Metals Recovery Area, Appendix B - Waste Characterization, Manifesting and Disposal, prepared by CPS Environmental, Inc. (October 1996).
- Remediation of the Exterior Areas Adjacent to Buildings 11 and 12, Section 4.4 - Waste Disposal, prepared by Roy F. Weston, Inc. (August 1996).
- Remediation of Building Interiors Buildings 4, 5, and 10, Attachment 7 - Building Interior Remediation Waste Shipping Summary, prepared by Roy F. Weston, Inc. (October 1996).

B. OTHER DATA

2. *Radiation surveys were conducted by the licensee to confirm the absence of radioactive materials and to confirm that no contamination remains on the premises covered by the license.*

Submission of the four final reports listed above also contained termination survey data demonstrating compliance with decommissioning criteria that were approved by the NRC. (Note: NRC approved TI's current decommissioning criteria on two occasions, August 1992 and July 1996, in response to two separate decommissioning plan submittals; the "Remediation Plan for the Identified Building 12 Burial Area (July 1992)", and the "Supplement to the 1992 Remediation Plan (December 1994).") TI submitted the final reports listed above within the month and year shown as the publication date.

Additionally, independent confirmatory surveys were conducted by the NRC or its contractor, Oak Ridge Institute for Science and Education (ORISE) at various times during the decommissioning process. The NRC surveys are documented in field trip inspection reports. ORISE documented one of its surveys in a report entitled "Confirmatory Survey of the Texas Instruments, Inc. Former Burial Site, Attleboro, Massachusetts", prepared by A.J. Ansari of ORISE (February 1994).

[redacted]

(423) 743-9141

March 13, 1997

Mr Michael J Elliott
Environmental Manager
Texas Instruments Incorporated
34 Forest Street
P O. Box 2964
Attleboro, MA 02703-0964

Subject: Texas Instruments Purchase Order No. 500803634

Dear Mr. Elliott:

This letter is to advise you that the uranium alloy scrap identified in the subject purchase order was received at Nuclear Fuel Services, Inc. (NFS) on March 10, 1997.

Attached for your records are the first two pages of NFS' Materials License SNM-124.

If you have any questions, please call me at (423)-743-1706.

Sincerely,

R D. Clark
R D. Clark
Sales & Contract Manager

RDC/ksr

Attachment

NRC FORM 374 (10-89)

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Nuclear Fuel Services, Inc.	3. License number SNM-124 Amendment 32
2. 1205 Banner Hill Road Erwin, TN 37650-9718	4. Expiration date June 30, 1996
	5. Docket or Reference No. 70-143

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Uranium enriched up to 100 w/o in the uranium-235 isotope which may contain up to 1 ppm of transuranic materials in the form of contaminants	A. As described in Chapters 1 (Appendix B) and 7 (Appendices A and B) of the application, excluding pyrophoric forms.	A. 7,000 kilograms of U-235
B. Uranium enriched up to 100 w/o in the uranium-233 isotope	B.1. As residual contamination from previous operations	B.1. One (1) kilogram of U-233
	2. As received for analysis and/or for input into development studies, any form	2. 250 grams of U-233
C. Plutonium containing greater than 60 w/o of the plutonium-239 isotope	C.1. Calibration and counting standards	C.1. 10 millicuries
	2. As residual contamination and holdup from previous operations	2. As specified in Chapter 7, Appendix B, Section 4.4 of the application

NRC FORM 374A (7-94) U.S. NUCLEAR REGULATORY COMMISSION

License Number SNM-124 Amendment 32

Docket or Reference Number 70-143

MATERIALS LICENSE SUPPLEMENTARY SHEET

3. As stored material from previous operations	3. 200 grams
4. As received for analysis and/or for input into development studies, any form	4. 200 grams
5. As waste resulting from decontamination and volume reduction of equipment received from other organizations, any form	5. 200 grams

9. Authorized place of use: The licensee's existing facilities in Unicoi County, Tennessee, as described in the referenced application.

10. This license shall be deemed to contain three sections: Safety Conditions, Safeguards Conditions, and Transportation Conditions. All these sections are part of the license and the licensee is subject to compliance with all listed conditions in each section.

FOR THE NUCLEAR REGULATORY COMMISSION

Michael T. Bla... for

Date: October 30, 1996

By: Robert C. Pierson
Division of Fuel Cycle Safety
and Safeguards
Washington, DC 20555

TELEPHONE CONVERSATION RECORD	Date:3/13/97 & 3/14/97	Time:2:30 & 2:10
Mail Control No.:118945	**License No.:** SNM-23	**Docket No.:** 070-00033
Person Called: Michael Elliott	**Organization:** Texas Instruments	**Telephone Number:**(508) 236-1809
Person Calling: Mark Roberts		
Subject: Status of radiological samples at the TI Attleboro site		
Summary: I returned Mr. Elliott's call. TI was holding a large group of archived samples until completion of the NRC confirmatory survey at the site. A small number of these samples were pre-remediation characterization samples and had total uranium concentrations that exceeded the NRC guidelines for release for unrestricted use. These samples were shipped from the TI facility on 3/7/97 and have arrived at the Envirocare site in Utah today. Actual in-ground disposal at Envirocare is scheduled for 3/14/97. Also, a 193-gram piece of (usable) enriched uranium was recovered during the remediation activities and was retained, rather than shipping as waste. This material was transferred to NFS (NRC License No. SNM-124) in Tennessee. Mr. Elliott confirmed that NFS was authorized to receive this material and has a copy of the NFS license. Mr. Elliott confirmed that NFS received this material on 3/10/97. Mr. Elliott will send a completed NRC-314 documenting the disposal/transfer of these materials. This was the last licensed material remaining on the site.		
Action Required/Taken: Continue actions for termination of the license.		
Signature: Mark Roberts	**Date:** 3/14/97	

OFFICIAL RECORD COPY ML 10

The Commonwealth of Massachusetts
Executive Office of Health and Human Services
Department of Public Health
Radiation Control Program
305 South Street, Jamaica Plain, MA 02130
(617) 727-6214 (617) 727-2098 - Fax

WILLIAM F. WELD
GOVERNOR

ARGEO PAUL CELLUCCI
LIEUTENANT GOVERNOR

JOSEPH GALLANT
SECRETARY

DAVID H. MULLIGAN
COMMISSIONER

070-00033

March 10, 1997

Ronald Bellamy, Chief
U S Nuclear Regulatory Commission
Region I, Nuclear Material Section
475 Allendale Road
King of Prussia, PA 19406-1415

Re Meeting MARCP 105 CMR 120 291 Requirements for Texas Instruments, Attleboro, MA

Dear Mr Bellamy,

The Radiation Control Program (MARCP) requested that Texas Instruments (TI) Incorporated of Attleboro, Massachusetts SNM No 23/Docket No 70-33, provide documentation to the MARCP which would demonstrate that TI's radiological remediation of the Attleboro site would met the requirements of 105 CMR 120 291

The regulation cited pertains to vacating premises, specifically releasing a site for unrestricted use

The regulation states " When deemed necessary by the Agency, the licensee, registrant, or person possessing non-exempt sources of radiation shall decontaminate the premises in such a manner that the annual effective dose equivalent (EDE) to any individual after the site is release for unrestricted use should not exceed ten millirem above background . "

The MARCP received documentation dated February 20, 1997 from Roy F Weston, Inc and (ms)^2 Scientific Consultants, Inc., TI's contractors The documentation included the radiological dose assessment from TI's interior and exterior decommissioning projects at the Attleboro site Included in the radiological dose assessment report were the exposure scenario and environmental pathway parameters

The evaluation of the dose to a maxim⁻ˡˡy exposed individuals from the residual source term was calculated utilizing the modeling code RESRAD Ver 5 62 This software code was developed by Argonne National Laboratory, Argonne, Illinois

1 1 8 9 4 5

MAR 1 3 1997

OFFICIAL RECORD COPY ML 10

The RESRAD code is one of the tools utilized by the MARCP for assessing the radiological impact to an individual from radioactive materials at a site. RESRAD allows the user to construct dose assessments scenarios in order to evaluate the dose to an individual from the future use of the remediated site

TI's bounding scenarios included evaluation of the doses for the current occupancy status of the TI site, i.e. maintenance workers and the dose to an individual due to the future conversion of the site to residential use.

The review of TI's SNM License Termination Radiological Dose Assessment document dated February 20, 1997, demonstrates that the assessment scenarios developed by TI would result in effective dose equivalents to current and future individuals which would be within 105 CMR 120.291 values.

Based on the documentation available, TI has demonstrated that the decommissioning projects performed on the interior and exterior areas, as of date of this letter, would met the MARCP requirements of 105 CMR 120.291 - Vacating Premises.

Sincerely,

Robert M. Hallisey
Director
Radiation Control Program

cc. T. O'Connell
Mark Roberts/USNRC
File

REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

March 12, 1997

Docket No.: 070-00033 License No.: SNM-23

David Lederer
U.S. Environmental Protection Agency
Region I
J. F. Kennedy Federal Building, HBO
Boston, Massachusetts 02203

SUBJECT: REMOVAL OF THE TEXAS INSTRUMENTS, INC., ATTLEBORO, MASSACHUSETTS SITE FROM THE NRC SITE DECOMMISSIONING MANAGEMENT PLAN AND TERMINATION OF USNRC LICENSE NO. SNM-23

Dear Mr. Lederer:

In 1990, the NRC staff identified approximately 50 sites that warranted special Nuclear Regulatory Commission oversight and created the Site Decommissioning Management Plan (SDMP). This action was taken for these sites to ensure timely and safe remediation of residual radioactive material in excess of the current NRC criteria for release for unrestricted use. One of the sites on the SDMP is the Texas Instruments, Inc., facility in Attleboro, Massachusetts.

The staff added this site to the SDMP because an on-site disposal of radioactive material had been made, but the location and extent of the disposal was not well-known, and the extent and location of soil contamination on this site was also not well-known. Although measurements taken in the 1980's had not indicated any contamination in groundwater, the staff was also concerned about potential radioactive contamination of the groundwater due to the presence of the buried radioactive material on the site.

Remediation of the on-site burial area was completed in the fall of 1993. Confirmatory measurements by an NRC contractor did not identify any residual radioactive contamination in this area in excess of the NRC criteria for release for unrestricted use. In the summer and early fall of 1994, Texas Instruments completed comprehensive characterization of the remainder of the exterior areas of the site. Radiological surveys of the building interiors were also performed at this time. Radiological contamination was identified in both interior and exterior areas of the site. Texas Instruments remediated the contamination in these areas in accordance with their 1992 remediation plan for the burial area and a 1994 supplement to the 1992 remediation plan.

Texas Instruments completed remediation of all exterior and interior areas in September 1996. Final radiological surveys were conducted by Texas Instruments' contractors and the reports were submitted to the NRC for review. Texas Instruments also submitted the results of the analysis of groundwater samples collected from monitoring wells on the site from 1993 through 1997. The NRC, accompanied by a representative of the

Commonwealth of Massachusetts, conducted confirmatory measurements at the site during the week of February 4-7, 1997.

Also, as you are aware, in approximately 1978, the NRC confirmed the presence of radioactive contamination at the Shpack landfill in nearby Norton, Massachusetts. Although the source of this contamination may have been the result of work performed at the Texas Instruments' Attleboro facility, the company has not acknowledged that their facility was the source of the material in the landfill. Texas Instruments and several other companies have entered into a consent order with EPA regarding the landfill. The landfill was listed on the U.S. Department of Energy (DOE) Formerly Utilized Site Remedial Action Program (FUSRAP) in 1980. Because the landfill is a DOE FUSRAP site and Texas Instruments is a party to the consent order with EPA, NRC believes that there is adequate regulatory consideration of any remaining radioactive material in the landfill.

Based on the actions taken by the licensee, our review of the surveys performed, and the results of the NRC confirmatory survey, the staff concludes that the site now meets the NRC criteria for release for unrestricted use. The staff plans to terminate NRC License No. SNM-23, issued to Texas Instruments. Inc. for the Attleboro, Massachusetts site, and to remove this site from the SDMP. The NRC intends to formally notify the licensee, by letter, and plans no further action on this site. The Commonwealth of Massachusetts is cognizant of the NRC plans and also plans no further action regarding the NRC licensed materials at the site. Mark Roberts of my staff discussed these issues with you on March 5, 1997.

If you have any questions concerning this letter, please contact Mr. Roberts at (610) 337-5094, or me at (610) 337-5200. Your cooperation with us is appreciated.

Sincerely,

Ronald R. Bellamy

Ronald R. Bellamy, Ph. D., Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety

License No. SNM-23
Docket No. 070-00033

cc:
Commonwealth of Massachusetts

Francis Veale
Environmental Safety & Health Department Manager
Texas Instruments, Inc.
34 Forest Street
Attleboro, Massachusetts 02703

James Wagoner
U.S. Department of Energy
Office of Restoration
12800 Middlebrook Road
Germantown, MD 20874

070-00033

ORISE

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

March 11, 1997

Mr. Mark Roberts
U.S. Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, Pennsylvania 19406-1415

SUBJECT: REPORT FOR ANALYSIS OF SOIL SAMPLES FROM TEXAS INSTRUMENTS, ATTLEBORO, MASSACHUSETTS (RFTA NO. 97-14)

Dear Mr. Roberts:

The Environmental Survey and Site Assessment Program (ESSAP) of Oak Ridge Institute for Science and Education (ORISE) performed isotopic uranium analysis on nine samples from Texas Instruments, located in Attleboro, Massachusetts. Results are provided in the enclosed table. Samples exhibited various isotopic uranium ratios. Sample TI #12 was depleted, TI #13 was natural and all other samples contained enriched uranium.

If you have any questions, please call me at (423) 576-3561 or Dale Condra at (423) 241-3242.

Sincerely,

Dale Condra for

Mark Laudeman
Radiochemist
Environmental Survey and Site
Assessment Program

MJL:dka

Enclosure

cc: R. Uleck, NRC/NMSS/TWFN 7F27
D. Tiktinsky, NRC/NMSS/TWFN 8A23
J. Kottan, NRC/Region I
File/684
W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
D. Condra, ORISE/ESSAP

TABLE 1

ISOTOPIC URANIUM CONCENTRATION IN SOIL
TEXAS INSTRUMENTS
ATTLEBORO, MA

Sample Identification TI#	Radionuclide Concentrations (pCi/g)		
	U-234	U-235	U-238
3	29.1 ± 2.1[a]	1.3 ± 0.2	8.6 ± 0.7
4	8.3 ± 0.5	0.3 ± 0.06	2.1 ± 0.2
5	10.4 ± 0.6	0.52 ± 0.07	5.1 ± 0.3
8	16.2 ± 0.9	0.67 ± 0.08	6.9 ± 0.4
12	5.2 ± 0.3	0.42 ± 0.07	13.3 ± 0.8
13	2.8 ± 0.2	0.14 ± 0.04	2.3 ± 0.2
14	14.3 ± 0.8	0.56 ± 0.08	1.6 ± 0.1
26	16.7 ± 1.0	0.77 ± 0.09	8.1 ± 0.5
27	11.0 ± 0.7	0.42 ± 0.07	0.33 ± 0.06

[a]Uncertainties represent the 95% confidence level, based only on counting statistics.

070-00033
SNM-23
L8

WESTON
MANAGERS DESIGNERS/CONSULTANTS

Roy F. Weston, Inc.
6501 Americas Parkway, NE, Suite 800
Albuquerque, New Mexico 87110-1617
505-884-5050 • Fax 505-837-6870

10 March 1997

Texas Instruments Incorporated
Attention: Michael Elliott
Mail Stop 10-2
34 Forest Street
Attleboro, MA 02703-0964

RE: TI Building Interiors/Exteriors Decommissioning Project RFW # 10923-004-005-0600-00
Hypothetical Radiological Dose and Exposure Rate Assessment
Priority 2 Drain Lines

Dear Mr. Elliott:

Enclosed are copies of the Hypothetical Radiological Dose and Exposure Rate Assessment. This document is compiled in support of the Texas Instruments, Special Nuclear Materials License No. 23 termination. The salient features of the Dose Assessment, including exposure scenarios and assumptions, were discussed during a teleconference call last Thursday afternoon between you, Steve Shafer and Mark Roberts. Comments aired during that call have been incorporated into the report. At your request a draft of the assessment was faxed to Mr. Roberts on March 9, 1997.

Under cover of this letter, this document is transmitted to the NRC and the Commonwealth of Massachusetts.

If you have any questions please call me (505) 837-6590 or Steve Shafer at (505) 837-6579.

Sincerely,

ROY F. WESTON, INC.

C. William Criswell
Senior Project Manager

CWC/

Enclosures

pc: Mark C. Roberts, CHP, US Nuclear Regulatory Commission, Region I
Thomas F. O'Connell, The Common Wealth of Massachusetts, Department of Public Health
Steve Shafer, RFW, Health Physicist
Mike Madonia, (ms)^2 Scientific Consultants
John B. Price, RFW, Project Director

118945
MAR 11 1997

TEXAS INSTRUMENTS INCORPORATED

Attleboro, Massachusetts

SNM LICENSE TERMINATION
HYPOTHETICAL RADIOLOGICAL DOSE AND EXPOSURE RATE ASSESSMENT PRIORITY 2 DRAIN LINES

NRC License/Docket No: SNM-23/70-33

Prepared by

WESTON

March 10, 1997

1.0 INTRODUCTION

The purpose of this dose and exposure rate assessment is to consider the potential radiological dose and gamma exposure to a hypothetical receptor as a result of exhuming Priority 2 drain lines at the Texas Instruments Incorporated (TI), Attleboro Facility. This assessment will be used by the United States Nuclear Regulatory Commission (NRC) to augment previously submitted documentation for termination of Special Nuclear Materials (SNM) license #23.

2.0 HISTORY

In the course of decontamination operations to support the request for termination of SNM license #23, TI grouped sections of underlying drainage systems. These groups were assigned increasing priority (Priority 1-3), based on their radioactive material content and percentage of residue blockage. Priority 2 drain lines were defined as lines containing total residue uranium concentrations between 500-1000 pCi/g, and would be subject to a hydrolasing decontamination technique. During an inspection by NRC on February 3-6, 1997, questions were raised concerning measurements of contamination in the interior of Priority 2 drain lines as the basis of unrestricted release. As a response to these questions, TI submitted to the NRC a supplemental analyses report dated February 11, 1997, which contained further explanation to support unrestricted release of the site. In addition, on February 20, 1997, TI submitted a document that contained a current-use worker intrusion scenario dose assessment and a site-wide exterior area residential future-use dose assessment.

3.0 SOURCE TERM

The source term for this report is defined as the total inventory of radioactive material contained within the area occupied by exhumed Priority 2 drain lines. The source term was calculated based on radionuclide concentrations of residuals within the volume of the drain lines in place before hydrolasing decontamination (used for pre-decontamination scenario) and residuals left in place after decontamination (used for post-decontamination scenario). In preparing source terms for input to the modeling approaches, it was necessary to identify the relative dimensions (length and diameter) of the Priority 2 drain lines. It was also necessary to develop assumptions that would enable the transformation of the Priority 2 drain lines into an area source for RESRAD and a disk source for MicroShield.

Source term concentrations and drain line characteristics information for the Priority 2 drain lines are presented in the Drainage System Unrestricted Release Information – Supplemental Analyses, February 11, 1997, Table 1 of Appendix 1. Supplemental information for this hypothetical dose assessment was also derived from Texas Instruments Incorporated Remediation of Building Interiors 4, 5, and 10 Report, Attachment 5 of Appendix 2.

Pipe volumes (as calculated with actual dimensions) and average densities were combined to determine the total mass of piping which, when crushed, was available for distribution over a surface area of thickness of 1 cm (as recommended by NRC.) It should be noted that the residual total uranium activity is distributed in a thin layer lining the pipes. This thin layer is assumed to be homogenized through the pipe mass during crushing. Based on total pipe length

To provide an extremely conservative bounding condition for output from RESRAD and MicroShield, the maximum pre-decontamination isotopic uranium concentrations were applied to the mass of piping to determine isotopic uranium inventories. Based on maximum isotopic concentrations of uranium-234 (71 pCi/g), uranium-235 (5 pCi/g), and uranium-238 (5 pCi/g), the resulting total activities are 1.6E-03 Ci, 1.0E-04 Ci, and 1.0E-04 Ci, respectively. A more realistic basis of potential dose and exposure calculations using post-decontamination isotopic uranium concentrations of uranium-234 (0.35 pCi/g), uranium-235 (0.002 pCi/g), and uranium-238 (0.002 pCi/g), resulted in total activities of 8.0E-06 Ci, 5.0E-08 Ci, and 5.0E-08 Ci respectively. Both sets of source term data are analyzed using dose and exposure rate modeling methods.

All source term assumptions and calculation are contained in Appendices 3 and 6.

4.0 EXPOSURE SCENARIO DEVELOPMENT/ENVIRONMENTAL PATHWAY ASSESSMENT

All possible environmental transport pathways for this dose assessment were used to perform the Priority 2 drain lines pre-and post-decontamination dose assessments. Pre-decontamination concentrations of residual total uranium in the drain lines were used to provide an upper bound for the exercise. Use of the concept of "bounding scenarios" provided streamlined final output dose assessment data and conclusions that can be used to support decision-making. When evaluating potential scenarios, it became evident that postulated doses from the Priority 2 pipes would be significantly higher than the Priority 3 drain lines. Analysis of potential doses from Priority 3 drain lines would result in significantly lower doses and is therefore unnecessary because the pre-decontamination scenario for Priority 2 drain would result in significantly higher doses.

In developing the methodology for this hypothetical dose assessment, both current- and future-use exposure scenarios were evaluated. The current-use and future-use scenario analyses accounted for all potential uses for the hypothetical drain line source area, given that there was absolutely no corporate control of the TI site. The analysis identifies the activity with the highest dose potential as exhuming the entire lot of Priority 2 drain lines during a one-time maintenance activity. Crushing and grinding of the drain lines would then be performed, with subsequent placement of the bulk line material in an area occupying 96 m^2 to a depth of 1 cm. The most conservative future-use scenario likely for the member of the public would result if, after drain line removal and grinding, a residence is built directly on top of the source. These scenarios are likely to yield highly conservative doses for several reasons:

1. Source calculations use maximum total uranium concentrations (including background concentrations) that overestimate the true concentration in bulk material (drain line).
2. Source calculations assume that the total volume of the drain lines is contaminated to the same maximum concentration as the residual total uranium in the line.

or were hydrolased, which significantly lowered the internal contamination. The post-decontamination scenario represents the actual current conditions in the Priority 2 drain lines.

4. All RESRAD default parameters with the exception of source area and depth were used. These default parameters were chosen by the code developers to provide conservative results. The RESRAD default parameters are extremely conservative given the probable current and future use of the land at the TI facility.

5. It is unlikely that any future activity would exhume **all** Priority 2 drain lines in a one time maintenance activity.

6. In application of the RESRAD code, source material is assumed to be consolidated at the surface directly under the future residence location.

5.0 DOSE ANALYSIS AND EXPOSURE RATE DETERMINATION METHODS

This hypothetical dose and exposure rate assessment included the application of two computer modeling packages. The computer modeling packages were applied and adapted to the conditions of the selected scenarios from a list of assumptions developed by the NRC and TI. It is believed that any problems associated with applicability of these codes to the proposed hypothetical scenarios would result in a conservative error.

Dose estimates for the proposed hypothetical scenarios are performed using the modeling code RESRAD 5.70 developed by Argonne National Laboratory. RESRAD allows optimal flexibility in assessing transport pathways associated with the proposed scenario.

Final RESRAD dose calculations are developed using the following process:

1. Define volume and radionuclide concentration resulting from exhuming and crushing Priority 2 drain lines. This information can be found in Appendix 3

2. Set all pathways in RESRAD menu – external gamma, inhalation, plant ingestion, meat ingestion, milk ingestion, aquatic foods, drinking water, soil ingestion, and radon.

3. Modify data parameters in RESRAD menu – contaminated zone parameters (contamination area and depth), initial concentrations of principal radionuclides (maximum concentration for pre-and post-decontamination) with all other inputs set as the RESRAD defaults.

4. Set RESRAD graphics.

5. Generate RESRAD output.

A summary of the hypothetical exposure scenario parameters for both pre- and post-decontamination dose assessments are included with the RESRAD code outputs presented in Appendices 4 and 5.

for optimal flexibility in developing versatile source geometry and shields for assessing exposure to materials and people at a designated location.

Final MicroShield exposure calculations are developed using the following process:

1. Input the source information, which includes the geometry, dimensions, dose point location, shield type, and shield dimensions. This information can be found in Appendix 6.
2. Input shield information, which includes type of material and density.
3. Input source information, which includes nuclides and source activity.
4. Load buildup factor reference material.
5. Load source energy activity and equilibrium file.
6. Identify all applicable photons from source.
7. Load integration parameters as related to the proposed geometry.
8. Provide a title for the case.
9. Run code and generate output.

All other specific inputs (steps 2-8 above) for the Priority 2 drain line exposure rate assessments can be found in the MicoShield output in Appendices 7 and 8.

6.0 DOSE AND EXPOSURE SUMMARY

6.1 Pre-decontamination RESRAD Results

The TEDE resulting from the proposed hypothetical scenario prior to decontamination of drain lines which represents the upper bound case is estimated to be 0.71 mrem in the first year after exposure. The inhalation pathway contributed 0.41 mrem, approximately 57% of the TEDE. Ingestion and direct gamma doses contributed 41%, combined. It should be noted that the projected dose in future years following residential placement decreases at a steady rate. The future dose then increases near the 300-year time frame due to infiltration of contaminants into shallow ground water, which directly impact all water-dependent pathways. However, the shallow aquifer has received contaminants from other industrial sites in the Attleboro area and is of poor quality. In all probability, the aquifer will never be used a future drinking water source. Detailed code calculation and output information for the hypothetical pre-decontamination scenario are presented in Appendix 4.

6.2 Post-decontamination RESRAD Results

The TEDE resulting from the proposed scenario after decontamination of drain lines, which represents the current conditions at the facility, is estimated to be 0.002 mrem in the first year

after exposure. The inhalation pathway contributed 0.0018 mrem, approximately 91% of the TEDE. Ingestion and direct gamma doses contributed approximately 8%, combined. It should be noted that the projected dose in future years following residential placement decreases at a steady rate. The future dose then increases near the 300-year time frame due to infiltration of contaminants into shallow ground water, which directly impacts all water-dependent pathways. However, the shallow aquifer has received contaminants from other industrial sites in the Attleboro area and is of poor quality. In all probability, this aquifer will never be used as a future drinking water source. Detailed code calculation and output information for the hypothetical post-decontamination scenario is presented in Appendix 5.

6.3 Pre-decontamination Scenario MicroShield Results

The exposure rate from the proposed hypothetical scenario and disk source geometry at 1 meter is estimated to be 0.9 μR/hr. Detailed code calculation and output information for the pre-decontamination drain line scenario can be found in Appendix 7.

6.4 Post-decontamination Scenario MicroShield Results

The exposure rate from the proposed hypothetical scenario and disk source geometry at 1 meter is estimated to be 0.0005 μR/hr. Detailed code calculation and output information for the post-decontamination drain line scenario can be found in Appendix 8.

after exposure. The inhalation pathway contributed 0.0018 mrem, approximately 91% of the TEDE. Ingestion and direct gamma doses contributed approximately 8%, combined. It should be noted that the projected dose in future years following residential placement decreases at a steady rate. The future dose then increases near the 300-year time frame due to infiltration of contaminants into shallow ground water, which directly impacts all water-dependent pathways. However, the shallow aquifer has received contaminants from other industrial sites in the Attleboro area and is of poor quality. In all probability, this aquifer will never be used as a future drinking water source. Detailed code calculation and output information for the hypothetical post-decontamination scenario is presented in Appendix 5.

6.3 Pre-decontamination Scenario MicroShield Results

The exposure rate from the proposed hypothetical scenario and disk source geometry at 1 meter is estimated to be 0.9 μR/hr. Detailed code calculation and output information for the pre-decontamination drain line scenario can be found in Appendix 7.

6.4 Post-decontamination Scenario MicroShield Results

The exposure rate from the proposed hypothetical scenario and disk source geometry at 1 meter is estimated to be 0.0005 μR/hr. Detailed code calculation and output information for the post-decontamination drain line scenario can be found in Appendix 8.

7.0 REFERENCES

ANL 1993. Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil. Environmental Assessment and Information Sciences Division, Argonne National Laboratory, ANL/EAIS-8. April, 1993.

DOE 1993. Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0. Environmental Assessment Division, Argonne National Laboratory, ANL/EAD/LD-2. September 1993.

GROVE 1994. MicroShield Version 4.20 Users Manual, Grove Engineering, Inc. October 1994.

TI 1996. Remediation of Building Interiors - Buildings 4, 5, and 10. Texas Instruments Incorporated report prepared by Roy F. Weston, Inc. October 1996.

TI 1997. Drainage System Unrestricted Release Information - Supplemental Analyses report prepared by (ms)2 Scientific Consultants, Inc., for Roy F. Weston, Inc. February 1997.

APPENDIX 1

Drainage System Unrestricted Release Information - Supplemental Analyses - February 11, 1997

APPENDIX 1

Drainage System Unrestricted Release Information - Supplemental Analyses - February 11, 1997

DRAINAGE SYSTEM UNRESTRICTED RELEASE INFORMATION - SUPPLEMENTAL ANALYSES - FEBRUARY 11, 1997

Introduction

In the course of decontamination operations to support the request for termination of Special Nuclear Materials (SNM) license #23, Texas Instruments Incorporated (TI), grouped sections of the underlying drainage system. These groups were assigned increasing priority (Priority 1-3), based on their radioactive material content and percentage residue blockage. Priority 2 lines were defined as containing total residue uranium concentrations between 500-1000 pCi/g, and were subject to a hydrolasing decontamination technique. During inspection by the U.S. Nuclear Regulatory Commission (NRC) on February 3-6, 1997, questions were raised concerning measurements of contamination in the interior of Priority 2 drain lines as defined in the final decommissioning report, and the use of drain line residue sample concentrations as the basis of unrestricted release. The information presented in this document supports the conclusion that drain lines have been decontaminated to applicable remediation criteria.

Summary of Response

Collection and analyses of representative samples of the drain line residue allow assessment of bulk material concentrations and pipe interior surface contamination levels. Direct measurements were not an acceptable means of determining compliance with remediation criteria for decontaminated drain lines due to the physical condition of the lines. The correlation of direct radiation measurements to interior pipe surface contamination levels is hampered by irregular surfaces in the drain lines, the presence of larger blockages, varying geometries, the presence of radium and other naturally-occurring radioactive material (NORM), and the presence of moisture and liquid resulting from active facility discharges.

Sample characterization data for the drainage system, Priority 2 drain line decontamination technique, and video record of decontaminated lines, support either bulk material concentration or interior surface contamination analyses. These analyses indicate that after decontamination of Priority 2 drain lines, both bulk material (30 pCi/g total uranium) and surface contamination (5000 dpm/100 cm^2 - average; 15,000 dpm/100 cm^2 - maximum) criteria were met. Use of the hydrolasing decontamination technique is believed to have effectively lowered removable contamination levels to essentially background levels.

During typical drain line maintenance in unaffected areas of the facility, workers are not significantly exposed to pipe interiors. Common handling involves removal and disposal of complete sections, or breakage to reduce volume. This handling is more likely to result in exposure to a bulk material and indicates that bulk material release criteria are most applicable to the drainage system.

Technical Concept

The following discussion describes the means used to calculate bulk material concentrations for drain lines and to calculate surface contamination levels on pipe interiors before and after Priority 2 drain line decontamination activities. Two parameters are used to assess bulk material concentrations and interior surface contamination levels of drain line sections. These parameters are the thickness of residue lining the pipes and the total uranium concentration in the residue. Both of these parameters must be determined using samples for "representative" sections of drain lines. Sampling methodologies, frequencies, and locations are discussed in the 1996 TI report "Drainage System Characterization."

Bulk Material Concentrations - For any given interior pipe area (that contains x thickness of residue at y concentration), there is a mass of drain line underlying the residue. This pipe mass is calculated based on the density for cast iron or vitreous clay and the thickness of the pipe wall, which varies based on the interior diameter of the pipe. If the drain line is treated as a bulk-contaminated object (which we propose) the total uranium concentration associated with the mass of residue is effectively diluted by the mass of

the pipe, resulting in our concept of concentration adjustment factor (CAF). The CAF may be multiplied by the residue concentration to yield an adjusted mass concentration (AMC) of total uranium in bulk pipe material.

Since the mass of underlying pipe per unit interior area is greater than that of the residue, significant dilution results (as shown in Table 5.1, Attachment 5, Remediation of Building Interiors Buildings 4, 5, and 10). It also can be seen that even relatively small reductions in the residue mass can result in large reduction to the CAF. Decontamination by hydrolasing actually achieved large reductions in residue mass.

Interior Surface Contamination Levels - Knowledge of the residue thickness and total uranium concentrations provides enough information to calculate the total uranium surface activity per unit area inside the pipe. The residue thickness (cm) may be multiplied by a 100 cm^2 area to determine the volume of residue within the reference area. This volume is multiplied by the average residue density (g/cm^3), total uranium concentration (pCi/g), and conversion factor from pCi to dpm (2.22) to yield a surface contamination level in dpm/100 cm^2 that may be compared to surface release criteria.

Due to the irregular pipe surfaces, blockage, and moisture content, this method of calculation likely yields a more accurate estimate of interior surface contamination than could be obtained by conversion from direct-reading radiation detector measurements. As with bulk material concentrations, even small residue mass changes resulting from decontamination will substantially reduce interior pipe surface contamination levels.

Technical Analyses

Bulk material and interior surface contamination levels are calculated based on parameters presented in Tables 1 and 2, respectively. Both tables present maximum estimated percent blockage as a percent of pipe inside diameter in each line prior to and following decontamination, and total uranium concentration as analyzed in representative samples in each designated section of line. Each table presents the estimated drain section length prior to decontamination and the total length that was actually subject to decontamination. In general, the decontaminated length of each section was substantially longer because complete drain systems were subject to decontamination, rather than only those sections located in affected areas.

A final total of 1220 lf of lines were subject to decontamination. Applying an average radius of 6.25 cm (5" line), the total interior volume of the drain lines was approximately 4.8 m^3. Based on intrusive drain system characterization and the observation that 10% of the line volume was blocked, the projected post-decontamination discharge sediment volume was calculated to be 0.48 m^3. The actual volume of sediment recovered after decontamination was approximately 0.40 m^3, which indicated an actual blockage percentage of 8%. The nearly identical projected and actual residue volume verify 1) the accuracy of the initial residue blockage estimates, and 2) the effectiveness of the decontamination method.

Bulk Material Concentrations - As noted in the final decommissioning report, adjusted mass concentrations in Priority 2 bulk drain line materials ranged from 44-81 pCi/g prior to decontamination. As noted in Table 1, the residue blockage was assumed to decrease from 10% to 0.5% as the result of decontamination activities. This reduction is supported through observation of the video record of the process. Appropriately, the significant reduction of residue mass results in decreasing CAFs, which are recalculated to range from 4E-4 to 8E-4. Multiplication of the original sample total uranium concentration in each line section by the post-decontamination CAFs yields AMCs ranging from 0.2 to 0.4 pCi/g.

Interior Surface Contamination Levels - Table 2 presents the calculated pre- and post-decontamination surface contamination levels. These levels are calculated based on the initial total uranium concentration as applied to the 10% residue blockage and 0.5% residue blockage, respectively. The average residue

layer thickness at 10% was calculated to be 0.32 cm, while the post-decontamination layer thickness of 0.5% yielded a calculated thickness of 0.02 cm. Total surface contamination levels prior to decontamination ranged from 53,000 - 95,000 dpm/100 cm^2, while calculated post decontamination levels ranged from 3300 - 5900 dpm/100 cm^2, with an average of 3900 dpm/100 cm^2.

Summary and Conclusions

The AMCs for total uranium in Priority 2 drain lines range from 0.2 - 0.4 pCi/g, well below the bulk material release criterion of 30 pCi/g total uranium. The calculated pipe interior surface contamination levels average 3900 dpm/100 cm^2, which is 20% less than the total surface contamination release criterion of 5000 dpm/100 cm^2 (average). Sampling strategies and protocol have been addressed in previous documents addressing the drainage system characterization.

Table 1 - TI Drain Calculations
Mass Basis Concentrations Before and After Decontamination

Section of Line From Figure 5.4	Type	Estimated Length Prior to Decon (ft)	Final Decon. Length (ft)	Total U Conc. (pCi/g)	Max % Blockage Pre-Decon	MDF Pre-Decon	Pre-Decon Adjusted Mass Conc. (pCi/g) of Pipe	Max % Blockage Pre-Decon	MDF Post-Decon	Post-Decon Adjusted Mass Conc. (pCi/g) of Pipe
1	VC	160	280	892	10	0.08	71	0.5	4.00E-04	0.4
2	VC	25	30	553	10	0.08	44	0.5	4.00E-04	0.2
3	CI	150	300	501	10	0.09	45	0.5	4.50E-04	0.2
	VC	150	310	501	10	0.09	45	0.5	4.50E-04	0.2
4	CI	150	300	507	10	0.16	81	0.5	8.00E-04	0.4

THIS DOCUMENT SUBJECT TO ATTORNEY - CLIENT PRIVILEGE

Table 2 - TI Drain Calculations
Conversions to Surface Activity

Section of Line From Figure 5.4	Type	Estimated Length Prior to Decon (ft)	Final Decon. Length (ft)	Total U Conc. (pCi/g)	Max % Blockage	Pre-Decon Total Activity per 100 cm2 (dpm)	% Blockage Post Decon	Post-Decon Total Activity per 100 cm2 (dpm)
1	VC	160	280	892	10	95052	0.5	5941
2	VC	25	30	553	10	58928	0.5	3683
3	CI	150	300	501	10	53387	0.5	3337
	VC	150	310	501	10	53387	0.5	3337
4	CI	150	300	507	10	54026	0.5	3377
					Average	62956		3935

Constant Input Factors	
Pipe Radius	6.25 cm (5" dia)
Calculated Layer Thickness Pre.	0.32 cm
Calculated Layer Thickness Post.	0.02 cm
Residue Density	1.5 g/cm3

APPENDIX 2

Remediation of Buildings Interiors
Buildings 4,5, and 10
Attachment 5, Building 4 and 10 Drainage System Data

TEXAS INSTRUMENTS INCORPORATED

Attleboro, Massachusetts

REMEDIATION OF BUILDING INTERIORS
BUILDINGS 4, 5, AND 10

NRC License/Docket No: SNM-23/70-33

Report
Version: 1.0

Prepared by

WESTON

October 1996

ATTACHMENT 5
BUILDINGS 4 AND 10 DRAINAGE SYSTEM DATA

ATTACHMENT 5
BUILDINGS 4 AND 10 DRAINAGE SYSTEM DATA

This attachment describes sections of the subsurface drainage system that were removed or decontaminated *in situ* during remediation activities in Buildings 4 and 10. Figures 5.1 and 5.2 illustrate the subsurface drainage system through affected areas of Buildings 4 and 10, respectively, prior to full-scale decontamination program implementation. No access or arterial lines were identified below the affected areas of Building 5. Where drain lines containing small quantities of uranium-contaminated residue were left in place, an estimate of the residual ~~ ~~active material inventory is presented. Where applied, *in-situ* decontamination techniques resulted i. ~~ ~~eduction of in-line contamination levels. Due to the high moisture content associated with active lines and to the irregular inner pipe surfaces resulting from residue accumulation, surface contamination levels are not quantified. However, a significant amount of both surface and loose contamination was removed using a two-step process.

Drainage System Description

Buildings 4 and 10 drainage systems consist of 4-inch vitreous clay (VC) and 4-, 5-, and 6-inch cast iron (CI) lines referred to as arterial lines. These lines are located 2 to 3 feet (ft) below facility grade. The arterial lines, which typically run from north to south or south to north, usually flow into east-west lines of 6 to 12 inches in diameter (referred to as main lines). Floor penetrations or "cleanout" points (referred to as feeder lines) are typically 4 inches in diameter and may be encountered at various locations above the subsurface drainage system. Main lines are routed to a lift station, followed by discharge to a stream channel running from the facility.

Conversations with Texas Instruments Incorporated personnel indicated that VC lines accepted flow from floor drains, while the CI lines accepted flow from the roof drains. These personnel also indicated that there have been historical instances of "cross-routing" between these systems. The terms drain and line are used interchangeably.

Characterization and Prioritization

Prior to the full-scale remediation project, a comprehensive characterization of the subsurface drainage system was performed. Characterization results were used to designate three levels of drain line decontamination prioritization with respect to the volume and concentration of radioactive material. Priority 1 lines exhibited residue blockage greater than or equal to 10 percent and/or total uranium concentrations in excess of 1,000 picocuries per gram (pCi/g), and were identified for complete removal and disposal as radioactive waste.

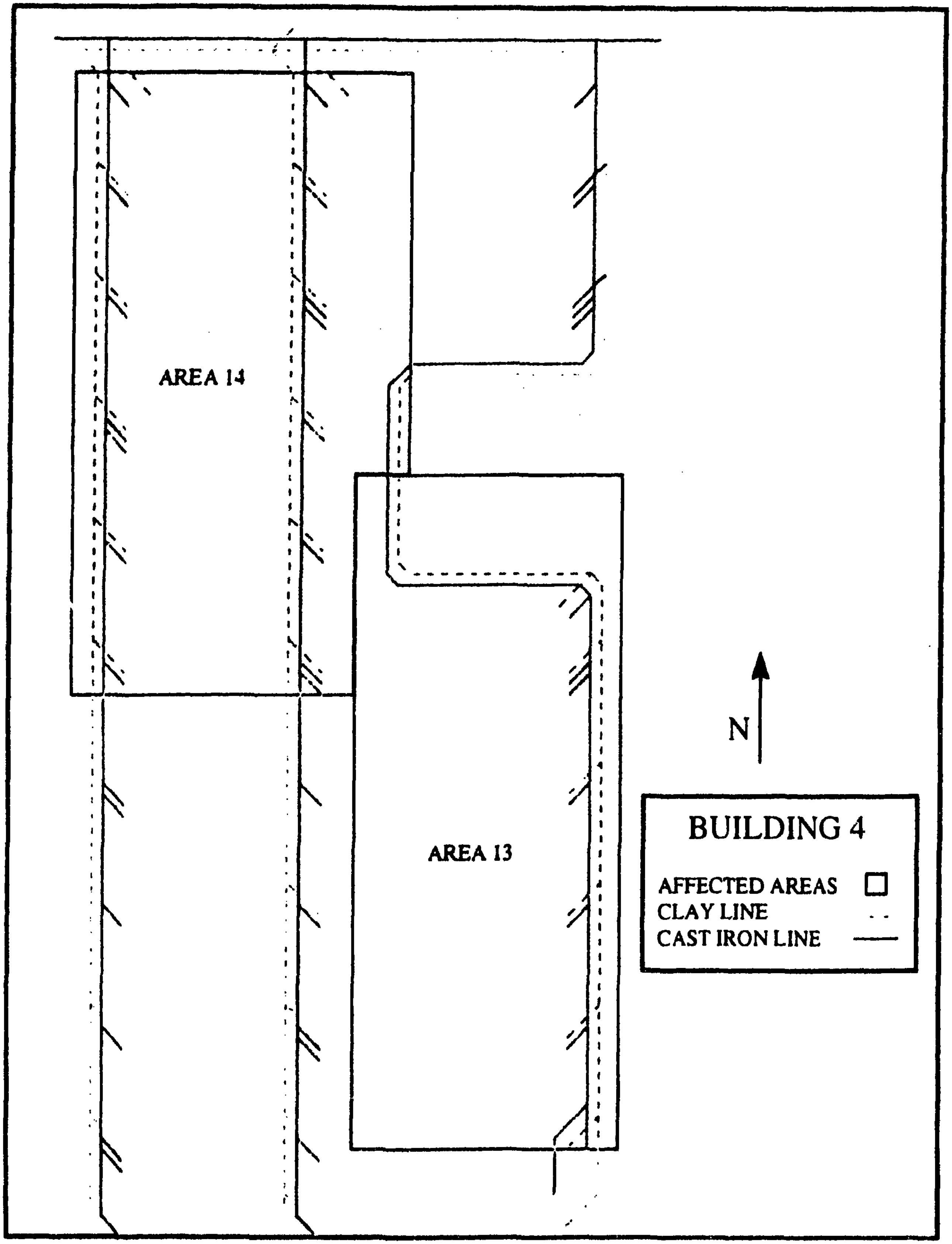


Figure 5.1. Building 4 Drainage System

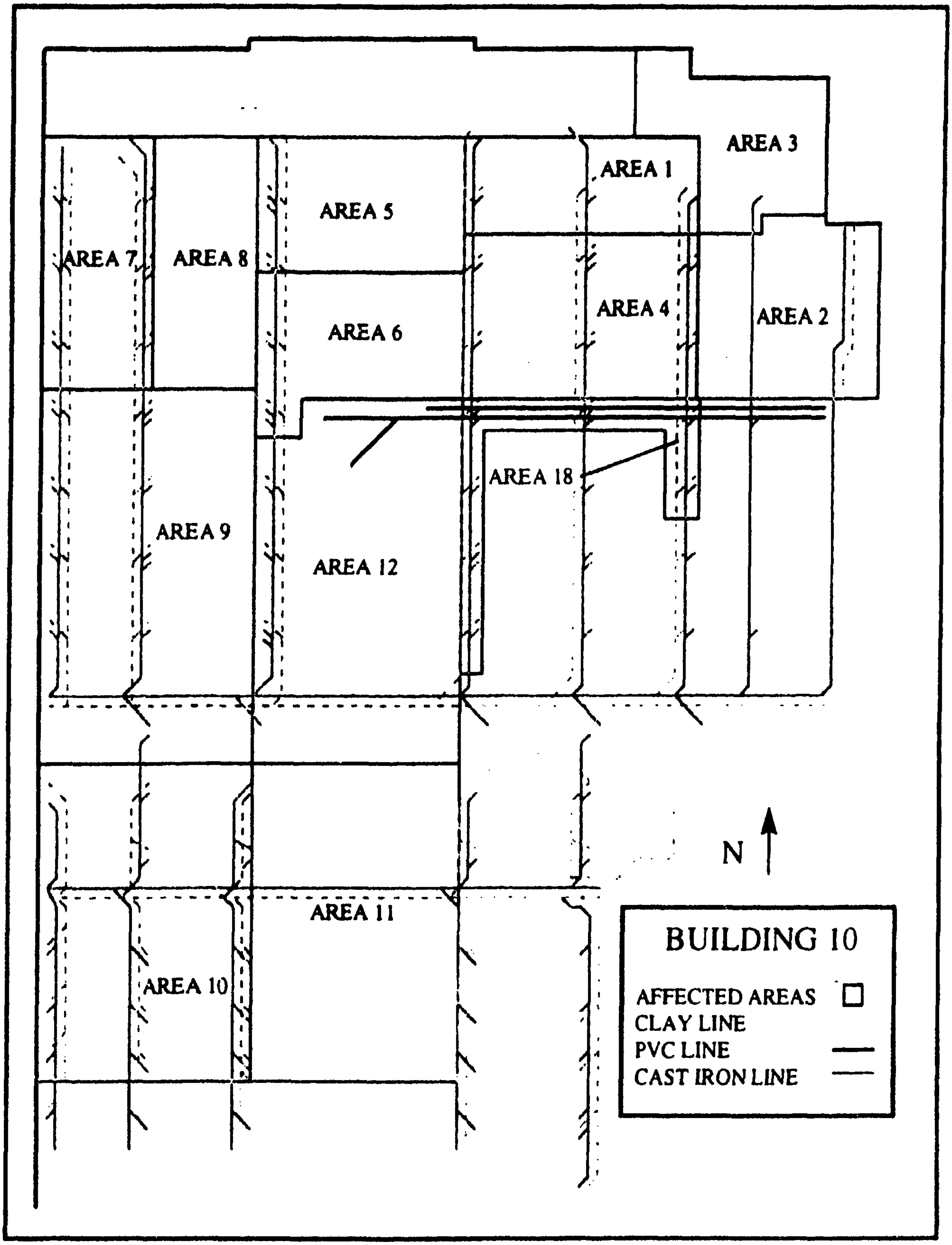


Figure 5.2. Building 10 Drainage System

Priority 2 lines exhibited residue blockage of less than 10 percent and/or total uranium concentrations of 500 to 1,000 pCi/g, and were subject to in-situ decontamination using hydrolasing techniques. If a drain line contained less than 5 percent blockage and/or a total uranium concentration in residue of less than 500 pCi/g, the line was designated as Priority 3 or no action.

Priority 1 Drain Line Removal

Priority 1 drain line removal was executed solely in Building 10, and resulted in the complete removal and disposal of approximately 520 linear feet (lf) of 4-inch VC drainage, 400 lf of CI drainage, and 360 lf of near-surface polyvinyl chloride (PVC) line. Drain line sections that were completely removed are illustrated on Figure 5.3. All cleanout or feed lines were removed along with these sections of drain lines.

Approximately 90 lf (70 lf during the pilot decontamination project) of near-surface recirculation piping was removed in conjunction with concrete slab decontamination. This recirculation piping had been left in place after large pieces of processing equipment were removed due to manufacturing requirement changes.

Priority 2 Drain Line Decontamination

Figure 5.4 presents sections of the Building 10 drainage system that, as Priority 2 lines, were subject to *in-situ* decontamination. The total Priority 2 drain line length was approximately 20 lf of 4-inch VC and 600 lf of 4-5-inch CI. Figure 5.4 designates sections of line that are represented by a discrete residue sample analyzed for total and isotopic uranium. These sections are the basis of analysis presented in Table 5.1. Table 5.1 applies a mass dilution factor (MDF)[1] to isotopic uranium concentrations representing the section of line. From this, the isotopic activity concentration per unit length of pipe is calculated, given the percentage of residue accumulation. As the residue accumulation decreases to an infinitesimal layer having no volume, the MDF and adjusted mass concentrations approach zero.

Table 5.1. Priority 2 Drain Bulk Contamination Levels Prior to Decontamination

Section of Line from Figure 5.4	Type	Length (ft)	Uranium Isotope	Concentration (pCi/g)	MDF	Adjusted Mass Concentration (pCi/g)
1	VC	160	U-234	795	0.08	64
			U-235	36	0.08	3
			U-238	61	0.08	5
2	VC	25	U-234	467	0.08	37
			U-235	21	0.08	2
			U-238	65	0.08	5
3	CI/VC	150 (ea)	U-234	437	0.09	39
			U-235	21	0.09	2
			U-238	43	0.09	4
4	CI	150	U-234	444	0.16	71
			U-235	30	0.16	5
			U-238	33	0.16	5

[1] The MDF is based upon the density and volume of residue and the thickness and density of CI and VC line matrices.

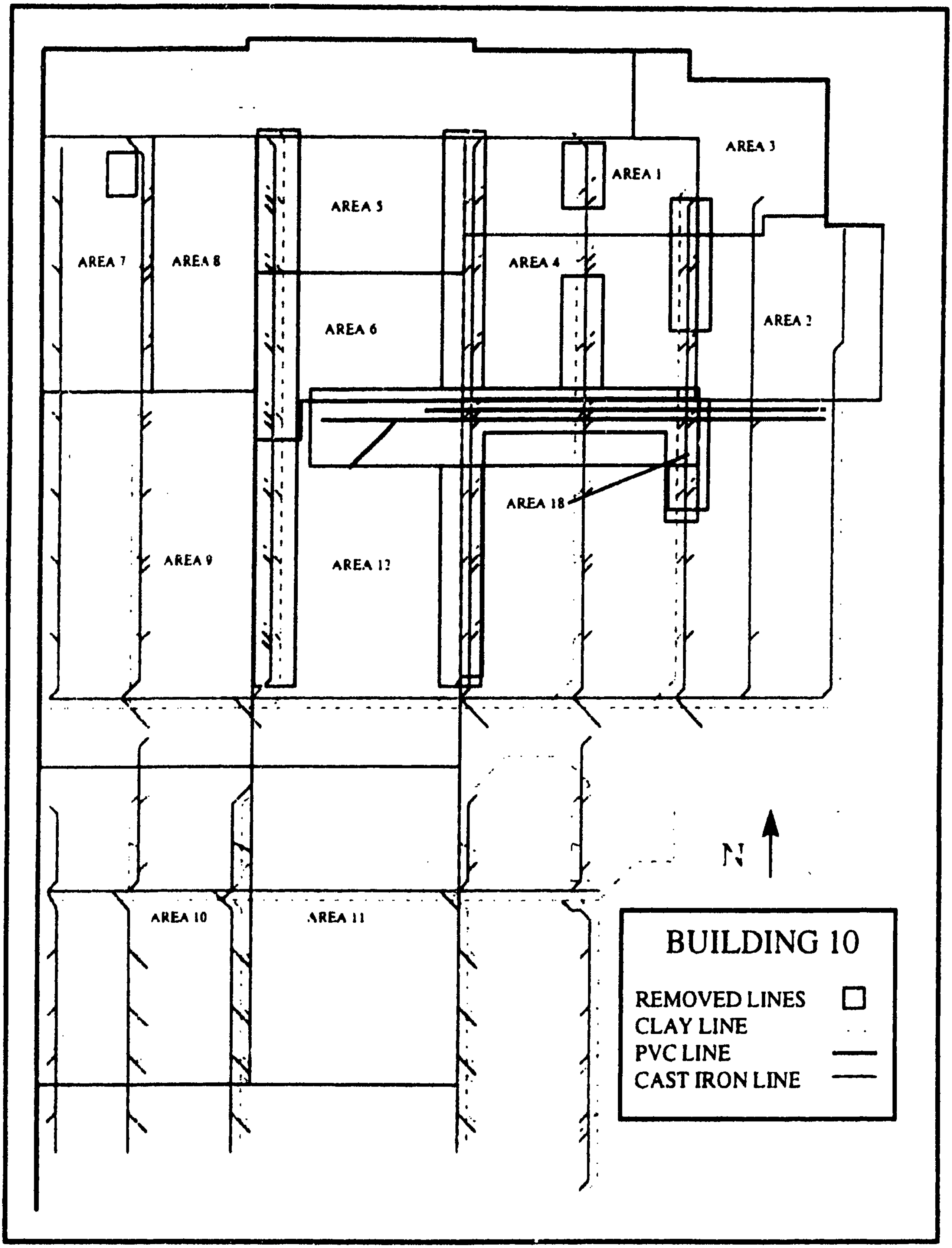


Figure 5.3. Priority 1 Drain Lines Subject to Total Removal

118945

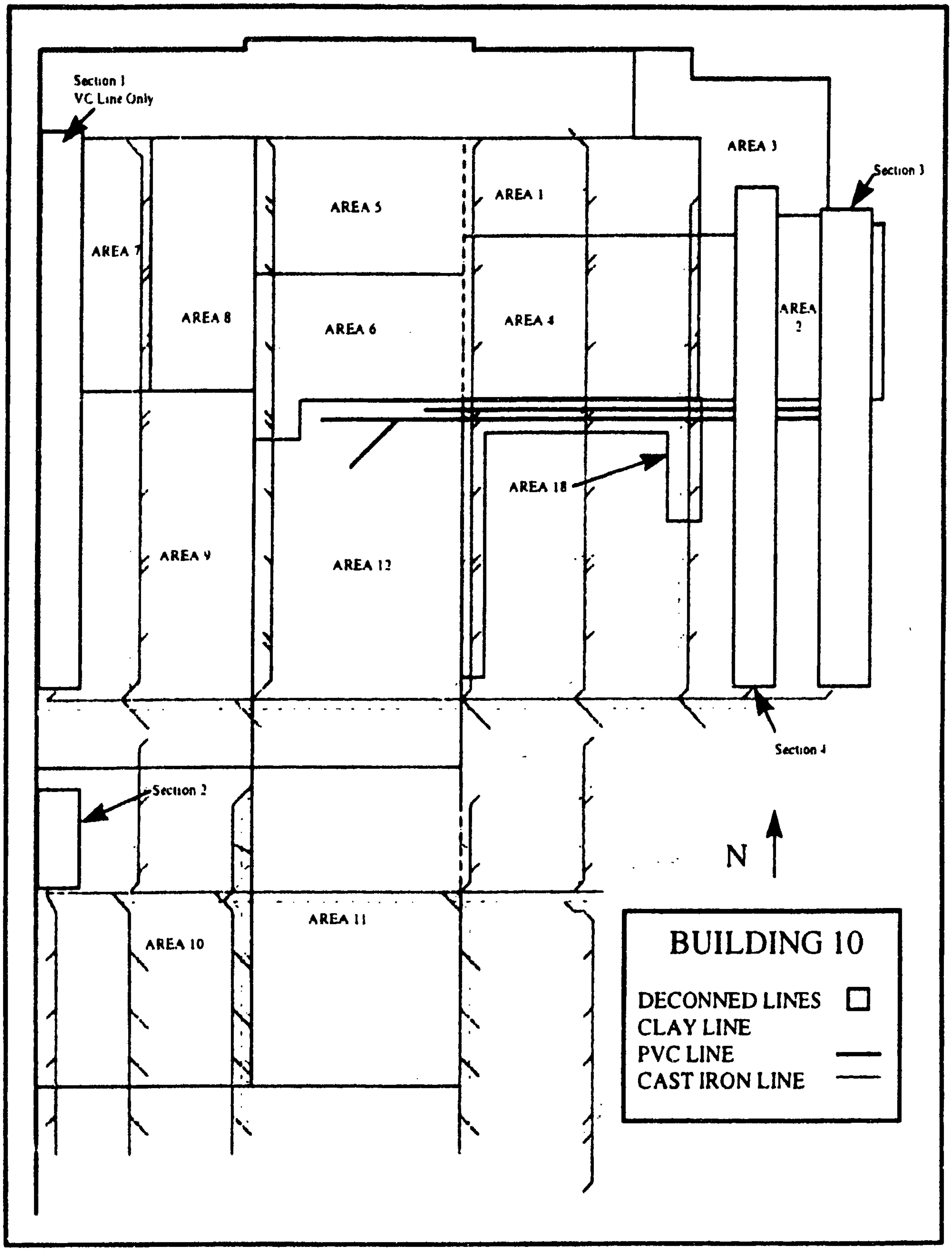


Figure 5.4. Priority 2 Drain Lines Subject to *In-Situ* Decontamination

Although, on an adjusted mass basis, the total uranium concentrations were only slightly above the bulk release criterion of 30 pCi/g (ranging from 44 to 81 pCi/g), a two-step decontamination process was implemented. The initial step included removal of loose bulk material from the line using a specially designed vacuum. Once the loose material and water were removed from the line, a hydrolaser was used to remove fixed-surface contamination. The contaminated material was removed from the line and sampled at the lift station. Finally, a video camera was sent through the decontaminated pipes to document the absence of potentially contaminated debris. Table 5.2 presents the analytical results of the debris removed from the pipes. The video tapes will be made available for review upon request.

Table 5.2. Bulk Material Removed from Priority 2 Drain Lines

Section of Line from Figure 5.4	Type	Length (ft)	Material Sampled	Uranium Isotope	Concentration (pCi/g)
1 & 3	VC	310	Sediment	U-234 U-235 U-238	3345.00 235.10 151.50
3 & 4	CI	300	Sediment	U-234 U-235 U-238	342.60 12.74 22.56
1 & 3	VC	310	Sediment, debris	U-234 U-235 U-238	1522.00 39.26 19.81
3 & 4	CI	300	Sediment, debris, scale, rust	U-234 U-235 U-238	1764.00 75.66 24.62

Analytical data from sediment and debris samples confirm that the decontamination techniques were effective in removing contamination as identified during drainline characterization.

Residual Inventory Assessment

Priority 1 lines that were completely removed and Priority 2 lines that were decontaminated are assumed not to contribute residual activity to the drainage system inventory. Priority 3 lines contribute a minor isotopic activity and are highlighted in Figure 5.5. Table 5.3 presents the isotopic uranium inventory in each designated pipe section, based on the mass and volume of residue.

It should be noted that application of the MDF (typically 0.08 to 0.2) results in bulk contamination levels less than 30 pCi/g total uranium. Based upon the residual activity estimate for each Priority 3 line described in Table 5.3, the total residual inventories are uranium-234: 0.03 millicuries (mCi); uranium-235: 0.002 mCi; and uranium-238: 0.008 mCi.

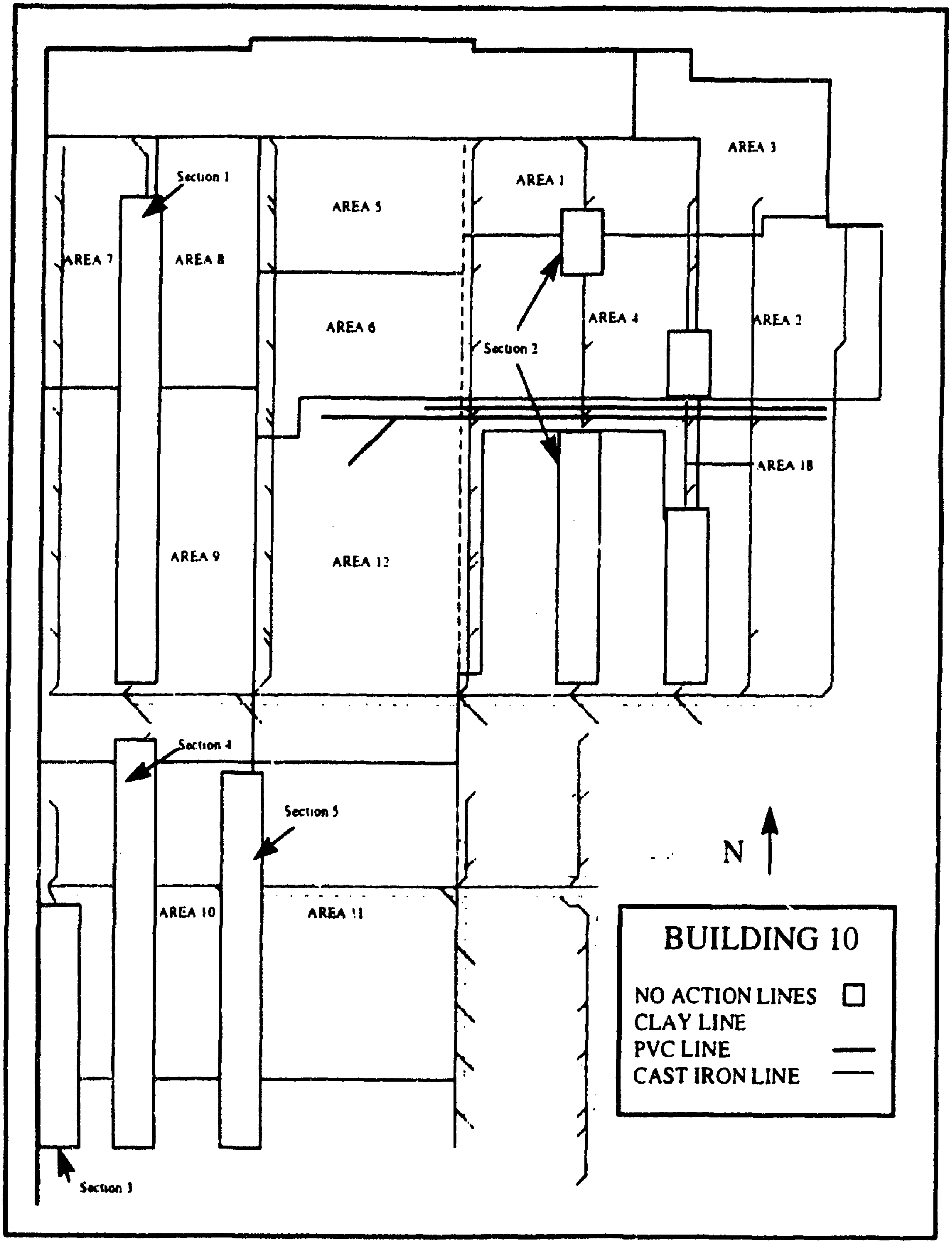


Figure 5.5. Priority 3 (No Action) Drain Lines

Table 5.3. Residual Radioactivity Inventory of Priority 3 Lines

Section Number	Type of Line (pipes)	Diameter (inch)	Length (feet)	Diameter (cm)	Length (cm)	Volume (cm^3)	Blockage	Volume Built Up	U-235 Conc (pCi/g)	Activity U-235 (mCi)	U-234 Conc (pCi/g)	Activity U-234 (mCi)	U-238 Conc (pCi/g)	Activity U-238 (mCi)
1	VC	4	150	10.16	4572	370868	0.1	37067	5.4	3.2E-04	127.5	7.6E-03	23.8	1.4E-03
	CI	4	60	10.16	1829	148267	0.1	14827	0.84	2.0E-05	18.5	4.4E-04	34.9	8.3E-04
		5	20	12.7	609.6	77222	0.1	7722	0.84	1.0E-05	18.5	2.3E-04	34.9	4.3E-04
		6	40	15.24	1219	222401	0.1	22240	0.84	3.0E-05	18.5	6.6E-04	34.9	1.2E-03
		8	30	20.32	914.4	296534	0.1	29653	0.84	4.0E-05	18.5	8.8E-04	34.9	1.7E-03
2	CI	4	20	10.16	609.6	49422	0.05	2471	16.5	6.5E-05	400.8	1.6E-03	19.8	7.8E-05
	CI	5	60	12.7	1829	231667	0.05	11583	16.5	3.1E-04	400.8	7.4E-03	19.8	3.7E-04
	CI	6	10	15.24	304.8	55600	0.05	2780	16.5	7.3E-05	400.8	1.8E-03	19.8	8.8E-05
	VC (ASSUME)	4	90	10.16	2743	222401	0.05	11120	16.5	2.9E-04	400.8	7.1E-03	19.8	3.5E-04
Undefined	CI	4	90	10.16	2743	222401	0.05	11120	0.8	1.4E-05	10.5	1.9E-04	2.8	5.0E-05
	VC (ASSUME)	4	90	10.16	2743	222401	0.05	11120	0.8	1.4E-05	10.5	1.9E-04	2.8	5.0E-05
3	VC	4	70	10.16	2134	172978	0.075	12973	13	2.7E-04	2	4.2E-05	13	2.7E-04
	CI	4	70	10.16	2134	172978	0.075	12973	1.8	3.7E-05	2	4.2E-05	1.8	3.7E-05
4	VC	4	100	10.16	3048	247112	0.075	18533	13	3.9E-04	2	5.9E-05	13	3.9E-04
	CI	4	100	10.16	3048	247112	0.075	18533	1.8	5.3E-05	2	5.9E-05	1.8	5.3E-05
5	VC	4	100	10.16	3048	247112	0.05	12356	1.4	2.8E-05	41	8.1E-04	6.6	1.3E-04
	CI	5	35	12.7	1067	135129	0.05	6757	2.6	2.8E-05	13	1.4E-04	2.9	3.1E-05
	CI	6	65	15.24	1981	261401	0.05	18070	2.6	7.5E-05	13	3.8E-04	2.9	8.4E-05

TOTAL	U-235	U-234	U-238
TOTAL	2.1E-03	3.0E-02	7.5E-03

APPENDIX 3

Assumptions Utilized to Develop Source Term for Running Computer Codes

WESTON
MANAGERS DESIGNERS/CONSULTANTS

CLIENT/SUBJECT TEXAS INSTRUMENTS INCORPORATED W.O. NO [illegible]
TASK DESCRIPTION SOURCE TERM PRIORITY 2 DRAIN LINES TASK NO. 00
PREPARED BY [signature] DEPT 1133 DATE 3/5/97
MATH CHECK BY [signature] DEPT 1003 DATE 3/7/97
METHOD REV. BY ______ DEPT ______ DATE ______
APPROVED BY ______ DEPT ______ DATE ______

DRAIN LINE SOURCE TERM

ASSUMPTIONS

1) ASSUME ALL PRIORITY 2 DRAIN LINES ARE REMOVED AND PLACED IN A PILE ON THE SURFACE. THEY GROUND-UP AND HOMOGENIZE
THICKNESS OF CONTAMINATION ZONE = 0.01 meters

2) VITRIFIED CLAY PIPE (VC) } TYPE OF PIPE
CAST IRON PIPE (CI) }

3) VC DENSITY = 1.6 g/cm^3
CI DENSITY = 7.9 g/cm^3

4) CALCULATION OF PIPE VOLUME

(LINEAR FEET) { VC PIPE LENGTH = 630 FT. (SOURCE TABLE 1 APPENDIX 1)
CI PIPE LENGTH = 600 FT. (")

(W) WALL THICKNESS OF = 1 IN.
(D) PIPE DIAMETER = 5 IN.
(FF) WIDTH DIMENSION OF PIPE WHEN FLATTEN IS A FACTOR OF 2 LARGER

VOLUME OF PIPE = (LF)(FF)(D)(2·W)

VC PIPE VOLUME = (630 ft)(2)(0.42 ft)[2(.083)] ≈ 87 ft^3

CI PIPE VOLUME = (600 ft)(2)(0.42 ft)[2·(.083)] ≈ 84 ft^3

TOTAL WEIGHT OF PIPE

$VC = 2.5E+06\ cm^3 \left(\frac{1.6\ g}{cm^3}\right) = 4.0E+06\ g$

$CI = 2.4E+06\ cm^3 \left(\frac{7.9\ g}{cm^3}\right) = 1.9E+07\ g$

WESTON

SHEET 2 of 2

CLIENT/SUBJECT TI W.O. NO.
TASK DESCRIPTION (CONT.) TASK NO.
PREPARED BY DEPT DATE APPROVED BY
MATH CHECK BY DEPT DATE
METHOD REV. BY DEPT DATE DEPT DATE

PRE-DECONTAMINATION
BOUNDING SOURCE CONCENTRATION OF RESIDUAL URANIUM IN PRIORITY 2 DRAIN LINES

(1a) U-234 = 71 pCi/g ; U-235 = 5 pCi/g ; U-238 = 5 pCi/g

SOURCE → TABLE 1, APPENDIX 1

POST-DECONTAMINATION
CURRENT CONCENTRATION OF RESIDUAL URANIUM IN PRIORITY 2 DRAIN LINES

(1b) U-234 = 0.35 pCi/g ; U-235 = .002 pCi/g ; U-238 = .002 pCi/g

TOTAL SOURCE TERM
* THIS ASSUMES ENTIRE VOLUME OF PIPE IS CONTAM. TO THE SAME LEVEL AS RESIDUAL
(PRE-DECONTAMINATION)

(2a) U-234 → 71 pCi/g (2.3E+07 g) = .0016 Ci
U-235 → 5 pCi/g (2.3E+07 g) = .0001 Ci
U-238 → 5 pCi/g (2.3E+07 g) = .0001 Ci

(POST-DECONTAMINATION)

(2b) U-234 → 0.35 pCi/g (2.3E+07 g) = .000008 Ci
U-235 → .002 pCi/g (2.3E+07 g) = .00000005 Ci
U-238 → .002 pCi/g (2.3E+07 g) = .00000005 Ci

(1a) INPUT FOR RESRAD RUN (APPENDIX 4)
(1b) INPUT " " " (APPENDIX 5)

(2a) INPUT FOR MICROSHIELD RUN (APPENDIX 7)
(2b) INPUT " " " (APPENDIX 7)

APPENDIX 4

RESRAD Output for the Pre-Decontamination Priority 2 Drain Lines

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

nu	Parameter	Current Value	Default	Parameter Name
1	Dose conversion factors for inhalation, mrem/pCi:			
1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
1	Th-230	3.260E-01	3.260E-01	DCF2(5)
1	U-234	1.320E-01	1.320E-01	DCF2(6)
1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
1	Dose conversion factors for ingestion, mrem/pCi:			
1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
1	Th-230	5.480E-04	5.480E-04	DCF3(5)
1	U-234	2.830E-04	2.830E-04	DCF3(6)
1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
34	Food transfer factors:			
34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
34				
34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
34				
34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
34				
34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
34				
34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
34				
34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
34				
34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

nu	Parameter	Current Value	Default	Parameter Name
4	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
4	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
4	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
	Bioaccumulation factors, fresh water, L/kg:			
	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
1	Area of contaminated zone (m**2)	9.600E+01	1.000E+04	---	AREA
1	Thickness of contaminated zone (m)	1.000E-02	2.000E+00	---	THICK0
1	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
1	Basic radiation dose limit (mrem/yr)	1.000E+01	3.000E+01	---	BRDL
1	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
1	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
1	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
1	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
1	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
1	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
1	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
1	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
1	Times for calculations (yr)	not used	0.000E+00	---	T(9)
1	Times for calculations (yr)	not used	0.000E+00	---	T(10)
2	Initial principal radionuclide (pCi/g): U-234	7.100E+01	0.000E+00	---	S1(6)
2	Initial principal radionuclide (pCi/g): U-235	5.000E+00	0.000E+00	---	S1(7)
2	Initial principal radionuclide (pCi/g): U-238	5.000E+00	0.000E+00	---	S1(8)
2	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
2	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
2	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
3	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
3	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
3	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
3	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
3	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
3	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
3	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
3	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
3	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
3	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
3	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
3	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
3	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
3	Irrigation mode	overhead	overhead	---	IDITCH
3	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
3	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
3	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
4	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
4	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
4	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
4	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
4	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
4	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
4	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
4	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
4	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
4	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
5	Number of unsaturated zone strata	1	1	---	NS
5	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
5	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
5	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
5	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
5	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
5	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
6	Distribution coefficients for U-234				
6	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
6	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
6	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
6	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(6)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
6	Distribution coefficients for U-235				
6	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
6	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
6	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
6	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(7)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
6	Distribution coefficients for U-238				
6	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
6	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
6	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
6	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(8)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
6	Distribution coefficients for daughter Ac-227				
6	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
6	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
6	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
6	Leach rate (/yr)	0.000E+00	0.000E+00	1.649E+00	ALEACH(1)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
6	Distribution coefficients for daughter Pa-231				
6	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
6	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
6	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
6	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(2)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
6	Distribution coefficients for daughter Pb-210				
6	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
6	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
6	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
6	Leach rate (/yr)	0.000E+00	0.000E+00	3.326E-01	ALEACH(3)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

Site-Specific Parameter Summary (continued)

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
6	Distribution coefficients for daughter Ra-226				
6	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
6	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
6	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
6	Leach rate (/yr)	0.000E+00	0.000E+00	4.747E-01	ALEACH(4)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
6	Distribution coefficients for daughter Th-230				
6	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
6	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
6	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
6	Leach rate (/yr)	0.000E+00	0.000E+00	5.556E-04	ALEACH(5)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
7	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
7	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
7	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
7	Exposure duration	3.000E+01	3.000E+01	---	ED
7	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
7	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
7	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
7	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
7	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS
7	Radii of shape factor array (used if FS = -1):				
7	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
7	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
7	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
7	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
7	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
7	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
7	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
7	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
7	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
7	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
7	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
7	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

Site-Specific Parameter Summary (continued)

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
7	Fractions of annular areas within AREA:				
7	Ring 1	not used	1.000E+00	---	FRACA(1)
7	Ring 2	not used	2.732E-01	---	FRACA(2)
7	Ring 3	not used	0.000E+00	---	FRACA(3)
7	Ring 4	not used	0.000E+00	---	FRACA(4)
7	Ring 5	not used	0.000E+00	---	FRACA(5)
7	Ring 6	not used	0.000E+00	---	FRACA(6)
7	Ring 7	not used	0.000E+00	---	FRACA(7)
7	Ring 8	not used	0.000E+00	---	FRACA(8)
7	Ring 9	not used	0.000E+00	---	FRACA(9)
7	Ring 10	not used	0.000E+00	---	FRACA(10)
7	Ring 11	not used	0.000E+00	---	FRACA(11)
7	Ring 12	not used	0.000E+00	---	FRACA(12)
8	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
8	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
8	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
8	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
8	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
8	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
8	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
8	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
8	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
8	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
8	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
8	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
8	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
8	Contamination fraction of plant food	-1	-1	0.480E-01	FPLANT
8	Contamination fraction of meat	-1	-1	0.480E-02	FMEAT
8	Contamination fraction of milk	-1	-1	0.480E-02	FMILK
9	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
9	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
9	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
9	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
9	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
9	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
9	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
9	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
9	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
9	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
9	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
9	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN

Site-Specific Parameter Summary (continued)

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
R	Storage times of contaminated foodstuffs (days):				
R	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
R	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
R	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
R	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
R	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
R	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
R	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
R	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
R	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
1	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
1	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
1	Total porosity of the cover material	not used	4.000E-01	---	TPCV
1	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
1	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
1	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL
1	Diffusion coefficient for radon gas (m/sec):				
1	in cover material	not used	2.000E-06	---	DIFCV
1	in foundation material	3.000E-07	3.000E-07	---	DIFFL
1	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
1	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
1	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
1	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
1	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
1	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
1	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed (time dependent)	DMFL
1	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
1	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	96.00 square meters	U-234	7.100E+01
Thickness:	0.01 meters	U-235	5.000E+00
ver Depth:	0.00 meters	U-238	5.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 10 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	7.122E-01	3.304E-01	6.845E-02	0.000E+00	0.000E+00	0.000E+00	7.647E-04	3.707E-02
M(t):	7.122E-02	3.304E-02	6.845E-03	0.000E+00	0.000E+00	0.000E+00	7.647E-05	3.707E-03

ximum TDOSE(t): 7.122E-01 mrem/yr   at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

ic-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	5.307E-03	0.0075	3.616E-01	0.5077	0.000E+00	0.0000	4.723E-03	0.0066	7.297E-05	0.0001	1.860E-04	0.0003	3.520E-03	0.0049
35	2.449E-01	0.3439	2.373E-02	0.0333	0.000E+00	0.0000	3.138E-04	0.0004	4.848E-06	0.0000	1.236E-05	0.0000	2.339E-04	0.0003
38	4.422E-02	0.0621	2.277E-02	0.0320	0.000E+00	0.0000	3.161E-04	0.0004	4.885E-06	0.0000	1.245E-05	0.0000	2.356E-04	0.0003
al	2.945E-01	0.4135	4.081E-01	0.5730	0.000E+00	0.0000	5.352E-03	0.0075	8.270E-05	0.0001	2.108E-04	0.0003	3.990E-03	0.0056

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

io-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.754E-01	0.5271
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.692E-01	0.3780
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.756E-02	0.0949
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.122E-01	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

io-lide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	2.596E-03	0.0079	1.676E-01	0.5072	2.202E-07	0.0000	2.188E-03	0.0066	3.381E-05	0.0001	8.620E-05	0.0003	1.631E-03	0.0049
35	1.135E-01	0.3437	1.100E-02	0.0333	0.000E+00	0.0000	1.459E-04	0.0004	2.279E-06	0.0000	5.727E-06	0.0000	1.085E-04	0.0003
38	2.068E-02	0.0626	1.055E-02	0.0319	1.362E-14	0.0000	1.465E-04	0.0004	2.263E-06	0.0000	5.770E-06	0.0000	1.092E-04	0.0003
al	1.368E-01	0.4141	1.891E-01	0.5724	2.202E-07	0.0000	2.481E-03	0.0075	3.836E-05	0.0001	9.770E-05	0.0003	1.849E-03	0.0056

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

io-lide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.741E-01	0.5270
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.248E-01	0.3777
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.149E-02	0.0953
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.304E-01	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	6.184E-04	0.0090	3.456E-02	0.5049	7.869E-07	0.0000	4.512E-04	0.0066	6.972E-06	0.0001	1.777E-05	0.0003	3.364E-04	0.0049
U-235	2.355E-02	0.3441	2.269E-03	0.0331	0.000E+00	0.0000	3.028E-05	0.0004	4.832E-07	0.0000	1.181E-06	0.0000	2.241E-05	0.0003
U-238	4.356E-03	0.0636	2.175E-03	0.0318	1.245E-13	0.0000	3.020E-05	0.0004	4.667E-07	0.0000	1.190E-06	0.0000	2.251E-05	0.0003
Total	2.853E-02	0.4168	3.900E-02	0.5698	7.869E-07	0.0000	5.117E-04	0.0075	7.922E-06	0.0001	2.014E-05	0.0003	3.813E-04	0.0056

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.599E-02	0.5258
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.588E-02	0.3780
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.585E-03	0.0962
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.845E-02	1.0000

*Sum of all water independent and dependent pathways.

118845

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

adio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

adio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
235	7.582E-04	0.9915	9.110E-07	0.0012	0.000E+00	0.0000	5.593E-06	0.0073	1.552E-09	0.0000	3.405E-09	0.0000	7.647E-04	1.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	7.582E-04	0.9915	9.110E-07	0.0012	0.000E+00	0.0000	5.593E-06	0.0073	1.552E-09	0.0000	3.405E-09	0.0000	7.647E-04	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	2.709E-02	0.7308	4.517E-06	0.0001	2.333E-05	0.0006	2.001E-04	0.0054	9.760E-07	0.0000	3.637E-06	0.0001	2.732E-02	0.7371
235	7.881E-03	0.2126	6.089E-06	0.0002	0.000E+00	0.0000	5.819E-05	0.0016	8.283E-07	0.0000	2.611E-07	0.0000	7.946E-03	0.2143
238	1.786E-03	0.0482	2.365E-07	0.0000	2.606E-09	0.0000	1.319E-05	0.0004	6.242E-08	0.0000	2.410E-07	0.0000	1.800E-03	0.0486
tal	3.676E-02	0.9916	1.084E-05	0.0003	2.333E-05	0.0006	2.714E-04	0.0073	1.367E-06	0.0001	4.139E-06	0.0001	3.707E-02	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

idio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
iclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
234	2.709E-02	0.7308	4.517E-06	0.0001	2.333E-05	0.0006	2.001E-04	0.0054	9.760E-07	0.0000	3.637E-06	0.0001	2.732E-02	0.7371
235	7.881E-03	0.2126	6.089E-06	0.0002	0.000E+00	0.0000	5.819E-05	0.0016	8.283E-07	0.0000	2.611E-07	0.0000	7.946E-03	0.2143
238	1.786E-03	0.0482	2.365E-07	0.0000	2.606E-09	0.0000	1.319E-05	0.0004	6.242E-08	0.0000	2.410E-07	0.0000	1.800E-03	0.0486
tal	3.676E-02	0.9916	1.084E-05	0.0003	2.333E-05	0.0006	2.714E-04	0.0073	1.867E-06	0.0001	4.139E-06	0.0001	3.707E-02	1.0000

um of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

rent (i)	Product (j)	Branch Fraction	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
234	U-234	1.000E+00	5.288E-03	2.452E-03	5.068E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.765E-04
234	Th-230	1.000E+00	0.000E+00	7.614E-08	1.054E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.440E-09
234	Ra-226	1.000E+00	0.000E+00	3.761E-09	1.348E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.016E-06
234	Pb-210	1.000E+00	0.000E+00	1.654E-13	1.485E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.340E-06
234	∑DSR(j)		5.288E-03	2.452E-03	5.069E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.849E-04
235	U-235	1.000E+00	5.385E-02	2.496E-02	5.175E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.562E-04
235	Pa-231	1.000E+00	0.000E+00	7.183E-07	4.455E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.962E-04
235	Ac-227	1.000E+00	0.000E+00	4.460E-08	5.105E-08	0.000E+00	0.000E+00	0.000E+00	1.529E-04	9.368E-04
235	∑DSR(j)		5.385E-02	2.496E-02	5.175E-03	0.000E+00	0.000E+00	0.000E+00	1.529E-04	1.589E-03
238	U-238	1.000E+00	1.351E-02	6.298E-03	1.317E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.589E-04
238	U-234	1.000E+00	0.000E+00	6.955E-09	4.311E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.069E-06
238	Th-230	1.000E+00	0.000E+00	9.611E-14	3.085E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.738E-12
238	Ra-226	1.000E+00	0.000E+00	3.303E-15	3.027E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.198E-09
238	Pb-210	1.000E+00	0.000E+00	8.608E-20	2.694E-18	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.858E-09
238	∑DSR(j)		1.351E-02	6.298E-03	1.317E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.600E-04

DSR(j,t) (mrem/yr)/(pCi/g)

anch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 10 mrem/yr

clide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
234	1.891E+03	4.078E+03	1.973E+04	*6.245E+09	*6.245E+09	*6.245E+09	*6.245E+09	2.598E+04
235	1.857E+02	4.006E+02	1.932E+03	*2.160E+06	*2.160E+06	*2.160E+06	6.539E+04	6.293E+03
238	7.401E+02	1.588E+03	7.593E+03	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	2.778E+04

: specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

clide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
234	7.100E+01	0.000E+00	5.288E-03	1.891E+03	5.288E-03	1.891E+03
235	5.000E+00	0.000E+00	5.385E-02	1.857E+02	5.385E-02	1.857E+02
238	5.000E+00	0.000E+00	1.351E-02	7.401E+02	1.351E-02	7.401E+02

mary : TI Priority 2 Pipe Dose (Pre-decontamination)
e   : C:\RESWIN\TIPIP1.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

DOSE(j,t), mrem/yr

lide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
34	U-234	1.000E+00	3.754E-01	1.741E-01	3.598E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.673E-02
34	U-238	1.000E+00	0.000E+00	3.478E-08	2.155E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.344E-06
34	∑DOSE(j):		3.754E-01	1.741E-01	3.598E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.674E-02
230	U-234	1.000E+00	0.000E+00	5.406E-06	7.481E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.442E-07
230	U-238	1.000E+00	0.000E+00	4.806E-13	1.542E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.369E-11
230	∑DOSE(j):		0.000E+00	5.406E-06	7.481E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.443E-07
226	U-234	1.000E+00	0.000E+00	2.670E-07	9.568E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.432E-04
226	U-238	1.000E+00	0.000E+00	1.651E-14	1.513E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.599E-08
226	∑DOSE(j):		0.000E+00	2.670E-07	9.568E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.432E-04
210	U-234	1.000E+00	0.000E+00	1.175E-11	1.054E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.501E-04
210	U-238	1.000E+00	0.000E+00	4.304E-19	1.347E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.929E-08
210	∑DOSE(j):		0.000E+00	1.175E-11	1.054E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.502E-04
35	U-235	1.000E+00	2.692E-01	1.248E-01	2.587E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.781E-03
231	U-235	1.000E+00	0.000E+00	3.591E-06	2.227E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.481E-03
227	U-235	1.000E+00	0.000E+00	2.230E-07	2.552E-07	0.000E+00	0.000E+00	0.000E+00	7.647E-04	4.684E-03
38	U-238	1.000E+00	6.756E-02	3.149E-02	6.585E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.794E-03

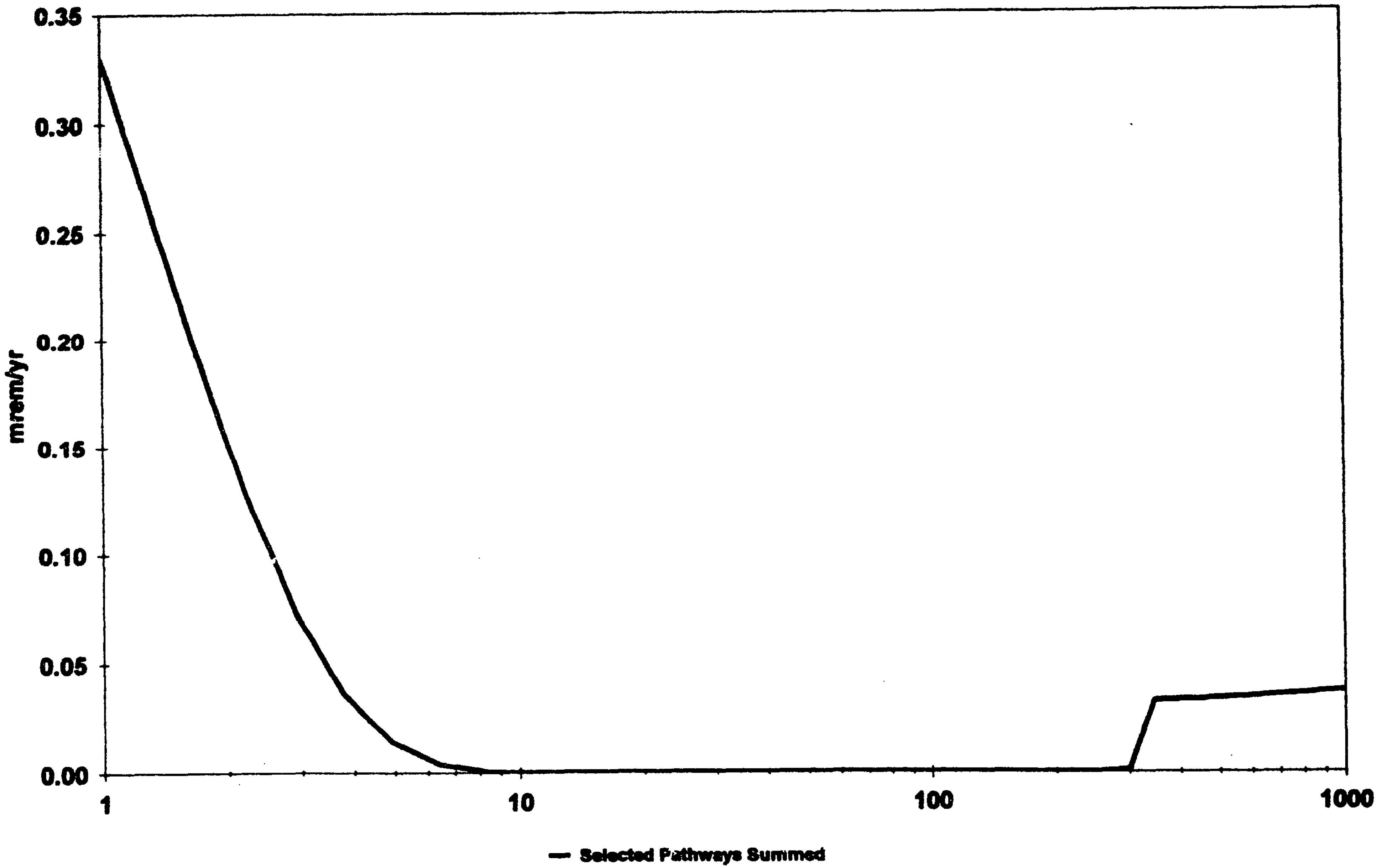
'(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

lide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
			S(j,t), pCi/g							
34	U-234	1.000E+00	7.100E+01	3.656E+01	9.691E+00	9.296E-02	1.593E-07	1.051E-27	0.000E+00	0.000E+00
34	U-238	1.000E+00	0.000E+00	7.298E-06	5.804E-06	1.856E-07	9.544E-13	2.098E-32	0.000E+00	0.000E+00
34	ΣS(j):		7.100E+01	3.656E+01	9.691E+00	9.296E-02	1.593E-07	1.051E-27	0.000E+00	0.000E+00
-230	U-234	1.000E+00	0.000E+00	4.669E-04	8.305E-04	9.569E-04	9.474E-04	9.107E-04	8.135E-04	5.479E-04
-230	U-238	1.000E+00	0.000E+00	4.150E-11	1.712E-10	2.855E-10	2.852E-10	2.741E-10	2.449E-10	1.649E-10
-230	ΣS(j):		0.000E+00	4.669E-04	8.305E-04	9.569E-04	9.474E-04	9.107E-04	8.135E-04	5.479E-04
-226	U-234	1.000E+00	0.000E+00	9.563E-08	4.368E-07	8.508E-07	8.648E-07	8.313E-07	7.425E-07	5.001E-07
-226	U-238	1.000E+00	0.000E+00	5.914E-15	6.908E-14	2.447E-13	2.603E-13	2.502E-13	2.235E-13	1.505E-13
-226	ΣS(j):		0.000E+00	9.563E-08	4.368E-07	8.508E-07	8.648E-07	8.313E-07	7.425E-07	5.001E-07
-210	U-234	1.000E+00	0.000E+00	9.909E-10	1.325E-08	6.336E-08	7.401E-08	7.115E-08	6.356E-08	4.281E-08
-210	U-238	1.000E+00	0.000E+00	4.665E-17	1.657E-15	1.680E-14	2.227E-14	2.142E-14	1.913E-14	1.289E-14
-210	ΣS(j):		0.000E+00	9.909E-10	1.325E-08	6.336E-08	7.401E-08	7.115E-08	6.356E-08	4.281E-08
35	U-235	1.000E+00	5.000E+00	2.574E+00	6.825E-01	6.547E-03	1.122E-08	7.402E-29	0.000E+00	0.000E+00
-231	U-235	1.000E+00	0.000E+00	5.447E-05	4.332E-05	1.385E-06	7.121E-12	1.565E-31	0.000E+00	0.000E+00
-227	U-235	1.000E+00	0.000E+00	6.349E-07	9.326E-07	3.909E-08	2.156E-13	4.849E-33	0.000E+00	0.000E+00
38	U-238	1.000E+00	5.000E+00	2.574E+00	6.825E-01	6.547E-03	1.122E-08	7.402E-29	0.000E+00	0.000E+00

'(i) is the branch fraction of the parent nuclide.

Dose for All Radionuclides for Pre-Decontamination Scenario



TIPIP1.RAD 03/08/97 Includes All Pathways

APPENDIX 5

RESRAD Output for the Post-Decontamination Priority 2 Drain Lines

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

u	Parameter	Current Value	Default	Parameter Name
	Dose conversion factors for inhalation, mrem/pCi:			
	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
	Pa-231	1.280E+00	1.280E+00	DCF2(2)
	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
	Th-230	3.260E-01	3.260E-01	DCF2(5)
	U-234	1.320E-01	1.320E-01	DCF2(6)
	U-235+D	1.230E-01	1.230E-01	DCF2(7)
	U-238+D	1.180E-01	1.180E-01	DCF2(8)
	Dose conversion factors for ingestion, mrem/pCi:			
	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
	Pa-231	1.060E-02	1.060E-02	DCF3(2)
	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
	Th-230	5.480E-04	5.480E-04	DCF3(5)
	U-234	2.830E-04	2.830E-04	DCF3(6)
	U-235+D	2.670E-04	2.670E-04	DCF3(7)
	U-238+D	2.690E-04	2.690E-04	DCF3(8)
4	Food transfer factors:			
4	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
4	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
4	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
4				
4	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
4	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
4	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
4				
4	Pb-210+D , plant/soil concentrat[illegible]imensionless	1.000E-02	1.000E-02	RTF(3,1)
4	Pb-210+D , beef/livestock-intake [illegible] (p[illegible]/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
4	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
4				
4	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
4	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
4	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
4				
4	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
4	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
4	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
4				
4	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
4	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
4	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
4				
4	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
4	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
4	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
4				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

u	Parameter	Current Value	Default	Parameter Name
4	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
4	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
4	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
	Bioaccumulation factors, fresh water, L/kg:			
	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
1	Area of contaminated zone (m**2)	9.600E+01	1.000E+04	---	AREA
1	Thickness of contaminated zone (m)	1.000E-02	2.000E+00	---	THICK0
1	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
1	Basic radiation dose limit (mrem/yr)	1.000E+01	3.000E+01	---	BRDL
1	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
1	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
1	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
1	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
1	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
1	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
1	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
1	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
1	Times for calculations (yr)	not used	0.000E+00	---	T(9)
1	Times for calculations (yr)	not used	0.000E+00	---	T(10)
2	Initial principal radionuclide (pCi/g): U-234	3.500E-01	0.000E+00	---	S1(6)
2	Initial principal radionuclide (pCi/g): U-235	2.000E-03	0.000E+00	---	S1(7)
2	Initial principal radionuclide (pCi/g): U-238	2.000E-03	0.000E+00	---	S1(8)
2	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
2	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
2	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
3	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
3	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
3	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
3	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
3	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
3	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
3	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
3	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
3	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
3	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
3	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
3	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
3	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
3	Irrigation mode	overhead	overhead	---	IDITCH
3	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
3	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
3	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
4	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
4	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
4	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
4	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
4	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
4	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
4	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
4	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
4	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
4	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
5	Number of unsaturated zone strata	1	1	---	NS
5	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
5	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
5	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
5	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
5	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
5	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
5	Distribution coefficients for U-234				
5	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
5	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
5	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
5	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(6)
5	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
5	Distribution coefficients for U-235				
5	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
5	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
5	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
5	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(7)
5	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
5	Distribution coefficients for U-238				
6	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
5	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
5	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
5	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(8)
5	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
5	Distribution coefficients for daughter Ac-227				
5	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
5	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
5	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
5	Leach rate (/yr)	0.000E+00	0.000E+00	1.649E+00	ALEACH(1)
5	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
5	Distribution coefficients for daughter Pa-231				
5	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
5	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
5	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
5	Leach rate (/yr)	0.000E+00	0.000E+00	6.638E-01	ALEACH(2)
5	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
5	Distribution coefficients for daughter Pb-210				
6	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
6	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
5	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
6	Leach rate (/yr)	0.000E+00	0.000E+00	3.326E-01	ALEACH(3)
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

Site-Specific Parameter Summary (continued)

nu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
.6	Distribution coefficients for daughter Ra-226				
.6	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
.6	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
.6	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
.6	Leach rate (/yr)	0.000E+00	0.000E+00	4.747E-01	ALEACH(4)
.6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
.6	Distribution coefficients for daughter Th-230				
.6	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
.6	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
.6	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
.6	Leach rate (/yr)	0.000E+00	0.000E+00	5.556E-04	ALEACH(5)
.6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
.7	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
.7	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
.7	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
.7	Exposure duration	3.000E+01	3.000E+01	---	ED
.7	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
.7	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
.7	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
.7	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
.7	Shape factor flag, external gamma	1.000E+00	1.000E+00	1 shows circular AREA.	FS
.7	Radii of shape factor array (used if FS = -1):				
.7	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
.7	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
.7	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
.7	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
.7	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
.7	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
.7	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
.7	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
.7	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
.7	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
.7	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
.7	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
.7	Fractions of annular areas within AREA:				
.7	Ring 1	not used	1.000E+00	---	FRACA(1)
.7	Ring 2	not used	2.732E-01	---	FRACA(2)
.7	Ring 3	not used	0.000E+00	---	FRACA(3)
.7	Ring 4	not used	0.000E+00	---	FRACA(4)
.7	Ring 5	not used	0.000E+00	---	FRACA(5)
.7	Ring 6	not used	0.000E+00	---	FRACA(6)
.7	Ring 7	not used	0.000E+00	---	FRACA(7)
.7	Ring 8	not used	0.000E+00	---	FRACA(8)
.7	Ring 9	not used	0.000E+00	---	FRACA(9)
.7	Ring 10	not used	0.000E+00	---	FRACA(10)
.7	Ring 11	not used	0.000E+00	---	FRACA(11)
.7	Ring 12	not used	0.000E+00	---	FRACA(12)

Site-Specific Parameter Summary (continued)

u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
8	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
8	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
8	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
8	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
8	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
8	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
8	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
8	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
8	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
8	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
8	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
8	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
8	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
8	Contamination fraction of plant food	-1	-1	0.480E-01	FPLANT
8	Contamination fraction of meat	-1	-1	0.480E-02	FMEAT
8	Contamination fraction of milk	-1	-1	0.480E-02	FMILK
9	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
9	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
9	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
9	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
9	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
9	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
9	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
9	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
9	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
9	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
9	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
9	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
)R	Storage times of contaminated foodstuffs (days):				
)R	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
)R	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
)R	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
)R	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
)R	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
)R	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
)R	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
)R	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
)R	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)

Site-Specific Parameter Summary (continued)

:u	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
:1	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
:1	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
:1	Total porosity of the cover material	not used	4.000E-01	---	TPCV
:1	Total porosity of the building foundation	1.000E-01	1.000E-01	---	TPFL
:1	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
:1	Volumetric water content of the foundation	3.000E-02	3.000E-02	---	PH2OFL
:1	Diffusion coefficient for radon gas (m/sec):				
:1	in cover material	not used	2.000E-06	---	DIFCV
:1	in foundation material	3.000E-07	3.000E-07	---	DIFFL
:1	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
:1	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
:1	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
:1	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
:1	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
:1	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
:1	Building depth below ground surface (m)	-1.000E+00	-1.000E+00	code computed (time dependent)	DMFL
:1	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
:1	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	96.00 square meters	U-234	3.500E-01
hickness:	0.01 meters	U-235	2.000E-03
er Depth:	0.00 meters	U-238	2.000E-03

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 10 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.985E-03	9.208E-04	1.904E-04	0.000E+00	0.000E+00	0.000E+00	3.059E-07	1.386E-04
M(t):	1.985E-04	9.208E-05	1.904E-05	0.000E+00	0.000E+00	0.000E+00	3.059E-08	1.386E-05

imum TDOSE(t): 1.985E-03 mrem/yr   at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

io-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	2.616E-05	0.0132	1.783E-03	0.8979	0.000E+00	0.0000	2.328E-05	0.0117	3.597E-07	0.0002	9.170E-07	0.0005	1.735E-05	0.0087
35	9.798E-05	0.0493	9.492E-06	0.0048	0.000E+00	0.0000	1.255E-07	0.0001	1.939E-09	0.0000	4.944E-09	0.0000	9.356E-08	0.0000
38	1.769E-05	0.0089	9.106E-06	0.0046	0.000E+00	0.0000	1.264E-07	0.0001	1.954E-09	0.0000	4.981E-09	0.0000	9.426E-08	0.0000
al	1.418E-04	0.0714	1.801E-03	0.9072	0.000E+00	0.0000	2.353E-05	0.0119	3.636E-07	0.0002	9.269E-07	0.0005	1.754E-05	0.0088

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

io-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.851E-03	0.9321
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.077E-04	0.0542
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.702E-05	0.0136
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.985E-03	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

io-lide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
34	1.280E-05	0.0139	8.261E-04	0.8971	1.085E-09	0.0000	1.079E-05	0.0117	1.667E-07	0.0002	4.249E-07	0.0005	8.042E-06	0.0087
35	4.542E-05	0.0493	4.400E-06	0.0048	0.000E+00	0.0000	5.836E-08	0.0001	9.116E-10	0.0000	2.291E-09	0.0000	4.339E-08	0.0000
38	8.271E-06	0.0090	4.220E-06	0.0046	5.447E-18	0.0000	5.860E-08	0.0001	9.054E-10	0.0000	2.308E-09	0.0000	4.368E-08	0.0000
al	6.649E-05	0.0722	8.347E-04	0.9065	1.085E-09	0.0000	1.090E-05	0.0118	1.685E-07	0.0002	4.295E-07	0.0005	8.129E-06	0.0088

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

io-lide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.583E-04	0.9321
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.992E-05	0.0542
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.260E-05	0.0137
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.208E-04	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

dio-clide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
234	3.048E-06	0.0160	1.704E-04	0.8947	3.879E-09	0.0000	2.224E-06	0.0117	3.437E-08	0.0002	8.762E-08	0.0005	1.658E-06	0.0087
235	9.421E-06	0.0495	9.076E-07	0.0048	0.000E+00	0.0000	1.211E-08	0.0001	1.933E-10	0.0000	4.724E-10	0.0000	8.962E-09	0.0000
238	1.742E-06	0.0092	8.701E-07	0.0046	4.979E-17	0.0000	1.208E-08	0.0001	1.867E-10	0.0000	4.759E-10	0.0000	9.006E-09	0.0000
tal	1.421E-05	0.0746	1.721E-04	0.9041	3.879E-09	0.0000	2.249E-06	0.0118	3.475E-08	0.0002	8.856E-08	0.0005	1.676E-06	0.0088

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

dio-clide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.774E-04	0.9318
235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.035E-05	0.0544
238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.634E-06	0.0138
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.904E-04	1.0000

um of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

lio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
:lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
:34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

lio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
:lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
:34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

io-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

io-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

io-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

io-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

io-lide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

io-lide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	3.033E-07	0.9915	3.644E-10	0.0012	0.000E+00	0.0000	2.237E-09	0.0073	6.206E-13	0.0000	1.362E-12	0.0000	3.059E-07	1.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	3.033E-07	0.9915	3.644E-10	0.0012	0.000E+00	0.0000	2.237E-09	0.0073	6.206E-13	0.0000	1.362E-12	0.0000	3.059E-07	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

lio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
:lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
:34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
:al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

lio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
:lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
:34	1.336E-04	0.9636	2.227E-08	0.0002	1.150E-07	0.0008	9.862E-07	0.0071	4.812E-09	0.0000	1.793E-08	0.0001	1.347E-04	0.9719
:35	3.152E-06	0.0227	2.436E-09	0.0000	0.000E+00	0.0000	2.328E-08	0.0002	3.313E-10	0.0000	1.044E-10	0.0000	3.178E-06	0.0229
:38	7.144E-07	0.0052	9.460E-11	0.0000	1.042E-12	0.0000	5.276E-09	0.0000	2.497E-11	0.0000	9.642E-11	0.0000	7.199E-07	0.0052
:al	1.374E-04	0.9915	2.480E-08	0.0002	1.150E-07	0.0008	1.015E-06	0.0073	5.168E-09	0.0000	1.813E-08	0.0001	1.386E-04	1.0000

m of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

io-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
35	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
38	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
al	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

io-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
lide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
34	1.336E-04	0.9636	2.227E-08	0.0002	1.150E-07	0.0008	9.862E-07	0.0071	4.812E-09	0.0000	1.793E-08	0.0001	1.347E-04	0.9719
35	3.152E-06	0.0227	2.436E-09	0.0000	0.000E+00	0.0000	2.328E-08	0.0002	3.313E-10	0.0000	1.044E-10	0.0000	3.178E-06	0.0229
38	7.144E-07	0.0052	9.460E-11	0.0000	1.042E-12	0.0000	5.276E-09	0.0000	2.497E-11	0.0000	9.642E-11	0.0000	7.199E-07	0.0052
al	1.374E-04	0.9915	2.480E-08	0.0002	1.150E-07	0.0008	1.015E-06	0.0073	5.168E-09	0.0000	1.813E-08	0.0001	1.386E-04	1.0000

m of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

ent)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
34	U-234	1.000E+00	5.288E-03	2.452E-03	5.068E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.765E-04
34	Th-230	1.000E+00	0.000E+00	7.614E-08	1.054E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.440E-09
34	Ra-226	1.000E+00	0.000E+00	3.761E-09	1.348E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.016E-06
34	Pb-210	1.000E+00	0.000E+00	1.654E-13	1.485E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.340E-06
34	∑DSR(j)		5.288E-03	2.452E-03	5.069E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.849E-04
35	U-235	1.000E+00	5.385E-02	2.496E-02	5.175E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.562E-04
35	Pa-231	1.000E+00	0.000E+00	7.183E-07	4.455E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.962E-04
35	Ac-227	1.000E+00	0.000E+00	4.460E-08	5.105E-08	0.000E+00	0.000E+00	0.000E+00	1.529E-04	9.368E-04
35	∑DSR(j)		5.385E-02	2.496E-02	5.175E-03	0.000E+00	0.000E+00	0.000E+00	1.529E-04	1.589E-03
38	U-238	1.000E+00	1.351E-02	6.298E-03	1.317E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.589E-04
38	U-234	1.000E+00	0.000E+00	6.955E-09	4.311E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.069E-06
38	Th-230	1.000E+00	0.000E+00	9.611E-14	3.085E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.738E-12
38	Ra-226	1.000E+00	0.000E+00	3.303E-15	3.027E-14	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.198E-09
38	Pb-210	1.000E+00	0.000E+00	8.608E-20	2.407E-18	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.858E-09
38	∑DSR(j)		1.351E-02	6.298E-03	1.317E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.600E-04

nch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 10 mrem/yr

lide i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
34	1.891E+03	4.078E+03	1.973E+04	*6.245E+09	*6.245E+09	*6.245E+09	*6.245E+09	2.598E+04
35	1.857E+02	4.006E+02	1.932E+03	*2.160E+06	*2.160E+06	*2.160E+06	6.539E+04	6.293E+03
38	7.401E+02	1.588E+03	7.593E+03	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	2.778E+04

specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

lide i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
34	3.500E-01	0.000E+00	5.288E-03	1.891E+03	5.288E-03	1.891E+03
35	2.000E-03	0.000E+00	5.385E-02	1.857E+02	5.385E-02	1.857E+02
38	2.000E-03	0.000E+00	1.351E-02	7.401E+02	1.351E-02	7.401E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

…lide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	DOSE(j,t), mrem/yr 1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
34	U-234	1.000E+00	1.851E-03	8.583E-04	1.774E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.318E-04
34	U-238	1.000E+00	0.000E+00	1.391E-11	8.622E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.138E-09
34	∑DOSE(j):		1.851E-03	8.583E-04	1.774E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.318E-04
230	U-234	1.000E+00	0.000E+00	2.665E-08	3.688E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.204E-09
230	U-238	1.000E+00	0.000E+00	1.922E-16	6.169E-16	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.348E-14
230	∑DOSE(j):		0.000E+00	2.665E-08	3.688E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.204E-09
226	U-234	1.000E+00	0.000E+00	1.316E-09	4.717E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.057E-07
226	U-238	1.000E+00	0.000E+00	6.605E-18	6.053E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.396E-12
226	∑DOSE(j):		0.000E+00	1.316E-09	4.717E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.057E-07
210	U-234	1.000E+00	0.000E+00	5.790E-14	5.197E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.219E-06
210	U-238	1.000E+00	0.000E+00	1.722E-22	4.815E-21	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.972E-11
210	∑DOSE(j):		0.000E+00	5.790E-14	5.197E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.219E-06
35	U-235	1.000E+00	1.077E-04	4.992E-05	1.035E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.124E-07
231	U-235	1.000E+00	0.000E+00	1.437E-09	8.909E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.924E-07
227	U-235	1.000E+00	0.000E+00	8.920E-11	1.021E-10	0.000E+00	0.000E+00	0.000E+00	3.059E-07	1.874E-06
38	U-238	1.000E+00	2.702E-05	1.260E-05	2.634E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.178E-07

(i) is the branch fraction of the parent nuclide.

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

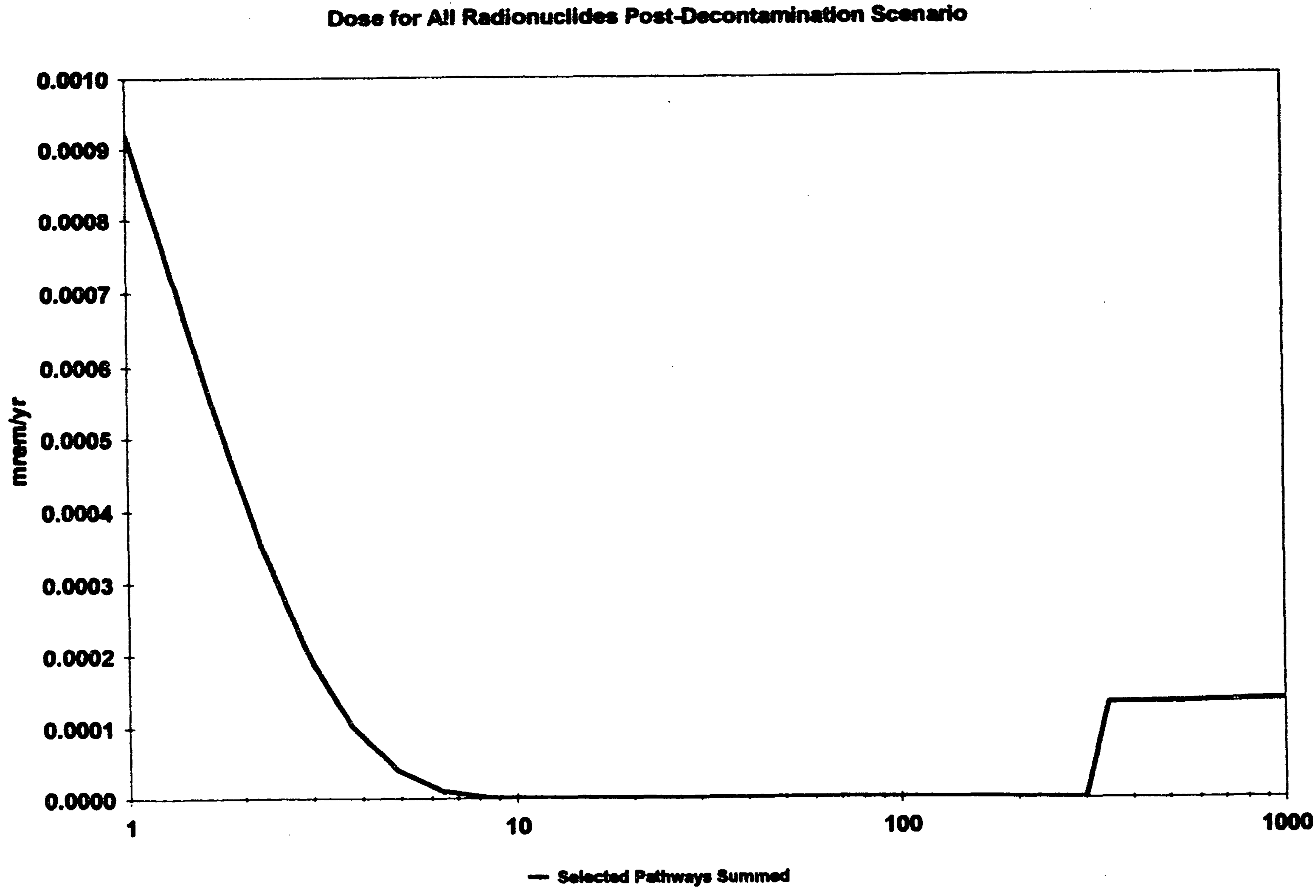
lide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
			DOSE(j,t), mrem/yr							
34	U-234	1.000E+00	1.851E-03	8.583E-04	1.774E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.318E-04
34	U-238	1.000E+00	0.000E+00	1.391E-11	8.622E-12	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.138E-09
34	∑DOSE(j):		1.851E-03	8.583E-04	1.774E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.318E-04
230	U-234	1.000E+00	0.000E+00	2.665E-08	3.688E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.204E-09
230	U-238	1.000E+00	0.000E+00	1.922E-16	6.169E-16	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.348E-14
230	∑DOSE(j):		0.000E+00	2.665E-08	3.688E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.204E-09
226	U-234	1.000E+00	0.000E+00	1.316E-09	4.717E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.057E-07
226	U-238	1.000E+00	0.000E+00	6.605E-18	6.053E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.396E-12
226	∑DOSE(j):		0.000E+00	1.316E-09	4.717E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.057E-07
210	U-234	1.000E+00	0.000E+00	5.790E-14	5.197E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.219E-06
210	U-238	1.000E+00	0.000E+00	1.722E-22	4.815E-21	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.972E-11
210	∑DOSE(j):		0.000E+00	5.790E-14	5.197E-13	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.219E-06
35	U-235	1.000E+00	1.077E-04	4.992E-05	1.035E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.124E-07
231	U-235	1.000E+00	0.000E+00	1.437E-09	8.909E-10	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.924E-07
227	U-235	1.000E+00	0.000E+00	8.920E-11	1.021E-10	0.000E+00	0.000E+00	0.000E+00	3.059E-07	1.874E-06
38	U-238	1.000E+00	2.702E-05	1.260E-05	2.634E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.178E-07

'(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

:lide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	S(j,t), pCi/g 1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
234	U-234	1.000E+00	3.500E-01	1.802E-01	4.777E-02	4.582E-04	7.855E-10	5.180E-30	0.000E+00	0.000E+00
234	U-238	1.000E+00	0.000E+00	2.919E-09	2.322E-09	7.424E-11	3.818E-16	8.393E-36	0.000E+00	0.000E+00
234	$\sum S(j)$:		3.500E-01	1.802E-01	4.777E-02	4.582E-04	7.855E-10	5.180E-30	0.000E+00	0.000E+00
-230	U-234	1.000E+00	0.000E+00	2.302E-06	4.094E-06	4.717E-06	4.670E-06	4.489E-06	4.010E-06	2.701E-06
-230	U-238	1.000E+00	0.000E+00	1.660E-14	6.848E-14	1.142E-13	1.141E-13	1.097E-13	9.795E-14	6.597E-14
-230	$\sum S(j)$:		0.000E+00	2.302E-06	4.094E-06	4.717E-06	4.670E-06	4.489E-06	4.010E-06	2.701E-06
-226	U-234	1.000E+00	0.000E+00	4.714E-10	2.153E-09	4.194E-09	4.263E-09	4.098E-09	3.660E-09	2.465E-09
-226	U-238	1.000E+00	0.000E+00	2.366E-18	2.763E-17	9.789E-17	1.041E-16	1.001E-16	8.940E-17	6.022E-17
-226	$\sum S(j)$:		0.000E+00	4.714E-10	2.153E-09	4.194E-09	4.263E-09	4.098E-09	3.660E-09	2.465E-09
-210	U-234	1.000E+00	0.000E+00	4.885E-12	6.530E-11	3.123E-10	3.648E-10	3.508E-10	3.133E-10	2.110E-10
-210	U-238	1.000E+00	0.000E+00	1.866E-20	6.627E-19	6.720E-18	8.909E-18	8.567E-18	7.652E-18	5.154E-18
-210	$\sum S(j)$:		0.000E+00	4.885E-12	6.530E-11	3.123E-10	3.648E-10	3.508E-10	3.133E-10	2.110E-10
235	U-235	1.000E+00	2.000E-03	1.030E-03	2.730E-04	2.619E-06	4.489E-12	2.961E-32	0.000E+00	0.000E+00
-231	U-235	1.000E+00	0.000E+00	2.179E-08	1.733E-08	5.540E-10	2.848E-15	6.258E-35	0.000E+00	0.000E+00
-227	U-235	1.000E+00	0.000E+00	2.539E-10	3.730E-10	1.564E-11	8.624E-17	1.940E-36	0.000E+00	0.000E+00
238	U-238	1.000E+00	2.000E-03	1.030E-03	2.730E-04	2.619E-06	4.489E-12	2.961E-32	0.000E+00	0.000E+00

F(i) is the branch fraction of the parent nuclide.



TIPIPE2.RAD 03/08/97 Includes All Pathways

APPENDIX 6

Input Parameters for MicroShield 4.20

* SEE APPENDIX 3 FOR DISK SOURCE TERM INPUT.

Dose Point

Location		Units
X	1	m
Y	0	m
Z	0	m

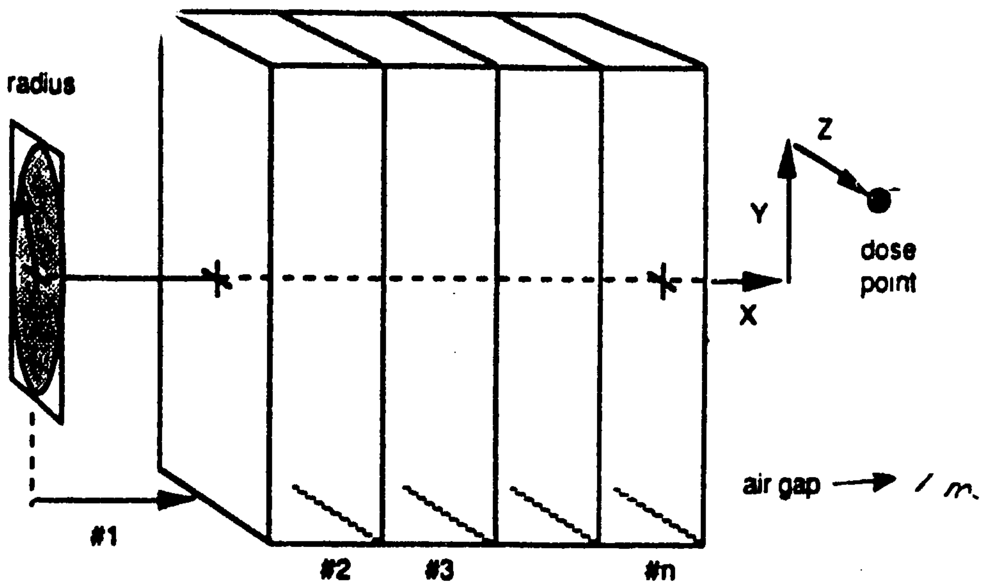
Source Dimension

Radius 5.5m

Quadrature Order

defaults { Radial # NA
Circum. # NA

Disk Geometry



Shields & Materials

Shield Number or Name: #1 #2 #3 #4 #5 #6

Thickness in units of NA :

√ Buildup Reference: ☑ ☑ ☑ ☑ ☑ ☑

Densities (Use √ to indicate default value or enter a partial or alternate density)

Material	Density (g/cc)	#1	#2	#3	#4	#5	#6
Air	0.00122	AIR	AIR	AIR	AIR	AIR	AIR
Tin	7.3						
Aluminum	2.702						
Titanium	4.5						
Concrete	2.35						
Tungsten	19.3						
Iron	7.86						
Uranium	18.75						
Lead	11.3						
Water	1.0						
Nickel	8.9						
Zirconium	6.5						
---------	----						
---------	----						

ASSUMPTIONS: 1) ASSUME PIPE IS FLATTENED AND PLACED INTO DISK GEOMETRY

2) FLATTENING TRANSFORMS PIPE DIAMETER TO A WIDTH DIMENSION THAT IS 2 TIMES THE ORIGINAL DIAMETER

3) TOTAL DISK AREA ≈ 1025 ft^2 ≈ 95.2 m^2

4) DOSE POINT IS 1 m. FROM THE SOURCE.

APPENDIX 7

MicroShield Output for the Pre-Decontamination Priority 2 Drain Lines

MicroShield 4.20

Page	: 1	File Ref:	___________
DOS File:	TIBOUND.MS4	Date:	___/___/___
Run Date:	March 6, 1997	By:	___________
Run Time:	9:07 p.m. Thursday	Checked:	___________
Duration:	0:00:01		

Case Title: TI Bounding Pipe Run (Pre-decontamination)

GEOMETRY 3 - Disk

	centimeters	feet and inches	
Dose point coordinate X:	100.0	3.0	3.4
Dose point coordinate Y:	0.0	0.0	.0
Dose point coordinate Z:	0.0	0.0	.0
Disk radius:	550.0	18.0	.5
Air Gap:	100.0	3.0	3.4

Source Area: 950332. sq cm 1022.93 sq ft. 147302. sq in.

MATERIAL DENSITIES (g/cm^3)

Material	Air Gap
Air	0.00122

BUILDUP

Method: Buildup Factor Tables

The material reference is Air Gap

INTEGRATION PARAMETERS

	Quadrature Order
Radial	20
Circumferential	20

SOURCE NUCLIDES

Nuclide	curies	μCi/cm²	Nuclide	curies	μCi/cm²
U-234	1.6000e-003	1.6836e-003	U-235	1.0000e-004	1.0523e-004
U-238	1.0000e-004	1.0523e-004			

------------------------------ RESULTS ------------------------------

Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec)		Exposure Rate In Air (mR/hr)	
		No Buildup	With Buildup	No Buildup	With Buildup
0.0532	6.986e+004	3.165e-003	3.549e-003	7.528e-006	8.440e-006
0.0664	3.589e+003	2.040e-004	2.269e-004	3.631e-007	4.039e-007
0.0727	4.070e+003	2.539e-004	2.812e-004	4.214e-007	4.667e-007
0.09	1.010e+005	7.820e-003	8.555e-003	1.202e-005	1.315e-005
0.0933	1.650e+005	1.327e-002	1.448e-002	2.032e-005	2.219e-005
0.105	7.633e+004	6.916e-003	7.503e-003	1.061e-005	1.151e-005
0.1091	5.550e+004	5.230e-003	5.664e-003	8.053e-006	8.722e-006
0.12	5.550e+003	5.757e-004	6.214e-004	8.997e-007	9.710e-007
0.1214	2.371e+004	2.490e-003	2.686e-003	3.899e-006	4.206e-006
0.1408	8.140e+003	9.927e-004	1.065e-003	1.609e-006	1.725e-006
0.1438	3.885e+005	4.840e-002	5.186e-002	7.884e-005	8.448e-005
0.1633	1.739e+005	2.466e-002	2.624e-002	4.148e-005	4.415e-005
0.1827	1.480e+004	2.350e-003	2.485e-003	4.063e-006	4.296e-006
0.1857	1.998e+006	3.226e-001	3.408e-001	5.599e-004	5.914e-004
0.1903	3.402e+004	5.632e-003	5.941e-003	9.829e-006	1.037e-005
0.1949	2.183e+004	3.702e-003	3.901e-003	6.497e-006	6.845e-006
0.2021	3.700e+004	6.509e-003	6.846e-003	1.151e-005	1.211e-005
0.2053	1.739e+005	3.108e-002	3.267e-002	5.517e-005	5.799e-005
0.2214	3.700e+003	7.138e-004	7.480e-004	1.287e-006	1.349e-006
TOTAL:	3.358e+006	4.866e-001	5.161e-001	8.343e-004	8.848e-004

APPENDIX 8

MicroShield Output for the Post-Decontamination Priority 2 Drain Lines

MicroShield 4.20

Page : 1
DOS File: TIPOST.MS4
Run Date: March 6, 1997
Run Time: 9:12 p.m. Thursday
Duration: 0:00:01

File Ref: ________
Date: __/__/__
By: ________
Checked: ________

Case Title: TI Pipe Run (Post-decontamination)

GEOMETRY 3 - Disk

	centimeters	feet and inches	
Dose point coordinate X:	100.0	3.0	3.4
Dose point coordinate Y:	0.0	0.0	.0
Dose point coordinate Z:	0.0	0.0	.0
Disk radius:	550.0	18.0	.5
Air Gap:	100.0	3.0	3.4

Source Area: 950332. sq cm 1022.93 sq ft. 147302. sq in.

MATERIAL DENSITIES (g/cm^3)

Material	Air Gap
Air	0.00122

BUILDUP
Method: Buildup Factor Tables
The material reference is Air Gap

INTEGRATION PARAMETERS

	Quadrature Order
Radial	20
Circumferential	20

SOURCE NUCLIDES

Nuclide	curies	μCi/cm²	Nuclide	curies	μCi/cm²
U-234	8.0000e-006	8.4181e-006	U-235	5.0000e-008	5.2613e-008
U-238	5.0000e-008	5.2613e-008			

=============================== RESULTS ===============================

Energy (MeV)	Activity (photons/sec)	Energy Fluence Rate (MeV/sq cm/sec) No Buildup	With Buildup	Exposure Rate In Air (mR/hr) No Buildup	With Buildup
0.0532	3.493e+002	1.583e-005	1.774e-005	3.764e-008	4.220e-008
0.0664	1.794e+000	1.020e-007	1.135e-007	1.816e-010	2.019e-010
0.0727	2.035e+000	1.269e-007	1.406e-007	2.107e-010	2.333e-010
0.09	5.048e+001	3.910e-006	4.277e-006	6.012e-009	6.577e-009
0.0933	8.249e+001	6.634e-006	7.241e-006	1.016e-008	1.109e-008
0.105	3.816e+001	3.458e-006	3.751e-006	5.304e-009	5.754e-009
0.1091	2.775e+001	2.615e-006	2.832e-006	4.026e-009	4.361e-009
0.12	2.775e+000	2.879e-007	3.107e-007	4.499e-010	4.855e-010
0.1214	1.186e+002	1.245e-005	1.343e-005	1.950e-008	2.103e-008
0.1408	4.070e+000	4.963e-007	5.323e-007	8.043e-010	8.626e-010
0.1438	1.942e+002	2.420e-005	2.593e-005	3.942e-008	4.224e-008
0.1633	8.695e+001	1.233e-005	1.312e-005	2.074e-008	2.208e-008
0.1827	7.400e+000	1.175e-006	1.243e-006	2.032e-009	2.148e-009
0.1857	9.990e+002	1.613e-004	1.704e-004	2.799e-007	2.957e-007
0.1903	1.701e+001	2.816e-006	2.971e-006	4.915e-009	5.185e-009
0.1949	1.091e+001	1.851e-006	1.950e-006	3.248e-009	3.423e-009
0.2021	1.850e+001	3.255e-006	3.423e-006	5.757e-009	6.056e-009
0.2053	8.695e+001	1.554e-005	1.633e-005	2.759e-008	2.900e-008
0.2214	1.850e+000	3.569e-007	3.740e-007	6.436e-010	6.744e-010
TOTAL:	2.100e+003	2.687e-004	2.861e-004	4.686e-007	4.993e-007

OFFICIAL RECORD COPY ML 10

Texas Instruments Incorporated
Materials and Controls Group
070-00033

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964

(508) 236-3800

February 24, 1997

SNM No. 23
Docket No. 70-33
Control No. 118945
10 CFR 70.38 (j)

Mr. Mark Roberts
US Nuclear Regulatory Commission
Region I, Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406-1415

RE: Transmittal of Groundwater Radiological Monitoring Data

Dear Mr. Roberts,

In accordance with Appendix B of the "Supplement to the 1992 Remediation Plan (December 1994)" that was approved by the US Nuclear Regulatory Commission (NRC) in July 1996, Texas Instruments Incorporated (TI) is transmitting the groundwater radiological monitoring data for its Attleboro site. This data includes the results of the sampling and analysis performed over two distinct time periods; one during August and September of 1995, and the second during December of 1996 and January/February of 1997.

These sampling and analysis efforts were strategically planned to represent groundwater conditions at the initiation of the latest remediation activities, and subsequent to completion of said activities. These results, taken in conjunction with a series of samples collected over a three month period in 1993, confirm that the migration of radionuclides through groundwater is not a pathway of concern with respect to the TI Attleboro facility.

The results of the most recent sampling are reported in Attachments 1 and 2 in the form of summary tables, original laboratory reports and field notes. In addition to listing the monitoring well locations, the summary tables also describe the remediation area nearest to the given well.

The analysis of a sample from one well, NRC-9, found a higher than expected level for gross alpha in December 1996. It was suspected that the level represented an error in the technique used for sample preservation. To test this hypothesis, well NRC-9 was

FEB 25 1997

OFFICIAL RECORD COPY MI. 10

118945

resampled along with two other wells. Care was taken to assure that proper sample preservation procedures were followed. The analysis of these three additional samples were found to be within the expected range. This confirmed that the initial sample for well NRC-9 was erroneous. The results of these three extra samples are included, along with the original results, in Attachment 2 on the summary table that describes gross alpha and gross beta results for the 1996/97 time period. As a further check, isotopic analyses were run on the resamples from the three wells. The results of the isotopic analyses are consistent with natural background levels for groundwater (Ref. Hem, J.D. 1970). Consequently, it is concluded that the second set of results was representative of actual conditions with respect to dissolved uranium and thorium

Attachment 3 is a copy of the Site Hydrology report that was originally submitted as Appendix F in the Former Burial Site Final Report (September 1993). It is included for your convenience. This report summarizes the site geological and hydrological conditions based on three comprehensive hydrogeological characterization reports and approximately 10 years of continuous groundwater monitoring data. It also includes summary tables that document the results of the groundwater sampling during the three month period in 1993. Furthermore, this report shows that the types of uranium employed in the former manufacturing processes at TI are insoluble in typical subsurface soil and groundwater conditions.

Finally, Attachment 4 is a uranium mobility report prepared by Roy F. Weston Inc., which contains a brief discussion of the geochemical properties of uranium mobility in groundwater, particularly focusing on uranium mobility under actual TI site conditions. This discussion concludes that, based on the types of uranium employed at the TI site and measured subsurface conditions, uranium mobility is highly unlikely. This conclusion is consistent with the radiological monitoring data contained in Attachments 1 and 2.

The data and the discussions presented in this correspondence confirm that groundwater is not a pathway of concern at the TI Attleboro site. Additionally, submission of this correspondence constitutes the final remaining activity to which TI committed in the 1994 Supplement Plan. As previously explained to you, during site remediation activities, TI discovered a small fragment of a uranium fuel element. Arrangements are being made to dispose of the fragment in accordance with applicable requirements. Once this has been accomplished all decommissioning activities will be complete. We anticipate being able to remove the fuel element fragment from the site and transfer it to another NRC licensee by early March. Having accomplished this, TI's Special Nuclear Materials License (SNM No. 23) can be terminated and the site released for unrestricted use.

If there are any questions concerning this matter, please do not hesitate to contact me at (508)236-1809.

Sincerely yours,
Materials & Controls Group

Michael J. Elliott
Environmental Manager

cc: Mr. Thomas F. O'Connell - Massachusetts Department of Public Health - Radiation Control Program

Attachments:

ATTACHMENT 1

TEXAS INSTRUMENTS INCORPORATED
MATERIALS AND CONTROLS GROUP

GROUNDWATER RADIOLOGICAL MONITORING REPORT

1995 DATA

TEXAS INSTRUMENTS INCORPORATED
METALS AND CONTROL GROUP
1995 GROSS ALPHA AND GROSS BETA ANALYSIS

REMEDIATED AREA PROXIMITY	MONITORING WELL LOCATION	SAMPLE DATE	WATER ELEVATION (feet above MSL)	GROSS ALPHA pCi/l	GROSS BETA pCi/l	SPEC. COND. Umhos/cm
Background	MW-7S	Aug. 27	120.18	2.80	2.60	289.0
Background	MW-7	Aug. 27	120.1	-0.02	0.10	274.0
Bldg. 4	GZA-1	Aug. 27	121.32	0.10	3.70	381.0
B-12 Burial Site	TI-4S	Aug. 27	121.95	3.8	1.60	258.0
Background	MW-2S	Aug. 27	119.24	0.60	1.50	127.0
B-12 Burial Site	MW-4S	Aug. 27	121.65	1.00	-2.20	449.0
Background	GEI-108	Aug. 27	121.58	0.10	0.20	281.0
Background	OW-7	Aug. 27	121.6	7.20	24.70	524.0
Stockade/RR Spur	MW-5S	Aug. 27	122.15	0.40	1.50	423.0
Stockade/RR Spur	MW-5	Aug. 27	122.67	1.10	1.00	298.0
Bldg. 10	BW-5	Sept. 10	N.A.	-1.00	3.60	870.0
B-5 Metals Recov	MW-6S	Sept. 10	121.22	1.10	1.60	390.0
B-12 South Lawn	GEI-104	Sept. 10	115.61	-0.30	0.60	500.0
Bldg. 4	GEI-110	Sept. 10	119.6	0.80	3.00	370.0
B-12 Burial Site	TI-15	Sept. 10	121.18	2.60	5.10	500.0
B-12 Burial Site	NRC-9	Sept. 10	N.A.	0.50	7.00	1140.0
B-12 Burial Site	NRC-10	Sept. 10	N.A.	1.30	7.20	530.0
B-17 Hill	OW-6	Sept. 17	120.66	1.10	2.50	430.0
Bldg. 10	MW-8S	Sept. 17	N.A.	1.40	4.60	330.0

NOTES: N.A. = NOT AVAILABLE
SAMPLES WERE TAKEN FROM ABOVE WELLS WITHOUT BEING PURGED.

Thermo Analytical Inc.

TMA/Eberline
601 Scarboro Rd.
Oak Ridge, TN 37830
(615) 481-0683 Fax (615) 483-4621

TMA/OR-3513

September 18, 1995
J. Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest St.
Attleboro, MA 02703-2481

CASE NARRATIVE
Work Order# 95-09-042-OR

SAMPLE RECEIPT

This work order contains ten water samples received 09/11/95. These samples were analyzed for Gross Alpha/Beta.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
#101-MW-7S	95-09-042-04	#106-MW-4S	95-09-042-09
#102-MW-7	95-09-042-05	#107-GEI-108	95-09-042-10
#103-GZA-1	95-09-042-06	#108-OW-7	95-09-042-11
#104-TI-4S	95-09-042-07	#109-MW-5S	95-09-042-12
#105-MW-2S	95-09-042-08	#110-MW-5	95-09-042-13

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 9/18/95

J. SZLACHCIUK
TEXAS INSTRUMENTS
Mail Stop 11-4
34 FOREST ST.
ATTLEBORO, MA 02703

P.O. # 500224169
SDG: 9509042
MATRIX: Water

Final Report of Analysis

Date Reported: 9/18/95

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	Units	MDA
95-09-042-01	K	KNOWN	091195	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	243.90	9.80	PCi/L	0.12
95-09-042-01	S	SPIKE	091195	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	223.50	4.60	PCi/L	0.12
95-09-042-02	B	BLANK	091195	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	-0.10	0.20	PCi/L	0.12
95-09-042-03	D	#109-MW-5S	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	0.60	0.60	PCi/L	0.38
95-09-042-04		#101-MW-7S	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	2.80	1.30	PCi/L	0.61
95-09-042-05		#102-MW-7	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	-0.20	0.60	PCi/L	0.48
95-09-042-06		#103-GZA-1	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	0.10	0.70	PCi/L	0.63
95-09-042-07		#104-TI-4S	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	3.80	2.00	PCi/L	1.09
95-09-042-08		#105-MW' 2S	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	0.60	0.60	PCi/L	0.38
95-09-042-09		#106-MW-4S	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	-0.50	1.00	PCi/L	0.84
95-09-042-10		#107-GEI-108	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	0.10	0.60	PCi/L	0.44
95-09-042-11		#108-OW-7	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	7.20	1.50	PCi/L	0.85
95-09-042-12		#109-MW-5S	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	0.40	0.60	PCi/L	0.38
95-09-042-13		#110-MW-5	082795	091195	091495	9509042	Gross Alpha	EPA 900.0 Modified	1.10	0.80	PCi/L	0.51
95-09-042-01	K	KNOWN	091195	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	430.60	17.20	PCi/L	0.16
95-09-042-01	S	SPIKE	091195	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	446.60	6.30	PCi/L	0.16
95-09-042-02	B	BLANK	091195	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	-0.10	0.50	PCi/L	0.16
95-09-042-03	D	#109-MW-5S	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	0.80	1.30	PCi/L	0.42
95-09-042-04		#101-MW-7S	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	2.60	2.20	PCi/L	0.67
95-09-042-05		#102-MW-7	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	0.10	1.50	PCi/L	0.48
95-09-042-06		#103-GZA-1	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	3.70	1.90	PCi/L	0.58
95-09-042-07		#104-TI-4S	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	1.60	3.50	PCi/L	1.12
95-09-042-08		#105-MW-2S	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	1.50	1.40	PCi/L	0.42
95-09-042-09		#106-MW-4S	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	-2.20	2.40	PCi/L	0.85
95-09-042-10		#107-GEI-108	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	0.20	1.30	PCi/L	0.43
95-09-042-11		#108-OW-7	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	24.70	3.20	PCi/L	0.71
95-09-042-12		#109-MW-5S	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	1.50	1.40	PCi/L	0.42
95-09-042-13		#110-MW-5	082795	091195	091495	9509042	Gross Beta	EPA 900.0 Modified	1.00	1.50	PCi/L	0.48

Approved by: M.R.M. 9/18/95
M.R. McDougall, Laboratory Manager

K=Known,S=Spike,B=Blank,D=Duplicate,MS=Matrix Spike

	STATION LOCATION	DATE	TIME	SAMPLE TYPE: WATER: COMP	SAMPLE TYPE: WATER: GRAB	SEQ. NO.	NO. OF CONT.	ANALYSIS REQUIRED
	MONITORING WELLS							
4	#101 - MW-7S	8-27-95	0820		X		1 GRT	GROSS ALPHA/BETA
5	#102 MW-7	8-27-95	0845		X		1 GRT	↓
6	#103 - GZA-1	8-27-95	0905		X		1 GRT	↓
7	#104 - TI-4S	8-27-95	0930		X		1 GRT	↓
8	#105 - MW-2S	8-27-95	1000		X		1 GRT	↓
9	#106 - MW-4S	8-27-95	1030		X		1 GRT	↓
0	#107 - GEI-103	8-27-95	1100		X		1 GRT	↓
1	#108 OW-7	8-27-95	1140		X		1 GRT	↓
2	#109 - MW-5S	8-27-95	1210		X		1 GRT	↓
3	#110 - MW-5	8-27-95	1250		X		1 GRT	↓

Received with HNO3

If you have any questions, please contact me at (508) 236-1343

RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
[signature] 9-7-95	[signature] Tasazaa	9/8/95 0930
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME

METHOD OF SHIPMENT:

1 week turnaround

RECEIVED SEP [illegible] TMA/Eberline OAK RIDGE LAB

Thermo Analytical Inc.

TMA/Eberline
801 Scarboro Rd.
Oak Ridge, TN 37830
(615) 481-0683 Fax (615) 483-4621

TMA/OR-3560

October 5, 1995

J. Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest St.
Attleboro, MA 02703-2481

CASE NARRATIVE
Work Order# 95-09-096-OR

SAMPLE RECEIPT

This work order contains nine water samples received 09/19/95. These samples were analyzed for Gross Alpha/Beta.

CLIENT ID	LAB ID	CLIENT ID	LAB ID
BW-5	95-09-096-04	NRC-9	95-09-096-09
MW-6S	95-09-096-05	NRC-10	95-09-096-10
GEI-104	95-09-096-06	OW-6	95-09-096-11
GEI-110	95-09-096-07	MW-8S	95-09-096-12
TI-15	95-09-096-08		

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 10/6/95

J. SZLACHCIUK
TEXAS INSTRUMENTS
MAIL STOP 11-4
34 FOREST ST.
ATTLEBORO, MA 02703-2481

P.O. # 500224169
SDG: 9509096
MATRIX: Water

Final Report of Analysis
Date Reported: 10/5/95

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	Units	MDA
95-09-096-01	K	KNOWN	091995	091995	092695	9509096	Gross Alpha	EPA 900.0 Modified	229.10	9.20	PCI/L	0.06
95-09-096-01	S	SPIKE	091995	091995	092695	9509096	Gross Alpha	EPA 900.0 Modified	223.60	3.30	PCI/L	0.06
95-09-096-02	B	BLANK	091995	091995	092695	9509096	Gross Alpha	EPA 900.0 Modified	0.00	0.20	PCI/L	0.06
95-09-096-03	D	MW-6S	091095	091995	092695	9509096	Gross Alpha	EPA 900.0 Modified	0.50	0.80	PCI/L	0.30
95-09-096-04		BW-5	091095	091995	092695	9509096	Gross Alpha	EPA 900.0 Modified	-1.00	1.10	PCI/L	0.62
95-09-096-05		MW-6S	091095	091995	092695	9509096	Gross Alpha	EPA 900.0 Modified	1.10	0.80	PCI/L	0.31
95-09-096-06		GEI-104	091095	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	-0.30	1.40	PCI/L	0.58
95-09-096-07		GEI-110	091095	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	0.80	0.80	PCI/L	0.36
95-09-096-08		TI-15	091095	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	2.60	1.10	PCI/L	0.45
95-09-096-09		NRC-9	091095	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	0.50	1.40	PCI/L	0.81
95-09-096-10		NRC-10	091095	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	1.30	0.80	PCI/L	0.36
95-09-096-11		OW-6	091795	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	1.10	1.00	PCI/L	0.48
95-09-096-12		MW-8S	091795	091995	092795	9509096	Gross Alpha	EPA 900.0 Modified	1.40	1.00	PCI/L	0.39
95-09-096-01	K	KNOWN	091995	091995	092695	9509096	Gross Beta	EPA 900.0 Modified	404.30	16.20	PCI/L	0.06
95-09-096-01	S	SPIKE	091995	091995	092695	9509096	Gross Beta	EPA 900.0 Modified	396.00	4.20	PCI/L	0.06
95-09-096-02	B	BLANK	091995	091995	092695	9509096	Gross Beta	EPA 900.0 Modified	0.30	0.30	PCI/L	0.07
95-09-096-03	D	MW-6S	091095	091995	092695	9509096	Gross Beta	EPA 900.0 Modified	2.40	1.40	PCI/L	0.27
95-09-096-04		BW-5	091095	091995	092695	9509096	Gross Beta	EPA 900.0 Modified	3.60	2.40	PCI/L	0.46
95-09-096-05		MW-6S	091095	091995	092695	9509096	Gross Beta	EPA 900.0 Modified	1.60	1.40	PCI/L	0.27
95-09-096-06		GEI-104	091095	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	0.60	2.70	PCI/L	0.54
95-09-096-07		GEI-110	091095	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	3.00	1.50	PCI/L	0.28
95-09-096-08		TI-15	091095	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	5.10	1.80	PCI/L	0.34
95-09-096-09		NRC-9	091095	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	7.00	2.60	PCI/L	0.52
95-09-096-10		NRC-10	091095	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	7.20	1.80	PCI/L	0.28
95-09-096-11		OW-6	091795	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	2.50	1.70	PCI/L	0.34
95-09-096-12		MW-8S	091795	091995	092795	9509096	Gross Beta	EPA 900.0 Modified	4.60	1.70	PCI/L	0.31

K=Known,S=Spike,B=Blank,D=Duplicate,MS=Matrix Spike

Approved by: M.R. McDougall 10/5/95
M.R. McDougall, Laboratory Manager

MONITORING WELLS	SAMPLERS: (SIGNATURE) [illegible]

STATION LOCATION	DATE	TIME	SAMPLE TYPE WATER COMP	GRAB	SEQ. NO.	NO. OF CONT.	ANALYSIS REQUIRED
WELLS:							
4 #111 BR-5	[illegible]	[illegible]		✓		1 [illegible]	GROSS ALPHA/BETA
5 #112 MW-6S	"	[illegible]		✓		1 [illegible]	
6 #113 GEI-10	"	[illegible]		✓		1 [illegible]	
7 #114 GEI-11	"	[illegible]		✓		[illegible]	
8 #115 TT-15	"	[illegible]		✓		[illegible]	
9 #116 NRC-9	"	[illegible]		✓		[illegible]	
10 #117 NRC-10	"	[illegible]				[illegible]	
118 [illegible]	[illegible]	[illegible]				[illegible]	
#119 MW-5	[illegible]	[illegible]				[illegible]	

Preserved with HNO3
Please [illegible] [illegible] filter prior [illegible] analyses.
Thank you

RECEIVED
SEP 19 1995
TMA/ [illegible]
OAK RIDGE LAB

RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
[illegible]	[illegible]	[illegible]
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME

METHOD OF SHIPMENT: [illegible]

95-09-[illegible]

ATTACHMENT 2

TEXAS INSTRUMENTS INCORPORATED
MATERIALS AND CONTROLS GROUP

GROUNDWATER RADIOLOGICAL MONITORING REPORT

1996 AND 1997 DATA

OFFICIAL RECORD COPY ML 10

GROUNDWATER RADIOLOGICAL MONITORING REPORT
TEXAS INSTRUMENTS INCORPORATED
METALS AND CONTROL GROUP

1996 AND 1997 GROSS ALPHA AND GROSS BETA ANALYSIS

REMEDIATED AREA PROXIMITY	MONITORING WELL LOCATION	SAMPLE DATE	WATER ELEVATION (feet above MSL)	GROSS ALPHA pCi/l	GROSS BETA pCi/l	SPEC. COND Umhos/cm
Background	MW-7S	Dec. 21	120.18	-0.49	1.76	262.0
B-12 Burial Site	TI-4S	Jan. 04	*	12.35	13.48	134.0
B-12 Burial Site	TI-4S**	Feb. 03	*	0.29	2.62	159.0
B-12 Burial Site	MW-4S	Dec. 21	121.65	-0.26	-2.20	359.0
Background	GEI-108	Dec. 21	121.58	0.50	3.67	449.0
Background	OW-7	Dec. 22	*	1.56	2.58	342.0
Stockade/RR Spur	MW-5S	Dec. 21	*	-0.38	-0.15	344.0
B-5 Metals Recov.	MW-6S	Jan. 08	*	12.53	5.92	390.0
B-12 South Lawn	GEI-104	Dec. 23	*	8.92	7.83	421.0
B-12 Burial Site	NRC-9	Dec. 23	*	37.88	22.65	740.0
B-12 Burial Site	NRC-9**	Feb. 04	*	4.61	14.19	380.0
B-12 Burial Site	NRC-10	Dec. 23	*	11.01	24.54	382.0
B-12 Burial Site	NRC-23	Dec. 21	N.A.	0.50	6.21	117.0
B-17 Hill	OW-6	Dec. 21	*	1.71	3.95	184.0
B-17 Hill	OW-6**	Feb. 04	*	-0.08	3.74	194.0
Bldg. 10	MW-8S	Jan. 04	*	0.48	3.90	219.0

NOTES:

N.A. = NOT AVAILABLE
SAMPLES WERE TAKEN FROM ABOVE WELLS AFTER BEING PURGED.
* = UNABLE TO GAUGE LEVEL. ORIGINAL ELEVATION ALTERED. NO NEW ELEVATION AVAILABLE.
** = EMPLOYED PROPER SAMPLING PRESERVATION TECHNIQUE.

GROUNDWATER RADIOLOGICAL SAMPLING REPORT
FOR YEAR 1996 AND 1997
FIELD NOTES SUMMARY

WELLS	SAMPLE DATE	WELL ELEV.	WATER DEPTH	WATER ELEV.	WELL DEPTH	TOTAL VOLUME	SPEC. COND. Umhos/cm	PH uS
MW-7S	12/21/96	125.28	2.75	122.53	38.70	53.96	262.0	7.64
TI-4S	12/21/96	*	3.08	*	30.05	4.70	134.0	6.85
MW-4S	12/21/96	128.55	4.21	124.34	21.10	25.35	359.0	7.21
GEI-108	12/21/96	133.88	6.51	127.37	18.92	2.16	449.0	6.15
OW-7	12/22/96	*	5.10	*	13.65	1.49	342.0	6.42
MW-5S	12/21/96	*	4.65	*	27.40	34.15	344.0	6.90
MW-6S	1/8/97	*	5.61	*	16.40	1.88	390.0	6.89
GEI-104	12/23/96	*	7.85		22.10	2.10	421.0	6.45
NRC-9	12/23/96	*	2.92	*	11.60	1.50	740.0	6.89
NRC-10	12/23/96	*	2.11	*	12.15	1.75	382.0	6.99
OW-6	12/21/96	*	3.47	*	14.65	1.95	117.0	6.75
MW-8S	1/4/97	*	5.65	*	22.00	24.54	184.0	6.97
RC-23	12/21/96	N.A.	0.00	N.A.	8.81	1.53	219.0	6.64

OTES: N.A. = NOT AVAILABLE
* = UNABLE TO GAUGE LEVEL. ORIGINAL ELEVATION ALTERED. NO NEW ELEVATION AVAILABLE.

GROUNDWATER RADIOLOGICAL MONITORING REPORT
TEXAS INSTRUMENTS INCORPORATED
METALS AND CONTROL GROUP

1997 ISOTOPIC RADIUM, THORIUM

REMEDIATED AREA PROXIMITY	MONITORING WELL LOCATION	SAMPLE DATE	Radium 228 pCi/l	Thorium 228 pCi/l	Thorium 230 pCi/l	Thorium 232 pCi/l
B-12 Burial Site	TI-4S	Feb. 03	1.20	0.31	0.53	0.38
B-12 Burial Site	NRC-9	Feb. 04	2.42	0.45	0.73	0.11
B-17 Hill	OW-6	Feb. 04	1.74	0.35	0.83	0.21

1997 TOTAL RADIUM, ISOTOPIC URANIUM

REMEDIATED AREA PROXIMITY	MONITORING WELL LOCATION	SAMPLE DATE	Total Radium pCi/l	Uranium 234 pCi/l	Uranium 235 pCi/l	Uranium 238 pCi/l
B-12 Burial Site	TI-4S	Feb. 03	0.58	0.11	0.00	0.11
B-12 Burial Site	NRC-9	Feb. 04	0.99	0.15	0.06	0.05
B-17 Hill	OW-6	Feb. 04	0.34	0.16	0.07	0.16

1997 FIELD NOTES SUMMARY

MONITORING WELL LOCATION	SAMPLE DATE	WATER DEPTH	TOTAL VOLUME	SPEC. COND. Umhos/cm	PH uS	TEMP. Deg. F
TI-4S	Feb. 03	3.12	4.70	159.00	6.91	54.00
NRC-9	Feb. 04	2.95	1.50	380.00	6.90	50.00
OW-6	Feb. 04	3.6	1.93	194.00	6.80	50.00

NOTES: N.A. = NOT AVAILABLE
SAMPLES WERE TAKEN FROM ABOVE WELLS AFTER BEING PURGED.
* = UNABLE TO GAUGE LEVEL. ORIGINAL ELEVATION ALTERED. NO NEW ELEVATION AVAILABLE

Thermo NUtech
[illegible]
Oak Ridge TN [illegible]
(423) [illegible]
FAX (423) [illegible]
FAX (423) [illegible]

TNU-OR-5547

January 16, 1997

Joseph Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest St.
Attleboro, MA 02703-2481

CASE NARRATIVE
Work Order# 97-01012-OR

SAMPLE RECEIPT

This work order contains thirteen water samples received 01/09/97. Samples were filtered through a 0.45 micron filter and the filtered portion was analyzed for Gross Alpha/Beta.

Client ID	Lab ID	Client ID	Lab ID
MW-75	97-01012-04	NRC-9	97-01012-11
TI-4 S	97-01012-05	NRC-10	97-01012-12
MW-4S	97-01012-06	OW-6	97-01012-13
GEI-108	97-01012-07	MW-8S	97-01012-14
OW-7	97-01012-08	NRC-23	97-01012-15
MW-5S	97-01012-09	MW-6S	97-01012-16
GEI-104	97-01012-10		

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No significant problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 1/16/97

Joseph Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest Street
Attleboro, MA 02703-2481

PO#: 500808588
SDG: 9701012
Matrix: Water

Final Report of Analysis
Date of Report: 1/16/97

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-01012-01	K	KNOWN	01/09/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	212.19	8.50		PCI/L
97-01012-01	S	SPIKE	01/09/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	223.00	7.69	0.87	PCI/L
97-01012-02	B	BLANK	01/09/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.24	0.31	0.86	PCI/L
97-01012-03	D	MW-7S	12/21/96	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.49	0.68	1.43	PCI/L
97-01012-04		MW-7S	12/21/96	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.26	0.73	1.44	PCI/L
97-01012-05		TI-4	01/04/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	12.35	3.73	4.41	PCI/L
97-01012-06		MW-4S	12/21/96	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.26	0.94	1.85	PCI/L
97-01012-07		GEI-108	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	0.50	0.94	1.65	PCI/L
97-01012-08		OW-7	12/22/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	1.56	0.74	1.03	PCI/L
97-01012-09		MW-5S	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.38	0.42	0.89	PCI/L
97-01012-10		GEI-104	12/23/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	8.92	2.84	3.43	PCI/L
97-01012-11		NRC-9	12/23/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	37.88	3.08	1.51	PCI/L
97-01012-12		NRC-10	12/23/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	11.01	1.48	1.09	PCI/L
97-01012-13		OW-6	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	1.71	1.90	3.14	PCI/L
97-01012-14		MW-8S	01/04/97	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	0.48	0.80	1.39	PCI/L
97-01012-15		NRC-23	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	0.50	1.07	1.89	PCI/L
97-01012-16		MW-6S	01/08/97	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	12.53	1.61	1.15	PCI/L

Approved by: MM 1/16/97
M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUtech

A Subsidiary of Thermo Remediation, a Thermo Electron Company

Thermo NUtech
601 Scarboro Road
Oak Ridge, TN 37831
(423) 481-[illegible]
FAX (423) 483-[illegible]
FAX (423) 481-[illegible]

TNU-OR-5547

January 16, 1997

Joseph Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest St.
Attleboro, MA 02703-2481

CASE NARRATIVE
Work Order# 97-01012-OR

SAMPLE RECEIPT

This work order contains thirteen water samples received 01/09/97. Samples were filtered through a 0.45 micron filter and the filtered portion was analyzed for Gross Alpha/Beta.

Client ID	Lab ID	Client ID	Lab ID
MW-75	97-01012-04	NRC-9	97-01012-11
TI-4 S	97-01012-05	NRC-10	97-01012-12
MW-4S	97-01012-06	OW-6	97-01012-13
GEI-108	97-01012-07	MW-8S	97-01012-14
OW-7	97-01012-08	NRC-23	97-01012-15
MW-5S	97-01012-09	MW-6S	97-01012-16
GEI-104	97-01012-10		

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No significant problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 1/16/97

Joseph Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest Street
Attleboro, MA 02703-2481

PO#: 500808588
SDG: 9701012
Matrix: Water

Final Report of Analysis
Date of Report: 1/16/97

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-01012-01	K	KNOWN	01/09/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	212.19	8.50		PCI/L
97-01012-01	S	SPIKE	01/09/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	223.00	7.69	0.87	PCI/L
97-01012-02	B	BLANK	01/09/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.24	0.31	0.86	PCI/L
97-01012-03	D	MW-7S	12/21/96	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.49	0.68	1.43	PCI/L
97-01012-04		MW-7S	12/21/96	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.26	0.73	1.44	PCI/L
97-01012-05		TI-4	01/04/97	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	12.35	3.73	4.41	PCI/L
97-01012-06		MW-4S	12/21/96	01/09/97	01/13/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.26	0.94	1.85	PCI/L
97-01012-07		GEI-108	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	0.50	0.94	1.65	PCI/L
97-01012-08		OW-7	12/22/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	1.56	0.74	1.03	PCI/L
97-01012-09		MW-5S	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	-0.38	0.42	0.89	PCI/L
97-01012-10		GEI-104	12/23/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	8.92	2.84	3.43	PCI/L
97-01012-11		NRC-9	12/23/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	37.88	3.08	1.51	PCI/L
97-01012-12		NRC-10	12/23/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	11.01	1.48	1.09	PCI/L
97-01012-13		OW-6	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	1.71	1.90	3.14	PCI/L
97-01012-14		MW-8S	01/04/97	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	0.48	0.80	1.39	PCI/L
97-01012-15		NRC-23	12/21/96	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	0.50	1.07	1.89	PCI/L
97-01012-16		MW-6S	01/08/97	01/09/97	01/14/97	9701012	Gross Alpha	EPA 900.0 Modified	12.53	1.61	1.15	PCI/L

Approved by: [signature] 1/16/97
M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Joseph Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest Street
Attleboro, MA 02703-2481

PO#: 500808588
SDG: 9701012
Matrix: Water

Final Report of Analysis
Date of Report: 1/16/97

Lab ID	Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-01012-01 K	KNOWN	01/09/97	01/09/97	01/13/97	9701012	Gross Beta	EPA 900 0 Modified	362.07	14.50		PCI/L
97-01012-01 S	SPIKE	01/09/97	01/09/97	01/13/97	9701012	Gross Beta	EPA 900.0 Modified	378 28	6.45	0.84	PCI/L
97-01012-02 B	BLANK	01/09/97	01/09/97	01/13/97	9701012	Gross Beta	EPA 900.0 Modified	0.00	0.60	1 12	PCI/L
97-01012-03 D	MW-7S	12/21/96	01/09/97	01/13/97	9701012	Gross Beta	EPA 900.0 Modified	2.29	0 95	1 46	PCI/L
97-01012-04	MW-7S	12/21/96	01/09/97	01/13/97	9701012	Gross Beta	EPA 900.0 Modified	1.76	0.92	1.47	PCI/L
97-01012-05	TI-4	01/04/97	01/09/97	01/13/97	9701012	Gross Beta	EPA 900.0 Modified	13.48	2.61	3.49	PCI/L
97-01012-06	MW-4S	12/21/96	01/09/97	01/13/97	9701012	Gross Beta	EPA 900.0 Modified	1.21	0.88	1.43	PCI/L
97-01012-07	GEI-108	12/21/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	3.67	1.03	1.50	PCI/L
97-01012-08	OW-7	12/22/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	2.58	0.83	1.23	PCI/L
97-01012-09	MW-5S	12/21/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	-0.15	0.67	1.20	PCI/L
97-01012-10	GEI-104	12/23/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	7.83	2.45	3.63	PCI/L
97-01012-11	NRC-9	12/23/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900 0 Modified	22.65	1.66	1.48	PCI/L
97-01012-12	NRC-10	12/23/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	24.54	1.58	1.30	PCI/L
97-01012-13	OW-6	12/21/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	3.95	1.82	2.84	PCI/L
97-01012-14	MW-8S	01/04/97	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	3.90	0.93	1.31	PCI/L
97-01012-15	NRC-23	12/21/96	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	6.21	1.56	2 21	PCI/L
97-01012-16	MW-6S	01/08/97	01/09/97	01/14/97	9701012	Gross Beta	EPA 900.0 Modified	5.92	0 99	1.26	PCI/L

K=Known,S=Spike,B=Blank,D=Duplicate,MS=Matrix Spike

Approved by: [signature] 1/16/97
M.R. McDougall, Laboratory Manager

97-01-012

TEXAS INSTRUMENTS, INC
WASTE WATER TREATMENT

CHAIN OF CUSTODY DOCUMENT

JAN - 9 1997
OAK RIDGE

SAMPLE COLLECTION:

DATE: 1-8-97 TSL NUMBER: BY: Joe Szlechcinski

NO.	SAMPLE I.D:	TIME:	SAMPLE TYPE: GRAB	SAMPLE TYPE: COMP	CONTAINER TYPE: NO.	TYPE	SIZE	PRES	ANALYSIS REQUIRED
1	MW-7S	12-21 (1200)	X		1			(X)	GROSS ALPHA *
2	TI-4S	01-4 (0900)	X		1				GROSS BETA **
3	MW-4S	12-21 (1000)	X		1				
4	GEI-108	12-21-(0840)	X		1				* IF GROSS ALPHA
5	DW-7	12-22 (0940)	X		1				EXCEEDS 15 pCi/L
6	MW-5S	12-21 (1130)	X		1				then perform SA.
7	GEI-104	12-23 (1430)	X		1				analysis for following
8	NRC-9	12-23 (1015)	X		1				Uranium, Thorium
9	NRC-10	12-23 (0900)	X		1				

RELINQUISHED BY Joe Szlechcinski 1-8-97 ACCEPTED BY C. Bolin 1/9/97

COMMENTS: PLEASE FILTER IN .45 µ filter prior to analysis

PRESERVATION CODE: I - ICED, F - FILTERED, N - NITRIC ACID, H - HYDROCHLORIC ACID, S - SODIUM HYDROXIDE, T - SODIUM THIOSULFATE, O - OTHER/ SPECIFY

CONTAINER TYPE: P - PLASTIC, C - CUBE, G - GLASS, A - AMBER GLASS, B - BACTERIA BOTTLE

(X) Preserved with HNO_3 - not marked on chain of custody

TEXAS INSTRUMENTS, INC
WASTE WATER TREATMEN.

CHAIN OF CUSTODY DOCUMENT

JAN - 1997

SAMPLE COLLECTION:

DATE: 1-8-97 TSL NUMBER : BY: Joe [illegible]

NO.	SAMPLE I.D.:	TIME:	SAMPLE TYPE : GRAB	COMP	CONTAINER TYPE: NO.	TYPE	SIZE	PRES	ANALYSIS REQUIRED
10	OW-6	12-21 (0800)	✓						GROSS ALPHA/BETA ACTIVITY
11	MW-8S	01-04 (0930)	X						
12	NRC-23	12-21 (1030)	X						** IF GROSS BETA EXCEEDS
13	MW-6S	01-08 (0900)	X						50 pCi/L then perform
									S.A analysis for the following
									Uranium, Thorium.

RELINQUISHED BY: Joe [illegible] 1-8-97 ACCEPTED BY: [illegible] 1/9/97

COMMENTS: PLEASE FILTER SAMPLES w/ .45u filter prior to analysis.

PRESERVATION CODE: I = ICED, F = FILTERED, N = NITRIC ACID, H = HYDROCHLORIC ACID, S = SODIUM HYDROXIDE, T = SODIUM THIOSULFATE, O = OTHER/SPECIFY

CONTAINER TYPE: P = PLASTIC, C = CUBI, G = GLASS, A = AMBER GLASS, B = BACTERIA BOTTLE

Thermo NUtech
601 Scarboro Road
Oak Ridge TN 37830
(423) 481-0683
FAX (423) 483-4621
FAX (423) 481-0121

TNU-OR-5605

February 12, 1997

J. Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest St.
Attleboro, MA 02703-2481

CASE NARRATIVE
Work Order# 97-02009-OR

SAMPLE RECEIPT

This work order contains three water samples received 02/05/97. These samples were analyzed for Radium-228, Isotopic Thorium, Total Radium and Isotopic Uranium. One sample was also analyzed for Gross Alpha/Beta. All samples were filtered through a 0.45 micron filter and the filtrate was analyzed.

CLIENT ID	LAB ID
TI-4S	97-02009-04
OW-6	97-02009-05
NRC-9	97-02009-06

SPECIAL PROBLEMS OR UNUSUAL CIRCUMSTANCES

No significant problems were noted during the analysis process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

M.R. McDougall
Laboratory Manager

Date: 2/12/97

J. Szlachciuk
Texas Instruments
Mail Stop 11-4
34 Forest Street
Attleboro, MA 02703-2481

P.O. # 500808588
SDG: 9702024
Matrix: Water

Final Report of Analysis
Date Reported: 2/18/97

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-02024-01	K	KNOWN	02/12/97	02/12/97	02/14/97	9702024	Gross Alpha	EPA 900.0 Modified	214.58	8.80		PCi/L
97-02024-01	S	SPIKE	02/12/97	02/12/97	02/14/97	9702024	Gross Alpha	EPA 900.0 Modified	201.09	7.07	0.77	PCi/L
97-02024-02	B	BLANK	02/12/97	02/12/97	02/14/97	9702024	Gross Alpha	EPA 900.0 Modified	-0.25	0.25	0.77	PCi/L
97-02024-03	D	TI-4S	02/03/97	02/12/97	02/14/97	9702024	Gross Alpha	EPA 900.0 Modified	0.29	1.39	2.58	PCi/L
97-02024-04		TI-4S	02/03/97	02/12/97	02/14/97	9702024	Gross Alpha	EPA 900.0 Modified	-0.08	1.38	2.88	PCi/L
97-02024-05		OW-6	02/04/97	02/12/97	02/14/97	9702024	Gross Alpha	EPA 900.0 Modified	-0.08	1.53	2.97	PCi/L
97-02024-01	K	KNOWN	02/12/97	02/12/97	02/14/97	9702024	Gross Beta	EPA 900.0 Modified	385.34	14.60		PCi/L
97-02024-01	S	SPIKE	02/12/97	02/12/97	02/14/97	9702024	Gross Beta	EPA 900.0 Modified	414.31	6.97	0.95	PCi/L
97-02024-02	B	BLANK	02/12/97	02/12/97	02/14/97	9702024	Gross Beta	EPA 900.0 Modified	0.26	0.72	1.27	PCi/L
97-02024-03	D	TI-4S	02/03/97	02/12/97	02/14/97	9702024	Gross Beta	EPA 900.0 Modified	2.22	1.99	3.30	PCi/L
97-02024-04		TI-4S	02/03/97	02/12/97	02/14/97	9702024	Gross Beta	EPA 900.0 Modified	2.62	2.03	3.32	PCi/L
97-02024-05		OW-6	02/04/97	02/12/97	02/14/97	9702024	Gross Beta	EPA 900.0 Modified	3.74	2.12	3.38	PCi/L

K=Known,S=Spike,B=Blank,D=Duplicate,MS=Matrix Spike

Approved by: [signature] 2/18/97
M.R. McDougall, Laboratory Manager

J. SZLACHCIUK
TEXAS INSTRUMENTS
MAIL STOP 11-4
34 FOREST ST.
ATTLEBORO, MA 02703

P.O. # 500808588
SDG: 9702009
MATRIX: Water

Final Report of Analysis
Date Reported: 2/12/97

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/06/97	9702009	Gross Alpha	EPA 900.0 Modified	211.75	8.50		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/06/97	9702009	Gross Alpha	EPA 900.0 Modified	192.48	6.91	0.69	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/06/97	9702009	Gross Alpha	EPA 900.0 Modified	0.00	0.31	0.70	PCI/L
97-02009-03	D	NRC-9	02/04/97	02/04/97	02/06/97	9702009	Gross Alpha	EPA 900.0 Modified	-3.47	4.81	9.80	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/06/97	9702009	Gross Alpha	EPA 900.0 Modified	4.61	5.94	10.02	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/06/97	9702009	Gross Beta	EPA 900.0 Modified	360.71	14.40		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/06/97	9702009	Gross Beta	EPA 900.0 Modified	404.95	6.88	0.95	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/06/97	9702009	Gross Beta	EPA 900.0 Modified	0.06	0.69	1.26	PCI/L
97-02009-03	D	NRC-9	02/04/97	02/04/97	02/06/97	9702009	Gross Beta	EPA 900.0 Modified	3.48	6.35	10.78	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/06/97	9702009	Gross Beta	EPA 900.0 Modified	14.19	6.73	10.81	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	13.77	0.76		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	11.69	1.20	1.12	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	0.44	0.46	1.04	PCI/L
97-02009-03	D	TI-4S	02/03/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	1.35	1.23	2.75	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	1.20	1.40	3.24	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	2.42	1.47	3.12	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/10/97	9702009	Radium-228	EPA 904.0 Modified	1.74	1.45	3.23	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	5.10	0.18		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	5.16	1.07	0.10	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	0.09	0.11	0.19	PCI/L
97-02009-03	D	OW-6	02/04/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	0.19	0.22	0.48	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	0.31	0.31	0.62	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	0.35	0.32	0.45	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/07/97	9702009	Thorium-228	EML TH-01 Modified	0.45	0.33	0.37	PCI/L

Approved by: [signature] 2/12/97
M.R. McDougall, Laboratory Manager

K=Known,S=Spike,B=Blank,D=Duplicate,MS=Matrix Spike

J. SZLACHCIUK
TEXAS INSTRUMENTS
MAIL STOP 11-4
34 FOREST ST.
ATTLEBORO, MA 02703

P.O. # 500808588
SDG: 9702009
MATRIX: Water

Final Report of Analysis
Date Reported: 2/12/97

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	5.90	0.12		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	5.66	1.16	0.10	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	0.37	0.22	0.17	PCI/L
97-02009-03	D	OW-6	02/04/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	0.56	0.39	0.37	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	0.53	0.42	0.35	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	0.83	0.50	0.38	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/07/97	9702009	Thorium-230	EML TH-01 Modified	0.73	0.42	0.26	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/07/97	9702009	Thorium-232	EML TH-01 Modified	5.10	0.18		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/07/97	9702009	Thorium-232	EML TH-01 Modified	5.66	1.16	0.09	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/07/97	9702009	Thorium-232	EML TH-01 Modified	0.03	0.06	0.19	PCI/L
97-02009-03	D	OW-6	02/04/97	02/04/97	02/07/97	9702009	Thorium-232	EML TH-01 Modified	0.25	0.25	0.29	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/07/9.'	9702009	Thorium-232	EML TH-01 Modified	0.38	0.35	0.21	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/07/97	9702009	Thorium-232	EML TH-01 Modified	0.21	0.24	0.32	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/07/97	9702009	Thorium-232	EML TH-01 Modified	0.11	0.16	0.34	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	11.12	0.61		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	11.42	1.21	0.24	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	0.30	0.22	0.24	PCI/L
97-02009-03	D	TI-4S	02/03/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	0.94	0.59	0.60	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	0.58	0.48	0.59	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	0.34	0.39	0.59	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/11/97	9702009	Total Radium	EPA 903.0 Modified	0.99	0.60	0.58	PCI/L

K=Known,S=Spike,B=Blank,D=Duplicate,MS=Matrix Spike

Approved by: [signature] 2/12/97
M.R. McDougall, Laboratory Manager

J. SZLACHCIUK
TEXAS INSTRUMENTS
MAIL STOP 11-4
34 FOREST ST.
ATTLEBORO, MA 02703

P.O. # 500808588
SDG: 9702009
MATRIX: Water

Final Report of Analysis
Date Reported: 2/12/97

Lab ID		Client ID	Sample Date	Receipt Date	Analysis Date	Batch ID	Analyte	Method	Result	Error	MDA	Units
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	8.50	0.32		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	8.85	1.85	0.14	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	0.19	0.13	0.10	PCI/L
97-02009-03	D	OW-6	02/04/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	0.18	0.21	0.35	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	0.11	0.15	0.25	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	0.16	0.19	0.35	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/07/97	9702009	Uranium-234	EML U-02 Modified	0.15	0.17	0.26	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.39	0.01		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.79	0.34	0.18	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.00	0.00	0.07	PCI/L
97-02009-03	D	OW-6	02/04/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.00	0.00	0.20	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.00	0.00	0.18	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.07	0.13	0.18	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/07/97	9702009	Uranium-235	EML U-02 Modified	0.06	0.12	0.16	PCI/L
97-02009-01	K	KNOWN	02/04/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	8.30	0.32		PCI/L
97-02009-01	S	SPIKE	02/04/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	8.60	1.81	0.11	PCI/L
97-02009-02	B	BLANK	02/04/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	0.00	0.00	0.11	PCI/L
97-02009-03	D	OW-6	02/04/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	0.18	0.20	0.16	PCI/L
97-02009-04		TI-4S	02/03/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	0.11	0.15	0.24	PCI/L
97-02009-05		OW-6	02/04/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	0.16	0.18	0.24	PCI/L
97-02009-06		NRC-9	02/04/97	02/04/97	02/07/97	9702009	Uranium-238	EML U-02 Modified	0.05	0.10	0.13	PCI/L

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Approved by: [signature] 2/12/97
M.R. McDougall, Laboratory Manager

97-02-009

TEXAS INSTRUMENTS, INC
WASTE WATER TREATMENT

CHAIN OF CUSTODY DOCUMENT

RECEIVED FEB - 5 1997

SAMPLE COLLECTION:

DATE: 02-04-97 TSL NUMBER : BY: Joe Szlachcik

NO.	SAMPLE I.D:	TIME:	SAMPLE TYPE : GRAB	COMP	CONTAINER TYPE: NO.	TYPE	SIZE	PRES.	ANALYSIS REQUIRED
1	TI-45	2-3 (1330)	x		1	PL	Gal	—	Three samples:
2	OW-6	2-4 (1100)	x		1	PL	Gal	—	Isotopic Thorium and Uranium
3	NRC-9*	2-4 (1200)	x		1	PL	Gal	—	Thorium-228, 230, 232
									Uranium-234, 235, 238
									TOTAL RADIUM-228
									Please Filter samples in
									.45u filter prior to
									analysis

RELINQUISHED BY Joe Szlachcik ACCEPTED BY C Billin 2/5/97 9:00

COMMENTS *NRC-9* – Gross Alpha

PRESERVATION CODE I = ICED, F = FILTERED, N = NITRIC ACID, H = HYDROCLORIC ACID, S = SODIUM HYDROXIDE, T = SODIUM THIOSULFATE, O = OTHER/ SPECIFY

CONTAINER TYPE P = PLASTIC, C = CUBE, G = GLASS, A = AMBER GLASS, B = BACTERIA BOTTLE

ATTACHMENT 3

TEXAS INSTRUMENTS INCORPORATED
MATERIALS AND CONTROLS GROUP

1993 SITE HYDROGEOLOGY REPORT

OFFICIAL RECORD COPY ML 10

118945

Appendix F

Site Hydrogeology

SITE HYDROGEOLOGY

1.0 Past Investigations and Documentation

Since 1983, TI Attleboro has expended considerable time and effort to characterize the site specific hydrogeological conditions. These efforts were largely motivated by the discovery of chlorinated solvent contamination in the subsurface of the site. TI voluntarily commenced an assessment process which ultimately led to the installation of a groundwater treatment (GWT) system in 1986. While the concerns of the chlorinated solvent contamination are geographically and chemically distinct from the concerns relating to the former Nuclear Burial Site, the hydrogeological information is directly applicable and equally valid for either situation. Therefore, the documents generated for the characterization of the site with respect to chlorinated solvent contamination are referenced in this report.

Independent consulting firms completed two hydrogeological assessment reports, one in 1983 and one in 1984. These studies evaluated the local hydrogeological conditions, as well as the magnitude and extent of the chlorinated solvent contamination. In 1989, TI retained another consulting firm to perform a groundwater modeling study. The model served to further define the site hydrogeology and to assess the effectiveness of the GWT performance.

Currently, there are 55 monitor wells installed across the site penetrating both the overburden and the bedrock water-bearing zones, 38 in the overburden and 17 in the bedrock. (Refer to Figure 1 for a site plan of the monitor well locations.) Many of these wells were initially sampled in 1983, and since 1986, TI has implemented a semi-annual sampling program to track the progress of the remediation. The results, and in many instances, an interpretation of the data, are documented in Semi-Annual Reports.

All the reports referred to above have been submitted to the Massachusetts Department of Environmental Protection at the Bureau of Waste Site Cleanup (DEP-BWSC). Copies are also available in TI's Environmental Department offices at the Attleboro site. Attachment 1 contains a list of all the reports submitted to the DEP-BWSC to date. These reports form the basis of the statements in the following section regarding site specific hydrogeology.

2.0 Hydrogeological Setting

The TI Attleboro site is situated in southeastern Massachusetts within the bounds of the Narraganset basin. The bedrock underlying the site consists of Rhode Island Formation meta-sediments which reveal folded synclinal and anticlinal structures as well as some fractures parallel to the axis of the folding. The predominant orientation of all structures is northeast to southwest.

Unconsolidated glacio-alluvial sediments cover the bedrock across the entire site and vary in depth from 10 to 40 feet. This overburden layer typically manifests a basal till consisting of poorly sorted rocks, sand, silt, and clay with fairly low hydraulic conductivity on the order of 10E-5 to 10E-6 cm/s. Above the till,the retreating glaciers deposited interbedded alluvial sediments ranging in composition from lacustrine silt layers to stream bed sands and gravels. On average,the hydraulic conductivity in the alluvial sediments are moderate,consistent with a sandy porous soil on the order of 10E-2 to 10E-5 cm/s. The recent deposits closest to the surface often contain peat and organic matter originating from the vegetated wetland environment that typified the area prior to anthropogenic development.

Both the Overburden and the Bedrock layers are water bearing zones. Pump tests have shown that hydraulic communication exists between the two zones. In general, the phreatic aquifer is encountered 4 to 5 feet below the surface. A groundwater flow divide bisects the site. The divide is oriented in a predominantly northwest to southeast direction. To the west of the divide, groundwater flows to the southwest into the Ten Mile River Watershed. To the east of the divide groundwater flows in an easterly direction toward Cooper's Pond and the Taunton River Watershed. This relationship is demonstrated on attached Figure 2 which shows a recent drawing of the potentiometric surface in the Overburden layer. This drawing was developed based on gauging measurements collected in May of 1990.

The Former Radioactive Burial Site was situated in an area that was formerly wetlands. The overburden layer in this location ranges in thickness from 12 to 15 feet before encountering bedrock. The top 2 to 3 feet of material consisted of clean fill imported as cover sometime after the Burial Site closure but prior to the construction of Building 12. It is worth noting that the location of the former burial site was in close proximity to the center-line of the groundwater flow divide,and depending on the season, just slightly extending onto its western flank.

The groundwater flow divide is not a precise line, but rather it is a broad feature in the potentiometric surface where the hydraulic gradient is flat. The location of the divide varies a little during the course of the year due to seasonal fluctuations. Since the hydraulic gradient at the divide is flat or nearly flat, groundwater flow rates in both the overburden and the bedrock layers are extremely slow (i.e., less than an inch per year).

3.0 Potential Contaminant Fate and Transport

The nature of potential groundwater contamination from the Former Radioactive Waste Burial Site is directly related to the materials

which were buried, and by extension, to the materials which were processed in the manufacturing operations at that time. Manufacturing in this regard primarily involved the fabrication of Uranium fuel elements for the Nuclear Navy. Credible testimony by employees knowledgeable of these operations indicates that Uranium Oxides were the only forms of Uranium employed in

such manufacturing. This fact is important since Oxides of Uranium are considered insoluble in water. Therefore,one would not expect any appreciable amount of dissolved Uranium to be present in the groundwater underlying the burial site. In the absence of dissolved species, it is even more unlikely that potential contaminants may have migrated any great distance from the Burial Site.

During the remediation of the Burial Site in 1992, excavations revealed that the maximum depth of the burial site partially penetrated the water table. It is likely that this situation has always existed, and depending on seasonal fluctuations, more or less of the Burial Site may have been submerged below the saturated zone. Though migration of dissolved contaminants would be highly unlikely given the discussion in the previous paragraph, TI implemented a groundwater sampling program to allay any concern about the possibility of the migration of dissolved contaminants.

The groundwater sampling program spanned three consecutive months from January through March of 1993. Precipitation during these months was very high, and the water table rose to within a foot or two of the ground surface. This large influx of water into the subsurface would have accelerated groundwater flow velocities, and therefore,increased the likelihood of detecting migrating contaminant species if they were present.

Since the burial site was situated on the groundwater flow divide, groundwater samples were collected from monitor wells in close proximity to, and surrounding the site in all directions. These samples were intended to detect the presence of contaminant species migrating away from the site. Samples were also collected from two wells located at a distance from the Burial Site. These were intended to represent background conditions. At the same time, samples were drawn from the open excavation, which had, by this time, filled up with infiltrating groundwater. These samples served to indicate the presence of contaminant species within the bounds of the burial site proper.

Groundwater samples were analyzed at a certified, outside laboratory for the presence of Gross Alpha and Gross Beta radiation in the dissolved aqueous phase. Gross Alpha and Gross Beta serve as primary indicators of radionuclide contamination.

The results of this sampling program can be found in Table F-1. Measured levels of Gross Alpha and Gross Beta radiation confirmed that migration of dissolved radioactive contamination was not a viable contaminant transport pathway of any significance. While certain concentrations of Gross Alpha and Gross Beta radiation were detected at levels slightly higher than background, these were largely limited to the samples collected from the open excavation. This is not an entirely unexpected phenomenon, however, as the mechanical excavation process would have caused a certain amount of colloidal matter to become suspended in the water column. (Note: colloids are not normally removed by standard filtration during sample preparation.) Nonetheless, the results were well within the allowable limits, prescribed in the EPA's Interim Drinking Water Standards as well as 10 CFR 20, Appendix B, Table II concentrations for uranium.

4.0 Conclusions

Due to the nature of the potential contaminants and the site specific hydrogeological conditions, groundwater does not provided a significant transport pathway. With the remediation of the former burial site in 1992 and 1993, any potential for migration via this pathway has been virtually eliminated.

FIGURE 1 GROUNDWATER MONITORING WELL LOCATIONS

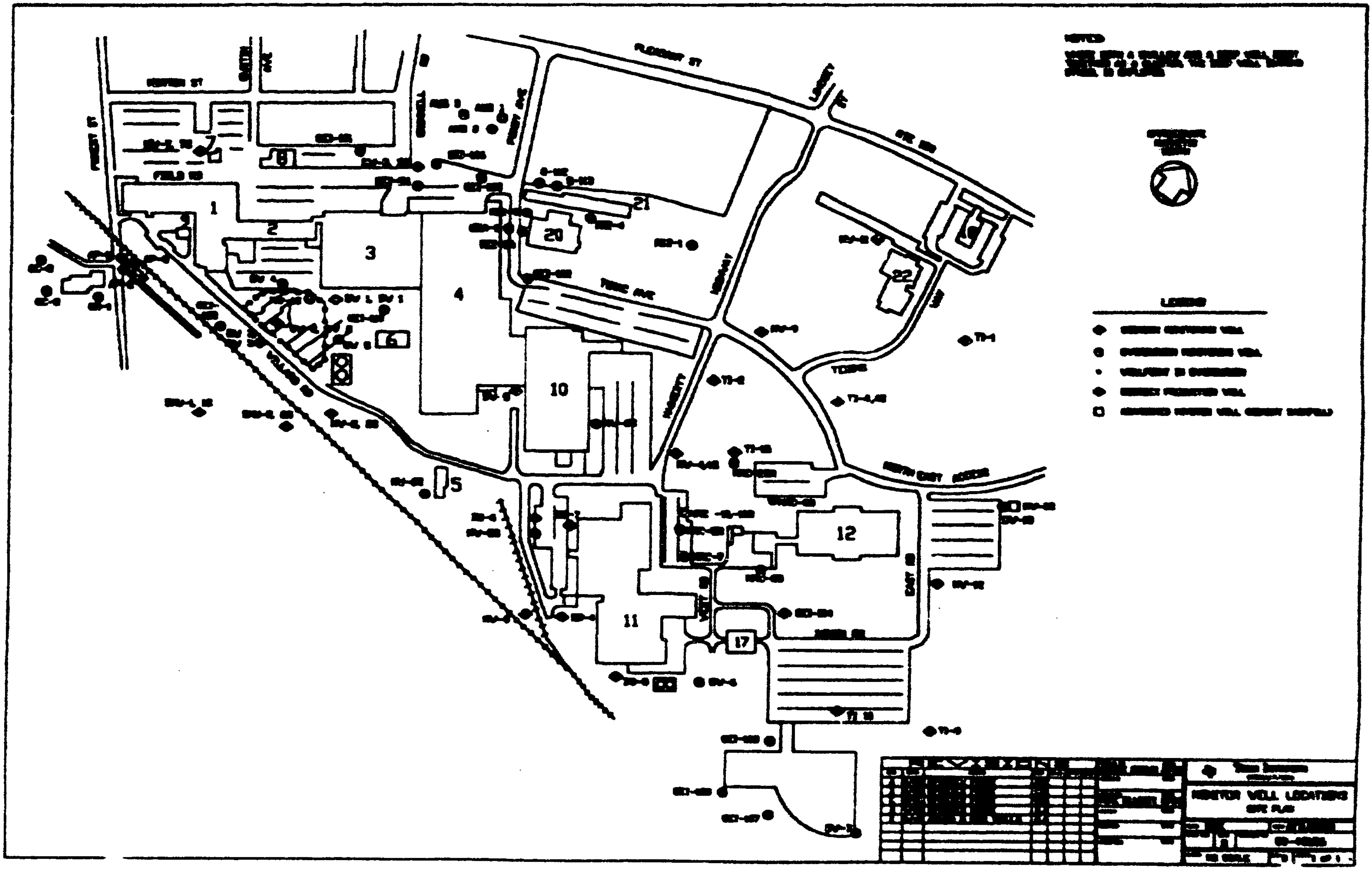


FIGURE 2 POTENTIOMETRIC MAP OF OVERBURDEN AQUIFER

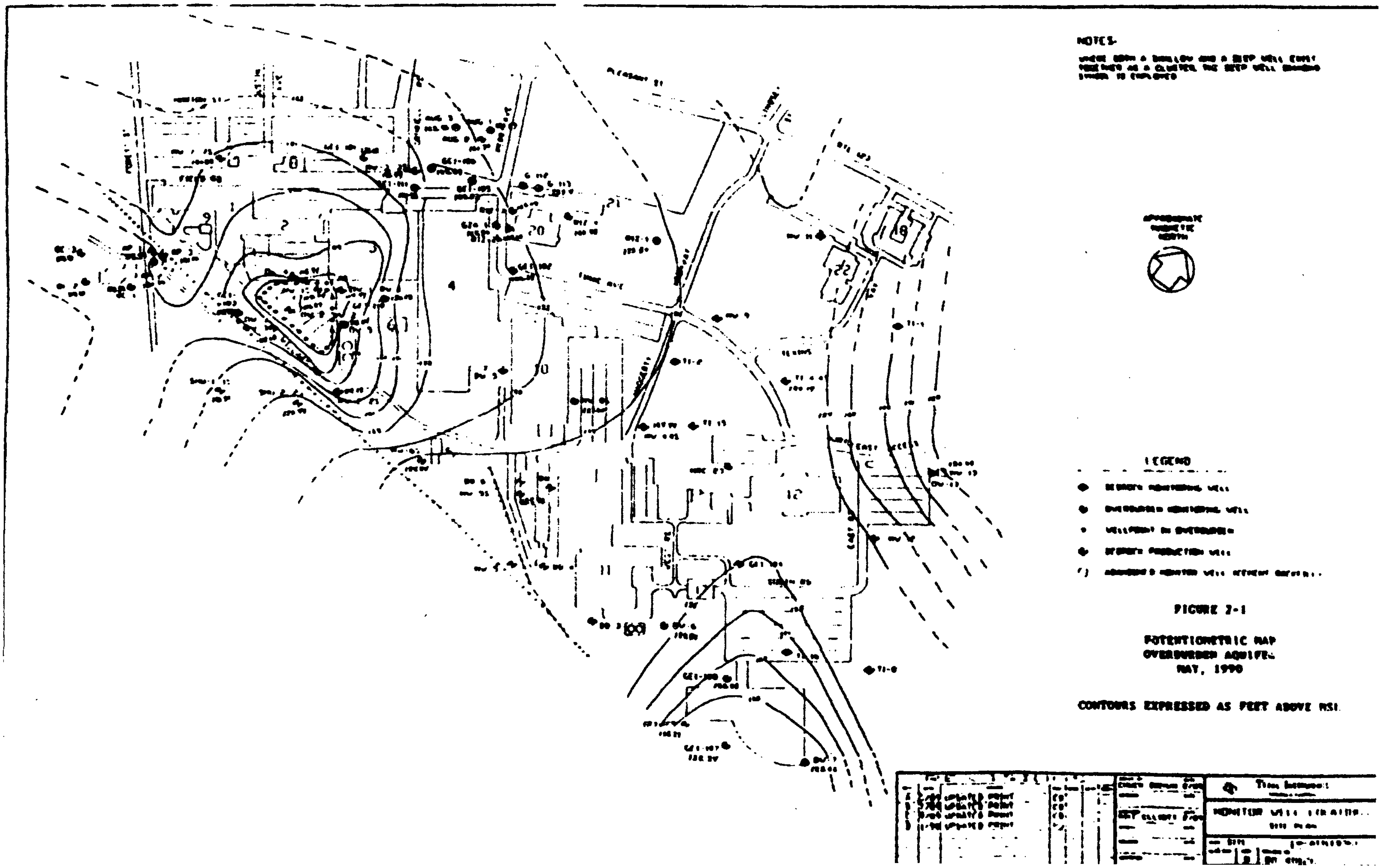


Table F-1

POST REMEDIATION GROUNDWATER SAMPLING DATA FROM LOCATIONS AROUND THE BURIAL AREA

GROUND WATER SAMPLING RESULTS						
Well ID Figure 1	Gross Alpha pCi/L Jan 30 - 31 1993	Gross Beta pCi/L Jan 30 - 31 1993	Gross Alpha pCi/L Feb 13 - 14 1993	Gross Beta pCi/L Feb 13 - 14 1993	Gross Alpha pCi/L Mar 13-20 1993	Gross Beta pCi/L Mar 13-20 1993
TI-4S	LT 2.0	LT 4.0	LT 2.0	LT 4.0	2.9	6.9
NW-4S	LT 2.0	LT 4.0	LT 2.0	LT 4.0	LT 2.0	LT 3.0
GEI-101	LT 2.0	LT 4.0	LT 2.0	LT 4.0	LT 3.0	12
NRC-22R	LT 2.0	4.6	LT 2.0	4.2	LT 3.0	11
NRC-7			LT 5.0	LT 5.0	LT 3.0	5.1
NRC-8R	LT 3.0	LT 5.0	LT 4.0	LT 5.0	LT 4.0	5.4
NRC-10					LT 4.0	13
NRC-10R	5.2	7.8	LT 4.0	LT 5.0	LT 4.0	LT 4.0
NRC-23			LT 2.0	LT 4.0	LT 2.0	4.4
NRC-25	7.6	11				
NRC-7R	LT 3.0	LT 4.0				

BACKGROUND WATER SAMPLES						
SP-1	LT 2.0	LT 2.0				
CW-1	LT 2.0	22				

SP-1 is Simpson Spring Co.,South Easton MA
CW-1 is Attleboro city water

STANDING WATER SAMPLES FROM WITHIN THE EXCAVATED AREA			
Locations	Date	Gross Alpha	Gross Beta
140 x 115	2/27/93	9.9	5.5
160 x 200	2/27/93	7.6	LT 4.0
160 x 125	2/27/93	4.7	5.3
180 x 125	2/27/93	6.9	7.3
155 x 110	2/27/93	37	16

LT is Less Than the stated value

TABLE F-2 DEWATERING OF THE EXCAVATION SITE DATA

Analysis of Distilled and Evaporated Water Post Filtration Through Various Filter Sizes

Sample ID	Filter size um	Vol. Dist. Liters	Vol. Evap. ml	Count Time min	Bkgrd Counts		Gross Counts		Net Counts		Concentration, uCi/ml	
					Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
1	Pond	600	63	10	0	338	0	350	MDA	MDA	<1.93E-09	<6.44E-08
2	120	700	108	10	0	338	0	352	MDA	MDA	<1.13E-09	<5.52E-08
3	80	700	107	10	0	338	3	403	3	MDA	3.5065E-08	<5.52E-08
4	45	750	107	10	0	338	4	357	4	MDA	4.0314E-08	<5.15E-08
5	25	750	105	10	0	338	0	380	MDA	MDA	<1.16E-09	<5.15E-08
6	10	400	53	10	0	338	8	404	8	MDA	1.1415E-07	<9.66E-08

Evaporated Only Water Samples Post Filtration Through Various Filter Sizes

Sample ID	Filter size um	Evap. Vol. ml	Count Time min	Bkgrd Counts		Gross Counts		Net Counts		Concentration, uCi/ml	
				Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
1	Pond	100	10	0	338	7	345	7	MDA	9.3844E-09	<1.18E-7
2	120	100	10	0	338	3	353	3	MDA	4.0219E-09	<1.18E-7
3	80	100	10	0	338	4	333	4	MDA	5.3625E-09	<1.18E-7
4	45	100	10	0	338	9	356	9	MDA	1.2066E-08	<1.18E-7
5	25	100	10	0	338	2	342	MDA	MDA	<3.62E-9	<1.18E-7
6	10	100	10	0	338	2	344	MDA	MDA	<3.62E-9	<1.18E-7

Analysis of Filters for the Various Filter Sizes Above

Sample ID	Filter size um	Vol. Filtered Liters	Net Weight gms	Count Time min	Bkgrd Counts		Gross Counts		Net Counts		Concentration, uCi/ml	
					Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
2A	120	12	0.1467	10	0	338	0	340	MDA	MDA	<3E-11	<1E-9
3A	80	10.8	0.691	10	0	338	2	344	MDA	MDA	<3E-11	<1E-9
4A	45	9.6	0.1722	10	0	338	5	437	5	99	6.982E-11	1.383E-08
5A	25	8.4	0.5768	10	0	338	189	535	188	197	3E-09	3.144E-08
6A	10	1	0.0875	10	0	338	5	362	5	24	6.703E-10	3.218E-08

ATTACHMENT NO. 1

LIST OF DOCUMENTS CONTAINING HYDROGEOLOGICAL INFORMATION THAT WERE PREVIOUSLY SUBMITTED TO THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF WASTE SITE CLEANUP.

- Environmental Systems Corporation, Knoxville, TN, "Results and Recommendations of the Groundwater Assessments at Texas Instruments Incorporated," Feb. 17, 1984
- Geotechnical Engineers Inc., Winchester, MA, "Supplementary Hydrogeologic Assessment and Recommendations for Remedial Action," Oct. 23, 1984 (Phase I document of record)
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report," Mar. 3, 1987
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report," Sep. 25, 1987
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report," May, 1988
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report," Feb. 21, 1989
- Texas Instruments Incorporated, Attleboro, MA, "Preliminary Assessment-Oil Contaminated Soil," August 4, 1989
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report," Oct. 5, 1989
- Metcalf & Eddy, Inc., Wakefield, MA, "Groundwater Contamination Study," July, 1990
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report 2H89 and 1H90," Aug. 14, 1990
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report 2H90 thru 1H92," Dec. 7, 1992
- Texas Instruments Incorporated, Attleboro, MA, "Semi-Annual Operating Report, 2H92," Feb. 1, 1993

ATTACHMENT 4

TEXAS INSTRUMENTS INCORPORATED
MATERIALS AND CONTROLS GROUP

URANIUM MOBILITY REPORT

118945

Uranium Mobility in Groundwater at Texas Instruments Incorporated

Texas Instruments Incorporated (TI) evaluated the potential for uranium to enter the groundwater at the TI Attleboro, MA facility. TI based its evaluation on several factors:

1. The historical use of uranium in manufacturing at TI
2. The history of waste management at TI
3. The geochemistry of uranium
4. Actual groundwater monitoring results at TI

We describe those four factors below. TI concludes that the licensed uranium used by TI at the Attleboro site has not dissolved into the groundwater and it is highly unlikely that it could dissolve into the groundwater in the future.

Usage

Uranium oxide was brought to TI-Attleboro in its final chemical form. The chemical forms used at TI were pure uranium metal, uranium alloys (with zinc or aluminum), and aluminum oxide powder (for the HFIR project). The manufacturing processes in which uranium was directly involved altered the licensed uranium with physical operations (e.g., rolling, melting, bonding). Experience by others suggests that a typical source of uranium in groundwater would normally be spills or discharges of uranium in solution. This was not a significant source at TI. The only chemical processing of the uranium known to have occurred at TI; primarily surface preparation prior to bonding and decontamination of non-nuclear material surfaces using an acid solution. The uranium was never involved in any chemical engineering operations that would have altered its chemical form. Consequently, there was little opportunity to spill or discharge uranium solution.

Waste Management

Waste at TI came in two forms. Pieces of uranium scrap were buried (in the Building 12 Former Burial Site). The burial site has been excavated and the scrap has been removed. Because the scrap is no longer there it cannot contaminate the groundwater.

Wash water from washing the uranium and from mopping the floor would have included some particles of uranium. The practice during facility operation was to put the wash water from the manufacturing areas in Buildings 10 and 4 into containers and transfer it to Building 5, where the wash water was evaporated at Building 5. The residue was disposed off the site at a Department of Energy (formerly Atomic Energy Commission) facility.

Based on observations during the 1996 remediation project, some wash water went into the Building 10 floor drains. Some portion of the water that entered the drains apparently leaked from the pipes depositing uranium in the surrounding soils. However, the uranium did not get into the ground water. Its travel in the ground had extended only about 5 feet

from the pipes through the soil when it was excavated during site remediation. TI measured this in 1996. This observation is explained by the geochemistry of uranium (see below). TI excavated the uranium contaminated soil in 1996. Where acid is known to have been used to decontaminate non-nuclear materials (e.g. west side of Building 5), excavation also found that the uranium had traveled only a limited distance in the soil. The amount of residual uranium left in the soil is sufficiently low that it does not constitute a significant risk of groundwater contamination.

Geochemistry

Under proper conditions uranium can dissolve in groundwater. Some uranium minerals are soluble and some are not. Uranium minerals that contain carbonate are the most soluble. Uranium oxides are not very soluble. The chemical form of uranium in the ground is controlled by the Eh and pH of the groundwater. Figure 1 is a common Eh-pH diagram used to describe uranium mineral equilibrium (Brookins 1988).

Figure 1 can be related to the groundwater conditions at TI's Attleboro site. At TI Attleboro the pH in shallow wells ranges from 6.95 to 8.02. Soluble iron concentration in the groundwater is high - the iron concentration is so high that it causes fouling of water treatment towers that TI uses for another project. The high soluble iron concentration indicates that Eh is also high. Because the pH is in the measured range and soluble iron is present (and Eh is high), uranium in the groundwater will form an insoluble oxide (UO2) instead of a soluble carbonate. This means that residual uranium in the soil cannot readily dissolve into the groundwater.

Monitoring Results

TI has sampled and analyzed the groundwater at Attleboro. These results confirm that uranium is not dissolving into the groundwater. The most recently measured uranium concentration were in the range of 0.22 - 0.39 pCi/l. This is consistent with naturally occurring (background) concentrations of uranium cited by Hem (1970). Such levels are consistent with the geochemical conditions of pH 6.95 - 8.02 and the presence of soluble iron.

Conclusion

The chemical forms of uranium used in the manufacturing process by TI at its Attleboro facility is very unlikely to dissolve into the groundwater. TI has removed the possible sources of uranium contamination of groundwater. The geochemistry of uranium and the TI site conditions are not conducive to uranium contamination of the groundwater. TI has analyzed the groundwater and did not find evidence of contamination with process uranium. TI concludes that uranium does not present a hazard to groundwater at the Attleboro site.

References

Brookins, Doug G. Eh-pH Diagrams for Geochemistry, Springer-Verlag, New York, NY (1988).

Hem, John D. Study and Interpretation of the Chemical Characteristics of Natural Water, second edition (1970).

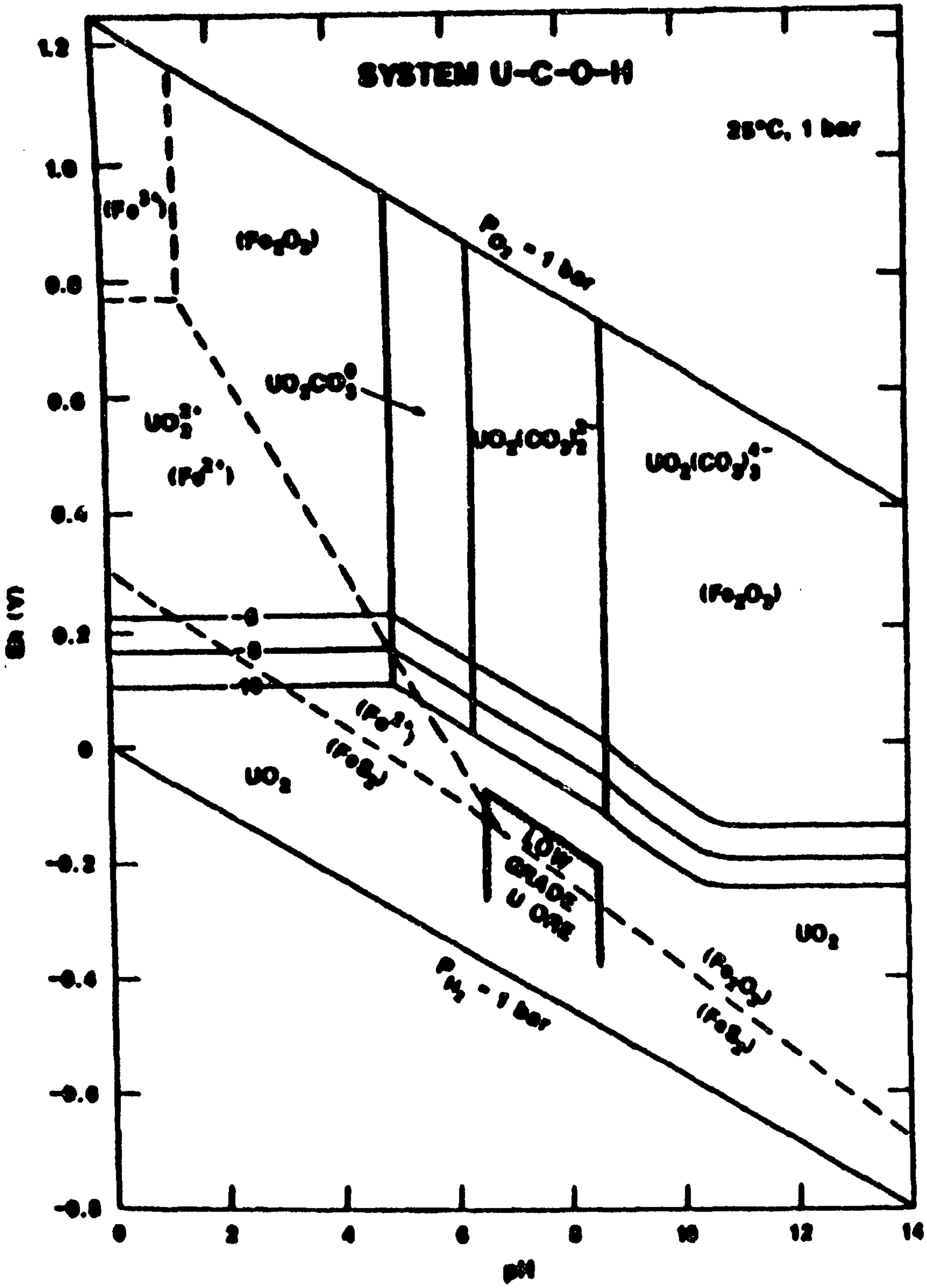


Fig. 87. Eh-pH diagram for part of the system U-C-O-H with part of the system Fe-S-O-H superimposed.
Assumed activities for dissolved species are: U = $10^{-6, -8, -10}$, C = 10^{-3}, Fe = 10^{-6}, S = 10^{-3}. Area marked *U Ore* from Brookins (1982). See text for details

118945

OFFICIAL RECORD COPY

Texas Instruments Incorporated
Materials and Controls Group

TEXAS INSTRUMENTS

34 Forest Street
P O Box 2964
Attleboro MA 02703-0964
(508) 236-3800

March 27, 1997

Mr. Mark Roberts
US Nuclear Regulatory Commission
Region I, Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406-1415

SNM No. 23
Docket No. 70-33
Control No. 118945
10 CFR 70.38 (c)(1)(iv)

RE: Permission to Release Drainage System Supplemental Analyses Report (2/11/97)

Dear Mr. Roberts,

Texas Instruments Incorporated, Materials & Controls Group (TI) authorizes the United States Nuclear Regulatory (NRC) to release the above referenced report that was transmitted to you on February 20, 1997. The full title of this report is "Drainage System Unrestricted Release Information - Supplemental Analyses - February 11, 1997." The narrative shows a revision date of 2/19/97, and the tables are dated 2/20/97.

The pages of the report were erroneously labeled with the phrase "This document subject to attorney-client privilege." The document is not an attorney-client privileged work product. It was, in fact, intended for general distribution in the public documents room.

Sincerely yours,

Materials & Controls Group

Michael J. Elliott
Environmental Manager

cc: Mr. Francis J. Veale Jr., Esq. - TI Attleboro

OFFICIAL RECORD COPY ML 10

DRAINAGE SYSTEM UNRESTRICTED RELEASE INFORMATION - SUPPLEMENTAL ANALYSES - FEBRUARY 11, 1997

Introduction

In the course of decontamination operations to support the request for termination of Special Nuclear Materials (SNM) license #23, Texas Instruments Incorporated (TI), grouped sections of the underlying drainage system. These groups were assigned increasing priority (Priority 1-3), based on their radioactive material content and percentage residue blockage. Priority 2 lines were defined as containing total residue uranium concentrations between 500-1000 pCi/g, and were subject to a hydrolasing decontamination technique. During inspection by the U.S. Nuclear Regulatory Commission (NRC) on February 3-6, 1997, questions were raised concerning measurements of contamination in the interior of Priority 2 drain lines as defined in the final decommissioning report, and the use of drain line residue sample concentrations as the basis of unrestricted release. The information presented in this document supports the conclusion that drain lines have been decontaminated to applicable remediation criteria.

Summary of Response

Collection and analyses of representative samples of the drain line residue allow assessment of bulk material concentrations and pipe interior surface contamination levels. Direct measurements were not an acceptable means of determining compliance with remediation criteria for decontaminated drain lines due to the physical condition of the lines. The correlation of direct radiation measurements to interior pipe surface contamination levels is hampered by irregular surfaces in the drain lines, the presence of larger blockages, varying geometries, the presence of radium and other naturally-occurring radioactive material (NORM), and the presence of moisture and liquid resulting from active facility discharges.

Sample characterization data for the drainage system, Priority 2 drain line decontamination technique, and video record of decontaminated lines, support either bulk material concentration or interior surface contamination analyses. These analyses indicate that after decontamination of Priority 2 drain lines, both bulk material (30 pCi/g total uranium) and surface contamination (5000 dpm/100 cm^2 - average; 15,000 dpm/100 cm^2 - maximum) criteria were met. Use of the hydrolasing decontamination technique is believed to have effectively lowered removable contamination levels to essentially background levels.

During typical drain line maintenance in unaffected areas of the facility, workers are not significantly exposed to pipe interiors. Common handling involves removal and disposal of complete sections, or breakage to reduce volume. This handling is more likely to result in exposure to a bulk material and indicates that bulk material release criteria are most applicable to the drainage system.

Technical Concept

The following discussion describes the means used to calculate bulk material concentrations for drain lines and to calculate surface contamination levels on pipe interiors before and after Priority 2 drain line decontamination activities. Two parameters are used to assess bulk material concentrations and interior surface contamination levels of drain line sections. These parameters are the thickness of residue lining the pipes and the total uranium concentration in the residue. Both of these parameters must be determined using samples for "representative" sections of drain lines. Sampling methodologies, frequencies, and locations are discussed in the 1996 TI report "Drainage System Characterization."

<u>*Bulk Material Concentrations*</u> - For any given interior pipe area (that contains x thickness of residue at y concentration), there is a mass of drain line underlying the residue. This pipe mass is calculated based on the density for cast iron or vitreous clay and the thickness of the pipe wall, which varies based on the interior diameter of the pipe. If the drain line is treated as a bulk-contaminated object (which we propose) the total uranium concentration associated with the mass of residue is effectively diluted by the mass of

110048

the pipe, resulting in our concept of concentration adjustment factor (CAF). The CAF may be multiplied by the residue concentration to yield an adjusted mass concentration (AMC) of total uranium in bulk pipe material.

Since the mass of underlying pipe per unit interior area is greater than that of the residue, significant dilution results (as shown in Table 5.1, Attachment 5, Remediation of Building Interiors Buildings 4, 5, and 10). It also can be seen that even relatively small reductions in the residue mass can result in large reduction to the CAF. Decontamination by hydrolasing actually achieved large reductions in residue mass.

Interior Surface Contamination Levels - Knowledge of the residue thickness and total uranium concentrations provides enough information to calculate the total uranium surface activity per unit area inside the pipe. The residue thickness (cm) may be multiplied by a 100 cm^2 area to determine the volume of residue within the reference area. This volume is multiplied by the average residue density (g/cm^3), total uranium concentration (pCi/g), and conversion factor from pCi to dpm (2.22) to yield a surface contamination level in dpm/100 cm^2 that may be compared to surface release criteria.

Due to the irregular pipe surfaces, blockage, and moisture content, this method of calculation likely yields a more accurate estimate of interior surface contamination than could be obtained by conversion from direct-reading radiation detector measurements. As with bulk material concentrations, even small residue mass changes resulting from decontamination will substantially reduce interior pipe surface contamination levels.

Technical Analyses

Bulk material and interior surface contamination levels are calculated based on parameters presented in Tables 1 and 2, respectively. Both tables present maximum estimated percent blockage as a percent of pipe inside diameter in each line prior to and following decontamination, and total uranium concentration as analyzed in representative samples in each designated section of line. Each table presents the estimated drain section length prior to decontamination and the total length that was actually subject to decontamination. In general, the decontaminated length of each section was substantially longer because complete drain systems were subject to decontamination, rather than only those sections located in affected areas.

A final total of 1220 lf of lines were subject to decontamination. Applying an average radius of 6.25 cm (5" line), the total interior volume of the drain lines was approximately 4.8 m^3. Based on intrusive drain system characterization and the observation that 10% of the line volume was blocked, the projected post-decontamination discharge sediment volume was calculated to be 0.48 m^3. The actual volume of sediment recovered after decontamination was approximately 0.40 m^3, which indicated an actual blockage percentage of 8%. The nearly identical projected and actual residue volume verify 1) the accuracy of the initial residue blockage estimates, and 2) the effectiveness of the decontamination method.

Bulk Material Concentrations - As noted in the final decommissioning report, adjusted mass concentrations in Priority 2 bulk drain line materials ranged from 44-81 pCi/g prior to decontamination. As noted in Table 1, the residue blockage was assumed to decrease from 10% to 0.5% as the result of decontamination activities. This reduction is supported through observation of the video record of the process. Appropriately, the significant reduction of residue mass results in decreasing CAFs, which are recalculated to range from 4E-4 to 8E-4. Multiplication of the original sample total uranium concentration in each line section by the post-decontamination CAFs yields AMCs ranging from 0.2 to 0.4 pCi/g.

Interior Surface Contamination Levels - Table 2 presents the calculated pre- and post-decontamination surface contamination levels. These levels are calculated based on the initial total uranium concentration as applied to the 10% residue blockage and 0.5% residue blockage, respectively. The average residue

layer thickness at 10% was calculated to be 0.32 cm, while the post-decontamination layer thickness of 0.5% yielded a calculated thickness of 0.02 cm. Total surface contamination levels prior to decontamination ranged from 53,000 - 95,000 dpm/100 cm^2, while calculated post decontamination levels ranged from 3300 - 5900 dpm/100 cm^2, with an average of 3900 dpm/100 cm^2.

Summary and Conclusions

The AMCs for total uranium in Priority 2 drain lines range from 0.2 - 0.4 pCi/g, well below the bulk material release criterion of 30 pCi/g total uranium. The calculated pipe interior surface contamination levels average 3900 dpm/100 cm^2, which is 20% less than the total surface contamination release criterion of 5000 dpm/100 cm^2 (average). Sampling strategies and protocol have been addressed in previous documents addressing the drainage system characterization.

Table 1 - TI Drain Calculations
Mass Basis Concentrations Before and After Decontamination

Section of Line From Figure 5.4	Type	Estimated Length Prior to Decon (ft)	Final Decon. Length (ft)	Total U Conc. (pCi/g)	Max % Blockage Pre-Decon	MDF Pre-Decon	Pre-Decon Adjusted Mass Conc. (pCi/g) of Pipe	Max % Blockage Pre-Decon	MDF Post-Decon	Post-Decon Adjusted Mass Conc. (pCi/g) of Pipe
1	VC	160	280	892	10	0.08	71	0.5	4.00E-04	0.4
2	VC	25	30	553	10	0.08	44	0.5	4.00E-04	0.2
3	CI	150	300	501	10	0.09	45	0.5	4.50E-04	0.2
	VC	150	310	501	10	0.09	45	0.5	4.50E-04	0.2
4	CI	150	300	507	10	0.16	81	0.5	8.00E-04	0.4

Table 2 - TI Drain Calculations
Conversions to Surface Activity

Section of Line From Figure 5.4	Type	Estimated Length Prior to Decon (ft)	Final Decon. Length (ft)	Total U Conc. (pCi/g)	Max % Blockage	Pre-Decon Total Activity per 100 cm2 (dpm)	% Blockage Post Decon	Post-Decon Total Activity per 100 cm2 (dpm)
1	VC	160	280	892	10	95052	0.5	5941
2	VC	25	30	553	10	58928	0.5	3683
3	CI	150	300	501	10	53387	0.5	3337
	VC	150	310	501	10	53387	0.5	3337
4	CI	150	300	507	10	54026	0.5	3377
					Average	62956		3935

Constant Input Factors	
Pipe Radius	6.25 cm (5° dia)
Calculated Layer Thickness Pre.	0.32 cm
Calculated Layer Thickness Post.	0.02 cm
Residue Density	1.5 g/cm3

119845

TEXAS INSTRUMENTS INCORPORATED

Attleboro, Massachusetts

SNM LICENSE TERMINATION
RADIOLOGICAL DOSE ASSESSMENT

NRC License/Docket No: SNM-23/70-33

Prepared by

WESTON

&

(ms)² Scientific Consultants, Inc.

February 20, 1997

1 1 8 9 4 5

OFFICIAL RECORD COPY ML 10

1.0 INTRODUCTION

The decontamination and remediation of the Texas Instruments Incorporated (TI) Attleboro facility was conducted in accordance with Remediation Plans (TI 1992 and TI 1994) that were approved by the U.S. Nuclear Regulatory Commission (NRC) in 1996. The purpose of this dose assessment is to consider the potential radiological dose from future use of the Attleboro site, and to enable a comparison between the potential dose and the criteria proposed by the Massachusetts Department of Public Health (MDPH).

Specific areas of the TI Attleboro Site subject to decommissioning/remediation activities include the Metals Recovery Area (TI 1996a), Former Burial Site (TI 1993), Buildings 11 and 12 exterior areas (TI 1996b) and Buildings 4, 5, and 10 interior areas (TI 1996c). These areas are referred to as "source areas" throughout this document, because they are the focus of source term and exposure scenario development supporting the dose assessment. Decommissioning activities and termination survey results are presented in the referenced report for each area. For consistency with data presented in TI 1996b, Buildings 11 and 12 exterior areas are divided into two primary source areas. Areas remediated prior to 1992 were not considered as source areas because this dose assessment only considers worst case areas where residual radioactive materials remain in place.

2.0 SITE DESCRIPTION

The TI Attleboro Site covers approximately 275 acres of zoned industrial land in Attleboro, Massachusetts. The site is bounded on the north/northwest by Route 123 (Pleasant Street), on the west by Forest Street, on the south by a railroad line owned by Conrail and operated by the Massachusetts Bay Transportation Authority, and on the east by a wooded area and private residences. Over 20 buildings are distributed over the site, housing heavy manufacturing and administrative operations. There are no private residences on the TI property; however, residences are found near all site boundaries. The surrounding Attleboro area is primarily a manufacturing center that includes numerous commercial and industrial facilities.

Descriptions of the five source areas pertinent to this dose assessment are presented below. All source areas are similar in that they have undergone subsurface excavation to remediate uranium concentrations to less than the criteria specified in TI 1992 and TI 1994, followed by backfill and cover with fill containing background concentrations of uranium.

Metals Recovery Area - located in southwest portion of the site; approximately 11,500 yd^3 of material has been excavated and backfilled; 95% of the area is covered with asphalt parking lot and 5% rock and soil.

Burial Site - located in the south central portion of the site; approximately 7,000 yd^3 of material has been excavated and backfilled; 30% of the area is covered with asphalt parking lot and 70% has been revegetated.

Buildings 11 Exterior Areas/Stockade and Railspur - located in the southwest quadrant of the site near Building 11; approximately 6550 yd^3 of material has been excavated and backfilled; 99% of the area is covered with road material and 1% has been revegetated.

Building 12 Exterior Areas - located in the southeast quadrant of the site to the south and west of Building 12; approximately 10,000 yd^3 of material has been excavated and backfilled; 95% of area has been revegetated and 5% is covered with road material.

Buildings 4, 5, and 10 Interior Areas - located in portions of designated buildings; approximately 1300 yd^3 of concrete slab, building material, and underlying soil have been removed. Building areas have been refilled, concrete poured, and walls and other structures repaired.

The location of each area is shown in yellow on Figures 1 and 2, Texas Instruments Incorporated Exterior and Interior Remediation Areas maps.

3.0 SOURCE TERM

The source term is defined as the total inventory of radioactive material contained within a given area of concern. The source term may be calculated based on radionuclide concentration within a volume of bulk material, or surface contamination activity and surface area. In preparing source terms for input to any pathway modeling approach, it is necessary to identify the relative dimensions and location of the feature comprising the source term. For example, a subsurface soil cell of dimensions 10 m x 10 m x 10 m (1000 m^3) containing an average uranium concentration equal to 30 pCi/g would contain a total source inventory of 0.05 μCi (at an average soil density of 1600 kg/m^3). However, the potential dose impacts resulting from environmental transport would be different between this cell located at the surface and the cell located below a 1 m meter-thick cover.

As previously noted, TI has remediated the following source areas: the metals recovery area; the burial site; Building 11 areas/stockade and railspur; Building 12 exterior areas; and Buildings 4, 5, and 10 interiors. Source term information for each area is presented in Table 1. It should be noted that during remediation operations, the typical decontamination and survey unit dimensions within each source area were 10 m by 10 m. It also should be noted that not all survey units within an area (i.e., building 12 exterior areas) were contiguous. Subsequently, the dimensions and total volume of an area (as presented in Table 1) were developed as the sum of all survey units from excavation area as-built drawings (see Appendix A for example geometrical representation). The average depth to a primary area was determined as the average depth of the survey units identified on the source area as-built excavation drawings.

At a minimum, four soil samples were analyzed from each complete survey unit as part of the termination survey process. Where stationary underground objects were found, contamination levels on these objects were recorded. The maximum and average recorded uranium concentrations for each of the five source areas were determined through review of termination sample data of all 10 m x 10 m grid blocks contained within the outdoor source area of interest.

Figure 1. Texas Instruments Incorporated Interior Remediation Areas Map.

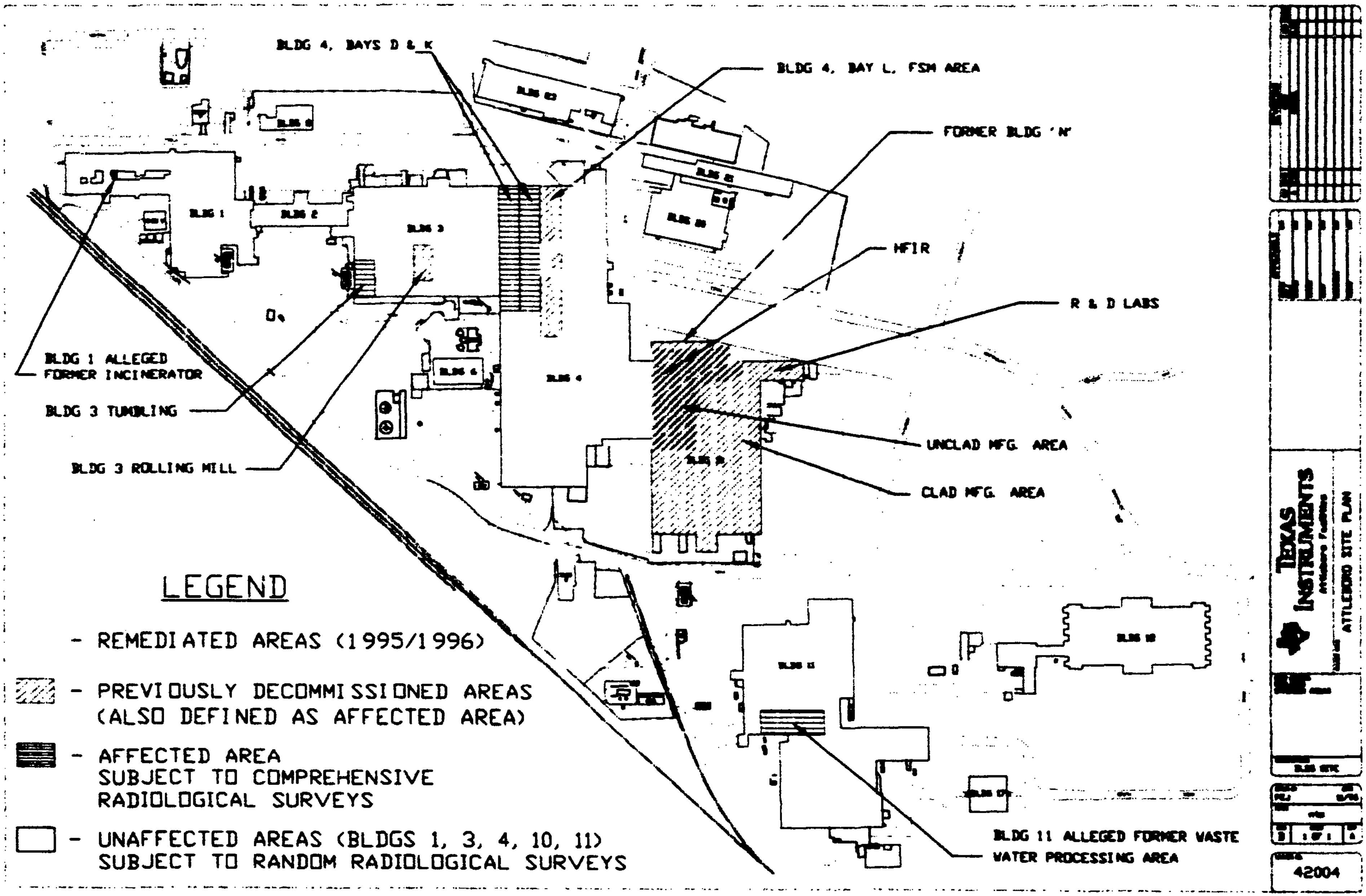
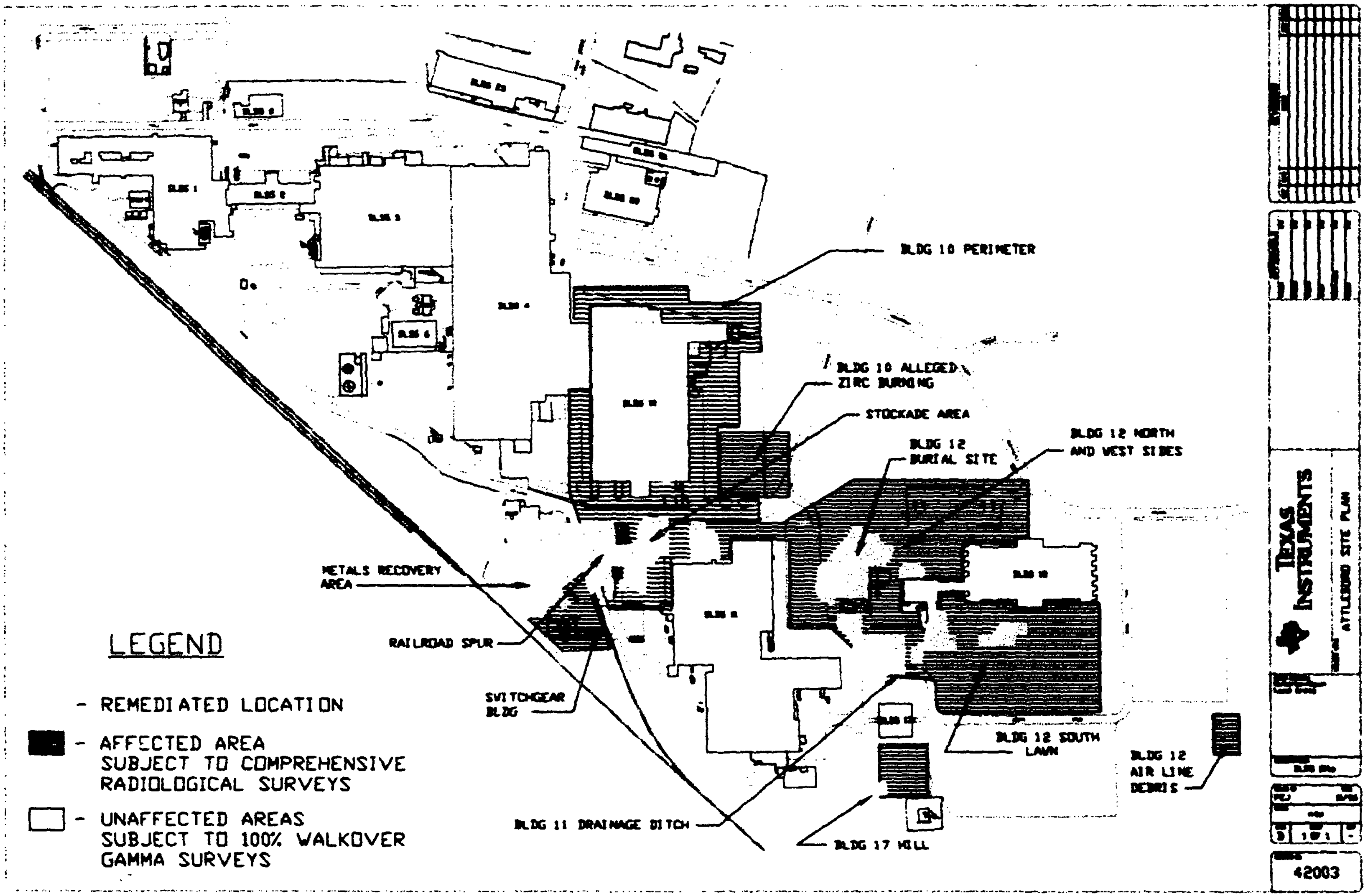
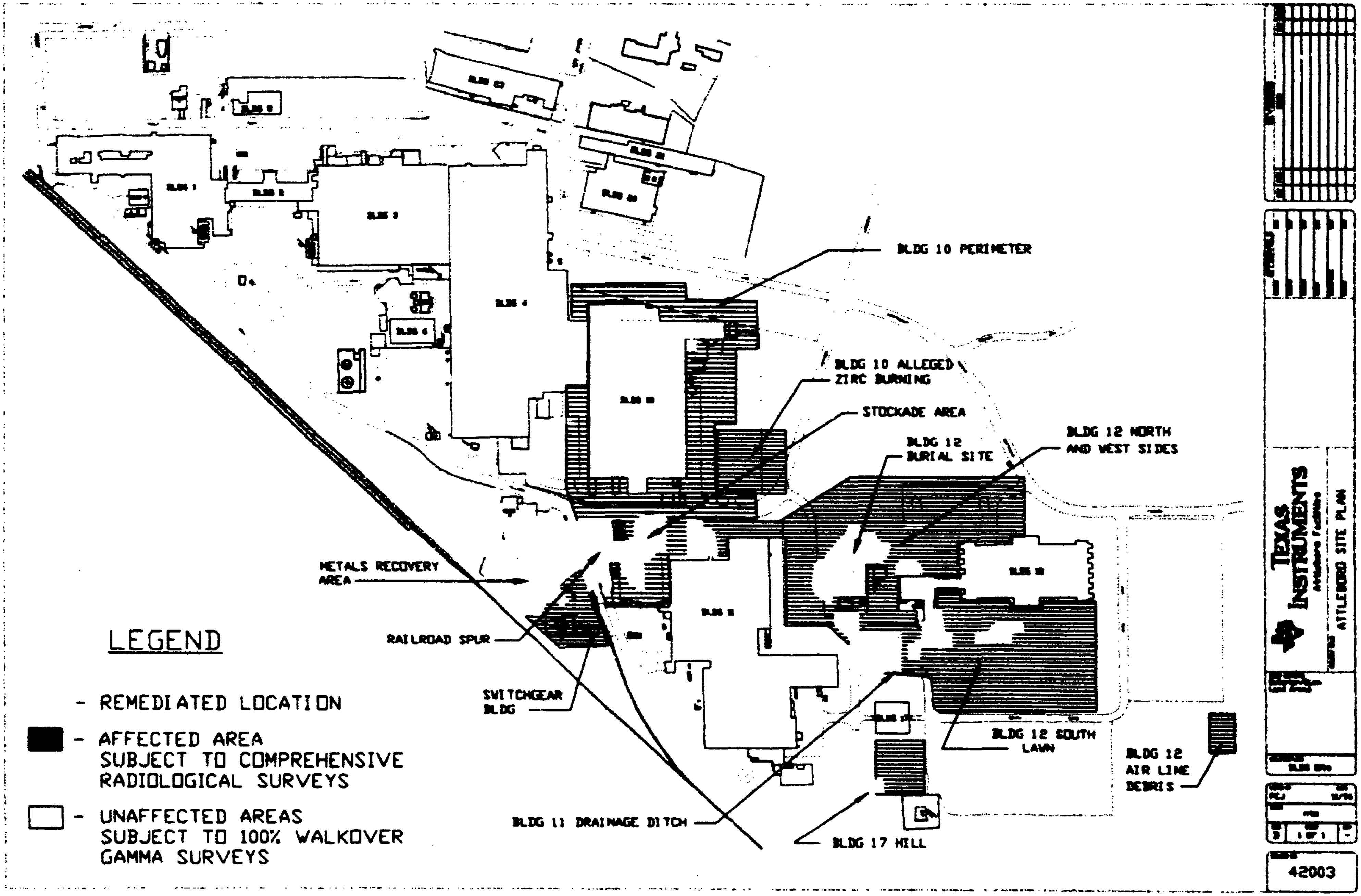
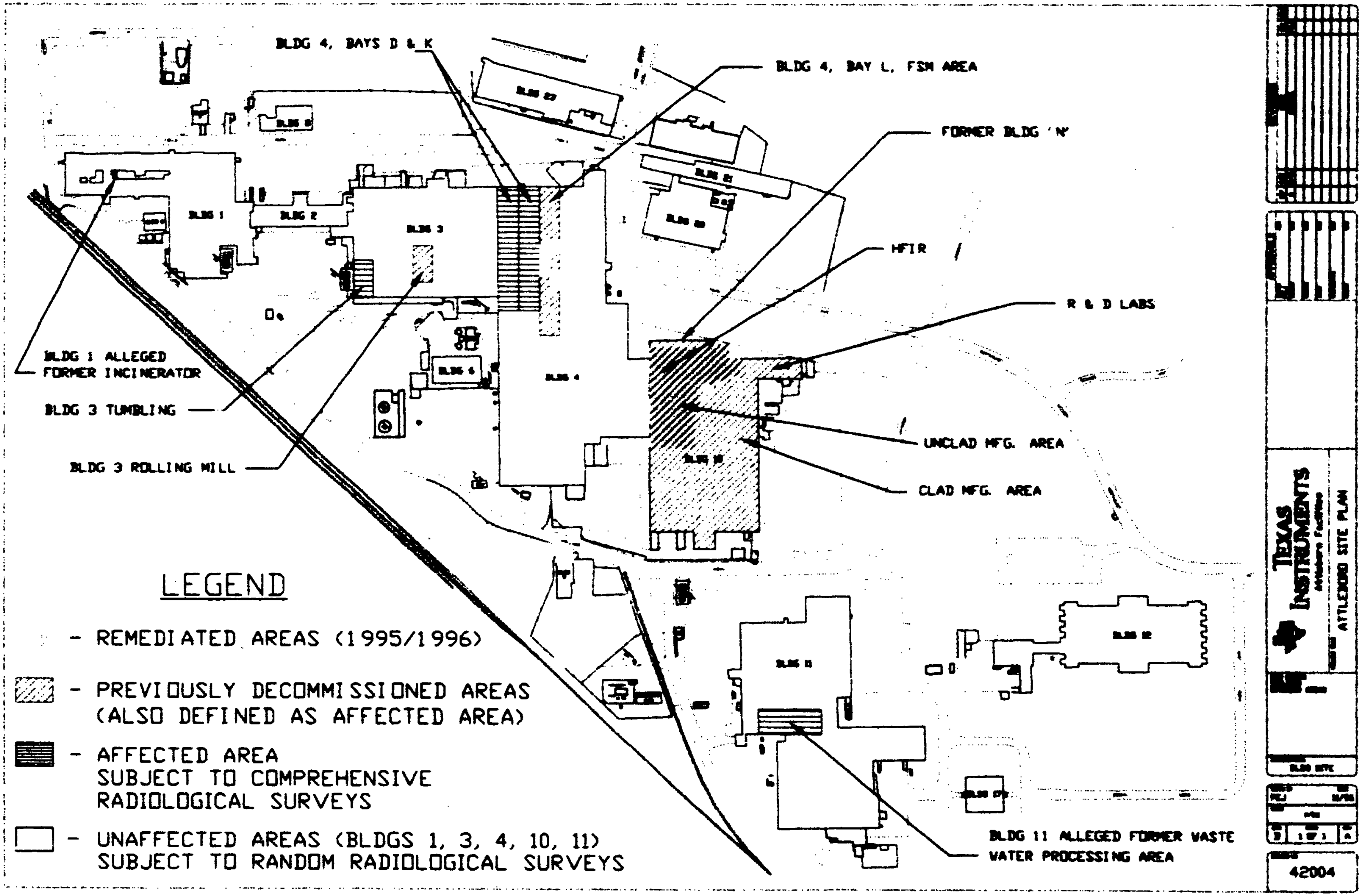


Figure 2. Texas Instruments Incorporated Exterior Remediation Areas Map.




BLDG 10 PERIMETER
BLDG 10 ALLEGED ZIRC BURNING
STOCKADE AREA
BLDG 12 BURIAL SITE
BLDG 12 NORTH AND WEST SIDES
METALS RECOVERY AREA
RAILROAD SPUR
SWITCHGEAR BLDG
BLDG 12 SOUTH LAWN
BLDG 12 AIR LINE DEBRIS
BLDG 11 DRAINAGE DITCH
BLDG 17 HILL
LEGEND
- REMEDIATED LOCATION
- AFFECTED AREA SUBJECT TO COMPREHENSIVE RADIOLOGICAL SURVEYS
- UNAFFECTED AREAS SUBJECT TO 100% WALKOVER GAMMA SURVEYS
TEXAS INSTRUMENTS
ATTLEBORO SITE PLAN
42003


BLDG 4, BAYS D & K
BLDG 4, BAY L, FSM AREA
FORMER BLDG 'N'
HFIR
R & D LABS
UNCLAD MFG. AREA
CLAD MFG. AREA
BLDG 1 ALLEGED FORMER INCINERATOR
BLDG 3 TUMBLING
BLDG 3 ROLLING MILL
BLDG 1
BLDG 2
BLDG 3
BLDG 4
BLDG 6
BLDG 10
BLDG 11
BLDG 12
BLDG 11 ALLEGED FORMER WASTE WATER PROCESSING AREA
LEGEND
- REMEDIATED AREAS (1995/1996)
- PREVIOUSLY DECOMMISSIONED AREAS (ALSO DEFINED AS AFFECTED AREA)
- AFFECTED AREA SUBJECT TO COMPREHENSIVE RADIOLOGICAL SURVEYS
- UNAFFECTED AREAS (BLDGS 1, 3, 4, 10, 11) SUBJECT TO RANDOM RADIOLOGICAL SURVEYS
TEXAS INSTRUMENTS
ATTLEBORO SITE PLAN
42004

An exception to this procedure was made in analyzing termination data from the interiors of Buildings 4, 5, and 10. While excavation and backfill of standard 10 m x 10 m survey units underlying the buildings did occur, further review indicated that uranium concentrations associated with any of the eight "residual contamination areas" exceeded those of the residual soil survey units. The characteristics of these residual contamination areas were analyzed in developing input to Table 1 for Buildings 4, 5, and 10 interiors. Relevant data are available in the aforementioned decommissioning report references.

Table 1 presents data for open excavation area at the time of radiological termination survey, residual material volume (based on an estimated layer depth of 1 m), calculated backfill volume, average depth of excavation below surface, average (including the weighted average in some survey units where residual material was left in place) and maximum isotopic uranium concentrations in the residual volume, and average isotopic uranium concentrations in the backfill volume. Table 1 also presents the weighted isotopic uranium concentrations in a mixture of the residual and backfill material volumes. It should be noted that the uranium concentrations presented in Table 1 have not been stripped of background.

The data indicate that on a localized basis, residual contamination areas identified in Buildings 4, 5, and 10 likely pose the highest potential dose due to inadvertent intrusion. However, the relatively small volume of these residual areas (typically less than 10 m^3) indicates that future earthworking would result in significant dilution of the material. Of the four "outdoor" source areas analyzed in Table 1, the highest weighted isotopic uranium concentrations would result from mixing of residual material and fill within the former metals recovery area. Such conditions would indicate potential applicability to a future use scenario that assumes large scale soil mixing is performed.

4.0 EXPOSURE SCENARIO DEVELOPMENT/ENVIRONMENTAL PATHWAY ASSESSMENT

The development of appropriate exposure scenarios on which to apply dose assessment is a function of the source term nature and activity, activities of an exposed individual at a given hypothetical receptor location (either at or removed from the source term), and the environmental pathways of transport from the source to the hypothetical receptor. Exposure scenarios are considered for both present and future uses of the facility and associated property, and whether the exposure occurs as the result of passive activities or as the result of inadvertent or intentional intrusion into the source. The development of representative exposure scenarios incorporates both conservatism in pathway selection and modeling input assumptions, and the application of scenario bounding of postulated doses.

4.1 Environmental Transport Pathways

Environmental transport pathways are routes by which contaminated material may be transferred to and taken into the body of an individual receptor, or by which that receptor could be exposed to direct gamma emissions from stationary or relocated source material. When developing exposure scenarios, potential environmental transport pathways are

Table 1 Source Term Development - TI Site Dose Assessment

Area Description	Comments	Excavation Area (m^2)	Residual Volume[1] (m^3)	Fill Volume (m^3)	Depth Below Surface (m)	Av. U-234 (pCi/g)[2,3]	Av. U-235 (pCi/g)[2,3]	Av. U-238 (pCi/g)[2,3]	Max U-234 (pCi/g)	Max U-235 (pCi/g)	Max U-238 (pCi/g)
Metals Recovery Area		8667	8667	9433	1.1	14.00 17.90 16.03	0.47 0.80 0.54	4.30 5.50 4.93	73.2 44.36	2.5 1.51	22.5 13.54
Former Burial Site		2667	2667	5805	2.2	12.30 10.70 11.20	0.97 0.80 0.85	10.40 9.16 9.51	28.6 16.33	2.3 1.27	24.2 13.85
Building 11 Areas/Stockade - Railspur	Multiple Areas - Dimensions Based on Sum Volume of Areas	3260	3260	5392	1.7	4.10 1.80 2.67	0.37 0.07 0.18	12.30 1.43 5.63	39.5 16.01	3.5 1.36	118 45.36
Building 12 Areas	Multiple Areas - Dimensions Based on Sum Volume of Areas	4221	4221	8270	2	6.60 5.00 5.54	0.52 0.40 0.46	5.62 4.30 4.93	37.9 16.12	3 1.64	32.1 17.81
Buildings 4, 5, and 10 Interior Areas	Residual Contamination Area of Highest Concentration Selected	5588	NA	1055	1.5	104.00 1.50 weighted values not applicable	4.21 0.05	47.50 1.80	133	5.47	84.9

[1] Calculated assuming residual material depth of 1 meter for exterior sites

[2] Second set of numbers are average backfill concentrations

[3] Third set of numbers represent weighted activities of combined residual and fill volumes.

the proposed scenarios in this dose assessment are presented in Table 2.

Table 2. Potential Environmental Transport Pathways from the TI Site

Pathway Description	Classification	TI Site Applicability	Comments
Direct Gamma Exposure	Direct	Low-Moderate	Likely only as the result of direct disturbance of source material
Direct Inhalation	Direct	Low-Moderate	Likely only as the result of direct disturbance of source material
Direct Ingestion	Direct	Low-Moderate	Likely only as the result of direct disturbance of source material
Offsite Dispersion of Airborne Particulates	Direct	Low	Limited by presence of clean soil cover over decontaminated areas
Groundwater Transport to Offsite Well Location	Direct	Low	The near surface aquifer is not accessed for drinking water and is therefore not a potential exposure pathway
Ingestion of Contaminated Garden Produce	Indirect	Extremely Low	Limited by presence of clean soil cover over decontaminated areas and dilution resulting from transport
Ingestion of Garden Produce Grown W/Irrigation Water	Indirect	Low	The near surface aquifer is not accessed for domestic uses because of poor quality, sporadic availability and the current and future planned use of surface water. This is not expected to change in the future
Gamma Exposure From Airborne and Deposited Particles	Indirect	Extremely Low	Presence of Clean Soil Cover/Nature of Uranium
Minor Pathways	Indirect	Extremely Low	Previously Mentioned Factors

Environmental transport pathways are classified as either direct or indirect. Direct transport occurs when contaminated material is transferred directly to a receptor, or that receptor is directly exposed to the gamma emissions of the source. Indirect transport involves a

secondary transfer mechanism, such as airborne contamination deposition on garden vegetables that are consumed. Site applicability was determined based on the relative location of the source(s) (under significant clean soil caps), site layout, and routine activities performed in those areas.

4.2 Bounding Scenario Concept

Use of the concept of "bounding scenarios" provides streamlined final output dose assessment data and conclusions that may be used to support decision-making. When evaluating potential scenarios, it becomes evident that postulated doses from some sources will be significantly higher than from others. Analysis of the scenario resulting in a significantly lower dose is unnecessary because the other scenario will result in significantly higher doses. An example of this is seen in the hypothetical case of a residential structure being placed on a disposal cell containing 10 pCi/g of a radionuclide versus a disposal cell of 1000 pCi/g. Given that all environmental transport pathways are held constant, the scenario dose from the 1000 pCi/g cell bounds that from the 10 pCi/g cell.

In addition to analyses of site source terms, the nature of the environmental pathways may be reviewed during the process of developing bounding scenarios. For instance, a scenario that includes multiple direct environmental pathways, such as direct gamma exposure, and inhalation and ingestion of source material would likely result in a higher postulated dose than a scenario involving only multiple indirect environmental pathways such as plant uptake, or gamma exposure due to offsite deposition.

4.3 Current Versus Future Exposure Scenarios

In developing the methodology for this dose assessment, both current and future exposure scenarios were evaluated. The current use scenario analysis accounted for all potential uses of the four source areas, given that the site would remain engaged in industrial manufacturing operations under TI control. This analysis identifies the activity with the highest dose potential as being an intrusion of site workers into a source area to perform maintenance activities. It should be noted that, according to current TI policy that site workers are considered as members of the public. Since no feasible current exposure scenario to members of the general public could be postulated, potential future uses of the site were reviewed. The most conservative scenario likely would result if, after site earthworking (relocation of residual uranium-containing material to the surface), residences were built on a vacant site (after manufacturing had ceased).

4.4 Scenario Development

4.4.1 Current Exposure Scenario

Current exposure scenarios evaluated for potential application to this dose assessment included:

1) Offsite dose to nearest resident (member of the general public) from any or all of the four outdoor source areas (metals recovery area, burial area, Building 11 areas/stockade and railspur and Building 12 exterior areas):

2) TI maintenance worker intrusion into any of the five primary source areas (including Buildings 4, 5, and 10 interior areas) to perform underground maintenance.

Maintenance worker intrusion into any of the five source areas was selected as the bounding scenario for dose assessment. Further, the Building 4, 5, and 10 residual areas were selected as having the highest localized uranium concentrations and highest likelihood of worker intrusion resulting from building maintenance operations This scenario location was selected because intrusion would allow multiple exposure pathways including direct exposure to gamma radiation, inhalation of resuspended dust, and ingestion of contaminated soils. Because each of the four exterior source areas are backfilled and covered with clean soil, airborne resuspension and dispersion to an offsite receptor, ingestion, or direct exposure to gamma radiation is not credible. Likewise, any distribution of contaminants into the shallow aquifer underlying the site would not result in a measurable dose component since the aquifer is of poor quality and sporadic availability and is therefore not used for drinking water.

Under the current exposure scenario, TI maintenance workers are assumed to excavate into contaminated areas within the Buildings 4, 5 and 10 interiors, which contain the highest concentrations of residual radioactive materials. Therefore, dose assessment using application of conditions associated with the building interiors is assumed to bound potential doses resulting from similar activities in any of the other four source areas outside the buildings. In the current exposure scenario, maintenance workers excavate a trench 10 m long, 3 m wide, and 1.5 m deep. Postulated environmental transport pathways associated with this scenario are described in Table 3. This maintenance is assumed to be performed twice per year.

Table 3. Environmental Transport Pathways Associated with Selected Scenarios

Scenario Description	Pathways	Anticipated Contribution to Postulated Dose
Current use scenario - building maintenance worker intrusion into subsurface area of Buildings 4, 5, or 10	direct exposure ingestion inhalation	moderate-low moderate moderate-high
Future Use Scenario - construction of residence on top of former metals recovery area after subsurface material is blended with cover fill	direct exposure ingestion inhalation ingested garden produce	low moderate moderate moderate-low

Postulated future uses of the site included continued performance of manufacturing operations in an industrial setting, closure of the site (including building demolition) with indefinite administrative control of site access, and closure of site with conversion to residential use.

Closure of the site with conversion to residential use was chosen as the bounding future use scenario. Analysis of the continued manufacturing scenario and the closure with control scenario indicated a very limited potential for large-scale intrusion into any of the four decommissioned outdoor areas. Residual contamination areas associated with the Buildings 4, 5, and 10 interiors have relatively small volumes that would be significantly diluted by mixing with existing fill material. As a result, most pathways of exposure (outside of maintenance intrusion selected as the current use scenario) resulted in very low potential for contribution to scenario doses.

Under the future-use exposure scenario, it is assumed that after the site is closed and industrial buildings are removed, major site earthwork is performed. This earthwork results in the mixing of subsurface material containing uranium with fill and the cover material that has been placed above it. It is assumed that this mixing occurs at the source area containing the largest volume of subsurface material that contains the highest uranium concentrations (metals recovery area). After the earthwork (mixing) is complete, a residence is constructed directly above the area. Although similar activities may be performed at the other three outdoor source areas, the potential dose contributions from these areas are assumed to be much less because of a lower residual source term as compared to the former metals recovery area. Postulated environmental transport pathways associated with this scenario are described in Table 3.

4.5 Scenario Conservatism

The scenarios presented in this document are likely to yield highly conservative doses for several reasons:

1. Source calculations use maximum uranium concentrations (including background concentrations) that overestimate the true concentration in bulk material (soil).
2. Scenario assumptions for ventilation and work times understate the true dilution effects of ventilation (current use scenario).
3. It is unlikely that any future uses of the site will include residential activities because of the current value of the industrial facilities.
4. In application of the RESRAD code, source material is assumed to be consolidated under future residence location. In the actual condition where survey units are further spread out, dilution through environmental pathways would reduce actual dose.

Dose assessment methods include the application of computer modeling packages and hand algorithms. In general, computer modeling packages may be applied if the conditions of the selected scenarios are consistent with the capabilities of the selected model. Hand algorithm calculation is used when available modeling codes are not capable of assessing the particular characteristics of the given scenario.

Calculated doses for direct gamma exposure pathways are expressed in terms of effective dose equivalent (EDE), while calculated doses from radionuclide intake pathways are expressed in terms of committed effective dose equivalent (CEDE). EDE is received immediately, while CEDE is received over a period of 50 years as the result of metabolic transfer in the body. Summary doses are expressed as the total effective dose equivalent (TEDE), which is the sum of the EDE and CEDE. The TEDE is the dose measure that is compared to regulatory criteria.

5.1 Current Use Scenario

Dose estimates for the current use scenario are performed using hand calculations, based on conservative assumptions regarding the activities described in the scenario. The application of RESRAD-BUILD developed by Argonne National Laboratory (DOE 1994) was investigated for application to the postulated worker intrusion scenario, but was determined not to be readily applicable. RESRAD-BUILD was more suited to extended exposure periods in contaminated rooms of known surface contamination, rather than the unique characteristics associated with subsurface maintenance at the TI facility.

Doses to maintenance workers under the current exposure scenario are calculated using the following sequential process:

1. Identify subsurface work area volume and reference breathing air zone (volume)
2. Identify gamma exposure rates within reference volume
3. Identify isotopic uranium concentrations within subsurface soils of reference volume
4. Determine exposed surface area of contaminated soil disturbed
5. Determine depth of contaminated soil disturbance
6. Calculate volume (mass) of contaminated soil disturbed
7. Determine worker exposure time
8. Calculate direct gamma radiation dose
9. Choose resuspension fraction to apply to disturbed material
10. Calculate mass of resuspended material
11. Determine what percentage of resuspended material is in respirable range
12. Calculate concentration of respirable material in reference breathing volume
13. Based on work time, calculate inhalation intake
14. Apply inhalation dose conversion factor to intake
15. Apply handling transfer factor to volume of disturbed soil
16. Apply ingestion fraction to mass of transferred soil
17. Apply ingestion dose conversion factor to intake
18. Multiply each dose by the number of maintenance events per year

This sequence of steps results in a calculated dose from the direct gamma exposure pathway, inhalation pathway, and ingestion pathway. Appendix B presents the input parameters used for calculation of the dose components within this scenario. Input parameters were obtained from several references including ANL (1993), ICRP (1974), and ORNL (1983).

5.2 Future Use Scenario

Dose estimates for the future use scenario are performed using the modeling code RESRAD 5.62 developed by Argonne National Laboratory (DOE 1993). RESRAD allows optimal flexibility in assessing transport pathways associated with the future use scenario.

Final RESRAD dose calculations are developed using the following process:

1. Define volume and radionuclide concentration in cover and contaminated layers
2. Calculate weighted radionuclide concentration in a completely mixed layer
3. Identify dimensions and depth of new layer
4. Set pathways in RESRAD menu - external gamma, inhalation, plant ingestion, soil ingestion
5. Modify data in RESRAD menu - contaminated zone parameters (contamination area and depth), initial concentrations of principal radionuclides (maximum weighted), dust inhalation and external gamma parameters, ingestion pathway data, dietary parameters - all other information fields should be blanked
6. Set RESRAD graphics
7. Generate RESRAD output

After the input of metals recovery area source term data (area, depth, and maximum weighted isotopic concentrations) presented in Table 1, the RESRAD data modification sequence was initiated. RESRAD default input values were used for all calculations, with the exception of the fruit, plant, and grain intake value. This value was modified from 160 kg/yr to 40 kg/yr, since the large intake value is based on a self-sufficient farm rather than a suburban residence. A summary of exposure scenario parameters is included with the code outputs presented in Appendix C.

6.0 DOSE SUMMARY AND CONCLUSIONS

6.1 Current Use Scenario

The TEDE resulting from the current use scenario is estimated to be 1.3 mrem as the result of the maintenance intrusion into the residual contamination areas of Buildings 4, 5, and 10 two times per year. The inhalation pathway contributed 1.2 mrem, approximately 90% of the TEDE. Ingestion and direct gamma doses contributed 0.013 mrem and 0.12 mrem, respectively. Detailed dose calculation and output information are presented in Appendix B.

Critical parameters effecting the calculated dose include the size of the reference breathing volume and resuspension fraction applied to contaminated soil. Conservatism is introduced to the scenario through the use of maximum uranium concentrations and the assumptions that no deposition or ventilation from the breathing volume occurs.

6.2 Future Use Scenario

The TEDE resulting from the future use scenario is estimated to be 7.3 mrem in the first year after residential exposure above the former Metals Recovery Area. Approximately 80% of the TEDE results from a postulated inhalation dose of 5.7 mrem. Ingestion and direct gamma doses contributed 1.1 mrem and 0.5 mrem, respectively. It should be noted that the projected dose in future years following residential placement decreases at a steady rate. This decline can be attributed to increased vegetation coverage and vertical migration of contaminants. Detailed code calculation and output information are presented in Appendix C.

Critical parameters affecting the calculated dose include mass resuspension rate and volume of ingested produce grown at the residence and consumed. The RESRAD default parameters are extremely conservative given the probable use of the land and the typical vegetative cover for the region.

7.0 REFERENCES

ANL 1993. Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil. Environmental Assessment and Information Sciences Division, Argonne National Laboratory, ANL/EAIS-8, April, 1993.

DOE 1994. RESRAD-BUILD: A Computer Model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material, ANL/EAD/LD-3, November 1994.

DOE 1993. Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0. Environmental Assessment Division, Argonne National Laboratory, ANL/EAD/LD-2, September 1993.

ICRP 1974. Report of the Task Group on Reference Man. International Commission on Radiological Protection Report 23, October 1974.

ORNL 1983. Radiological Assessment - A Textbook on Environmental Dose Analysis. Oak Ridge National Laboratory report ORNL-5968, NUREG/CR-3332, September 1983.

TI 1996a. Remediation of Metals Recovery Area. Texas Instruments Incorporated report prepared by Creative Pollution Solutions, Inc., October 1996

TI 1996b. Remediation of Exterior Areas Adjacent to Buildings 11 and 12. Texas Instruments Incorporated report prepared by Roy F. Weston, Inc., August 1996.

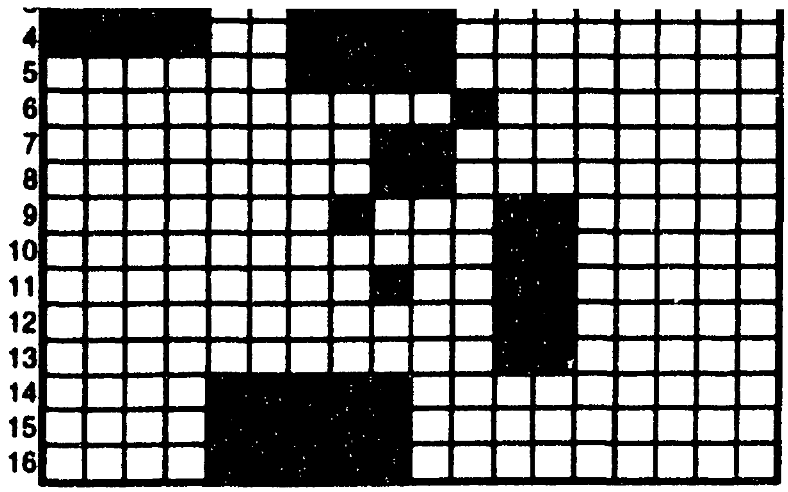
TI 1996c. Remediation of Building Interiors - Buildings 4, 5, and 10 Texas Instruments Incorporated report prepared by Roy F. Weston, Inc., October 1996.

TI 1994. Supplement to the 1992 Remediation Plan. Texas Instruments Incorporated report prepared by Materials and Controls Group, Environmental, Safety and Health Department. December 1994.

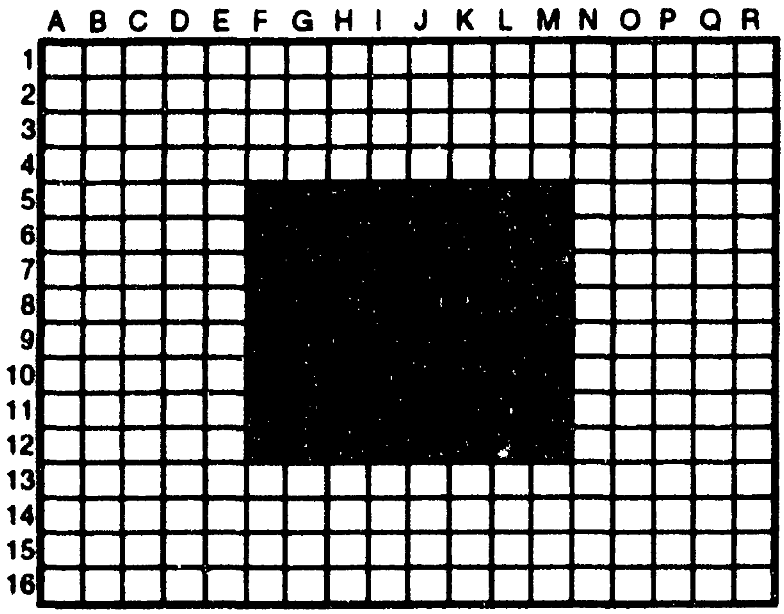
TI 1993. Remediation of the Former Radioactive Waste Burial Site. Texas Instruments Incorporated report prepared by Creative Pollution Solutions, Inc., September 1993.

TI 1992. 1992 Remediation Plan. Texas Instruments Incorporated, 1992.

APPENDIX A
GEOMETRICAL REPRESENTATION
TERMINATION SURVEY UNIT GROUPING



Hypothetical Remediation Area
Survey Unit Grouping for Source Term and Code Input Calculations



APPENDIX B
CURRENT USE SCENARIO
MAINTENANCE INTRUSION DOSE CALCULATIONS

ISOTOPE-SPECIFIC INFORMATION					
		U-234	U-235	U-238	Total
A	Average (pCi/g)	104	4.2	47.5	155.7
B	Maximum (pCi/g)	133	5.5	84.9	223.4
C	Background (pCi/g)	1.5	0.05	1.8	3.35
D	Inhalation DCF (mrem/pCi)	1.30E-01	1.20E-01	1.20E-01	
E	Ingestion DCF (mrem/pCi)	2.60E-04	2.50E-04	2.50E-04	
	alphanumeric designator	1	2	3	4

GENERAL WORK AREA PARAMETERS				
F	Subsurface excavation volume	45	m^3	10m by 3m by 1.5 m
G	Breathing air zone volume	90	m^3	includes excavation volume and identical air shell above
H	Gamma exposure rate in excavation	30	uR/hr	developed from actual site measurements
I	Exposed surface area of contaminated soil	30	m^2	developed from excavation bottom - 10m by 3m
J	Depth of contaminated soil layer	1	m	developed based on thickness of residual contamination areas
K	Volume of contaminated soil	30	m^3	calculation I*J
L	Mass of contaminated soil	40000	kg	calculation K*1600kg/m^3
M	Worker exposure time	4	hr	based on site observation

INHALATION SPECIFIC PARAMETERS AND ASSESSMENT				
N	Resuspension fraction of disturbed soil	1.00E-07		based on moderate mixing - (PNL 1981)
O	Mass of resuspended soil	4.00	g	calculation L*N*1000 g/kg
P	Respirable fraction of resuspended soil	10	%	(DOE 1993)
Q	Mass of respirable resuspended soil	0.4	g	calculation M*N
R1	Static airborne concentration U-234	0.6	pCi/m^3	calculation (Q/G)*B1
R2	Static airborne concentration U-235	0.0	pCi/m^3	calculation (Q/G)*B2
R3	Static airborne concentration U-238	0.4	pCi/m^3	calculation (Q/G)*B3
S	Worker breathing rate	1.2	m^3/hr	ICRP 23 "working"
T	Total breathed volume	4.8	m^3	calculation Q*K
U1	Airborne intake U-234	2.8	pCi	calculation R1*T
U2	Airborne intake U-235	u.1	pCi	calculation R2*T
U3	Airborne intake U-238	1.8	pCi	calculation R3*T
V1	U-234 CEDE	0.37	mrem	calculation U1*D1
V2	U-235 CEDE	0.01	mrem	calculation U2*D2
V3	U-238 CEDE	0.22	mrem	calculation U3*D3
W	Total inhalation CEDE	0.60	mrem	calculation V1+V2+V3

INGESTION SPECIFIC PARAMETERS AND ASSESSMENT				
X	reserved			
Y	max daily ingestion	480	mg	restrictive value from ANL (1993)
Z	Total soil ingested	0.24	g	calculation((Y/8)*M)/1000
AA1	Ingestion intake U-234	31.9	pCi	calculation B1*Z
AA2	Ingestion intake U-235	1.3	pCi	calculation B2*Z
AA3	Ingestion intake U-238	20.4	pCi	calculation B3*Z
BB1	U-234 CEDE	0.01	mrem	calculation AA1*E1
BB2	U-235 CEDE	0.00	mrem	calculation AA2*E2
BB3	U-238 CEDE	0.01	mrem	calculation AA3*E3
CC	Total ingestion CEDE	0.01	mrem	calculation BB1+BB2+BB3

DIRECT GAMMA DOSE ASSESSMENT				
DD	Total gamma exposure	0.12	mR	calcuation (M*H)/1000
EE	Total gamma dose	0.12	mrem	apply QF 1 to DD

DOSE SUMMARY		
	Inhalation CEDE (W)	0.600
	Ingestion CEDE (CC)	0.014
	Gamma EDE (EE)	0.120
FF	TEDE	0.734

APPENDIX C
FUTURE USE SCENARIO
FUTURE RESIDENT DOSE CALCULATIONS

OFFICIAL RECORD COPY ML 10

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
D-1	U-234	2.830E-04	2.830E-04	DCF3(6)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary

File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
D-1	U-234	2.830E-04	2.830E-04	DCF3(6)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-0[illegible]	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,[illegible]
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	8.667E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.100E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	2.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	4.440E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.610E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	1.350E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.161E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.161E-03	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.161E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.853E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.161E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.584E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.261E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.645E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	5.000E-02	3.000E+00	---	LM
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	0.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(1
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Fruits, vegetables and grain consumption (kg/yr)	4.000E+01	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	not used	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	not used	4.500E+01	---	STOR_T(9)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	not used	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	active
9 -- radon	suppressed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	8667.00 square meters	U-234	4.440E+01
Thickness:	2.10 meters	U-235	1.610E+00
Cover Depth:	0.00 meters	U-238	1.360E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 10 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	7.352E+00	7.329E+00	7.283E+00	7.126E+00	6.696E+00	5.389E+00	2.923E+00	2.752E+00
M(t):	7.352E-01	7.329E-01	7.283E-01	7.126E-01	6.696E-01	5.389E-01	2.923E-01	2.752E-01

Maximum TDOSE(t): 7.352E+00 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract
U-234	0.000E+00	0.0000	4.428E+00	0.6023	0.000E+00	0.0000	8.518E-01	0.1159	0.000E+00	0.0000	0.000E+00	0.0000	3.440E-01	0.04
U-235	0.000E+00	0.0000	1.403E-01	0.0191	0.000E+00	0.0000	2.733E-02	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	1.104E-02	0.001
U-238	0.000E+00	0.0000	1.204E+00	0.16[illegible]7	0.000E+00	0.0000	2.462E-01	0.0335	0.000E+00	0.0000	0.000E+00	0.0000	9.941E-02	0.01
Total	0.000E+00	0.0000	5.[illegible]2E+00	0.7851	0.000E+00	0.0000	1.125E+00	0.1531	0.000E+00	0.0000	0.000E+00	0.0000	4.544E-01	0.06

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	mrem/yr	fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.624E+00	0.76
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.787E-01	0.02
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.549E+00	0.21
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.352E+00	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	frac
U-234	0.000E+00	0.0000	4.414E+00	0.6023	0.000E+00	0.0000	8.491E-01	0.1159	0.000E+00	0.0000	0.000E+00	0.0000	3.429E-01	0.04
U-235	0.000E+00	0.0000	1.399E-01	0.0191	0.000E+00	0.0000	2.734E-02	0.0037	0.000E+00	0.0000	0.000E+00	0.0000	1.101E-02	0.00
U-238	0.000E+00	0.0000	1.200E+00	0.1637	0.000E+00	0.0000	2.454E-01	0.0335	0.000E+00	0.0000	0.000E+00	0.0000	9.910E-02	0.01
Total	0.000E+00	0.0000	5.754E+00	0.7851	0.000E+00	0.0000	1.122E+00	0.1531	0.000E+00	0.0000	0.000E+00	0.0000	4.530E-01	0.06

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and [illegible]action of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	frac
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.607E+00	0.7
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.783E-01	0.0
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.544E+00	0.2
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.329E+00	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
U-234	0.000E+00	0.0000	4.387E+00	0.6023	0.000E+00	0.0000	8.438E-01	0.1159	0.000E+00	0.0000	0.000E+00	0.0000	3.407E-01	0.0
U-235	0.000E+00	0.0000	1.391E-01	0.0191	0.000E+00	0.0000	2.735E-02	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	1.096E-02	0.0
U-238	0.000E+00	0.0000	1.192E+00	0.1637	0.000E+00	0.0000	2.439E-01	0.0335	0.000E+00	0.0000	0.000E+00	0.0000	9.847E-02	0.0
Total	0.000E+00	0.0000	5.718E+00	0.7851	0.000E+00	0.0000	1.115E+00	0.1531	0.000E+00	0.0000	0.000E+00	0.0000	4.502E-01	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.571E+00	0.7
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.774E-01	0.0
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.535E+00	0.2
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.283E+00	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract
U-234	0.000E+00	0.0000	4.291E+00	0.6022	0.000E+00	0.0000	8.254E-01	0.1158	0.000E+00	0.0000	0.000E+00	0.0000	3.333E-01	0.04
U-235	0.000E+00	0.0000	1.365E-01	0.0192	0.000E+00	0.0000	2.741E-02	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	1.080E-02	0.00
U-238	0.000E+00	0.0000	1.166E+00	0.1637	0.000E+00	0.0000	2.385E-01	0.0335	0.000E+00	0.0000	0.000E+00	0.0000	9.632E-02	0.01
Total	0.000E+00	0.0000	5.594E+00	0.7850	0.000E+00	0.0000	1.091E+00	0.1531	0.000E+00	0.0000	0.000E+00	0.0000	4.404E-01	0.06

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* frac
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.450E+00	0.76
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.747E-01	0.02
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.501E+00	0.21
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.126E+00	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract
U-234	0.000E+00	0.0000	4.030E+00	0.6019	0.000E+00	0.0000	7.750E-01	0.1157	0.000E+00	0.0000	0.000E+00	0.0000	3.130E-01	0.04
U-235	0.000E+00	0.0000	1.300E-01	0.0194	0.000E+00	0.0000	2.766E-02	0.0041	0.000E+00	0.0000	0.000E+00	0.0000	1.041E-02	0.00
U-238	0.000E+00	0.0000	1.095E+00	0.1635	0.000E+00	0.0000	2.239E-01	0.0334	0.000E+00	0.0000	0.000E+00	0.0000	9.043E-02	0.01
Total	0.000E+00	0.0000	5.255E+00	0.7849	0.000E+00	0.0000	1.027E+00	0.1533	0.000E-00	0.0000	0.000E+00	0.0000	4.138E-01	0.06

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways mrem/yr	All Pathways frac
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.118E+00	0.76
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.681E-01	0.02
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.409E+00	0.21
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.695E+00	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	frac
U-234	0.000E+00	0.0000	3.226E+00	0.6004	0.000E+00	0.0000	6.231E-01	0.1156	0.000E+00	0.0000	0.000E+00	0.0000	2.513E-01	0.04
U-235	0.000E+00	0.0000	1.121E-01	0.0208	0.000E+00	0.0000	2.809E-02	0.0052	0.000E+00	0.0000	0.000E+00	0.0000	9.323E-03	0.00
U-238	0.000E+00	0.0000	8.777E-01	0.1629	0.000E+00	0.0000	1.795E-01	0.0333	0.000E+00	0.0000	0.000E+00	0.0000	7.249E-02	0.01
Total	0.000E+00	0.0000	4.226E+00	0.7841	0.000E+00	0.0000	8.307E-01	0.1541	0.000E+00	0.0000	0.000E+00	0.0000	3.331E-01	0.06

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	frac
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.110E+00	0.76
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.495E-01	0.02
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.130E+00	0.20
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.389E+00	1.00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	frac
U-234	0.000E+00	0.0000	1.733E+00	0.5930	0.000E+00	0.0000	3.443E-01	0.1178	0.000E+00	0.0000	0.000E+00	0.0000	1.352E-01	0.04
U-235	0.000E+00	0.0000	7.283E-02	0.0249	0.000E+00	0.0000	2.416E-02	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	6.528E-03	0.00
U-238	0.000E+00	0.0000	4.667E-01	0.1597	0.000E+00	0.0000	9.546E-02	0.0327	0.000E+00	0.0000	0.000E+00	0.0000	3.855E-02	0.01
Total	0.000E+00	0.0000	2.273E+00	0.7776	0.000E+00	0.0000	4.639E-01	0.1587	0.000E+00	0.0000	0.000E+00	0.0000	1.803E-01	0.06

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	frac
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.213E+00	0.75
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.825E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	1.093E-01	0.03
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.007E-01	0.20
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.825E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	2.923E+00	1.0(

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract
U-234	0.000E+00	0.0000	2.171E-01	0.0789	0.000E+00	0.0000	8.986E-02	0.0327	0.000E+00	0.0000	0.000E+00	0.0000	1.987E-02	0.007
U-235	0.000E+00	0.0000	1.301E-02	0.0047	0.000E+00	0.0000	6.136E-03	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	1.317E-03	0.000
U-238	0.000E+00	0.0000	5.116E-02	0.0186	0.000E+00	0.0000	1.048E-02	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	4.227E-03	0.001
Total	0.000E+00	0.0000	2.812E-01	0.1022	0.000E+00	0.0000	1.065E-01	0.0387	0.000E+00	0.0000	0.000E+00	0.0000	2.541E-02	0.00

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E+00	0.5921	0.000E+00	0.0000	0.000E+00	0.0000	1.956E+00	0.71
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.426E-01	0.0881	0.000E+00	0.0000	0.000E+00	0.0000	2.630E-01	0.09
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.669E-01	0.1697	0.000E+00	0.0000	0.000E+00	0.0000	5.328E-01	0.19
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.339E+00	0.8499	0.000E+00	0.0000	0.000E+00	0.0000	2.752E+00	1.00

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	1.267E-01	1.263E-01	1.255E-01	1.227E-01	1.162E-01	9.231E-02	4.903E-02	4.152E-02
U-234	Th-230	1.000E+00	0.000E+00	2.493E-06	7.435E-06	2.449E-05	7.118E-05	2.131E-04	4.808E-04	7.467E-04
U-234	Ra-226	1.000E+00	0.000E+00	2.884E-09	2.583E-08	2.830E-07	2.449E-06	2.378E-05	1.477E-04	6.409E-04
U-234	Pb-210	1.000E+00	0.000E+00	5.746E-11	1.279E-09	4.142E-08	9.160E-07	1.964E-05	1.776E-04	1.146E-03
U-234	ΣDSR(j)		1.267E-01	1.263E-01	1.256E-01	1.228E-01	1.163E-01	9.257E-02	4.984E-02	4.406E-02
U-235	U-235	1.000E+00	1.183E-01	1.180E-01	1.172E-01	1.147E-01	1.076E-01	8.627E-02	4.585E-02	3.924E-02
U-235	Pa-231	1.000E+00	0.000E+00	8.739E-05	2.596E-04	8.454E-04	2.280E-03	6.352E-03	1.010E-02	3.270E-02
U-235	Ac-227	1.000E+00	0.000E+00	2.229E-06	1.901E-05	1.888E-04	1.283E-03	6.393E-03	1.646E-02	1.022E-01
U-235	ΣDSR(j)		1.183E-01	1.181E-01	1.175E-01	1.157E-01	1.113E-01	9.902E-02	7.241E-02	1.742E-01
U-238	U-238	1.000E+00	1.148E-01	1.144E-01	1.137E-01	1.112E-01	1.044E-01	8.366E-02	4.446E-02	3.934E-02
U-238	U-234	1.000E+00	0.000E+00	3.596E-07	1.069E-06	3.481E-06	9.800E-06	2.618E-05	4.172E-05	1.199E-04
U-238	Th-230	1.000E+00	0.000E+00	3.546E-12	3.161E-11	3.454E-10	2.980E-09	2.862E-08	1.728E-07	5.778E-07
U-238	Ra-226	1.000E+00	0.000E+00	2.727E-16	7.317E-14	2.666E-12	6.881E-11	2.179E-09	3.801E-08	5.530E-07
U-238	Pb-210	1.000E+00	0.000E+00	4.474E-17	2.817E-15	3.003E-13	2.023E-11	1.516E-09	4.217E-08	1.225E-06
U-238	ΣDSR(j)		1.148E-01	1.144E-01	1.137E-01	1.112E-01	1.044E-01	8.368E-02	4.450E-02	3.946E-02

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 10 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	7.894E+01	7.919E+01	7.969E+01	8.147E+01	8.675E+01	1.080E+02	2.007E+02	2.270E+02
U-235	8.450E+01	8.470E+01	8.510E+01	8.643E+01	8.985E+01	1.010E+02	1.381E+02	5.741E+01
U-238	8.714E+01	8.741E+01	8.797E+01	8.993E+01	9.580E+01	1.195E+02	2.247E+02	2.534E+02

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	4.440E+01	0.000E+00	1.267E-01	7.894E+01	1.267E-01	7.894E+01
U-235	1.510E+00	1.000E+03	1.742E-01	5.741E+01	1.183E-01	8.450E+01
U-238	1.350E+01	0.000E+00	1.148E-01	8.714E+01	1.148E-01	8.714E+01

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	5.624E+00	5.606E+00	5.571E+00	5.449E+00	5.115E+00	4.099E+00	2.177E+00	1.844E+00
U-234	U-238	1.000E+00	0.000E+00	4.854E-06	1.443E-05	4.699E-05	1.323E-04	3.534E-04	5.632E-04	1.619E-03
U-234	ΣDOSE(j):		5.624E+00	5.606E+00	5.571E+00	5.449E+00	5.115E+00	4.099E+00	2.177E+00	1.845E+00
Th-230	U-234	1.000E+00	0.000E+00	1.107E-04	3.301E-04	1.087E-03	3.160E-03	9.461E-03	2.135E-02	3.316E-02
Th-230	U 238	1.000E+00	0.000E+00	4.787E-11	4.267E-10	4.663E-09	4.022E-08	3.864E-07	2.332E-06	7.800E-06
Th-230	ΣDOSE(j):		0.000E+00	1.107E-04	3.301E-04	1.087E-03	3.160E-03	9.461E-03	2.135E-02	3.316E-02
Ra-226	U-234	1.000E+00	0.000E+00	1.280E-07	1.147E-06	1.256E-05	1.087E-04	1.056E-03	6.556E-03	2.846E-02
Ra-226	U-238	1.000E+00	0.000E+00	3.681E-14	9.878E-13	3.599E-11	9.289E-10	2.942E-08	5.131E-07	7.465E-06
Ra-226	ΣDOSE(j):		0.000E+00	1.280E-07	1.147E-06	1.256E-05	1.088E-04	1.056E-03	6.556E-03	2.846E-02
Pb-210	U-234	1.000E+00	0.000E+00	2.551E-09	5.680E-08	1.839E-06	4.067E-05	8.720E-04	7.887E-03	5.087E-02
Pb-210	U-238	1.000E+00	0.000E+00	6.040E-16	3.803E-14	4.054E-12	2.731E-10	2.047E-08	5.692E-07	1.654E-05
Pb-210	ΣDOSE(j):		0.000E+00	2.551E-09	5.680E-08	1.839E-06	4.067E-05	8.720E-04	7.887E-03	5.089E-02
U-235	U-235	1.000E+00	1.787E-01	1.781E-01	1.770E-01	1.731E-01	1.625E-01	1.303E-01	6.923E-02	5.925E-02
Pa-231	U-235	1.000E+00	0.000E+00	1.320E-04	3.920E-04	1.277E-03	3.593E-03	9.592E-03	1.526E-02	4.938E-02
Ac-227	U-235	1.000E+00	0.000E+00	3.366E-06	2.371E-05	2.851E-04	1.937E-03	9.654E-03	2.485E-02	1.544E-01
U-238	U-238	1.000E+00	1.549E+00	1.544E+00	1.535E+00	1.501E+00	1.409E+00	1.129E+00	6.002E-01	5.311E-01

BRF(i) is the branch fraction of the parent nuclide

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	4.440E+01	4.426E+01	4.398E+01	4.302E+01	4.038E+01	3.236E+01	1.719E+01	1.876E+00
U-234	U-238	1.000E+00	0.000E+00	3.815E-05	1.137E-04	3.708E-04	1.044E-03	2.790E-03	4.446E-03	1.620E-03
U-234	ΣS(j):		4.440E+01	4.426E+01	4.398E+01	4.302E+01	4.038E+01	3.236E+01	1.719E+01	1.878E+00
Th-230	U-234	1.000E+00	0.000E+00	3.991E-04	1.193E-03	3.934E-03	1.144E-02	3.424E-02	7.727E-02	1.200E-01
Th-230	U-238	1.000E+00	0.000E+00	1.719E-10	1.541E-09	1.687E-08	1.456E-07	1.399E-06	8.442E-06	2.820E-05
Th-230	ΣS(j):		0.000E+00	3.991E-04	1.193E-03	3.934E-03	1.144E-02	3.424E-02	7.728E-02	1.200E-01
Ra-226	U-234	1.000E+00	0.000E+00	8.641E-08	7.746E-07	8.490E-06	7.349E-05	7.136E-04	4.431E-03	1.589E-02
Ra-226	U-238	1.000E+00	0.000E+00	2.482E-14	6.671E-13	2.422E-11	6.277E-10	1.988E-08	3.468E-07	3.170E-06
Ra-226	ΣS(j):		0.000E+00	8.641E-08	7.746E-07	8.490E-06	7.349E-05	7.137E-04	4.431E-03	1.590E-02
Pb-210	U-234	1.000E+00	0.000E+00	8.884E-10	2.353E-08	8.160E-07	1.842E-05	3.977E-04	3.604E-03	1.484E-02
Pb-210	U-238	1.000E+00	0.000E+00	1.963E-16	1.528E-14	1.781E-12	1.232E-10	9.327E-09	2.600E-07	2.906E-06
Pb-210	ΣS(j):		0.000E+00	8.884E-10	2.353E-08	8.160E-07	1.842E-05	3.977E-04	3.604E-03	1.484E-02
U-235	U-235	1.000E+00	1.510E+00	1.505E+00	1.496E+00	1.463E+00	1.373E+00	1.101E+00	5.850E-01	6.399E-02
Pa-231	U-235	1.000E+00	0.000E+00	3.186E-05	9.494E-05	3.095E-04	8.715E-04	2.227E-03	3.701E-03	1.340E-03
Ac-227	U-235	1.000E+00	0.000E+00	5.008E-07	4.373E-06	4.378E-05	2.981E-04	1.487E-03	2.932E-03	1.136E-03
U-238	U-238	1.000E+00	1.350E+01	1.346E+01	1.337E+01	1.308E+01	1.228E+01	9.841E+00	5.230E+00	5.721E-01

BRF(i) is the branch fraction of the parent nuclide.

118945

OFFICIAL RECORD COPY ML 10

SNM-23

TEXAS INSTRUMENTS INCORPORATED

Attleboro, Massachusetts

Supplemental Surveys of Building Interiors Overhead Structures and Upper Walls

NRC License/Docket No: SNM-23/70-33

Version 1.0

Prepared by:

CPS Environmental, Inc.

February, 1997

118945

FEB 21 1997

OFFICIAL RECORD COPY

TEXAS INSTRUMENTS INCORPORATED

Attleboro, Massachusetts

Supplemental Surveys of Building Interiors
Overhead Structures and Upper Walls

NRC License/Docket No: SNM-23/70-33

Version 1.0

Prepared by:

CPS Environmental, Inc.

February, 1997

FEB 21

Supplemental Surveys of Building Interiors
Overhead Structures and Upper Walls

SNM-23/Docket 70-33 **February, 1997**

1.0 Introduction

Texas Instruments Incorporated (TI) completed a supplemental radiological survey of the building interiors on the Attleboro, Massachusetts site. These surveys were conducted in accordance with the *Supplement to the 1992 Remediation Plan* (December, 1994). These building interior surveys included buildings known to have previously housed nuclear activities, including areas that were previously decommissioned. The survey results presented in this report are limited to overhead structures and upper wall surfaces. While floor and lower wall surveys were conducted as part of the Supplemental Radiological Survey Program, these surveys are not included as part of this report since comprehensive surveys of the floors and lower walls were conducted during "In-Process" surveys and Final Status surveys (see Section 1.2) when full grid cell access was provided. Figure 1 depicts the classification of each building or area within a building as Affected, Unaffected or Previously Decommissioned.

1.1 Purpose

This report provides survey results and information for the walls and overhead structures of defined affected and unaffected building interiors obtained during the conduct of supplemental surveys.

1.2 Scope

These surveys were conducted in accordance with the *Supplement to the 1992 Remediation Plan* (December, 1994), *Appendix A: Supplemental Radiological Survey Plan in Support of the Supplement to the 1992 Remediation Plan*. These plans incorporate the design basis methods established within NUREG/CR-5849 except as noted within the plan.

The surveys to be conducted as detailed within the *Supplemental Radiological Survey Plan* included: 1) Supplemental Surveys, 2) In-Process Surveys, and 3) Final Status Surveys. This document provides information only as it relates to the supplemental surveys of overhead structures and upper walls. In-Process Surveys refer to surveys conducted during the remediation process to further define the limits of decontamination activities. Where the In-Process Surveys also served as termination surveys, they are reported along with the Final Status Surveys within a separate report entitled *Remediation of Building Interiors - Buildings 4, 5 and 10* (WESTON, October 1996).

The supplemental surveys for building interiors provide the basis for determining which areas required remediation.

1.3 Background

The TI site in Attleboro, Massachusetts had been involved in various activities in the processing of uranium materials which have been extensively documented in previous reports including: *1992 Remediation Plan, Supplement to the 1992 Remediation Plan, 1994*, and *Supplemental Radiological Survey Plan in Support of the Supplement to the 1992 Remediation Plan, 1994.*

The conduct of these supplemental surveys encompassed a period from October, 1994 through February, 1995. The processing of uranium materials had ceased long before these supplemental surveys were conducted.

2.0 Supplemental Survey Methods

In accordance with the *Supplemental Radiological Survey Plan in Support of the Supplement to the 1992 Remediation Plan*, surveys for removable contamination were performed for overhead structures and upper walls. These "swipe" surveys, for removable contamination, were performed on horizontal and vertical surfaces in which material could collect.

The removable contamination "swipe" density was to be a nominal density of 5 per 100 square meters. For any areas (grid areas) exhibiting activity in excess of 25% of the criteria (see section 2.1) an increased sampling pattern was to be initiated.

2.1 Release Guidelines

The applicable survey criteria are defined in Appendix E of *the Supplement to the Remediation Plan, 1994*. Specifically, surface contamination limits are 1,000 disintegrations per minute (dpm)/100 square centimeters (cm^2) (removable), 5,000 dpm/100 cm^2 (total), and 15,000 dpm/100 cm^2 (maximum).

2.2 Instrumentation

Surface contamination "swipes" were analyzed using a Ludlum Model 43-10-1 Alpha/Beta Tray Counter coupled to a Ludlum Model 2929 Dual Channel Scaler for gross alpha and beta measurements. Surface scans and static measurements were performed using Ludlum Model 44-9 GM Pancake detectors coupled to Ludlum Model 3 Rate Meters.

Determination of the minimum detection criteria for these systems was based on guidelines established within NUREG/CR-5849. The characteristics of the systems are detailed within the following documents: *The Supplemental Radiological Survey Plan, The Supplement to the 1992 Remediation Plan*, and additional correspondence with the Nuclear Regulatory Commission (Letter to Mr. Mark Roberts, NRC from Michael Elliott, TI, dated June 6, 1995).

3.0 Survey Areas and Results

As described within the *Supplemental Radiological Survey Plan in Support of the Supplement to the 1992 Remediation Plan*, areas requiring survey are defined as either unaffected or affected. Each building investigated was classified as described in the 1994 Supplement Plan.

3.1 Building 10

Within Building 10 three primary survey areas were established based on previous decommissioning reports for this building (TI, 1982). These areas are the High Flux Isotope Reactor (HFIR) area, the UnClad Manufacturing Area (UMA) and the Clad Manufacturing Area (CMA). The HFIR, UMA and CMA incorporate 16, 13, and 98 10-meter by 10-meter grids respectively (Appendix A-1). Two additional areas included in the survey of Building 10 were: the "Lab Wing or R&D Labs" on the North East portion of the building and the High Bay Area on the southernmost portion of the building. These two areas are not depicted in the grid map within Appendix A-1.

These five areas have been defined as previously decommissioned areas and were initially treated as unaffected areas. Shortly after initiating the supplemental survey program fixed contamination was identified on floor surfaces within the HFIR area and the UMA area. At this point these areas were redefined as affected areas and surveyed accordingly. Additionally, the scope of the CMA floor survey was expanded to include 100% of the accessible areas.

Overhead and upper wall surveys were conducted in all accessible grids within the HFIR and UMA areas. In addition, overhead and upper wall surveys were conducted within accessible, randomly selected CMA grids.

The grids included in the upper wall and overhead surveys were as follows: 11 of 16 grids in HFIR, 4 of 13 in the UMA, and 18 of the 30 random grids within the CMA. In addition, the High Bay Area was surveyed as a separate survey unit (see detailed survey map Appendix A-2).

All of these surveys indicated removable contamination levels less than the criteria (1000 dpm/100 cm^2); however, two grid areas identified as HFIR-11 and HFIR-12 had removable contamination at approximately 25% of the criteria. As a result, more detailed swipe surveys of overhead structures within these grids were performed (see Appendix A-3 for survey results). All survey results, including the more detailed surveys, yielded results less than the established criteria.

The results of all overhead swipe surveys are included as a table within Appendix A-3. The results of the upper wall surveys are included as a table within Appendix A-4

3.2 Building 11

Within Building 11 one small area was defined as an affected area. This area, the Alleged Former Wastewater Processing Area, encompassed 16 10-meter by 10-meter grids in the center of the building. For the remaining portion of the building (unaffected) 30 randomly selected wall areas were surveyed for removable contamination (Appendix B-1).

For all swipe measurements performed in Building 11 no activity in excess of the defined criteria (1000 dpm/100 cm^2) was identified. Results of these surveys are included as a Table within Appendix B-2.

3.3 Building 3

Within Building 3 two small areas were defined as affected: Building 3 Rolling Mill (center of the building) and Building 3 Tumbling (southwest corner of the building). Overhead surveys were conducted in the area defined as the Building 3 Rolling Mill (grid #1). For the remaining portion of the building (unaffected) 30 randomly selected grid walls were surveyed for removable contamination. The grid system used for Building 3 is shown in Appendix C-1.

For all swipe measurements performed in Building 3 no activity in excess of the defined criteria (1000 dpm/100 cm^2) were identified. Results of the overhead "swipe" measurements and upper wall measurements are included as tables within Appendix C-3 and C-4 respectively.

3.4 Building 4

Within Building 4 the survey focused on the areas identified as Building 4 Bay D, Building 4 Bay K, and Building 4 Bay L. This entire area was defined as an unaffected area for purposes of the supplemental survey. Thirty randomly selected 10-meter by

All of these surveys indicated removable contamination levels less than the criteria (1000 dpm/100 cm^2); however, two grid areas identified as HFIR-11 and HFIR-12 had removable contamination at approximately 25% of the criteria. As a result, more detailed swipe surveys of overhead structures within these grids were performed (see Appendix A-3 for survey results). All survey results, including the more detailed surveys, yielded results less than the established criteria.

The results of all overhead swipe surveys are included as a table within Appendix A-3. The results of the upper wall surveys are included as a table within Appendix A-4

3.2 Building 11

Within Building 11 one small area was defined as an affected area. This area, the Alleged Former Wastewater Processing Area, encompassed 16 10-meter by 10-meter grids in the center of the building. For the remaining portion of the building (unaffected) 30 randomly selected wall areas were surveyed for removable contamination (Appendix B-1).

For all swipe measurements performed in Building 11 no activity in excess of the defined criteria (1000 dpm/100 cm^2) was identified. Results of these surveys are included as a Table within Appendix B-2.

3.3 Building 3

Within Building 3 two small areas were defined as affected: Building 3 Rolling Mill (center of the building) and Building 3 Tumbling (southwest corner of the building). Overhead surveys were conducted in the area defined as the Building 3 Rolling Mill (grid #1). For the remaining portion of the building (unaffected) 30 randomly selected grid walls were surveyed for removable contamination. The grid system used for Building 3 is shown in Appendix C-1.

For all swipe measurements performed in Building 3 no activity in excess of the defined criteria (1000 dpm/100 cm^2) were identified. Results of the overhead "swipe" measurements and upper wall measurements are included as tables within Appendix C-3 and C-4 respectively.

3.4 Building 4

Within Building 4 the survey focused on the areas identified as Building 4 Bay D, Building 4 Bay K, and Building 4 Bay L. This entire area was defined as an unaffected area for purposes of the supplemental survey. Thirty randomly selected 10-meter by

10-meter grids were surveyed and, where accessible, overhead and upper wall surveys were conducted (15 overhead and 5 upper wall surveys). The grid system for Building 4 is shown within Appendix C-2.

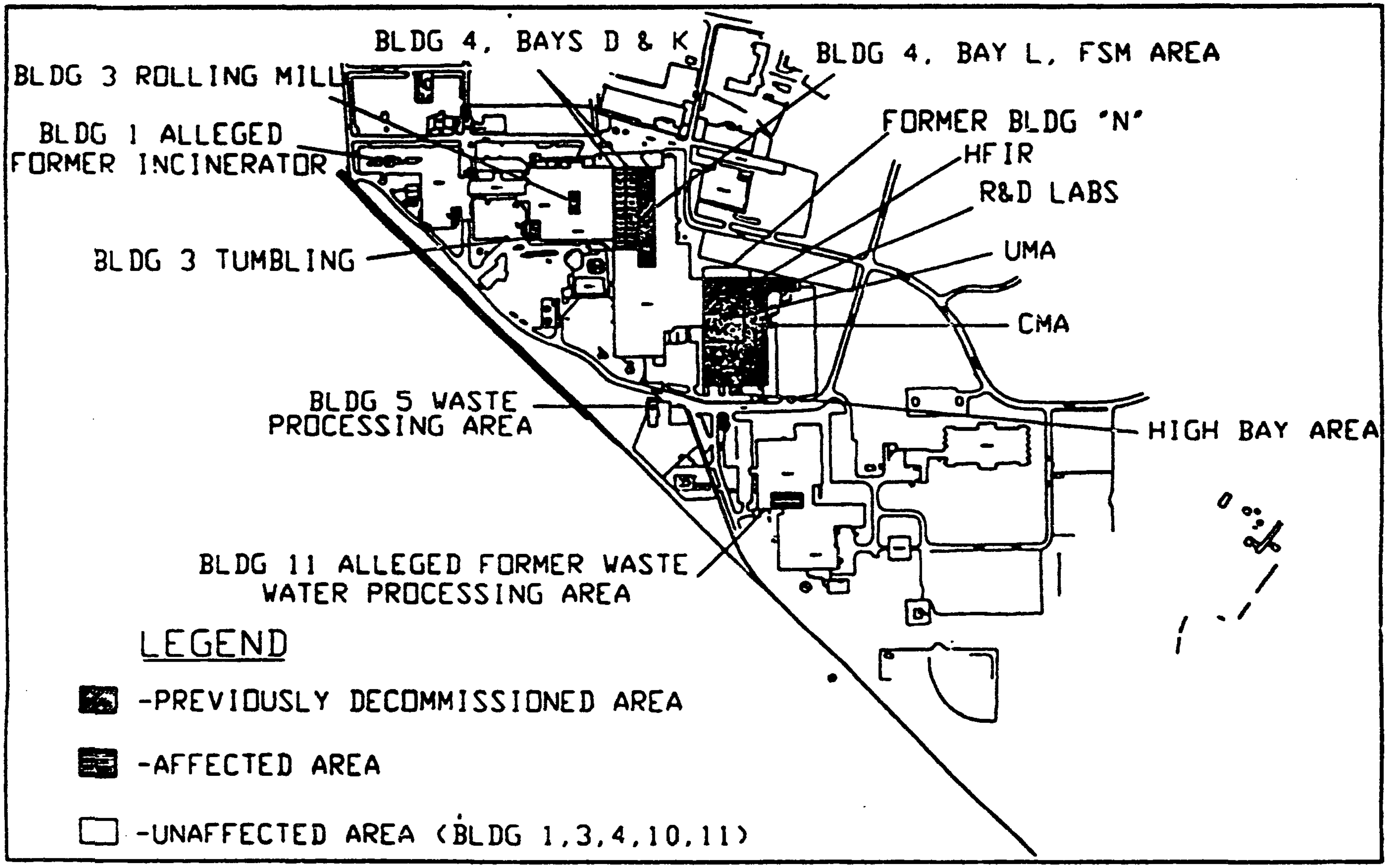
For all survey measurements performed in Building 4 no activity in excess of the defined criteria (1000 dpm/100 cm^2) was identified. Results of the overhead "swipe" measurements and upper wall measurements are included as tables within Appendix C-3 and C-4 respectively.

4.0 Conclusions

Areas were surveyed in accordance with the *Supplemental Radiological Survey Plan*. Within the upper wall and overhead structure surveys, no activity was identified to be in excess of the applicable limits.

Figure 1

Map of Building Areas Depicting Affected, Unaffected, and Previously Decommissioned Areas



Appendix A

Building 10 Upper Wall and Overhead Surveys

Appendix A

Building 10 Upper Wall and Overhead Surveys

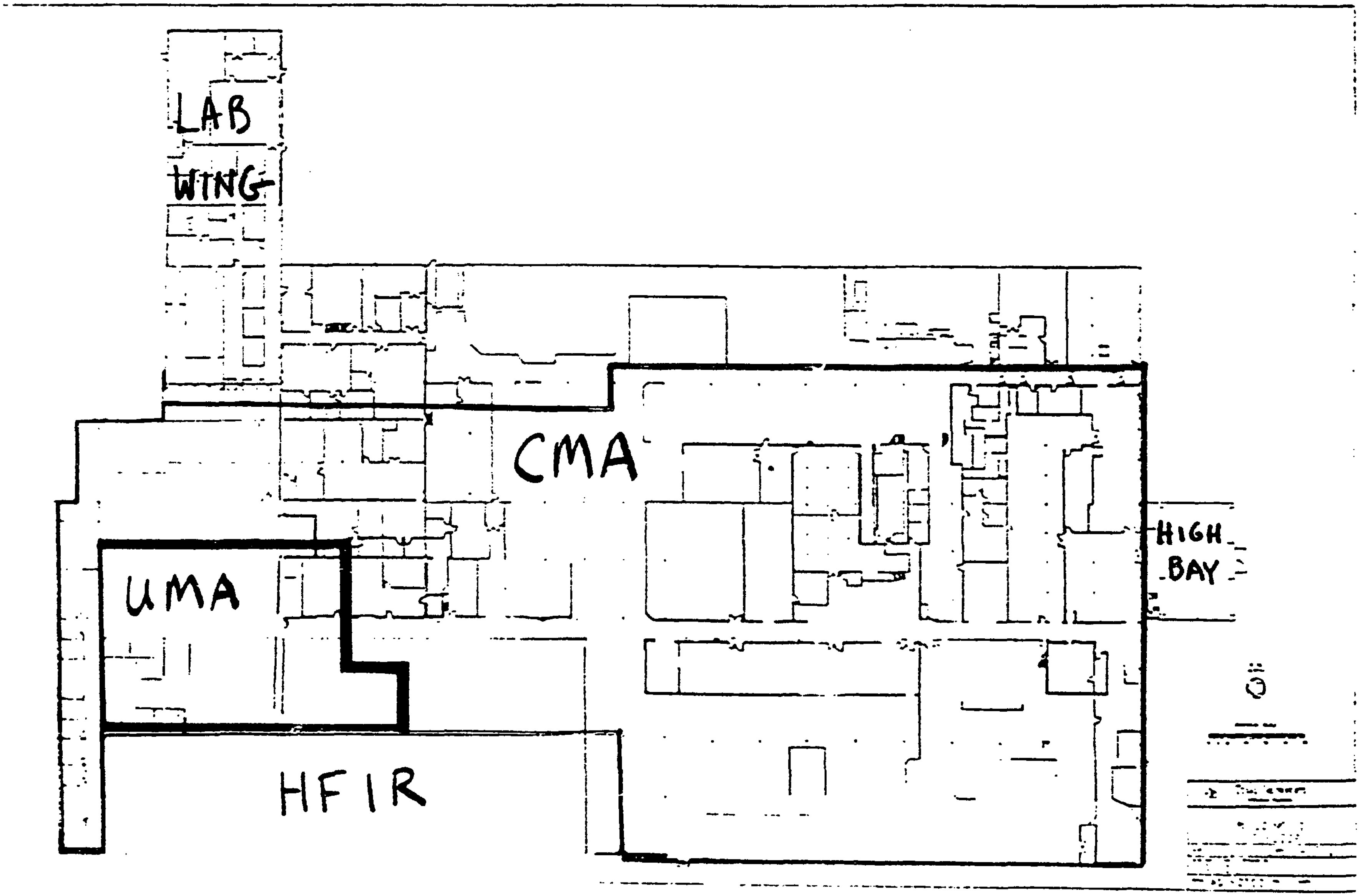
Appendix A-1

Building 10 Survey Maps

Appendix A-1-1

Building 10 Area Classifications

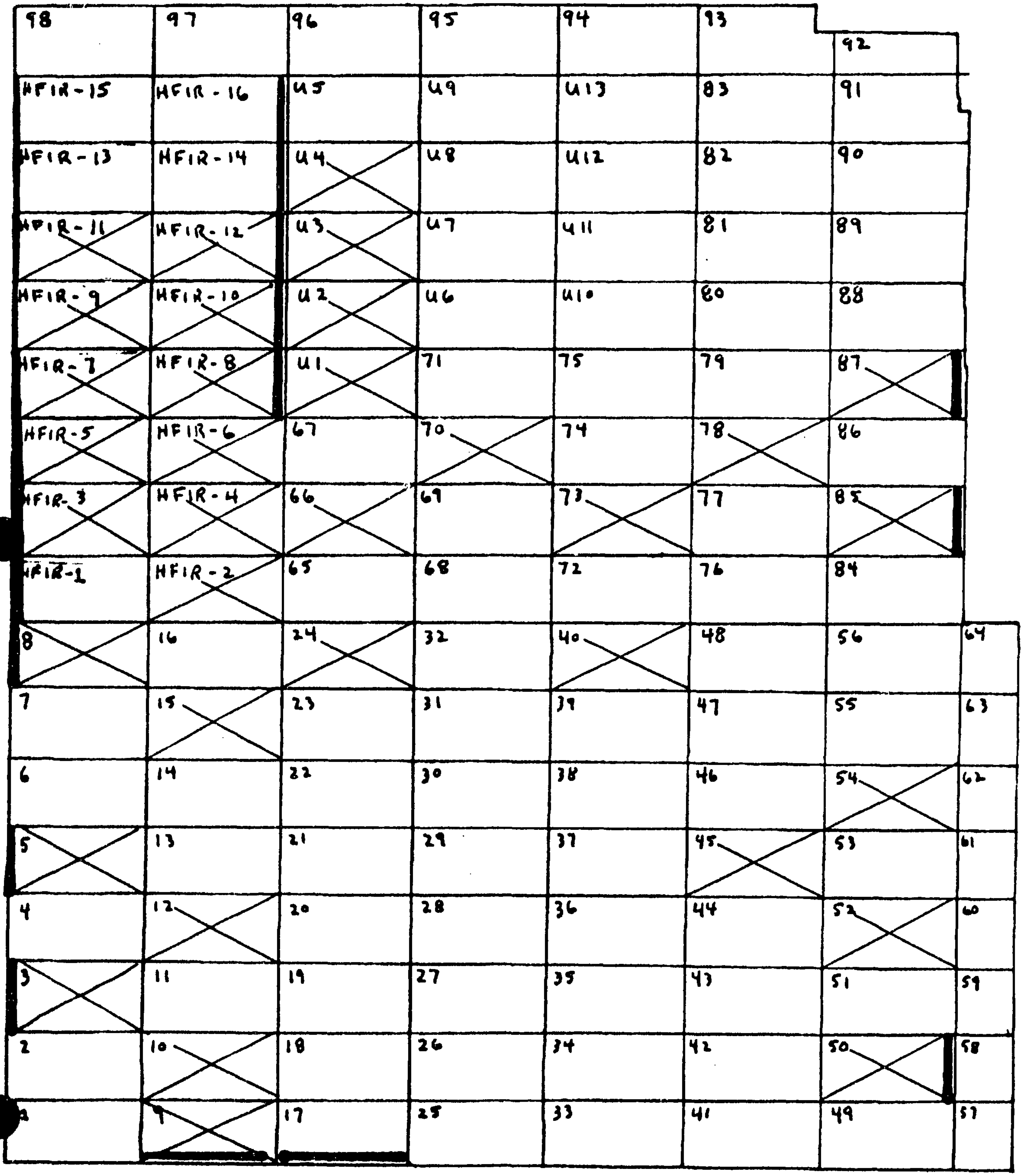
Appendix A-1-1: Building 10 Area Classifications



Appendix A-1-2

Grid Map and Survey Locations of CMA, UMA, and HFIR areas within Building 10

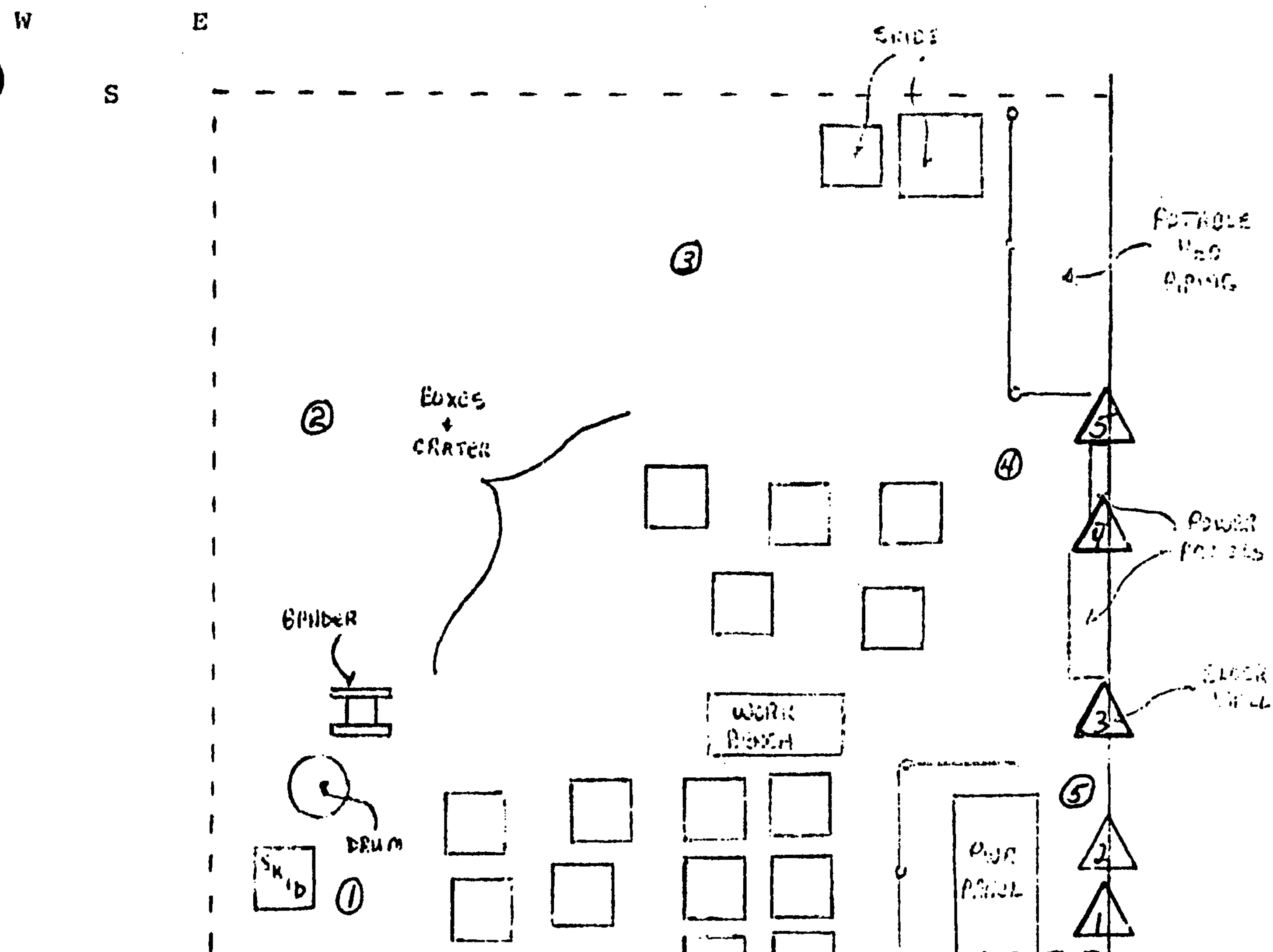
Appendix A-1-2: Grid Map and Survey Locations of CMA, UMA, and HFIR areas within Building 10



Appendix A-1-3

Individual Grid Detailed Floor Survey Maps for Areas where Overhead and Upper Wall Surveys were Conducted

BUILDING # 10
TEXAS INSTRUMENTS



△ Denotes wall smear
(All smears are < 10 ncpm)

DIRECT FRISK RESULTS

LOCATION	N/A
TECH #1	J. HALEY
TECH #2	M. HURTON
METER/PROBE SERIAL NUMBER	
#1)	115404 / N/A
#2)	115507 / N/A

BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 80 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2: 80 cpm

SMEAR SURVEY RESULTS

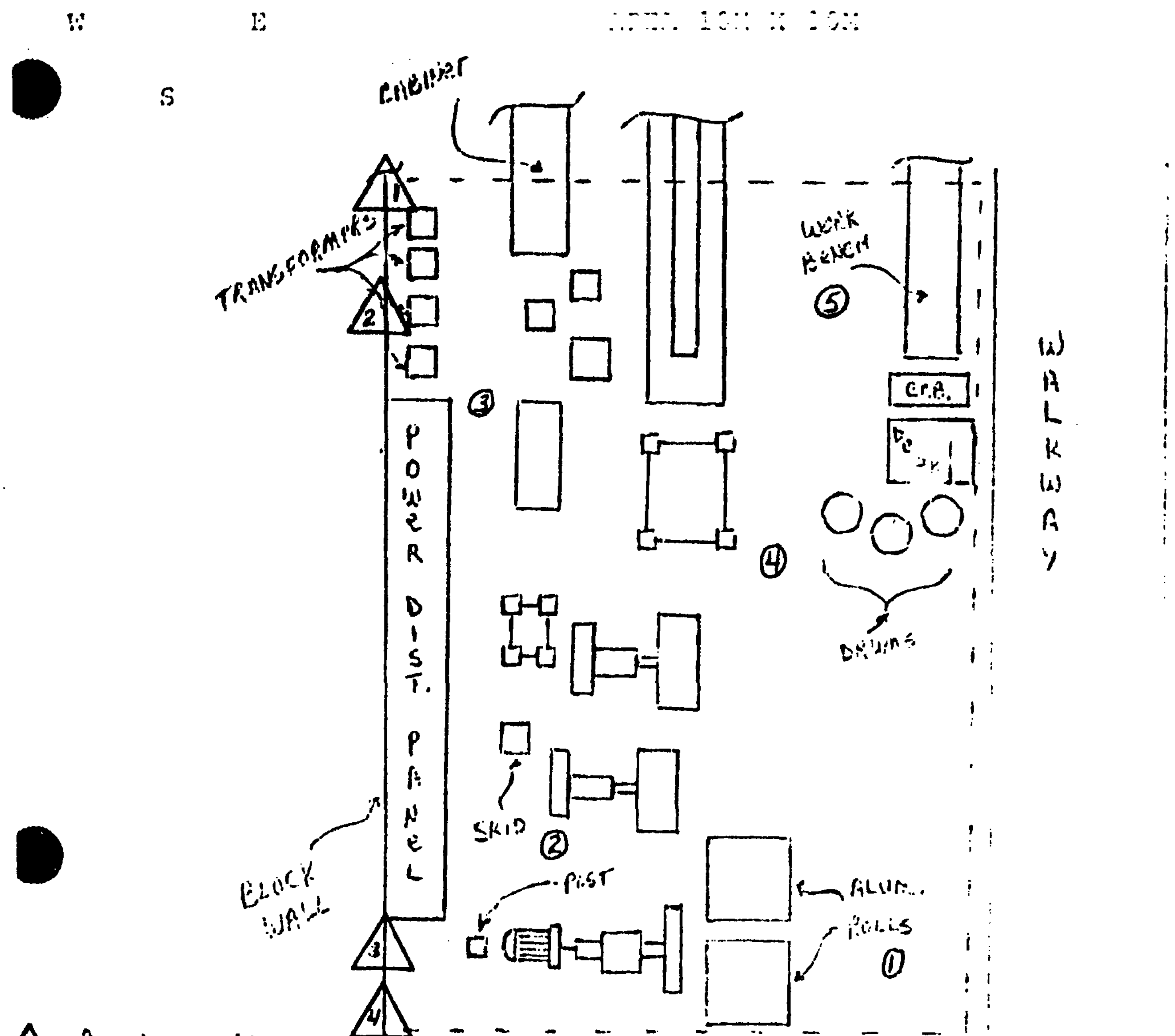
METER	SCALER
SERIAL #	111577
COUNT TIME	1 min.
BACKGROUND	0α 70 βγ

10-12-94

SMEAR #	RESULTS (CPM)	
1	0 α	52 βγ
2	2 α	54 βγ
3	0 α	70 βγ
4	2 α	60 βγ
5	0 α	58 βγ

direct frisks of walls < bkg

AREA 10M X 10M



△ denotes wall smears

smears < 10 ncpm)

DIRECT FRISK RESULTS

LOCATION N/A

TECH #1 J. HALEY

TECH #2 N/A

METER/PROBE

SERIAL NUMBER

#1) 110948 / N/A

#2) N/A / N/A

BATTERY CHECK: #1 OK #2 N/A

BACKGROUND: #1 60 cpm #2

OF SOURCE CHECK: #1 32K #2

AVERAGE READING FOR GRID (CPM):

TECH #1: 80 cpm TECH #2:

SMEAR SURVEY RESULTS

METER SCALER

SERIAL # 111577

COUNT TIME 1 MIN.

BACKGROUND 0 α 70 $\beta\gamma$

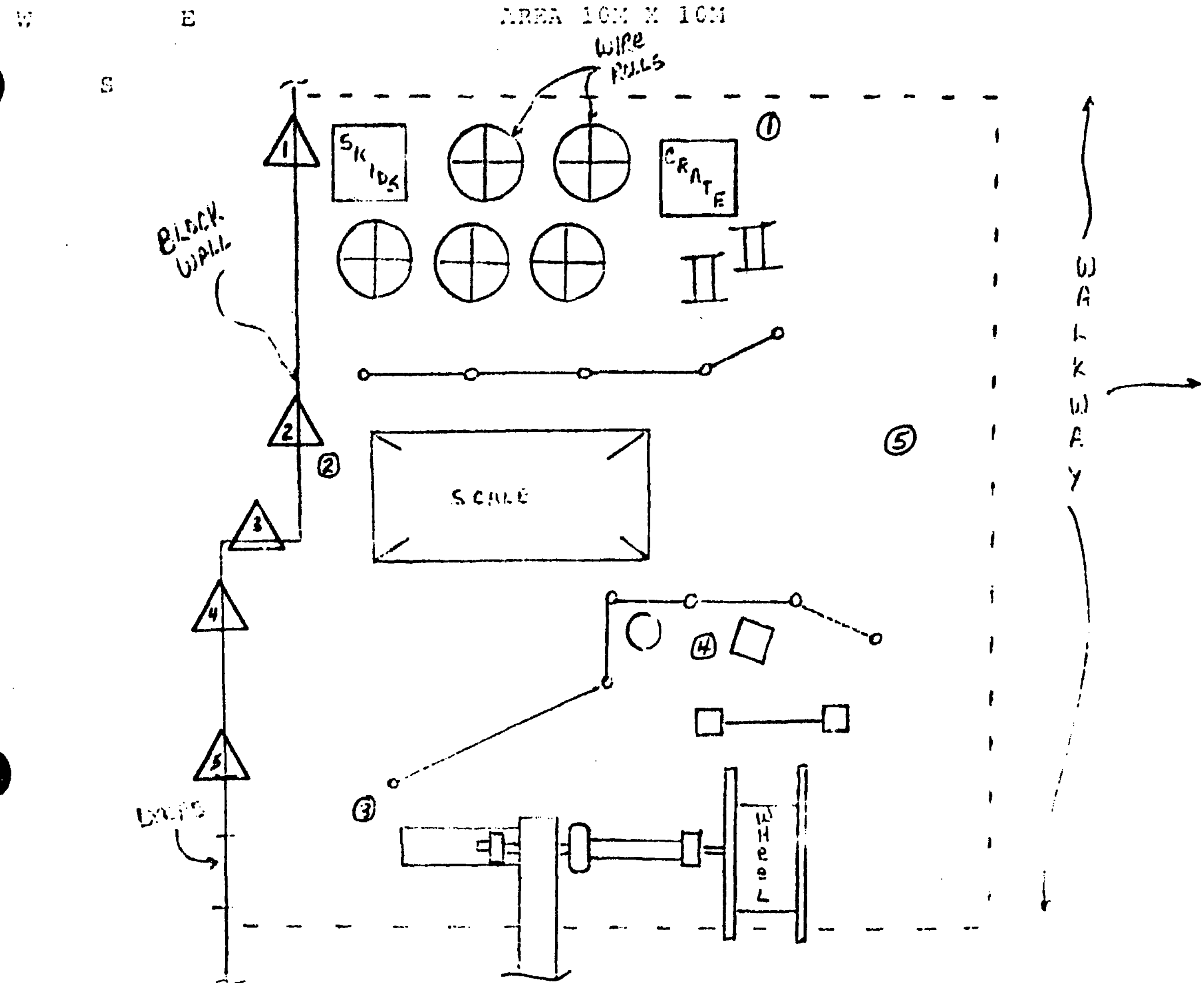
10-12-94

SMEAR #		RESULTS (CPM)
1	0 α	46 $\beta\gamma$
2	0 α	48 $\beta\gamma$
3	0 α	56 $\beta\gamma$
4	0 α	65 $\beta\gamma$
5	0 α	73 $\beta\gamma$

Direct frisks of walls < bkg

TEXAS INSTRUMENTS

AREA 10M X 10M



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 J. HECKMAN
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 80cpm / #2
CS SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2:

SMEAR SURVEY RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 70βγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	0 α	65 βγ
2	0 α	48 βγ
3	0 α	68 βγ
4	0 α	58 βγ
5	1 α	54 βγ

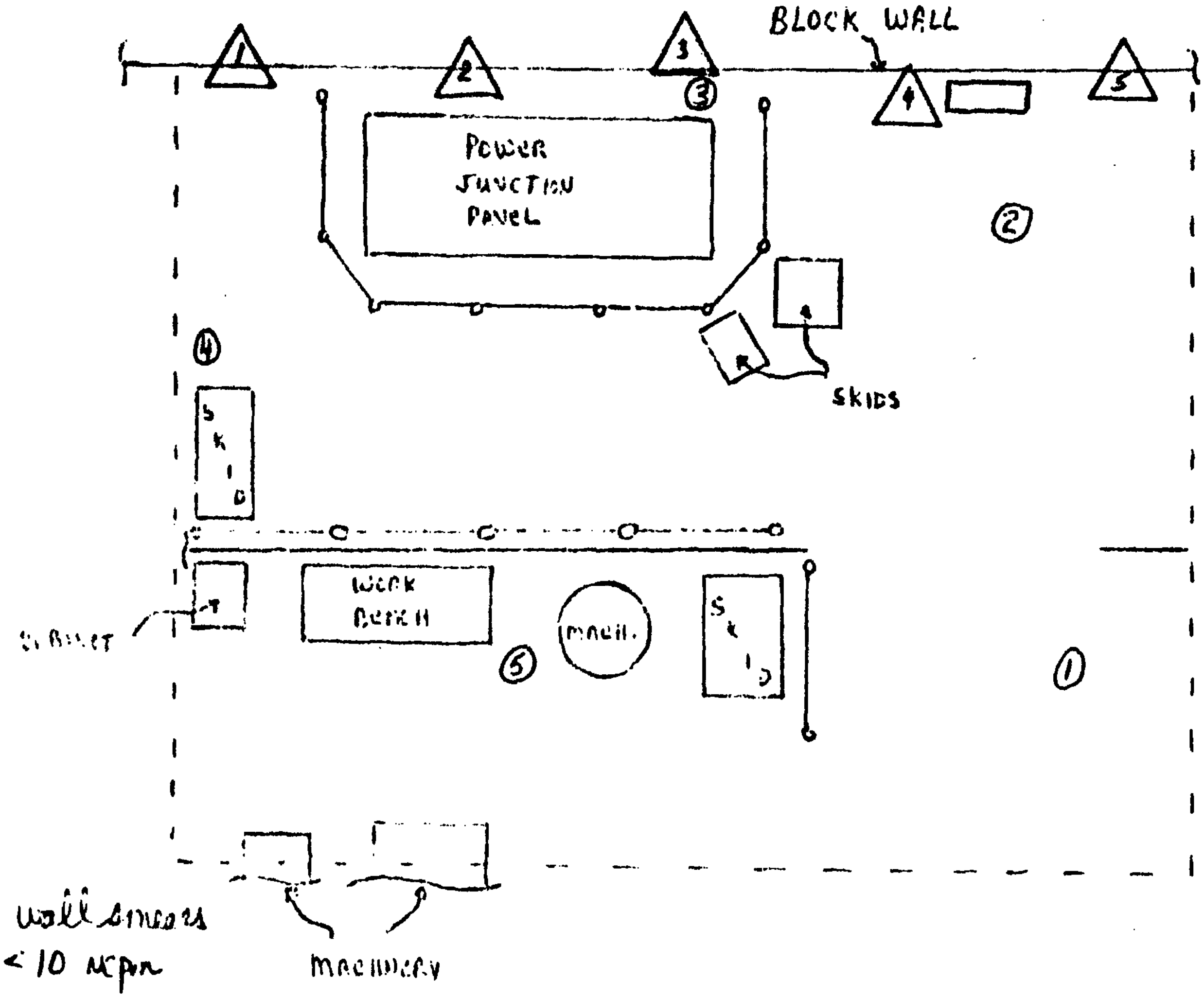
△ denotes wall smears
all smears < 10 ncpm
Direct frisks of wall < 10 ncpm

TEXAS INSTRUMENTS

W E

AREA 10M X 10M

S



△ denotes wall smears
All smears < 10 ncpm

LOCATION N/A
TECH #1 MIKE HYRTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

BACKGROUND/SAFETY CHECKS
SAFETY CHECK: #1 OK #2 N/A
BACKGROUND: #1 60 cpm #2
GE SOURCE CHECK: #1 3CK #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 70βγ
10-12-94

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	0 α	52 βγ
2	2 α	54 βγ
3	1 α	59 βγ
4	1 α	41 βγ
5	0 α	60 βγ

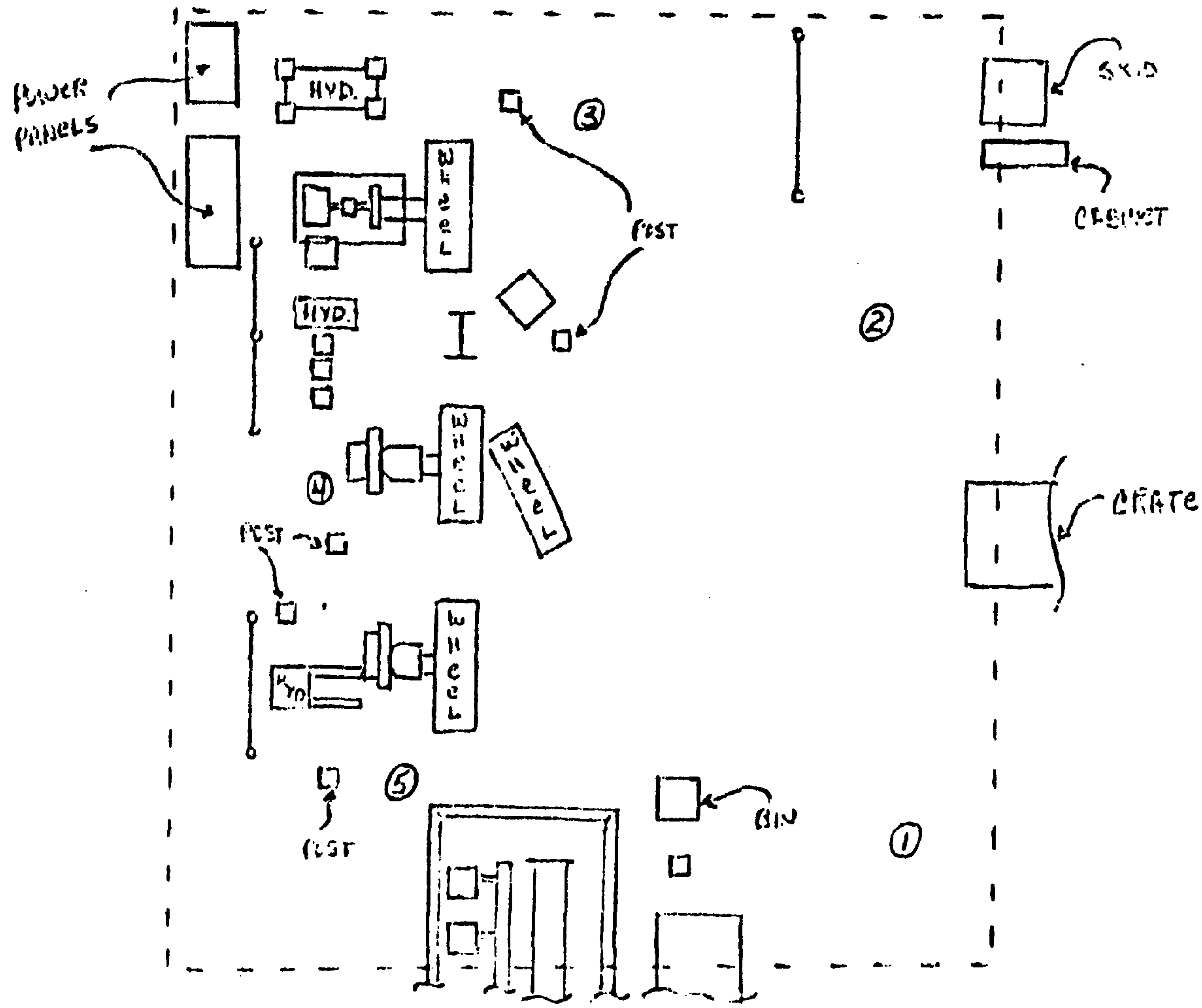
Dust friks of walls < 10 ncpm

TEXAS INSTRUMENTS

W E

AREA 10M X 10M

S



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 M. HURTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm / #2
QC SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

[illegible] RESULTS

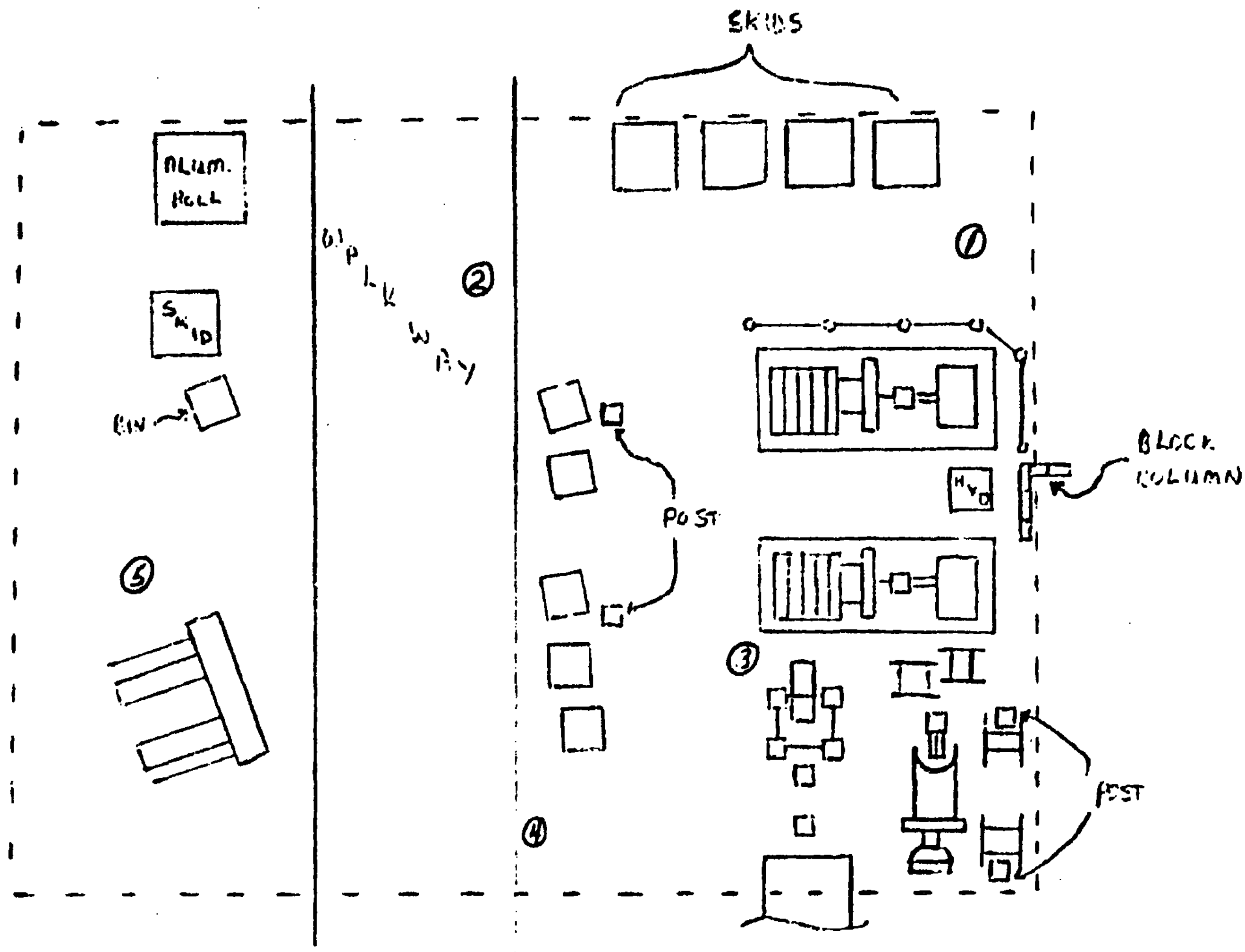
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0α 70βγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	1 α	63 βγ
2	0 α	55 βγ
3	0 α	58 βγ
4	0 α	57 βγ
5	0 α	45 βγ

TEXAS INSTRUMENTS

W E AREA 10M X 10M

S



[illegible] RESULTS

LOCATION N/A
TECH #1 J. HALEY
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

BATTERY CHECK: #1 OK #2 N/A
BACKGROUND: #1 80 cpm #2
QC SOURCE CHECK: #1 30K #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2:

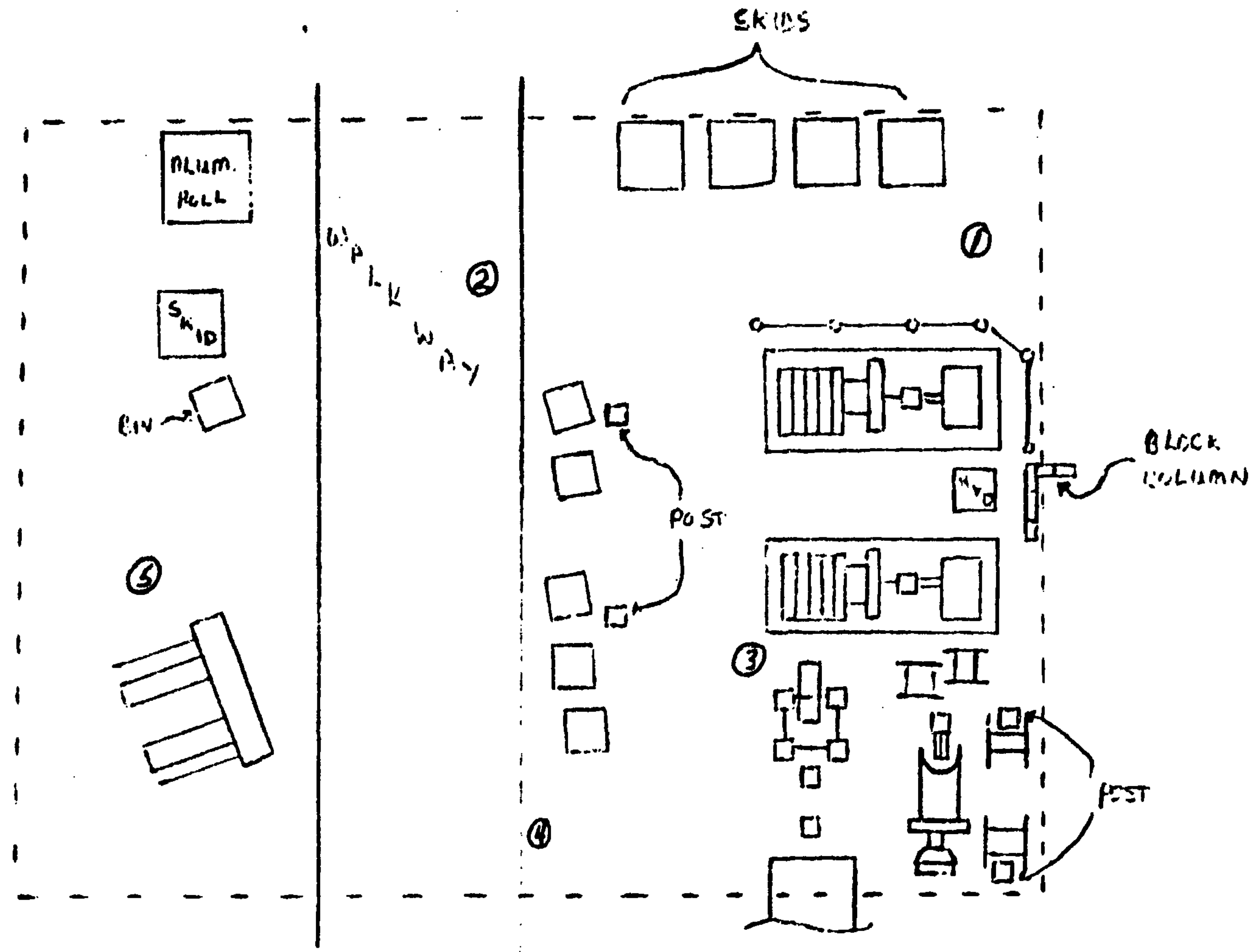
SMEAR SURVEY RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α 70 βγ
10-12-94

SMEAR #		RESULTS (CPM)
1	0 α	49 βγ
2	0 α	61 βγ
3	1 α	51 βγ
4	0 α	56 βγ
5	0 α	57 βγ

W E AREA 10M X 10M

S



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 J. HALEY
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

BATTERY CHECK: #1 OK /#2 N/A
BACKGROUND: #1 80 cpm /#2
CC SOURCE CHECK: #1 30K /#2
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2:

SMEAR SURVEY RESULTS

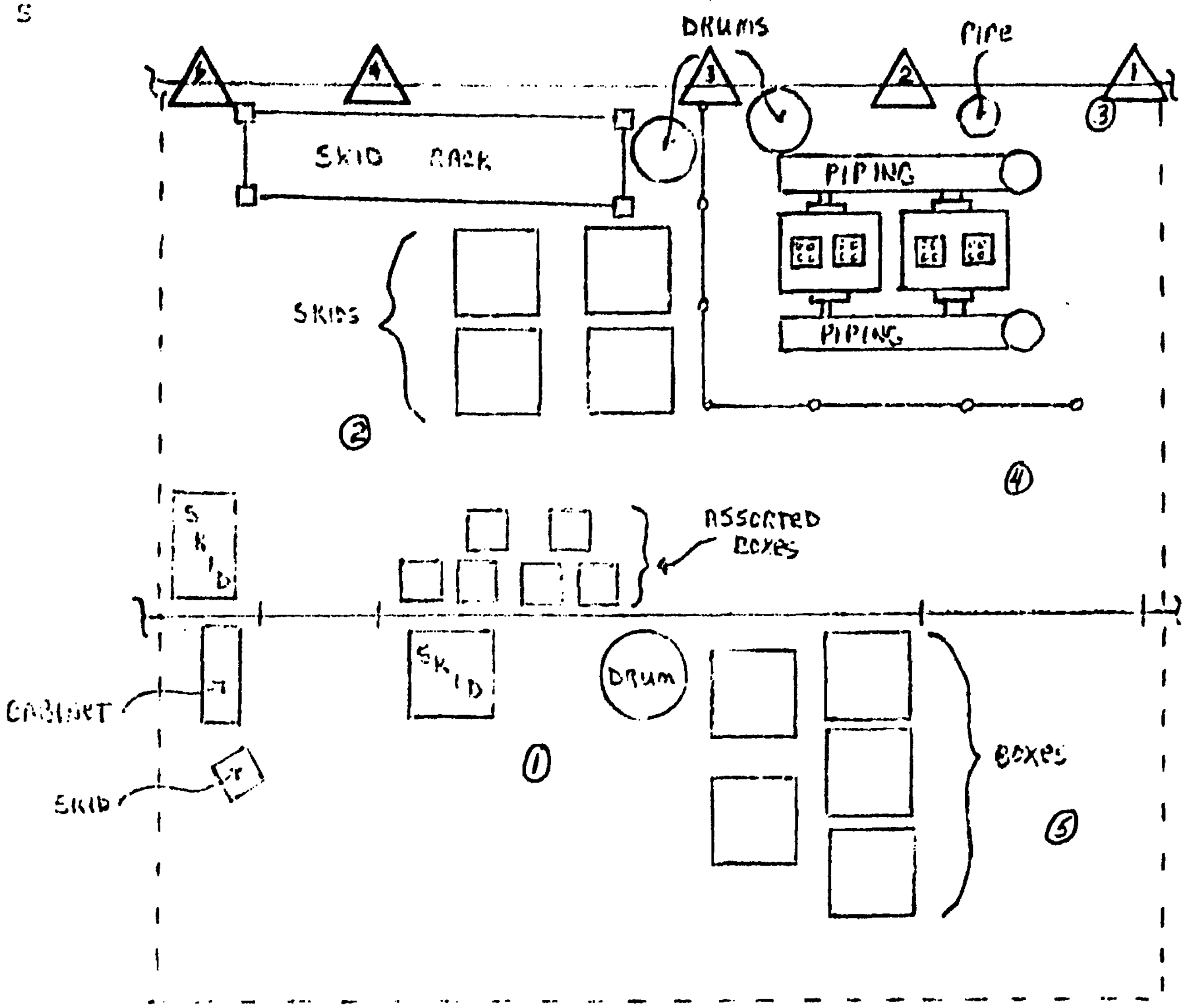
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α 7c βγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	0 α	49 βγ
2	0 α	61 βγ
3	1 α	51 βγ
4	0 α	36 βγ
5	0 α	57 βγ

TEXAS INSTRUMENTS

W E S

AREA 10M X 10M



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 J. Heckman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115414 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm / #2
SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR SAMPLE RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α 70 βγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	1 α	54 βγ
2	1 α	66 βγ
3	4 α	75 βγ
4	0 α	56 βγ
5	0 α	60 βγ

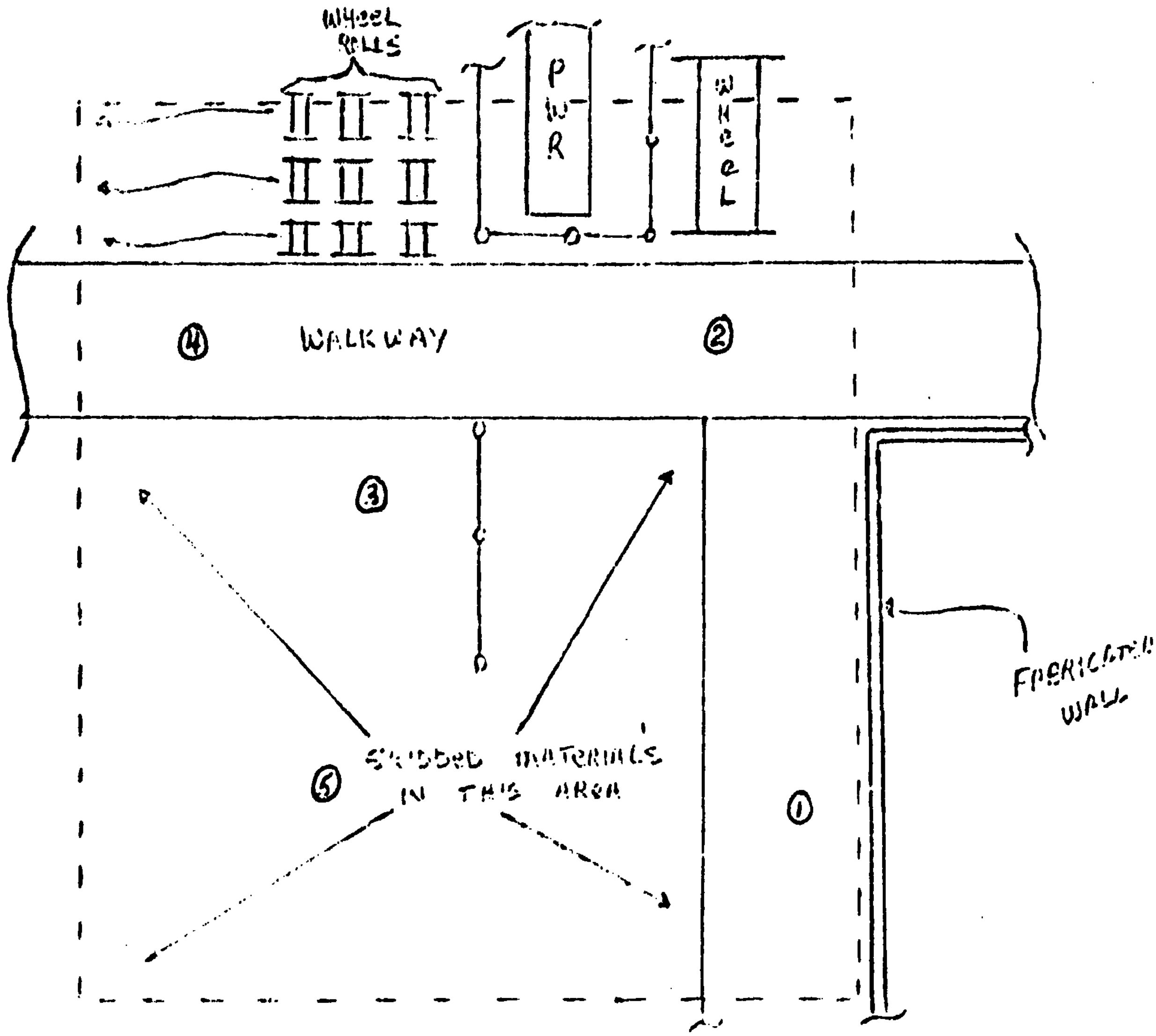
△ denotes wall smears
all smears < 10 ncpm
direct fricks of walls < 10 ncpm

TEXAS INSTRUMENTS

W E

AREA 10M X 10M

S



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 J. Heckman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm / #2
QC SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

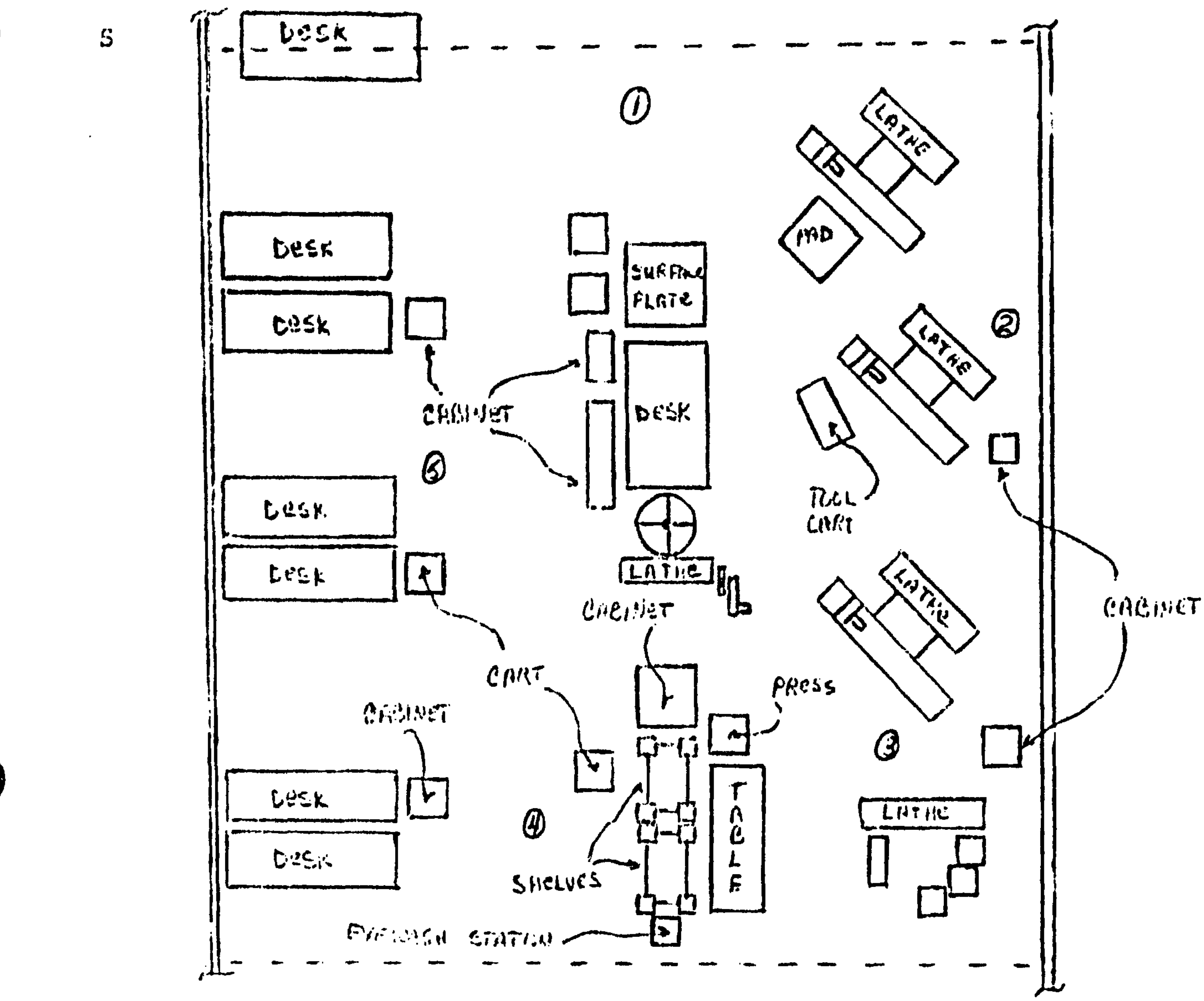
SMEAR SURVEY RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 70 Bγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	0 α	61 Bγ
2	1 α	47 Bγ
3	1 α	61 Bγ
4	0 α	63 Bγ
5	1 α	54 Bγ

TEXAS INSTRUMENTS

AREA 10M X 10M



DIRECT FRISK RESULTS

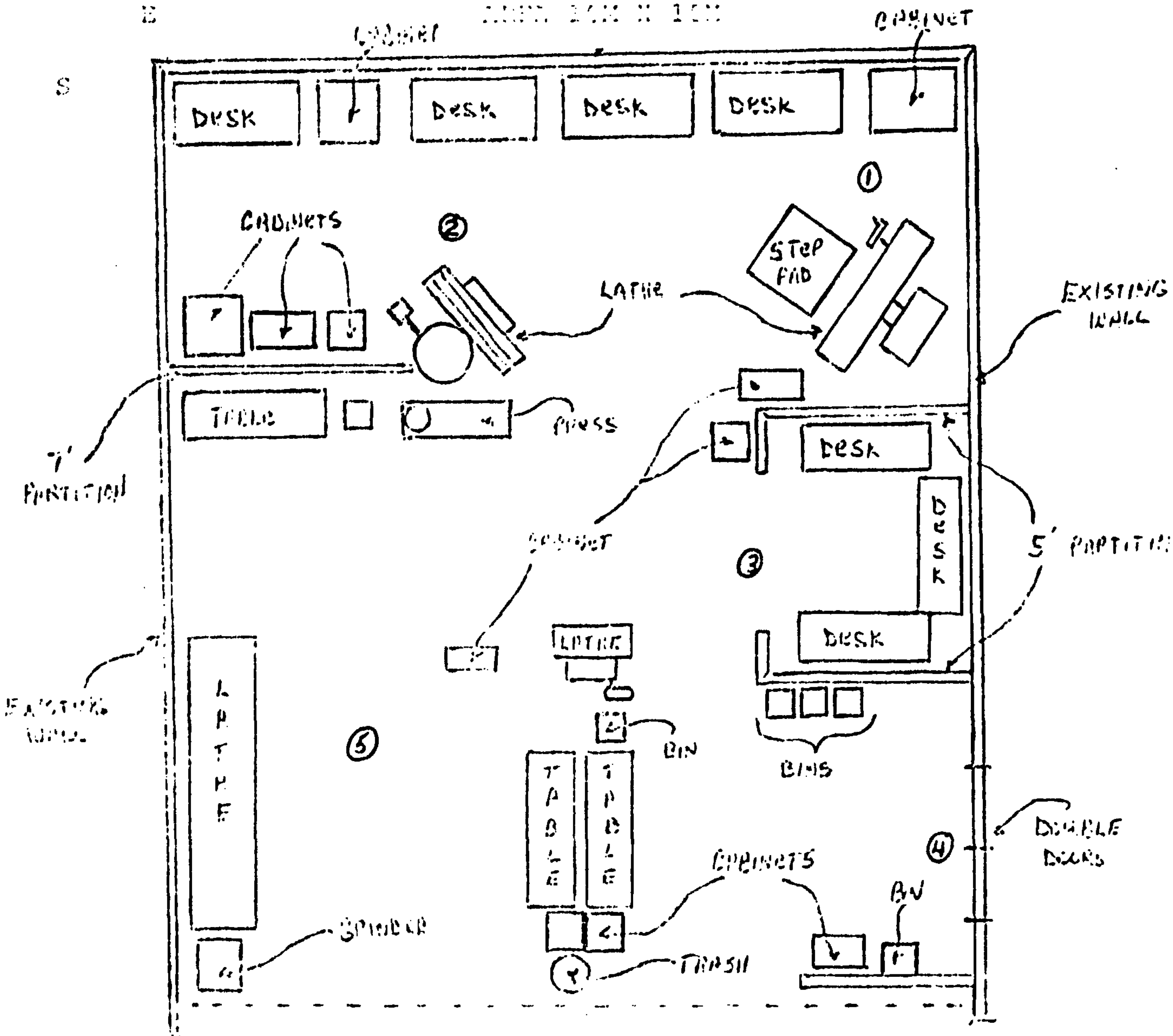
LOCATION N/A	BATTERY CHECK: #1 OK #2 N/A
TECH #1 M HURTON	BACKGROUND: #1 60 cpm #2
TECH #2 N/A	CS SOURCE CHECK: #1 30K #2
METER/PROBE	AVERAGE READING FOR GRID (CPM):
SERIAL NUMBER	TECH #1: 80 cpm TECH #2:
#1) 110948 / N/A	
#2) N/A /	

SMEAR SURVEY RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 70Bγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	0 α	51 Bγ
2	1 α	44 Bγ
3	0 α	57 Bγ
4	0 α	56 Bγ
5	0 α	55 Bγ

TEXAS INSTRUMENTS



LOCATION: N/A
TECH #1: J. HALEY
TECH #2: N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

[illegible]: #1 OK #2 N/A
[illegible]: #1 60 cpm #2
[illegible]: 30K #2
[illegible]
TECH #1: 80 cpm TECH #2:

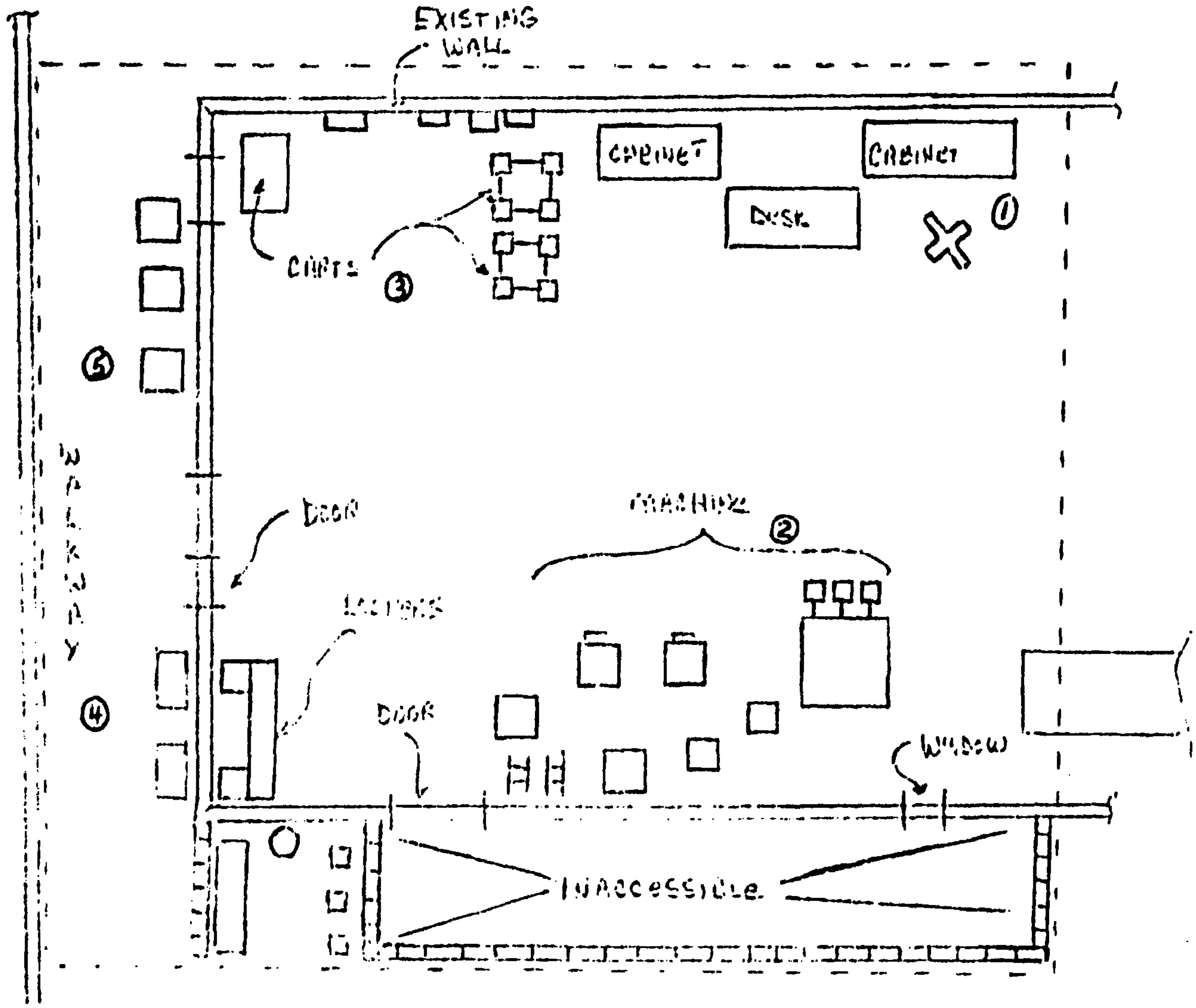
METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0α 70 βγ
10-12-94

[illegible]		[illegible]
1	0 α	49 βγ
2	1 α	64 βγ
3	0 α	49 βγ
4	0 α	58 βγ
5	0 α	58 βγ

[illegible]

W E [illegible]

S



[illegible]

LOCATION N/A
TECH #1 M HURTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 11094B / N/A
#2) N/A /

[illegible]: #1 OK #2 N/A
BACKGROUND: #1 70 cpm #2
[illegible]: #1 32K #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2:

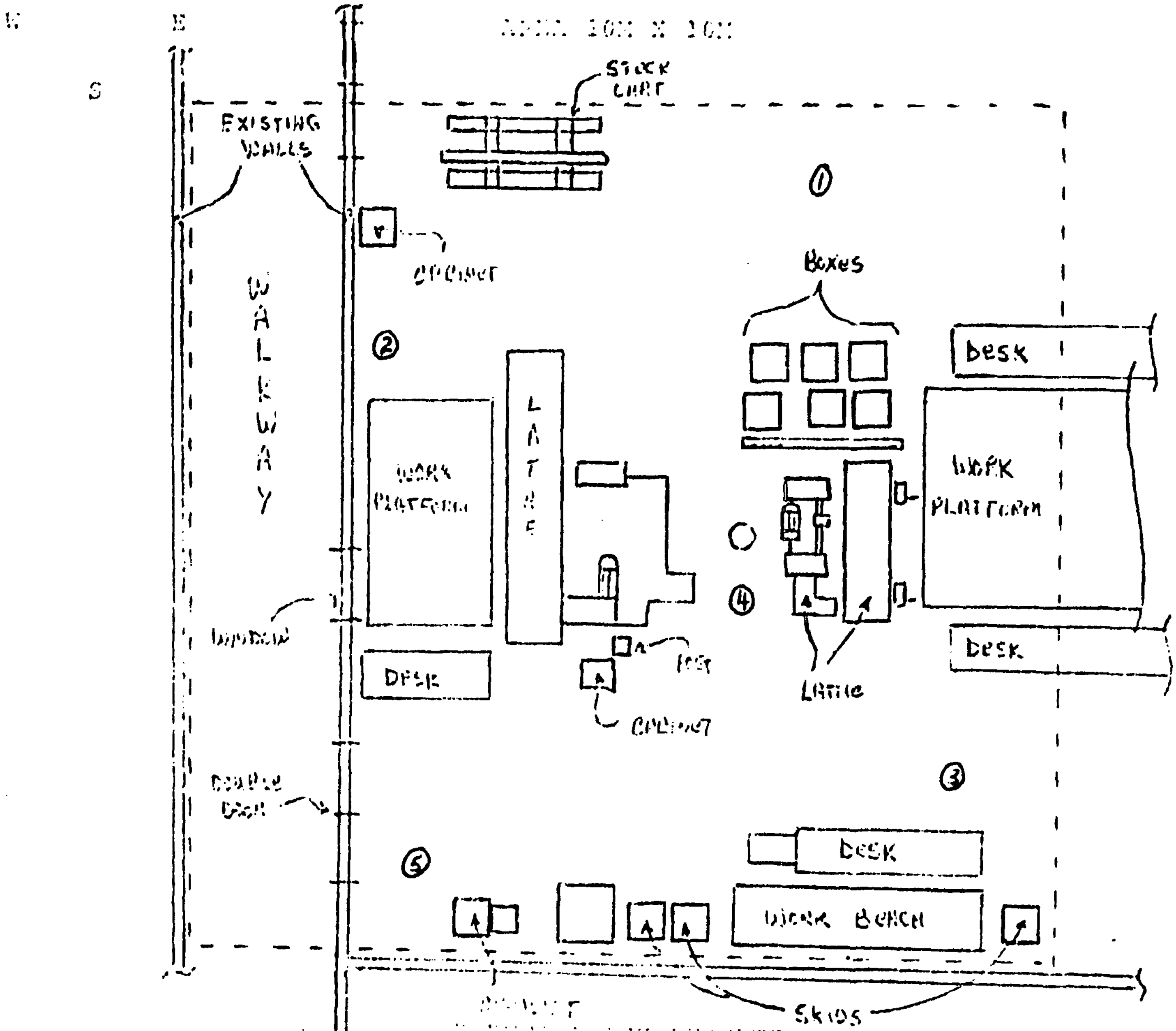
[illegible]

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 70 βγ
10-12-94

SMEAR #		RESULTS (CPM)
1	0 α	60 βγ
2	0 α	59 βγ
3	1 α	51 βγ
4	1 α	67 βγ
5	0 α	50 βγ

TEXAS INSTRUMENTS

AREA 10M X 10M



LOCATION N/A
TECH #1 J. HECKMAN
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / N/A
BACKGROUND: #1 60 cpm /
CS SOURCE CHECK: #1 30K /
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0α + 70 βγ
10-12-94

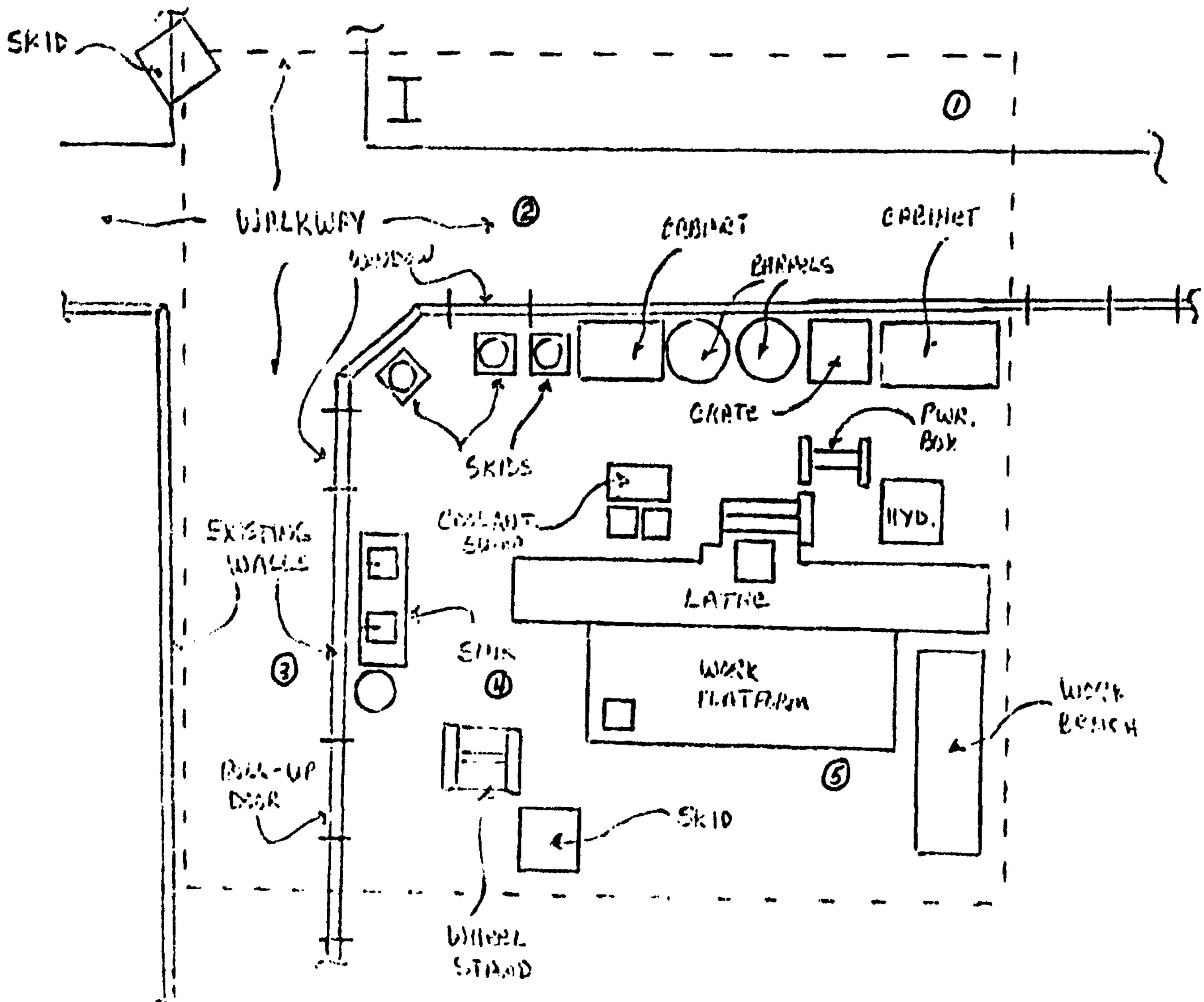
SMEAR #	RESULTS (CPM)	
1	0 α	57 βγ
2	0 α	53 βγ
3	0 α	60 βγ
4	0 α	50 βγ
5	0 α	45 βγ

TEXAS INSTRUMENTS

W E

AREA 10M X 10M

S



METER CHECK DATA

LOCATION N/A
TECH #1 J. Heckman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A /

BATTERY CHECK: #1 OK #2 N/A
BACKGROUND: #1 60 cpm #2
QC SOURCE CHECK: #1 30K #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 90 cpm TECH #2:

SMEAR SAMPLE RESULTS

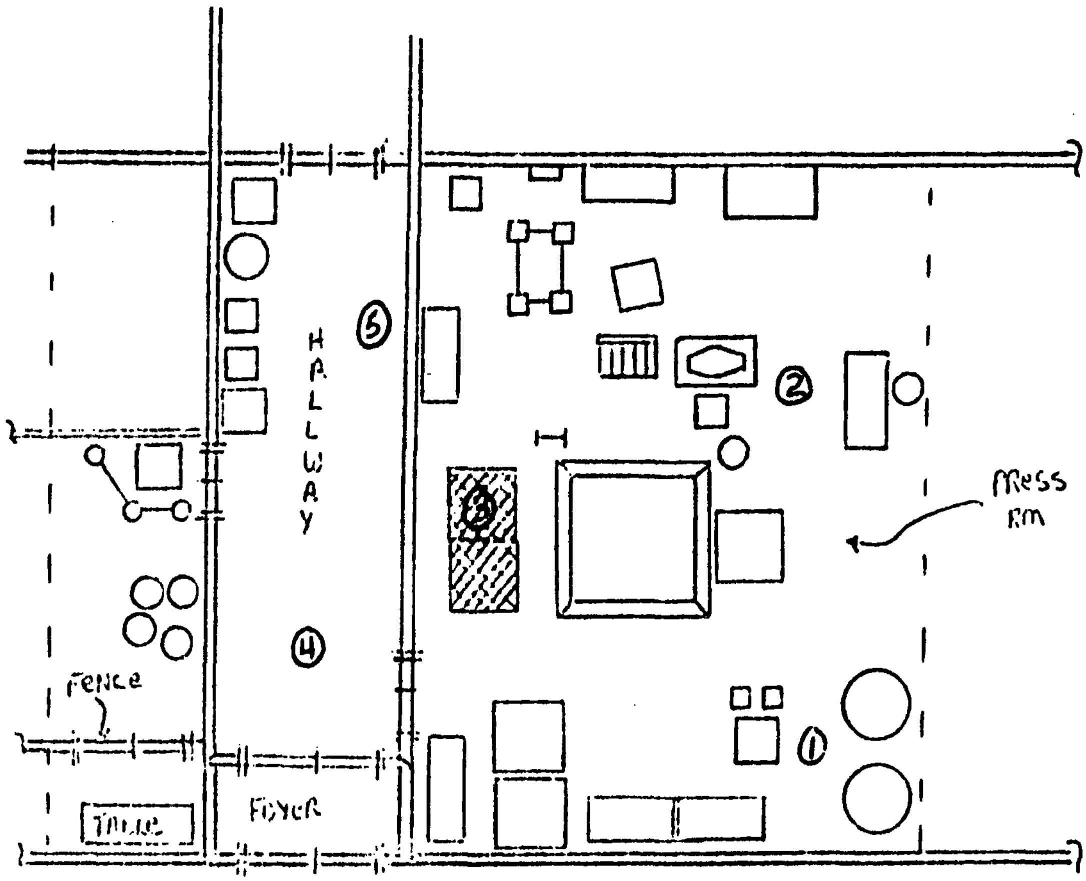
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α + 70 βγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	0 α	59 βγ
2	0 α	65 βγ
3	1 α	66 βγ
4	0 α	54 βγ
5	2 α	52 βγ

TEXAS INSTRUMENTS

W E S

AREA 16M X 16M



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 M HURTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 110948 / N/A
#2) N/A / I

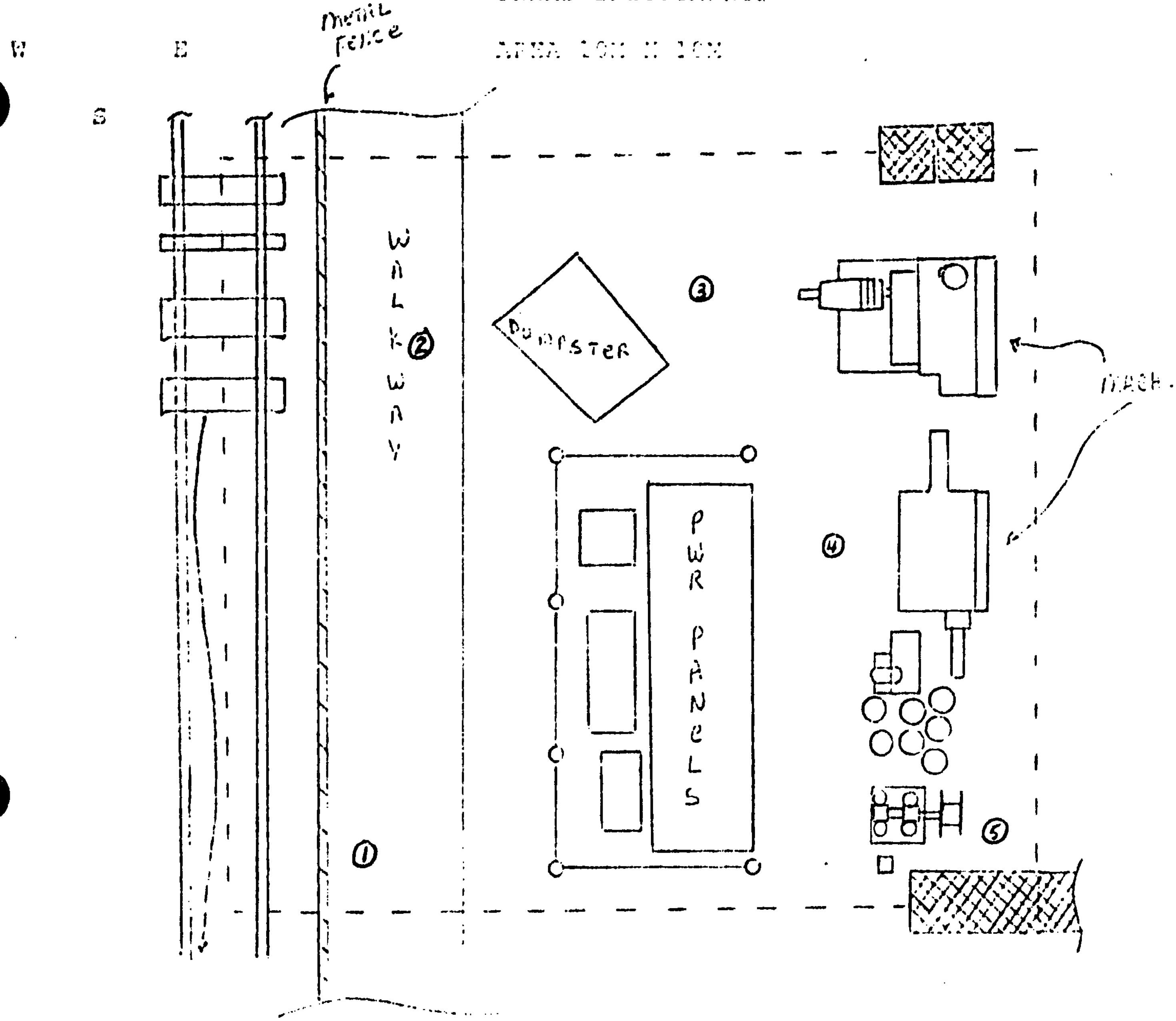
BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 70 cpm / #2
QC SOURCE CHECK: #1 32K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR SURVEY RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0α + 70 βγ
10-12-94

GRID #		RESULTS (CPM)
1	0α	58 βγ
2	1α	80 βγ
3	1α	62 βγ
4	1α	62 βγ
5	1α	57 βγ

TEXAS INSTRUMENTS



FIELD CHECK RESULTS

LOCATION N/A
TECH #1 J. HALEY
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm /#2
Cs SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR SAMPLE RESULTS

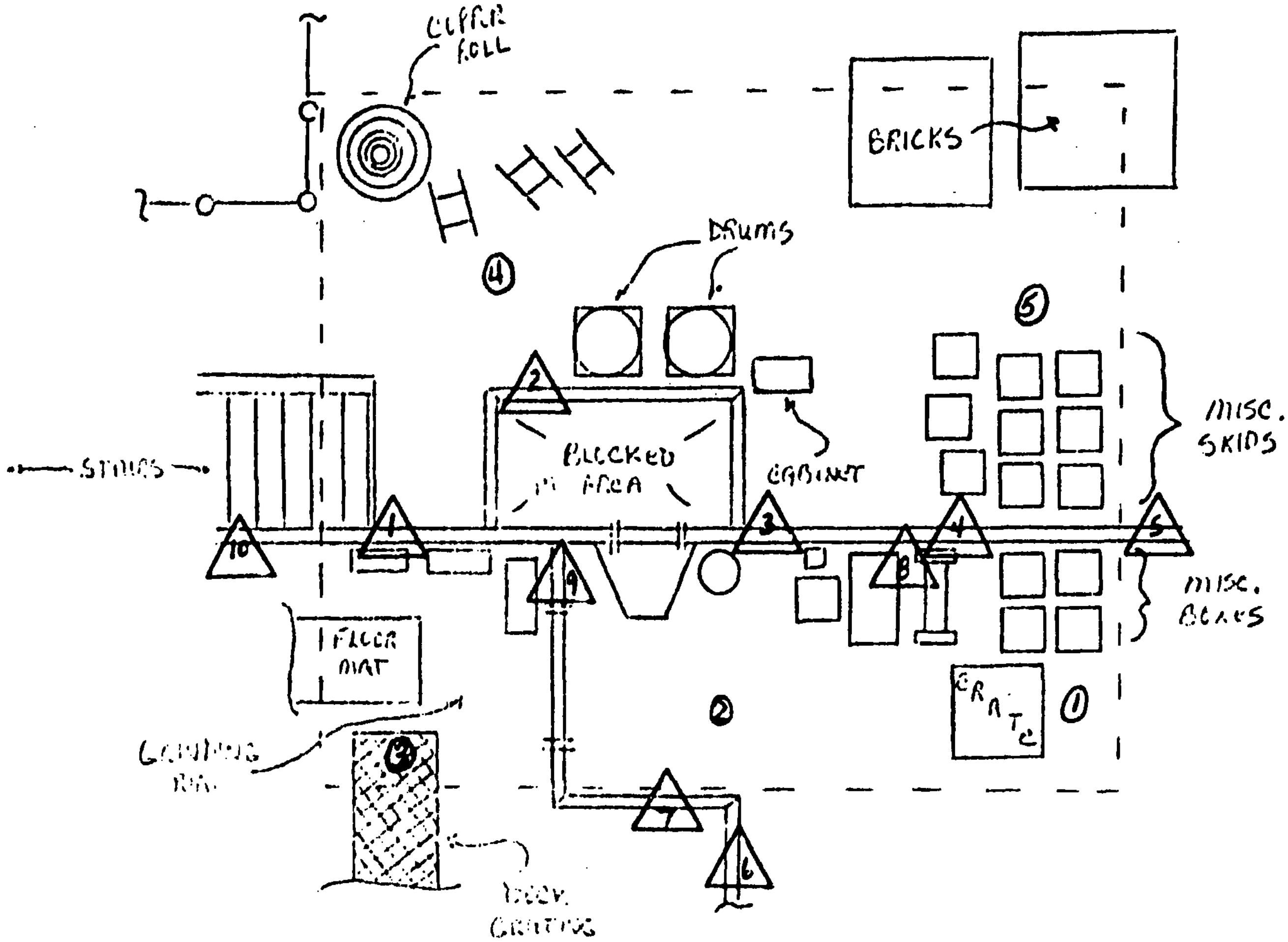
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α + 70 βγ
10-12-94

SMEAR #	RESULTS (CPM)	
1	3 α	54 βγ
2	0 α	55 βγ
3	1 α	59 βγ
4	0 α	58 βγ
5	1 α	60 βγ

TEXAS INSTRUMENTS

W E AREA 10M X 10M

S



[illegible]

LOCATION N/A
TECH #1 J. HECKMAN
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A /

[illegible] CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm / #2
[illegible]: #1 30K / #2
AVERAGE READING FOR [illegible] (CPM):
TECH #1: 80 cpm TECH #2:

[illegible]

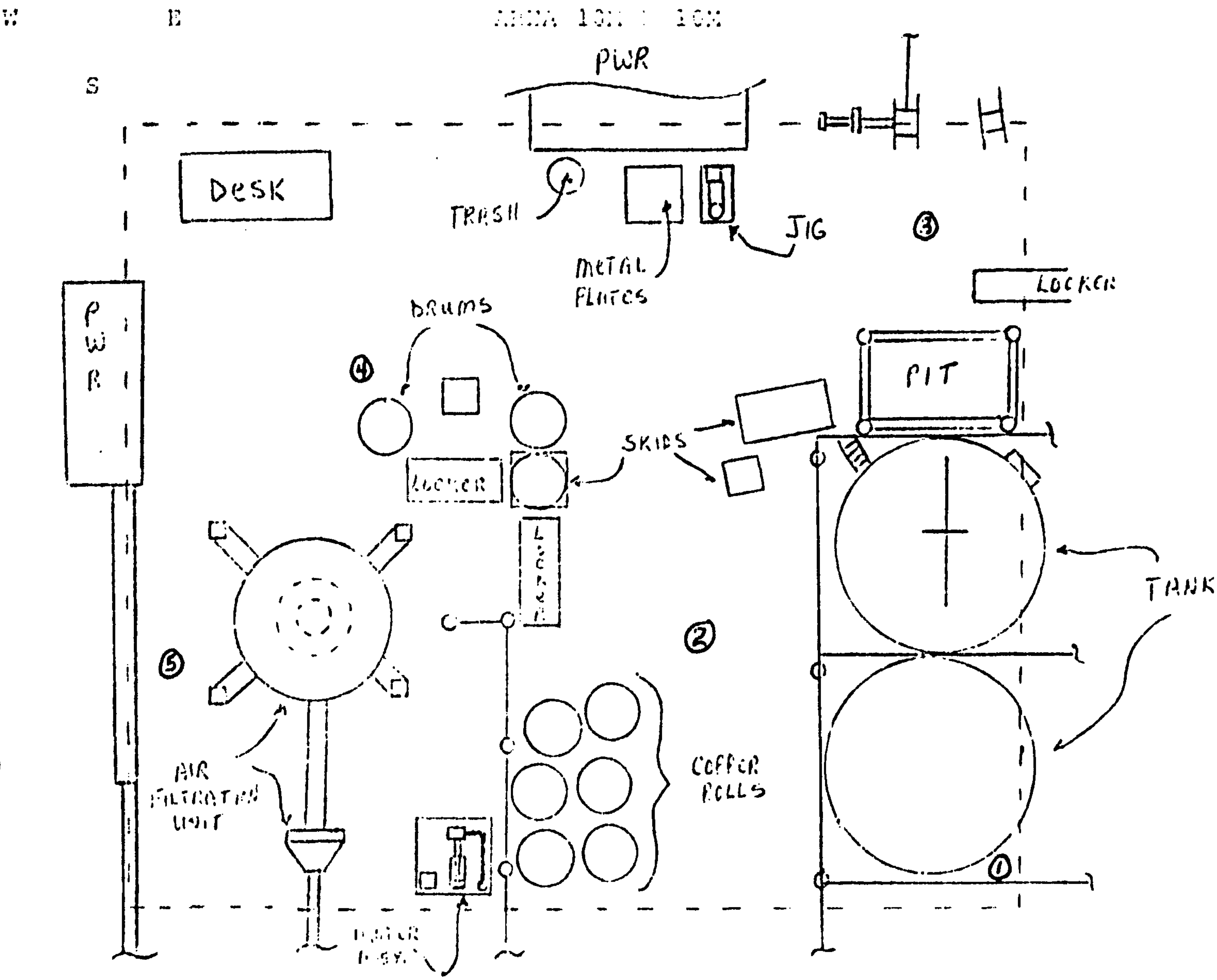
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α + 70 βγ
10-12-94

[illegible]	RESULTS (CPM)	
1	0 α	53 βγ
2	1 α	70 βγ
3	0 α	56 βγ
4	0 α	56 βγ
5	0 α	51 βγ

△ denotes wall smears
all smears < 10 ncpm
direct frisks of walls are < 10 ncpm

TEXAS INSTRUMENTS

AREA 10H / 10M



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 M. HURTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 11D948 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm / 2
QC SOURCE CHECK: #1 32K / 2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR COUNT RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α + 70 βγ
10-12-94

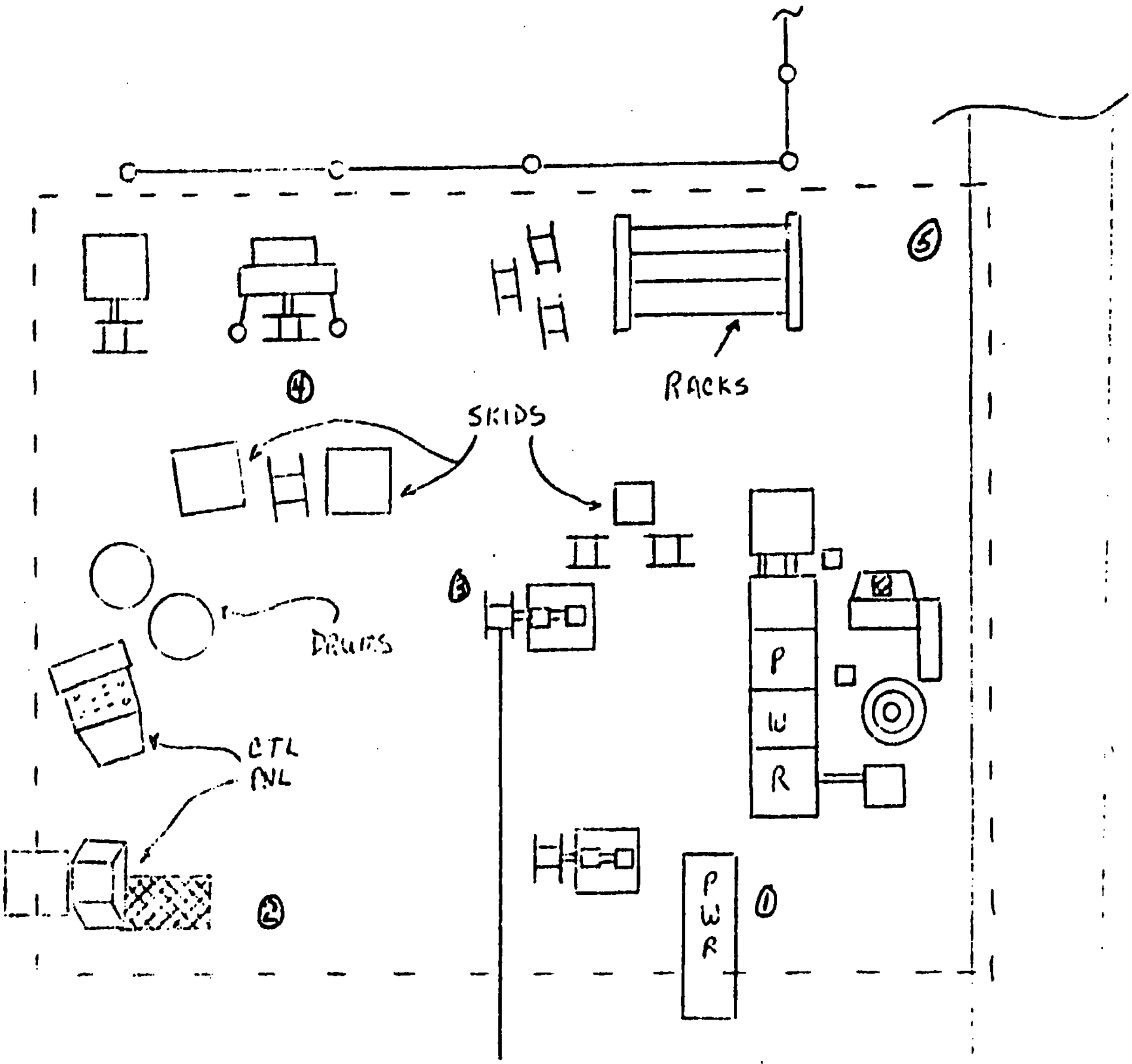
SMEAR #	RESULTS (CPM)	
1	0 α	54 βγ
2	0 α	76 βγ
3	1 α	58 βγ
4	0 α	54 βγ
5	0 α	56 βγ

TEXAS INSTRUMENTS

AREA 10M X 10M

W E

S



DIRECT FRISK RESULTS

LOCATION	N/A
TECH #1	J. HECKMAN
TECH #2	N/A
METER/PROBE SERIAL NUMBER	
#1)	115464 / N/A
#2)	N/A / (

BATTERY CHECK:	#1 OK	/#2 N/A
BACKGROUND:	#1 60 cpm	/#2
QC SOURCE CHECK:	#1 30K	/#2

AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR SURVEY RESULTS

METER	SCALER
SERIAL #	111577
COUNT TIME	1 min
BACKGROUND	0α + 70 βγ

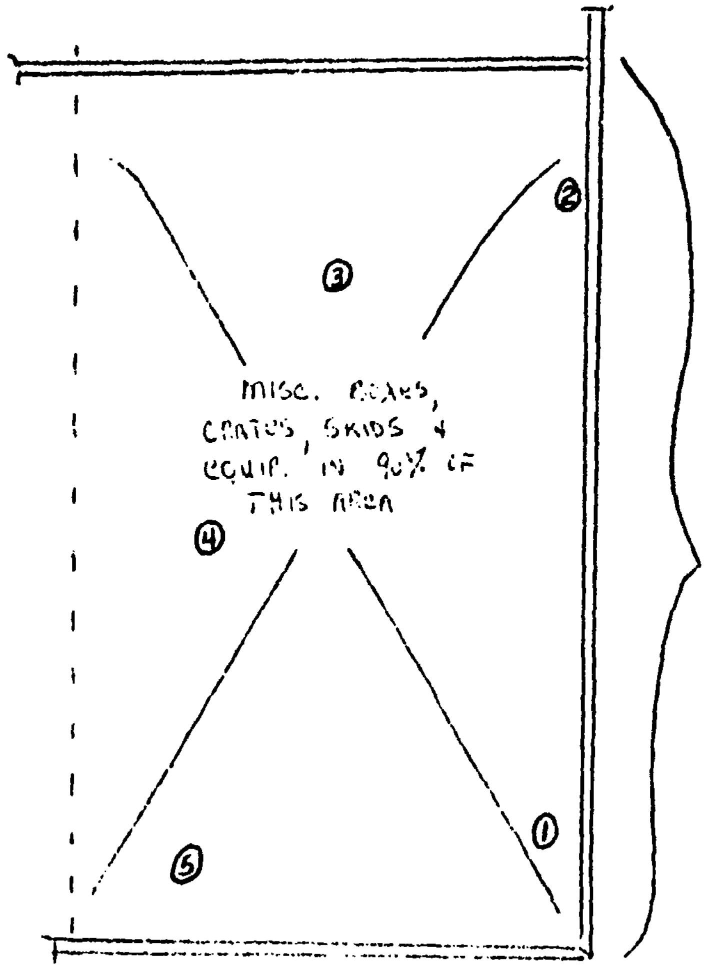
10-12-94

SMEAR #		RESULTS (CPM)
1	0 α	59 βγ
2	2 α	53 βγ
3	1 α	53 βγ
4	0 α	51 βγ
5	0 α	57 βγ

[illegible]

W E [illegible]

S



[illegible]

[illegible]: N/A
TECH #1: J. HALEY
TECH #2: N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

[illegible]: #1 OK / #2 N/A
[illegible]: #1 60 cpm / #2
[illegible] CHECK: #1 30K / #2
[illegible] (CPM):
TECH #1: 80 cpm TECH #2:

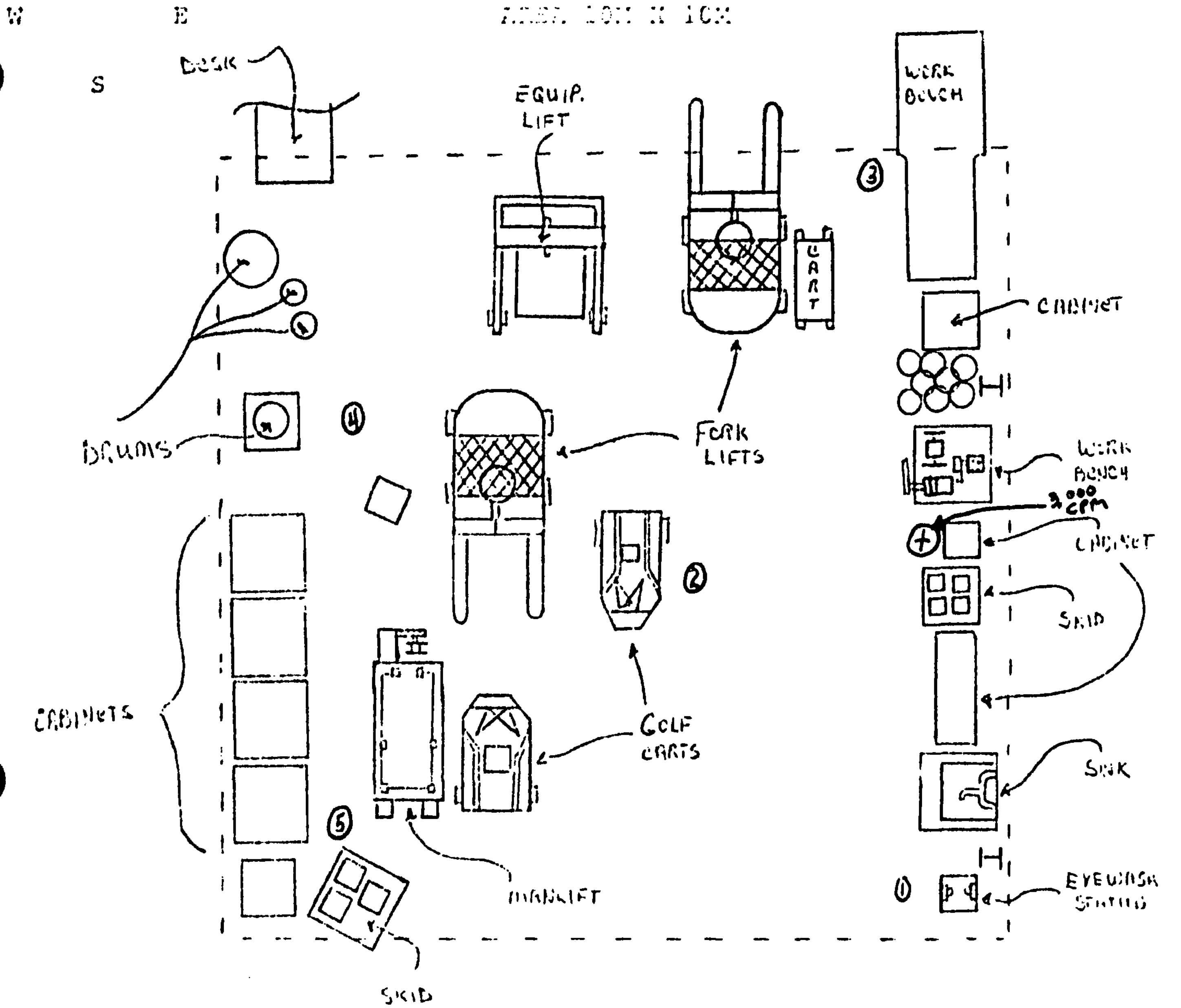
[illegible]

METER: SCALER
SERIAL #: 111577
COUNT TIME: 1 min.
BACKGROUND: 0α + 70 βγ
10-12-94

[illegible]		[illegible]
1	1 α	57 βγ
2	2 α	56 βγ
3	0 α	64 βγ
4	2 α	65 βγ
5	1 α	48 βγ

TEXAS INSTRUMENTS

AREA 10M X 10M



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 J. Heckman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115464 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 90 cpm / #2
QC SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2:

SMEAR RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0 α 62 βγ
10 3-94

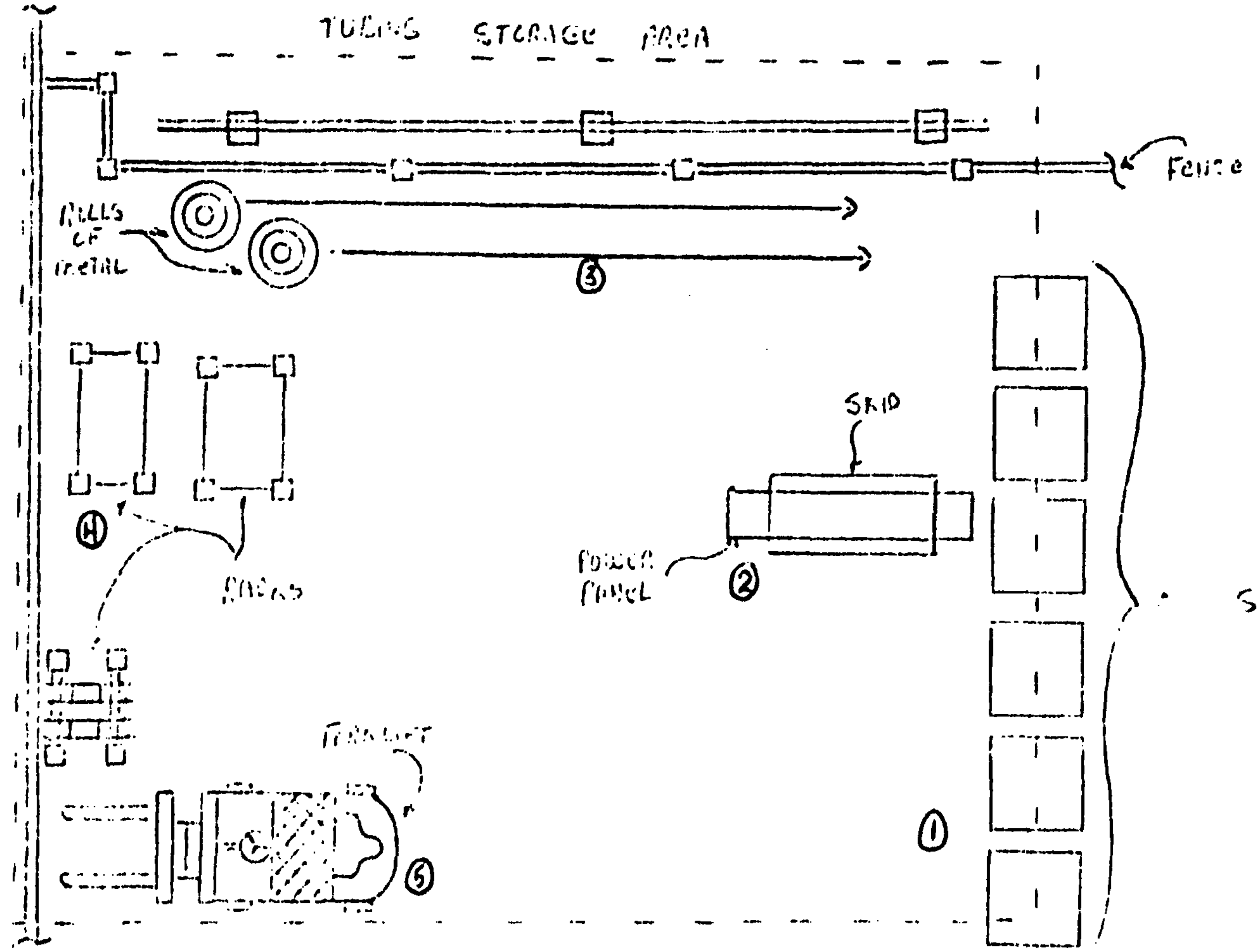
SMEAR #	RESULTS (CPM)	
1	1 α	62 βγ
2	1 α	60 βγ
3	0 α	48 βγ
4	0 α	62 βγ
5	2 α	48 βγ

TEXAS INSTRUMENTS

W E

AREA 10M X 10M

S



LOCATION N/A
TECH #1 M. HURTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 110948 / N/A
#2) N/A /

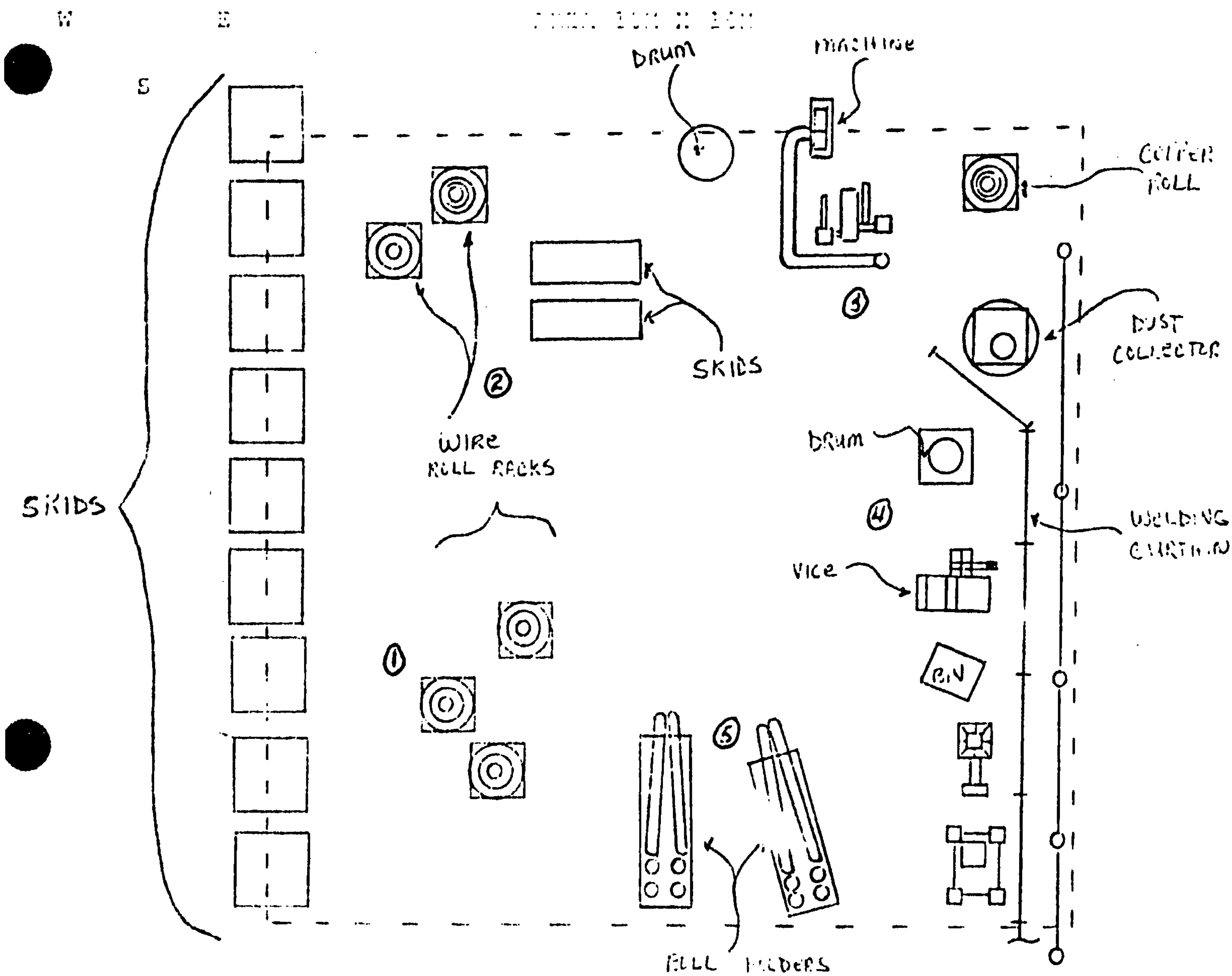
BATTERY CHECK: OK / N/A
BACKGROUND: 60 cpm
SOURCE CHECK: 30K
AVERAGE TIME TO ... (...):
TECH #1: 80 cpm TECH #2:

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 62 βγ
10-13-94

1	0 α	51 βγ
2	1 α	72 βγ
3	0 α	62 βγ
4	0 α	72 βγ
5	0 α	68 βγ

[illegible]
[illegible]

[illegible]



LOCATION N/A
TECH #1 J. Haley
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60 cpm / #2
CS SOURCE CHECK: #1 32K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

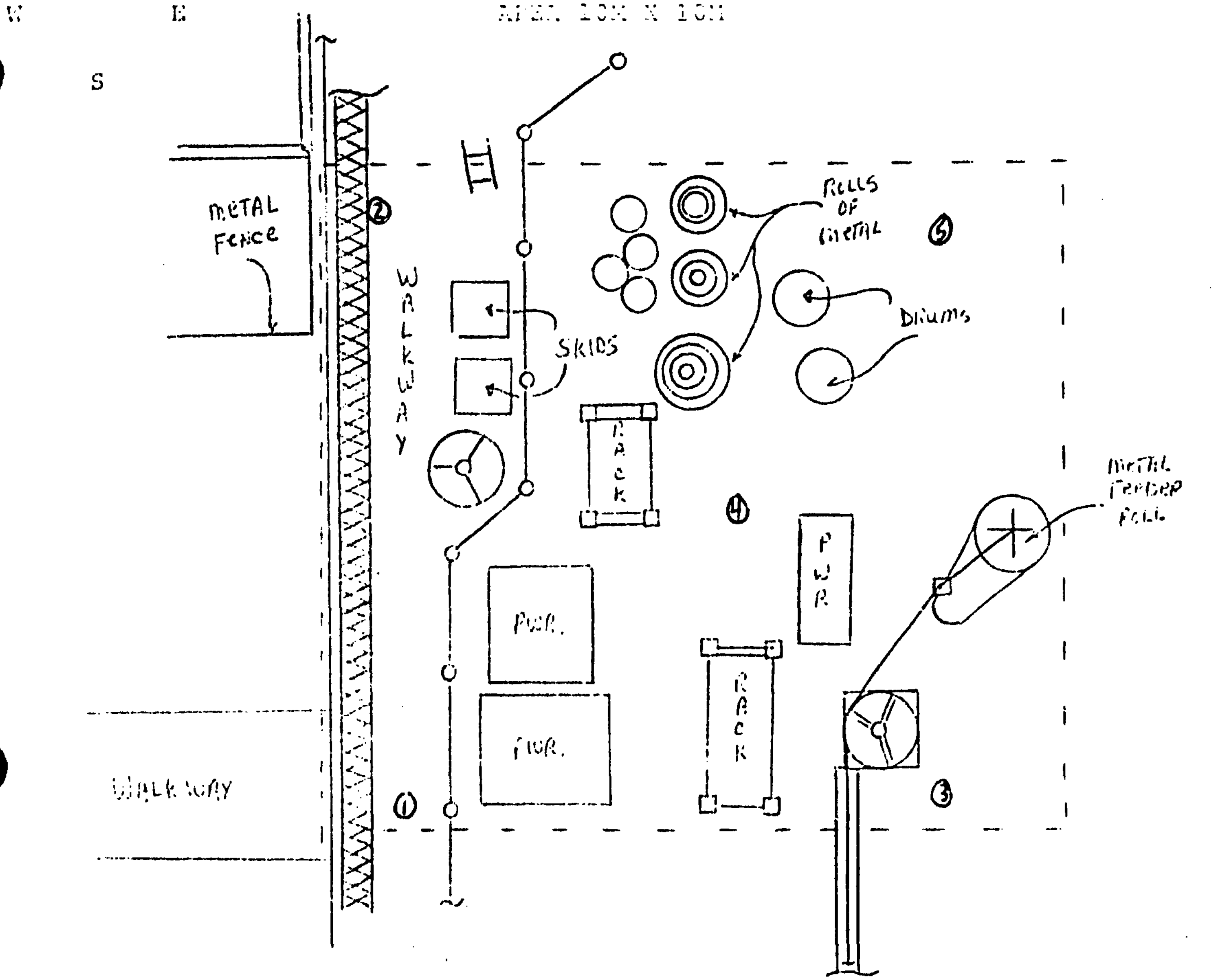
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0α 62 βγ
10-13-94

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	0 α	63 βγ
2	0 α	64 βγ
3	0 α	64 βγ
4	0 α	64 βγ
5	0 α	56 βγ

TEXAS INSTRUMENTS

AREA 10M X 10M



[illegible]

LOCATION	N/A	BATTERY CHECK: #1 OK	#2 N/A
TECH #1	J. HALEY	BACKGROUND: #1 70 cpm	#2
TECH #2	N/A	QC SOURCE CHECK: #1 32K	#2
METER/PROBE		AVERAGE READING FOR GRID (CPM):	
SERIAL NUMBER		TECH #1: 80 cpm	TECH #2:
#1) 115507 / N/A			
#2) N/A /			

[illegible]

METER	SCALER
SERIAL #	111577
COUNT TIME	1 MIN.
BACKGROUND	0α 62 βγ

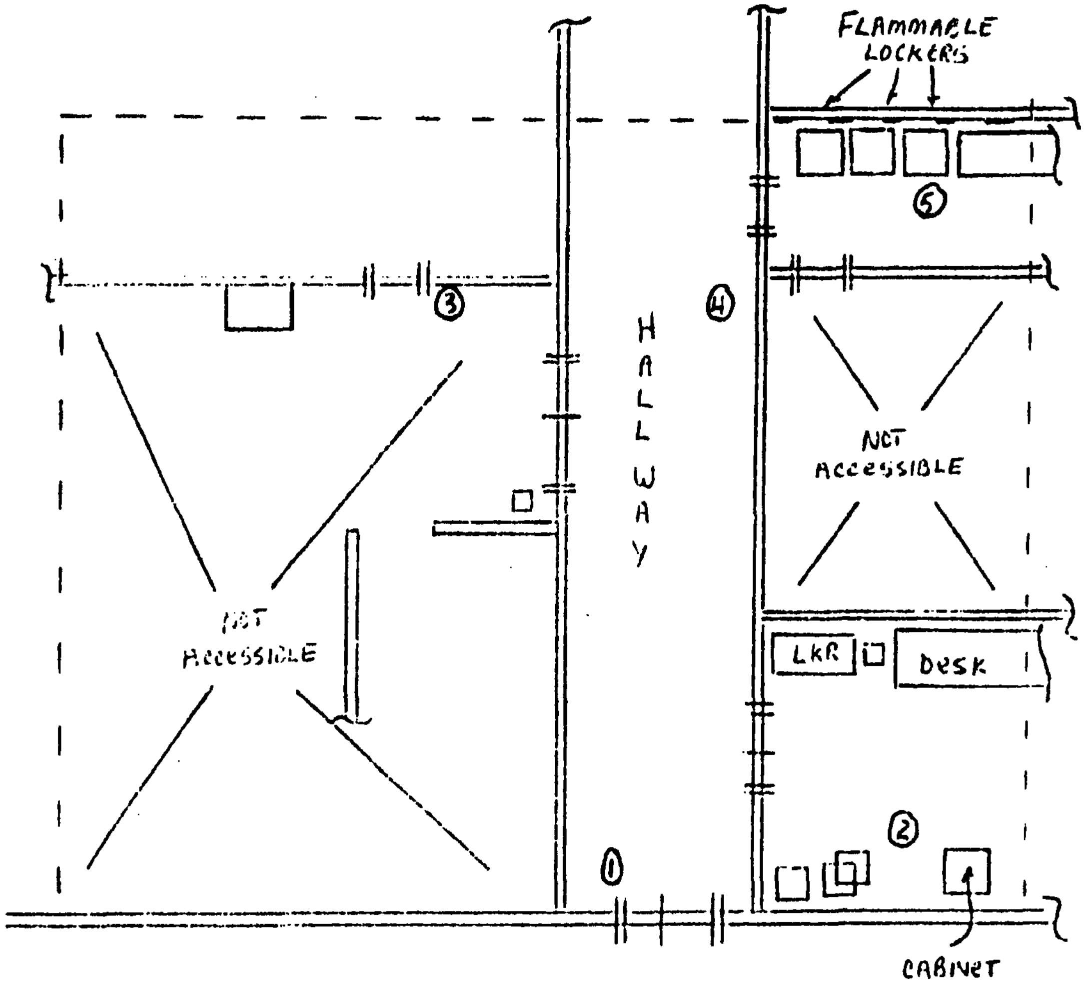
10-13-94

[illegible] #	RESULTS (CPM)	
1	0 α	57 βγ
2	0 α	42 βγ
3	0 α	65 βγ
4	1 α	55 βγ
5	0 α	55 βγ

TEXAS INSTRUMENTS

W E S

AREA 1CM X 1CM



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 M HURTON
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A / 〃

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 66 cpm / #2 〃
QC SOURCE CHECK: #1 3ok / #2 〃
AVERAGE READING FOR GRID (CPM):
TECH #1: 100 cpm TECH #2: 〃

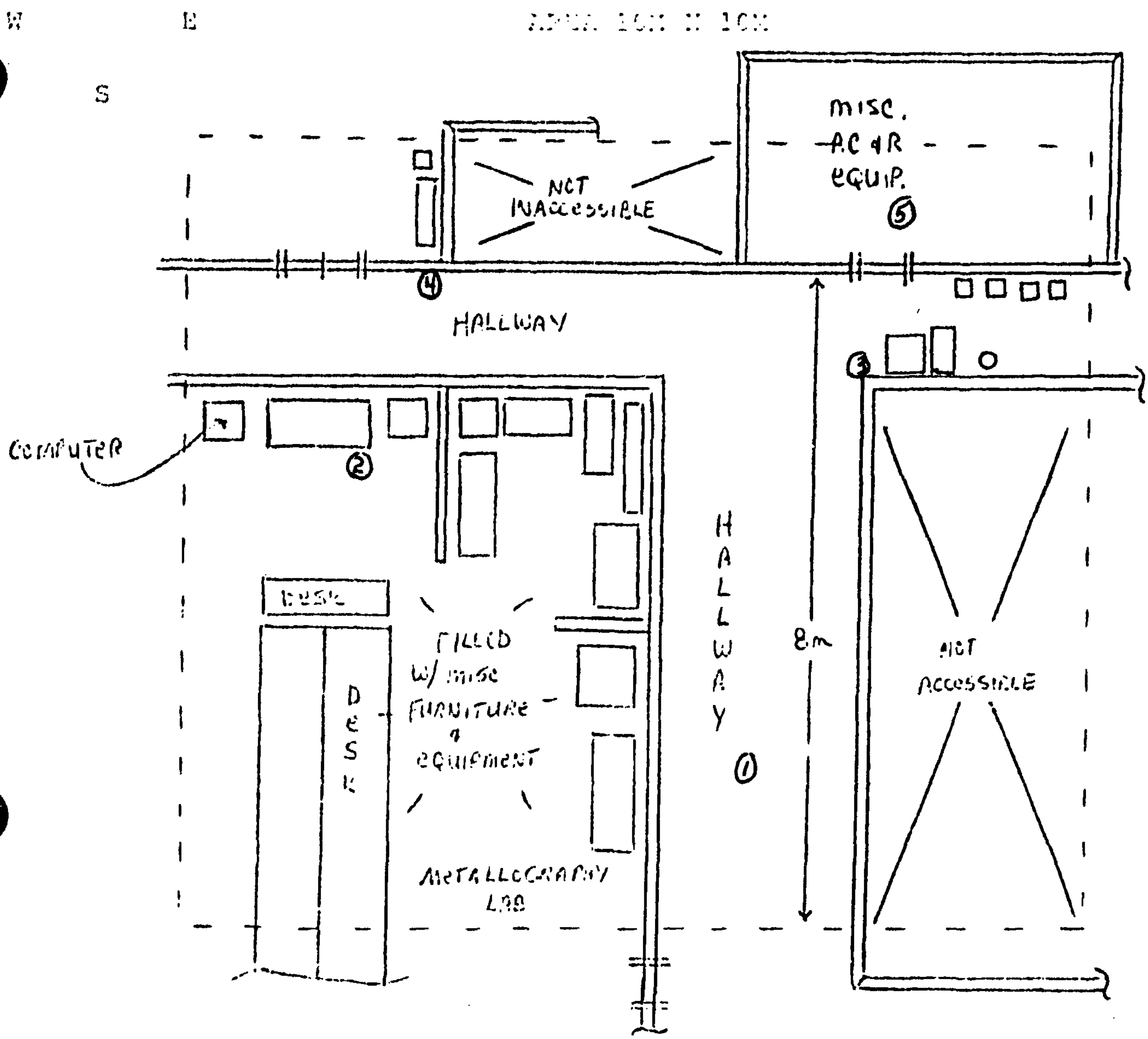
SMEAR SURVEY RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0 α 62 βγ
10-13-94

SMEAR #	RESULTS (CPM)	
1	0 α	49 βγ
2	1 α	64 βγ
3	0 α	59 βγ
4	0 α	57 βγ
5	0 α	56 βγ

BUILDING # 10
TEXAS INSTRUMENTS

AREA 10M X 10M



[illegible]

LOCATION N/A
TECH #1 J. Heckman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER N/A
#1) 11544 /
#2) N/A /

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 60cpm / #2
QC SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80cpm TECH #2:

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 62 βγ
10-13-94

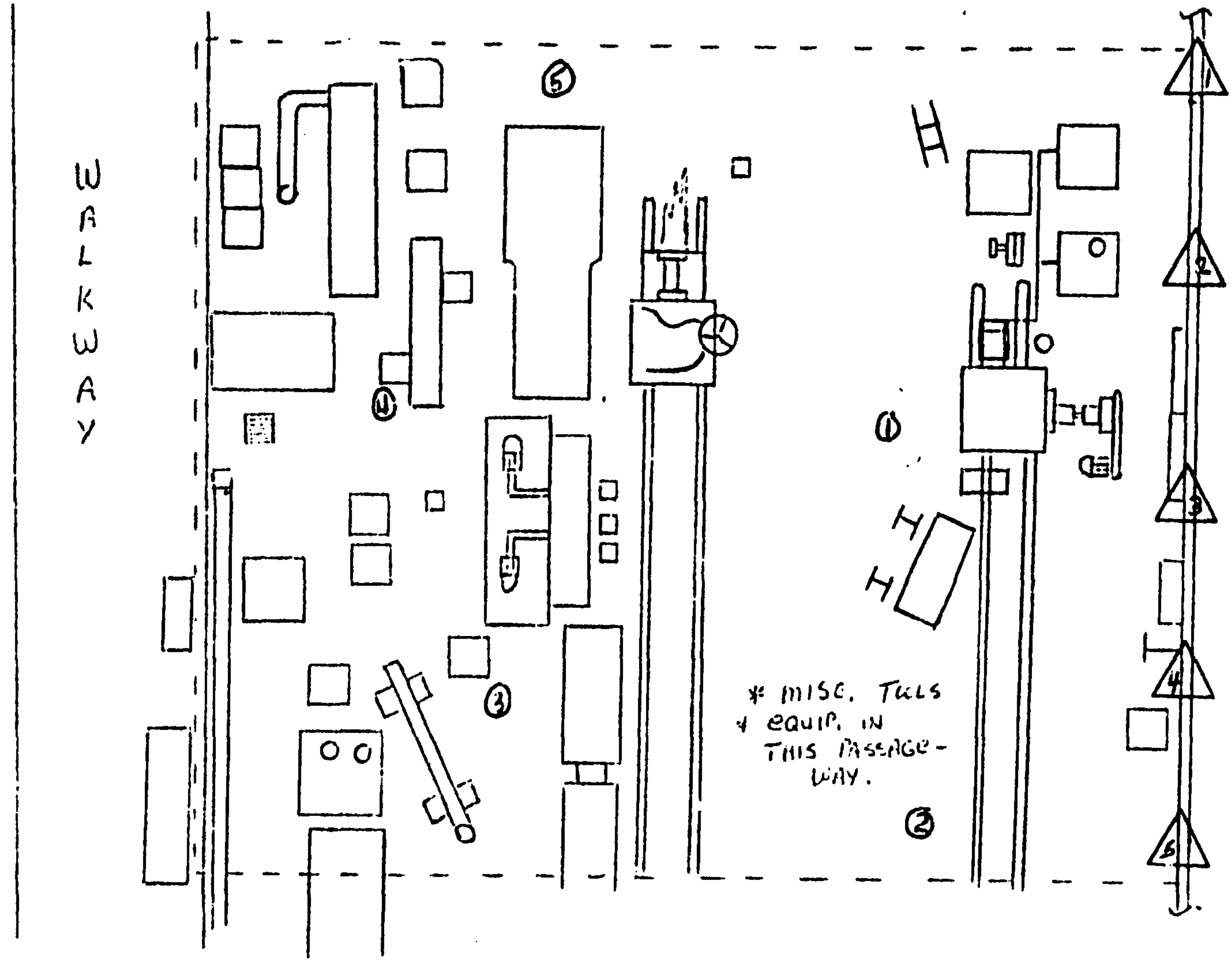
[illegible]

SMEAR #	RESULTS (CPM)	
1	1 α	58 βγ
2	0 α	56 βγ
3	1 α	65 βγ
4	0 α	55 βγ
5	0 α	47 βγ

[illegible]
TEXAS INSTRUMENTS

W E S

AREA 10M X 10M



INSTRUMENT CHECK RESULTS

LOCATION N/A
TECH #1 J. Heskman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A /

BATTERY CHECK: #1 OK #2 N/A
BACKGROUND: #1 60 cpm /#2
DC SOURCE CHECK: #1 30K /#2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR SURVEY RESULTS

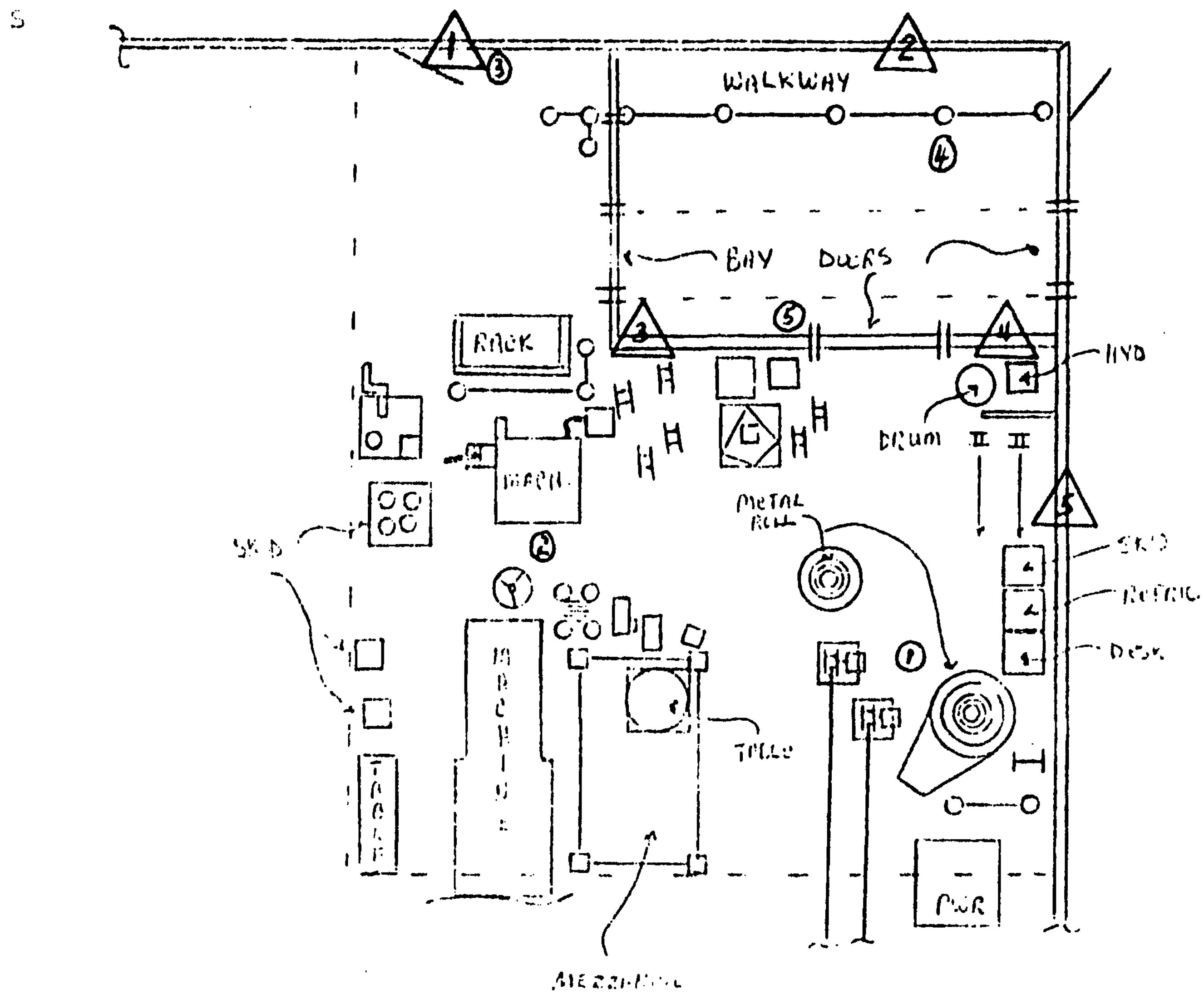
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α 62 βγ
10-13-94

SMEAR #	RESULTS (CPM)	
1	1 α	48 βγ
2	1 α	66 βγ
3	0 α	65 βγ
4	0 α	77 βγ
5	0 α	68 βγ

△ denotes wall smears
all smears < 10 ncpm
direct frisks of walls < 10 ncpm

[illegible]

W N [illegible]



LOCATION	OK
TECH #1	M. HURTON
TECH #2	N/A
INSTRUMENT/PROBE	
SERIAL NUMBER	
(1)	115507 / N/A
(2)	N/A / ↓

[illegible] CHECK:	OK	N/A
[illegible]:	60 cpm	
[illegible] CHECK:	32 K	
[illegible] (CPM):		
[illegible]:	80 cpm	TECH [illegible]:

METER	SCALER
SERIAL #	111577
COUNT TIME	1 min.
BACKGROUND	0α 62 βγ

10-13-94

1	0 α	49 βγ
2	0 α	61 βγ
3	0 α	54 βγ
4	0 α	49 βγ
5	1 α	56 βγ

△ denotes wall smears
all smears are < 10 ncpm
direct frisks of walls < 10 ncpm

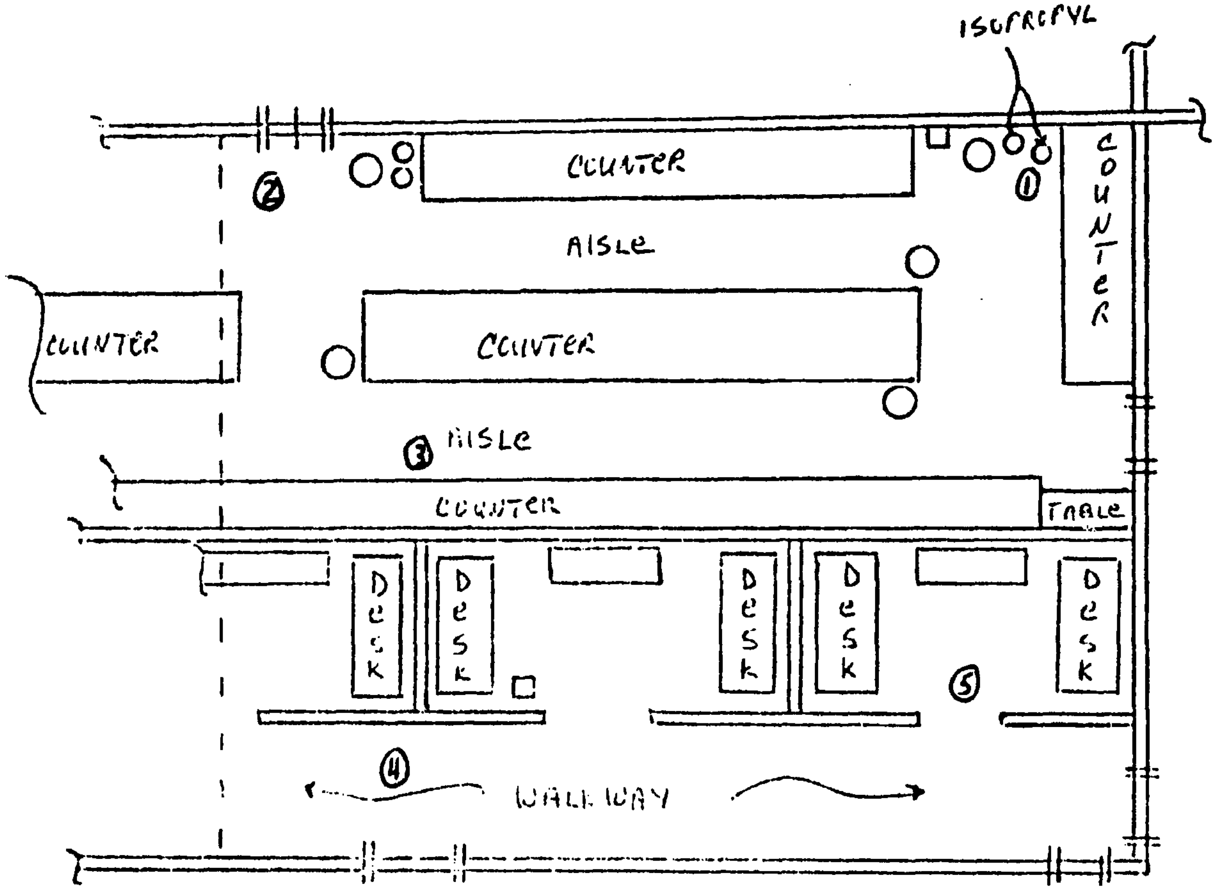
TEXAS INSTRUMENTS

AREA [illegible]

W E

S

OFFICES & LABS



[illegible] RESULTS

LOCATION N/A
TECH #1 M. HURTON
TECH #2 J. Heckman
METER/PROBE
SERIAL NUMBER
#1) 115507 / N/A
#2) 115404 / 〃

BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 32K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1: 60 cpm TECH #2: 80 cpm

[illegible] RESULTS

METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 62 βγ
10-13-94

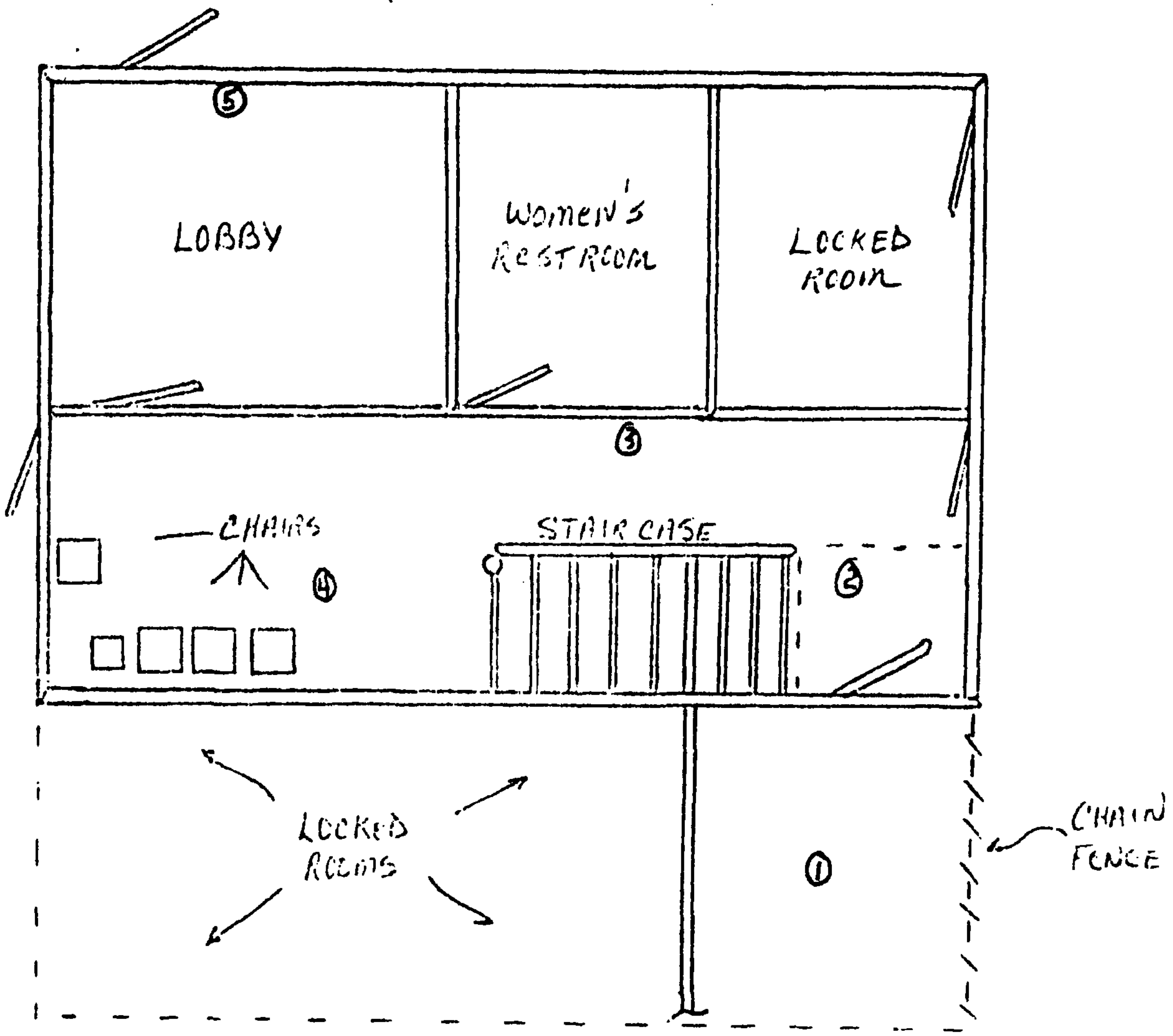
[illegible] #	RESULTS (CPM)	
1	0 α	85 βγ
2	1 α	62 βγ
3	0 α	62 βγ
4	0 α	49 βγ
5	0 α	51 βγ

[illegible] INSTRUMENTS

N E AREA 1CM X 1CM

S

BLDG #10
MAIN ENTRANCE



DIRECT FRISK RESULTS

LOCATION N/A
TECH #1 J. Heckman
TECH #2 N/A
METER/PROBE
SERIAL NUMBER
#1) 115404 / N/A
#2) N/A / ↓

BATTERY CHECK: #1 OK / #2 N/A
BACKGROUND: #1 66 cpm / #2
4C SOURCE CHECK: #1 30K / #2
AVERAGE READING FOR GRID (CPM):
TECH #1: 80 cpm TECH #2:

SMEAR SURVEY RESULTS

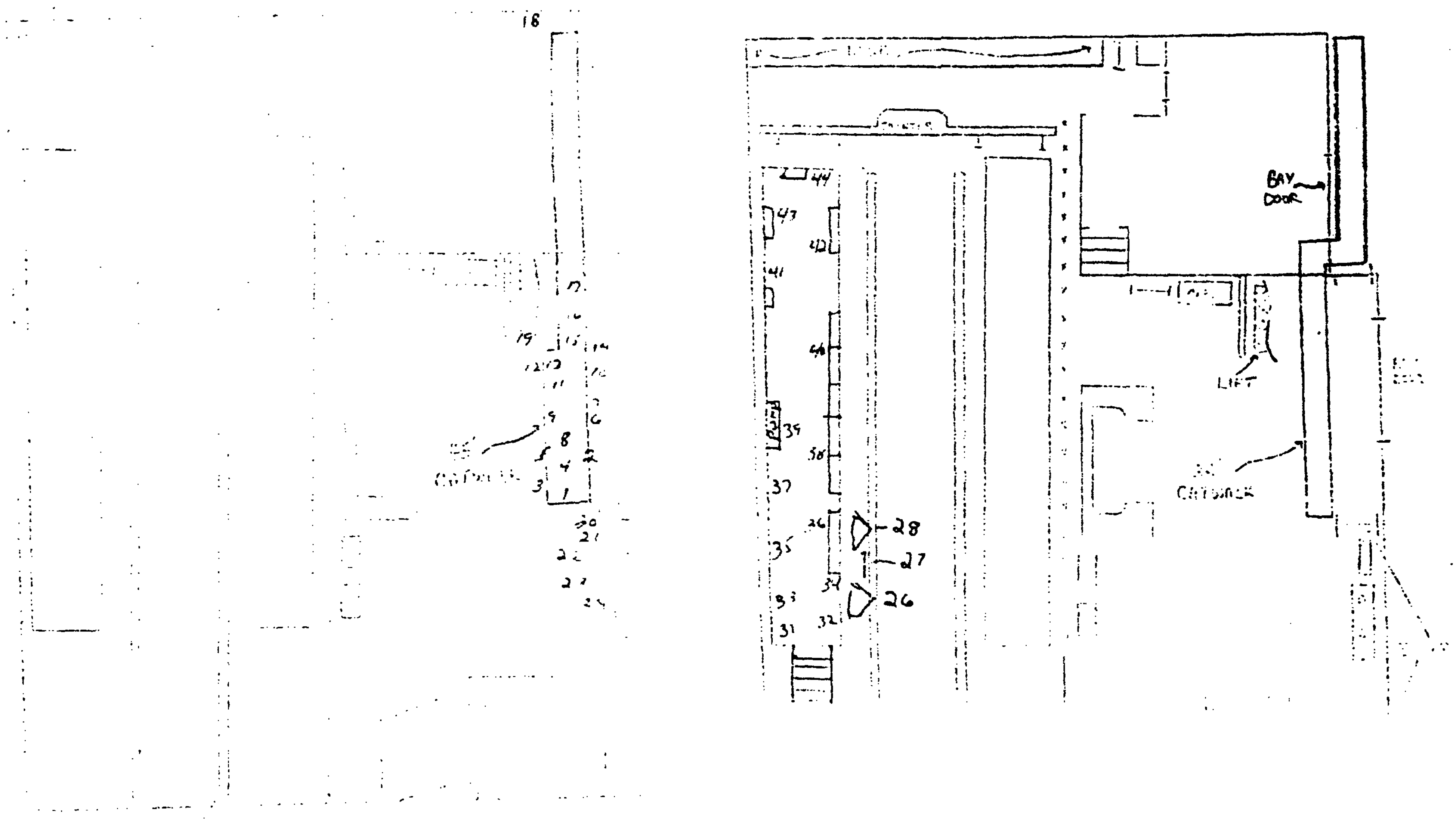
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α 62 βγ
10-13-94

SMEAR #	RESULTS (CPM)	
1	0 α	60 βγ
2	3 α	56 βγ
3	1 α	61 βγ
4	0 α	54 βγ
5	0 α	49 βγ

Appendix A-2

High Bay Area Survey

Appendix A-2: High Bay Area Survey



Appendix A-3

Building 10 Scoping Survey: Overhead Swipe Measurements

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Background Time	Sample Count	Sample Time	Activity dpm	Background Count	Background Time	Sample Count	Sample Time	Activity
3	OH	I-beam	Oct-94	5	10	0	1	-2	520	10	55	1	8.108108
3	OH	I-beam	Oct-94	5	10	0	1	-2	520	10	56	1	10.81081
3	OH	power box	Oct-94	5	10	0	1	-2	520	10	65	1	35.13514
5	0H-4	recirc.	Oct-94	5	10	1	1	2	520	10	47	1	-13.5135
5	OH-1	I-beam	Oct-94	5	10	1	1	2	520	10	60	1	21.62162
5	OH-2	power box	Oct-94	5	10	0	1	-2	520	10	59	1	18.91892
5	OH-3	recirc.	Oct-94	5	10	1	1	2	520	10	73	1	56.75676
5	OH-5	pipe	Oct-94	5	10	1	1	2	520	10	63	1	29.72973
8	OH-1	pipe	Oct-94	5	10	0	1	-2	520	10	67	1	40.54054
8	OH-2	control box	Oct-94	5	10	1	1	2	520	10	56	1	10.81081
8	OH-3	pipe	Oct-94	5	10	1	1	2	520	10	60	1	21.62162
8	OH-4	pipe	Oct-94	5	10	1	1	2	520	10	46	1	-16.2162
8	OH-5	pipe	Oct-94	5	10	0	1	-2	520	10	61	1	24.32432
9	OH	I-beam	Oct-94	5	10	1	1	2	520	10	62	1	27.02703
9	OH	pipe	Oct-94	5	10	2	1	6	520	10	51	1	-2.7027
9	OH-1	Angle Iron	Oct-94	5	10	0	1	-2	520	10	68	1	43.24324
9	OH-2	Angle Iron	Oct-94	5	10	0	1	-2	520	10	60	1	21.62162
9	OH-3	recirc.	Oct-94	5	10	1	1	2	520	10	63	1	29.72973
9	OH-4	I-beam	Oct-94	5	10	0	1	-2	520	10	67	1	40.54054
9	OH-5	I-beam	Oct-94	5	10	1	1	2	520	10	52	1	0
10	OH-1	pipe	Oct-94	5	10	1	1	2	520	10	60	1	21.62162
10	OH-2	I-beam	Oct-94	5	10	2	1	6	520	10	64	1	32.43243
10	OH-3	I-beam	Oct-94	5	10	1	1	2	520	10	64	1	32.43243
10	OH-4	pipe	Oct-94	5	10	0	1	-2	520	10	78	1	70.27027
10	OH-5	pipe	Oct-94	5	10	0	1	-2	520	10	56	1	10.81081
12	OH-1	pipe	Oct-94	5	10	0	1	-2	520	10	62	1	27.02703
12	OH-2	roof hatch	Oct-94	5	10	0	1	-2	520	10	55	1	8.108108
12	OH-3	roof hatch	Oct-94	5	10	0	1	-2	520	10	65	1	35.13514
12	OH-4	I-beam	Oct-94	5	10	0	1	-2	520	10	51	1	-2.7027
12	OH-5	I-beam	Oct-94	5	10	2	1	6	520	10	47	1	-13.5135
15	0H-4	I-beam	Oct-94	5	10	3	1	10	520	10	60	1	21.62162
15	OH-1	I-beam	Oct-94	5	10	2	1	6	520	10	64	1	32.43243

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
15	OH-2	pipe	Oct-94	5	10	0	1	-2	520	10	65	1	35.13514
15	OH-3	angle iron	Oct-94	5	10	0	1	-2	520	10	62	1	27.02703
15	OH-5	recirc	Oct-94	5	10	0	1	-2	520	10	70	1	48.64865
24	OH	angle iron	Oct-94	5	10	1	1	2	520	10	52	1	0
24	OH	hatch	Oct-94	5	10	0	1	-2	520	10	65	1	35.13514
24	OH	hatch	Oct-94	5	10	0	1	-2	520	10	62	1	27.02703
24	OH	window	Oct-94	5	10	0	1	-2	520	10	48	1	-10.8108
24	OH	I-beam	Oct-94	5	10	0	1	-2	520	10	52	1	0
40	OH-1	I-beam	Oct-94	5	10	0	1	-2	520	10	75	1	62.16216
40	OH-2	I-beam	Oct-94	5	10	3	1	10	520	10	51	1	-2.7027
45	OH-1	I-beam	Oct-94	5	10	1	1	2	520	10	63	1	29.72973
45	OH-2	I-beam	Oct-94	5	10	1	1	2	520	10	52	1	0
45	OH-3	pipe	Oct-94	5	10	0	1	-2	520	10	61	1	24.32432
50	OH-1	pipe	Oct-94	5	10	0	1	-2	520	10	64	1	32.43243
50	OH-2	pipe	Oct-94	5	10	1	1	2	520	10	53	1	2.702703
52	OH-1	pipe	Oct-94	5	10	0	1	-2	520	10	56	1	10.81081
52	OH-2	duct	Oct-94	5	10	0	1	-2	520	10	54	1	5.405405
52	OH-3	pipe	Oct-94	5	10	0	1	-2	520	10	92	1	108.1081
52	OH-4	I-beam	Oct-94	5	10	0	1	-2	520	10	45	1	-18.9189
54	OH-1	fan	Oct-94	5	10	2	1	6	520	10	56	1	10.81081
54	OH-2	fan	Oct-94	5	10	0	1	-2	520	10	50	1	-5.40541
54	OH-3	I-beam	Oct-94	5	10	0	1	-2	520	10	43	1	-24.3243
54	OH-4	I-beam	Oct-94	5	10	0	1	-2	520	10	43	1	-24.3243
54	OH-5	I-beam	Oct-94	5	10	2	1	6	520	10	53	1	2.702703
66	0H-4	pipe	Oct-94	5	10	0	1	-2	520	10	57	1	13.51351
66	OH-1	I-beam	Oct-94	5	10	0	1	-2	520	10	56	1	10.81081
66	OH-2	I-beam	Oct-94	5	10	0	1	-2	520	10	68	1	43.24324
66	OH-3	I-beam	Oct-94	5	10	2	1	6	520	10	53	1	2.702703
66	OH-5	I-beam	Oct-94	5	10	1	1	2	520	10	61	1	24.32432
70	0H-4	pipe	Oct-94	5	10	0	1	-2	520	10	65	1	35.13514
70	OH-1	I-beam	Oct-94	5	10	0	1	-2	520	10	62	1	27.02703
70	OH-2	I-beam	Oct-94	5	10	0	1	-2	520	10	48	1	-10.8108

11845

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
70	OH-3	I-beam	Oct-94	5	10	0	1	-2	520	10	65	1	35.13514
70	OH-5	I-beam	Oct-94	5	10	2	1	6	520	10	71	1	51.35135
73	0H-4	I-beam	Oct-94	5	10	1	1	2	520	10	57	1	13.51351
73	OH-1	I-beam	Oct-94	5	10	0	1	-2	520	10	57	1	13.51351
73	OH-2	steam	Oct-94	5	10	0	1	-2	520	10	57	1	13.51351
73	OH-3	airline	Oct-94	5	10	0	1	-2	520	10	69	1	45.94595
78	0H-4	I-beam	Oct-94	5	10	1	1	2	520	10	57	1	13.51351
78	OH-1	vent box	Oct-94	5	10	2	1	6	520	10	53	1	2.702703
78	OH-2	I-beam	Oct-94	5	10	0	1	-2	520	10	51	1	-2.7027
78	OH-3	I-beam	Oct-94	5	10	1	1	2	520	10	58	1	16.21622
85	0H-4	pipe	Oct-94	5	10	1	1	2	520	10	56	1	10.81081
85	OH-1	I-beam	Oct-94	5	10	0	1	-2	520	10	60	1	21.62162
85	OH-2	I-beam	Oct-94	5	10	1	1	2	520	10	54	1	5.405405
85	OH-3	I-beam	Oct-94	5	10	2	1	6	520	10	54	1	5.405405
85	OH-5	I-beam	Oct-94	5	10	0	1	-2	520	10	56	1	10.81081
87	OH-1	pipe	Oct-94	5	10	1	1	2	520	10	53	1	2.702703
87	OH-2	I-beam	Oct-94	5	10	1	1	2	520	10	53	1	2.702703
87	OH-3	I-beam	Oct-94	5	10	2	1	6	520	10	49	1	-8.10811
87	OH-4	pipe	Oct-94	5	10	1	1	2	520	10	68	1	43.24324
87	OH-5	I-beam	Oct-94	5	10	0	1	-2	520	10	55	1	8.108108
2-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	54	1	-14.0541
2-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	63	1	10.27027
2-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	68	1	23.78378
2-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	57	1	-5.94595
2-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	63	1	10.27027
2-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	68	1	23.78378
2-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	62	1	7.567568
2-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	72	1	34.59459
3-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	60	1	2.162162
3-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	61	1	4.864865
3-HFIR	OH	duct	Oct-94	4	10	0	1	-1.6	592	10	75	1	42.7027
3-HFIR	OH-1	light	Oct-94	4	10	1	1	2.4	592	10	53	1	-16.7568

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
3-HFIR	OH-3	fan	Oct-94	4	10	2	1	6.4	592	10	57	1	-5.94595
3-HFIR	OH-4	pipe	Oct-94	4	10	2	1	6.4	592	10	66	1	18.37838
3-HFIR	OH-5	pipe	Oct-94	4	10	0	1	-1.6	592	10	48	1	-30.2703
4-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	48	1	-30.2703
4-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	50	1	-24.8649
4-HFIR	OH	light	Oct-94	4	10	0	1	-1.6	592	10	64	1	12.97297
4-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	66	1	18.37838
4-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	63	1	10.27027
4-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	64	1	12.97297
4-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	46	1	-35.6757
4-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	75	1	42.7027
4-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	59	1	-0.54054
4-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	66	1	18.37838
4-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	69	1	26.48649
5-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	53	1	-16.7568
5-HFIR	OH	I-beam	Oct-94	4	10	3	1	10.4	592	10	74	1	40
5-HFIR	OH	I-beam	Oct-94	4	10	4	1	14.4	592	10	56	1	-8.64865
5-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	62	1	7.567568
5-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	68	1	23.78378
5-HFIR	OH	G1	Oct-94	4	10	2	1	6.4	592	10	66	1	18.37838
6-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	68	1	23.78378
6-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	51	1	-22.1622
6-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	62	1	7.567568
6-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	59	1	-0.54054
6-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	54	1	-14.0541
6-HFIR	OH	light	Oct-94	4	10	1	1	2.4	592	10	50	1	-24.8649
6-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	58	1	-3.24324
6-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	75	1	42.7027
6-HFIR	OH	pipe	Oct-94	4	10	3	1	10.4	592	10	43	1	-43.7838
6-HFIR	OH	I-beam	Oct-94	4	10	4	1	14.4	592	10	55	1	-11.3514
6-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	61	1	4.864865
6-HFIR	OH	light	Oct-94	4	10	1	1	2.4	592	10	62	1	7.567568

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
7-HFIR	OH	pipe	Oct-94	4	10	2	1	6.4	592	10	49	1	-27.5676
7-HFIR	OH	I-beam	Oct-94	4	10	3	1	10.4	592	10	51	1	-22.1622
7-HFIR	OH	airline	Oct-94	4	10	2	1	6.4	592	10	71	1	31.89189
7-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	66	1	18.37838
7-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	63	1	10.27027
7-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	592	10	62	1	7.567568
7-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	61	1	4.864865
7-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	62	1	7.567568
7-HFIR	OH	angle iron	Oct-94	4	10	1	1	2.4	592	10	62	1	7.567568
8-HFIR	OH	duct	Oct-94	4	10	2	1	6.4	592	10	61	1	4.864865
8-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	56	1	-8.64865
8-HFIR	OH	steam	Oct-94	4	10	1	1	2.4	592	10	56	1	-8.64865
8-HFIR	OH	light	Oct-94	4	10	1	1	2.4	592	10	58	1	-3.24324
8-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	57	1	-5.94595
8-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	49	1	-27.5676
8-HFIR	OH	pipe	Oct-94	4	10	3	1	10.4	592	10	61	1	4.864865
8-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	72	1	34.59459
9-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	53	1	-16.7568
9-HFIR	OH	water line	Oct-94	4	10	3	1	10.4	592	10	55	1	-11.3514
9-HFIR	OH	breaker box	Oct-94	4	10	0	1	-1.6	592	10	60	1	2.162162
9-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	56	1	-8.64865
9-HFIR	OH	duct	Oct-94	4	10	2	1	6.4	592	10	60	1	2.162162
9-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	58	1	-3.24324
9-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	60	1	2.162162
10-HFIR	OH	I-beam	Oct-94	4	10	2	1	6.4	592	10	59	1	-0.54054
10-HFIR	OH	pipe	Oct-94	4	10	2	1	6.4	592	10	55	1	-11.3514
10-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	48	1	-30.2703
11-HFIR	OH	I-beam	Oct-94	4	10	41	1	162.4	592	10	61	1	4.864865
11-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	74	1	40
11-HFIR	OH	pipe	Oct-94	4	10	4	1	14.4	592	10	52	1	-19.4595
11-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	62	1	7.567568
11-HFIR	OH	pipe	Oct-94	4	10	6	1	22.4	592	10	70	1	29.18919

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
11-HFIR	OH	duct	Oct-94	4	10	3	1	10.4	592	10	60	1	2.162162
11-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	53	1	-16.7568
11-HFIR	OH	pipe	Oct-94	4	10	0	1	-1.6	592	10	61	1	4.864865
11-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	57	1	-5.94595
11-HFIR	OH-1	NA	10/26/94	0	1	2	1	8	63	1	57	1	-16.2162
11-HFIR	OH-2	NA	10/26/94	0	1	3	1	12	63	1	59	1	-10.8108
11-HFIR	OH-3	NA	10/26/94	0	1	0	1	0	63	1	59	1	-10.8108
11-HFIR	OH-4	NA	10/26/94	0	1	1	1	4	63	1	49	1	-37.8378
11-HFIR	OH-5	NA	10/26/94	0	1	1	1	4	63	1	52	1	-29.7297
11-HFIR	OH-6	NA	10/26/94	0	1	1	1	4	63	1	55	1	-21.6216
11-HFIR	CH-7	NA	10/26/94	0	1	5	1	20	63	1	59	1	-10.8108
11-HFIR	OH-8	NA	10/26/94	0	1	0	1	0	63	1	64	1	2.702703
11-HFIR	OH-9	NA	10/26/94	0	1	1	1	4	63	1	65	1	5.405405
11-HFIR	OH-10	NA	10/26/94	0	1	0	1	0	63	1	63	1	0
11-HFIR	OH-11	NA	10/26/94	0	1	0	1	0	63	1	58	1	-13.5135
11-HFIR	OH-12	NA	10/26/94	0	1	1	1	4	63	1	52	1	-29.7297
11-HFIR	OH-13	NA	10/26/94	0	1	2	1	8	63	1	60	1	-8.10811
11-HFIR	OH-14	NA	10/26/94	0	1	1	1	4	63	1	50	1	-35.1351
11-HFIR	OH-15	NA	10/26/94	0	1	0	1	0	63	1	49	1	-37.8378
11-HFIR	OH-16	NA	10/26/94	0	1	0	1	0	63	1	71	1	21.62162
11-HFIR	OH-17	NA	10/26/94	0	1	1	1	4	63	1	65	1	5.405405
11-HFIR	OH-18	NA	10/26/94	0	1	0	1	0	63	1	55	1	-21.6216
11-HFIR	OH-19	NA	10/26/94	0	1	1	1	4	63	1	60	1	-8.10811
11-HFIR	OH-20	NA	10/26/94	0	1	0	1	0	63	1	64	1	2.702703
11-HFIR	OH-21	NA	10/26/94	0	1	60	1	240	63	1	70	1	18.91892
11-HFIR	OH-22	NA	10/26/94	0	1	3	1	12	63	1	56	1	-18.9189
11-HFIR	OH-23	NA	10/26/94	0	1	0	1	0	63	1	65	1	5.405405
11-HFIR	OH-24	NA	10/26/94	0	1	5	1	20	63	1	68	1	13.51351
11-HFIR	OH-25	NA	10/26/94	0	1	0	1	0	63	1	57	1	-16.2162
12-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	66	1	18.37838
12-HFIR	OH	I-beam	Oct-94	4	10	27	1	106.4	592	10	84	1	67.02703
12-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	80	1	56.21622

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
12-HFIR	OH	light	Oct-94	4	10	0	1	-1.6	592	10	68	1	23.78378
12-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	67	1	21.08108
12-HFIR	OH	duct	Oct-94	4	10	1	1	2.4	592	10	53	1	-16.7568
12-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	592	10	52	1	-19.4595
12-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	592	10	56	1	-8.64865
12-HFIR	OH	duct	Oct-94	4	10	35	1	138.4	592	10	90	1	83.24324
12-HFIR	OH	pipe	Oct-94	4	10	1	1	2.4	520	10	66	1	37.83784
12-HFIR	OH	I-beam	Oct-94	4	10	1	1	2.4	520	10	60	1	21.62162
12-HFIR	OH	I-beam	Oct-94	4	10	0	1	-1.6	520	10	74	1	59.45946
U1	OH-4	pipe	10/22/94	2	5	1	1	2.4	273	5	61	1	17.2973
U1	OH-1	I-beam	10/22/94	2	5	1	1	2.4	273	5	66	1	30.81081
U1	OH-2	pipe	10/22/94	2	5	0	1	-1.6	273	5	65	1	28.10811
U1	OH-3	pipe	10/22/94	2	5	1	1	2.4	273	5	57	1	6.486486
U1	OH-5	pipe	10/22/94	2	5	1	1	2.4	273	5	60	1	14.59459
U2	OH-1	I-beam	10/22/94	2	5	1	1	2.4	273	5	63	1	22.7027
U2	OH-10	I-beam	10/22/94	2	5	1	1	2.4	273	5	55	1	1.081081
U2	OH-11	I-beam	10/22/94	2	5	0	1	-1.6	273	5	52	1	-7.02703
U2	OH-12	I-beam	10/22/94	2	5	0	1	-1.6	273	5	57	1	6.486486
U2	OH-2	pipe	10/22/94	2	5	1	1	2.4	273	5	64	1	25.40541
U2	OH-3	I-beam	10/22/94	2	5	0	1	-1.6	273	5	62	1	20
U2	OH-4	heater	10/22/94	2	5	0	1	-1.6	273	5	54	1	-1.62162
U2	OH-5	I-beam	10/22/94	2	5	0	1	-1.6	273	5	53	1	-4.32432
U2	OH-6	recirc.	10/22/94	2	5	1	1	2.4	273	5	51	1	-9.72973
U2	OH-7	window	10/22/94	2	5	4	1	14.4	273	5	63	1	22.7027
U2	OH-8	window	10/22/94	2	5	4	1	14.4	273	5	61	1	17.2973
U2	OH-9	city gas	10/22/94	2	5	4	1	14.4	273	5	62	1	20
U3	OH	light	10/22/94	2	5	4	1	14.4	273	5	60	1	14.59459
U3	OH	I-beam	10/22/94	2	5	4	1	14.4	273	5	57	1	6.486486
U3	OH	tray	10/22/94	2	5	1	1	2.4	273	5	62	1	20
U3	OH	I-beam	10/22/94	2	5	4	1	14.4	273	5	66	1	30.81081
U3	OH	bus-duct	10/22/94	2	5	4	1	14.4	273	5	55	1	1.081081
U3	OH	heater	10/22/94	2	5	4	1	14.4	273	5	64	1	25.40541

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
U3	OH	bus-duct	10/22/94	2	5	0	1	-1.6	273	5	55	1	1.081081
U3	OH	I-beam	10/22/94	2	5	0	1	-1.6	273	5	59	1	11.89189
U3	OH	bus-duct	10/22/94	2	5	0	1	-1.6	273	5	59	1	11.89189
U3	OH-1	I-beam	10/22/94	2	5	0	1	-1.6	273	5	54	1	-1.62162
U3	OH-2	Angle Iron	10/22/94	2	5	0	1	-1.6	273	5	52	1	-7.02703
U3	OH-4	recirc.	10/22/94	2	5	0	1	-1.6	273	5	51	1	-9.72973
U3	OH-5	hatch	10/22/94	2	5	0	1	-1.6	273	5	65	1	28.10811
U3	OH-6	hatch	10/22/94	2	5	0	1	-1.6	273	5	64	1	25.40541
U3	OH-7	pipe	10/22/94	2	5	4	1	14.4	273	5	62	1	20
U3	OH-8	water pipe	10/22/94	2	5	4	1	14.4	273	5	54	1	-1.62162
U3	OH-3	I-beam	10/22/94	2	5	1	1	2.4	273	5	55	1	1.081081
U4	OH	I-beam	10/22/94	2	5	1	1	2.4	273	5	63	1	22.7027
U4	OH	pipe	10/22/94	2	5	0	1	-1.6	273	5	54	1	-1.62162
U4	OH	pipe	10/22/94	2	5	8	1	30.4	273	5	58	1	9.189189
U4	OH	ceiling vent	10/22/94	2	5	0	1	-1.6	273	5	57	1	6.486486
U4	OH	caustic pipe	10/22/94	2	5	4	1	14.4	273	5	71	1	44.32432
1	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	52	1	-16.2162
2	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	46	1	-32.4324
3	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	47	1	-29.7297
4	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	51	1	-18.9189
5	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	61	1	8.108108
6	High Bay	Append A-2	Sep-94	0	1	1	1	4	58	1	54	1	-10.8108
7	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	55	1	-8.10811
8	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	52	1	-16.2162
9	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	66	1	21.62162
10	High Bay	Append A-2	Sep-94	0	1	2	1	8	58	1	47	1	-29.7297
11	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	52	1	-16.2162
12	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	54	1	-10.8108
13	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	55	1	-8.10811
14	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	73	1	40.54054
15	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	70	1	32.43243
16	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	74	1	43.24324

Appendix A-3: Building 10 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
17	High Bay	Append A-2	Sep-94	0	1	1	1	4	58	1	61	1	8.108108
18	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	46	1	-32.4324
19	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	48	1	-27.027
20	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	52	1	-16.2162
21	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	54	1	-10.8108
22	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	60	1	5.405405
23	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	51	1	-18.9189
24	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	72	1	37.83784
25	High Bay	Append A-2	Sep-94	0	1	3	1	12	58	1	60	1	5.405405
26	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	50	1	-21.6216
27	High Bay	Append A-2	Sep-94	0	1	1	1	4	58	1	52	1	-16.2162
28	High Bay	Append A-2	Sep-94	0	1	1	1	4	58	1	46	1	-32.4324
29	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	64	1	16.21622
30	High Bay	Append A-2	Sep-94	0	1	1	1	4	58	1	56	1	-5.40541
31	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	64	1	16.21622
32	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	61	1	8.108108
33	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	60	1	5.405405
34	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	52	1	-16.2162
35	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	50	1	-21.6216
36	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	57	1	-2.7027
37	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	53	1	-13.5135
38	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	55	1	-8.10811
39	High Bay	Append A-2	Sep-94	0	1	1	1	4	58	1	52	1	-16.2162
40	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	64	1	16.21622
41	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	54	1	-10.8108
42	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	67	1	24.32432
43	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	57	1	-2.7027
44	High Bay	Append A-2	Sep-94	0	1	0	1	0	58	1	49	1	-24.3243

Appendix A-4

Building 10 Scoping Survey: Wall Swipe Measurements

Appendix A-4: Building 10 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Sample	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
Bldg 10 HFIR Grids Accessible Grids													
1	Wall	A	Oct-94	6	10	1	1	1.6	581	10	61	1	7.837838
1	Wall	B	Oct-94	6	10	0	1	-2.4	581	10	54	1	-11.08108
1	Wall	C	Oct-94	6	10	1	1	1.6	581	10	52	1	-16.48649
3	Wall	A	Oct-94	5	10	1	1	1.6	581	10	50	1	-21.89189
3	Wall	B	Oct-94	6	10	0	1	-2.4	581	10	77	1	51.08108
3	Wall	C	Oct-94	6	10	1	1	1.6	581	10	68	1	26.75676
5	Wall	D	Oct-94	6	10	1	1	1.6	581	10	61	1	7.837838
5	Wall	E	Oct-94	6	10	0	1	-2.4	581	10	64	1	15.94595
5	Wall	A	Oct-94	6	10	0	1	-2.4	581	10	60	1	5.135135
7	Wall	B	Oct-94	6	10	0	1	-2.4	581	10	55	1	-8.378378
7	Wall	C	Oct-94	6	10	0	1	-2.4	581	10	73	1	40.27027
7	Wall	D	Oct-94	6	10	0	1	-2.4	581	10	65	1	18.64865
8	Wall	E	Oct-94	6	10	0	1	-2.4	581	10	61	1	7.837838
8	Wall	A	Oct-94	6	10	1	1	1.6	581	10	66	1	21.35135
8	Wall	B	Oct-94	6	10	0	1	-2.4	581	10	58	1	-0.27027
9	Wall	C	Oct-94	6	10	1	1	1.6	581	10	60	1	5.135135
9	Wall	D	Oct-94	6	10	1	1	1.6	581	10	62	1	10.54054
9	Wall	E	Oct-94	6	10	0	1	-2.4	581	10	61	1	7.837838
10	Wall	A	Oct-94	6	10	1	1	1.6	581	10	54	1	-11.08108
10	Wall	B	Oct-94	6	10	1	1	1.6	581	10	57	1	-2.972973
10	Wall	C	Oct-94	6	10	0	1	-2.4	581	10	59	1	2.432432
11	Wall	D	Oct-94	6	10	1	1	1.6	581	10	50	1	-21.89189
11	Wall	E	Oct-94	6	10	0	1	-2.4	581	10	74	1	42.97297
11	Wall	A	Oct-94	6	10	2	1	5.6	581	10	53	1	-13.78378
12	Wall	B	Oct-94	6	10	1	1	1.6	581	10	52	1	-16.48649
12	Wall	C	Oct-94	6	10	4	1	13.6	581	10	55	1	-8.378378
12	Wall	D	Oct-94	6	10	0	1	-2.4	581	10	61	1	7.837838
13	Wall	E	Oct-94	6	10	0	1	-2.4	581	10	60	1	5.135135
13	Wall	A	Oct-94	6	10	0	1	-2.4	581	10	67	1	24.05405

Appendix A-4: Building 10 Scoping Survey: Wall Swipe Measurements

Grid # / Location	Type of Sample	Sample	Date	Alpha Background Count	Alpha Background Time	Alpha Sample Count	Alpha Sample Time	Alpha Activity dpm	Beta Background Count	Beta Background Time	Beta Sample Count	Beta Sample Time	Beta Activity
13	Wall	B	Oct-94	6	10	1	1	1.6	581	10	50	1	-21.89189
14	Wall	C	Oct-94	6	10	0	1	-2.4	581	10	51	1	-19.18919
14	Wall	D	Oct-94	6	10	0	1	-2 4	581	10	52	1	-16.48649
14	Wall	E	Oct-94	6	10	1	1	1 6	581	10	49	1	-24.59459
15	Wall	A	Oct-94	6	10	1	1	1.6	581	10	53	1	-13.78378
15	Wall	B	Oct-94	6	10	2	1	5 6	581	10	52	1	-16 48649
15	Wall	C	Oct-94	6	10	1	1	1 6	581	10	55	1	-8.378378
16	Wall	D	Oct-94	6	10	1	1	1 6	581	10	51	1	-19.18919
16	Wall	E	Oct-94	6	10	0	1	-2 4	581	10	58	1	-0.27027
16	Wall	A	Oct-94	6	10	0	1	-2 4	581	10	54	1	-11.08108
Bldg 10 CMA Grids Accessible Grids													
3	Wall	A	Oct-94	6	10	1	1	1.6	581	10	53	1	-13.78378
3	Wall	B	Oct-94	6	10	1	1	1 6	581	10	60	1	5.135135
3	Wall	C	Oct-94	6	10	0	1	-2.4	581	10	61	1	7.837838
5	Wall	A	Oct-94	6	10	0	1	-2 4	581	10	66	1	21.35135
5	Wall	B	Oct-94	6	10	0	1	-2 4	581	10	55	1	-8.378378
5	Wall	C	Oct-94	6	10	1	1	1.6	581	10	50	1	-21.89189
8	Wall	A	Oct-94	6	10	0	1	-2 4	581	10	51	1	-19.18919
8	Wall	B	Oct-94	6	10	1	1	1 6	581	10	58	1	-0.27027
8	Wall	C	Oct-94	6	10	1	1	1 6	581	10	59	1	2.432432
9	Wall	A	Oct-94	6	10	0	1	-2.4	581	10	52	1	-16 48649
9	Wall	B	Oct-94	6	10	0	1	-2 4	581	10	64	1	15.94595
9	Wall	C	Oct-94	6	10	1	1	1 6	581	10	57	1	-2.972973
17	Wall	A	Oct-94	6	10	3	1	9 6	581	10	73	1	40.27027
17	Wall	B	Oct-94	6	10	0	1	-2.4	581	10	65	1	18.64865
17	Wall	C	Oct-94	6	10	0	1	-2 4	581	10	63	1	13 24324
50	Wall	A	Oct-94	4	10	1	1	2 4	535	10	53	1	-1.351351
50	Wall	B	Oct-94	4	10	1	1	2 4	535	10	58	1	12.16216

Appendix A-4: Building 10 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Gnd # / Location	Type of Sample	Sample	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
50	Wall	C	Oct-94	4	10	0	1	-1.6	535	10	53	1	-1.351351
85	Wall	A	Oct-94	4	10	0	1	-1.6	535	10	62	1	22.97297
85	Wall	B	Oct-94	4	10	0	1	-1.6	535	10	61	1	20.27027
85	Wall	C	Oct-94	4	10	1	1	2.4	535	10	54	1	1.351351
87	Wall	A	Oct-94	4	10	0	1	-1.6	535	10	68	1	39.18919
87	Wall	B	Oct-94	4	10	1	1	2.4	535	10	49	1	-12.16216
87	Wall	C	Oct-94	4	10	0	1	-1.6	535	10	53	1	-1.351351
Bldg 10 Lab Wing													
Conf. Room E of Metallography	Wall	1	10/25/94	0	1	2	1	8	62	1	54	1	-21.62162
	Wall	2		0	1	0	1	0	62	1	48	1	-37.83784
	Wall	3		0	1	1	1	4	62	1	64	1	5.405405
	Wall	4		0	1	2	1	8	62	1	12	1	-135.1351
	Wall	5		0	1	1	1	4	62	1	53	1	-24.32432
Hallway North of Metallography Lab	Wall	1	10/25/94	0	1	0	1	0	62	1	64	1	5.405405
	Wall	2		0	1	0	1	0	62	1	70	1	21.62162
	Wall	3		0	1	1	1	4	62	1	68	1	16.21622
	Wall	4		0	1	0	1	0	62	1	59	1	-8.108108
	Wall	5		0	1	0	1	0	62	1	57	1	-13.51351
Front Offices S. West of Lobby	Wall	1	10/25/94	0	1	2	1	8	62	1	62	1	0
	Wall	2		0	1	2	1	8	62	1	65	1	8.108108
	Wall	3		0	1	0	1	0	62	1	78	1	43.24324
	Wall	4		0	1	0	1	0	62	1	69	1	18.91892
	Wall	5		0	1	0	1	0	62	1	62	1	0
Metallography Lab	Wall	1	10/25/94	0	1	0	1	0	62	1	50	1	-32.43243
	Wall	2		0	1	1	1	4	62	1	52	1	-27.02703
	Wall	3		0	1	0	1	0	62	1	57	1	-13.51351
	Wall	4		0	1	1	1	4	62	1	54	1	-21.62162
	Wall	5		0	1	1	1	4	62	1	58	1	-10.81081

Appendix B

Building 11 Upper Walls and Overhead Surveys

Appendix B

Building 11 Upper Walls and Overhead Surveys

Appendix B-1 Building 11 Survey Maps

- Appendix B-1-1 Grid Map and Survey Locations of Affected Area within Building 11
- Appendix B-1-2 Grid Map and Survey Locations of Unaffected Areas within Building 11
- Appendix B-1-3 Individual grid detailed floor survey maps for affected area within Building 11

Appendix B-2 Building 11 Supplement Wall Swipe Measurements

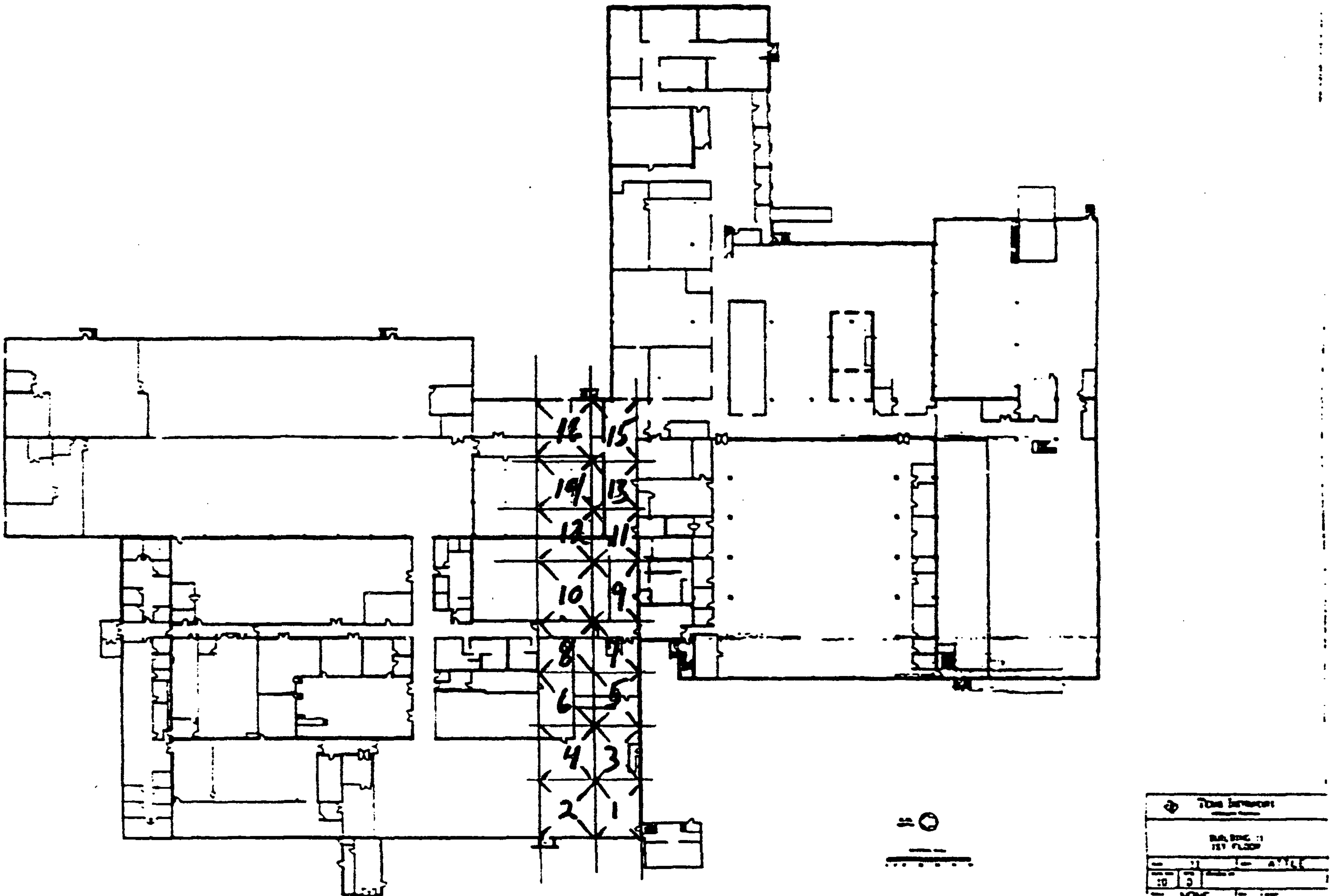
Appendix B-1

Building 11 Survey Maps

Appendix B-1-1

Grid Map and Survey Locations of Affected Area within Building 11

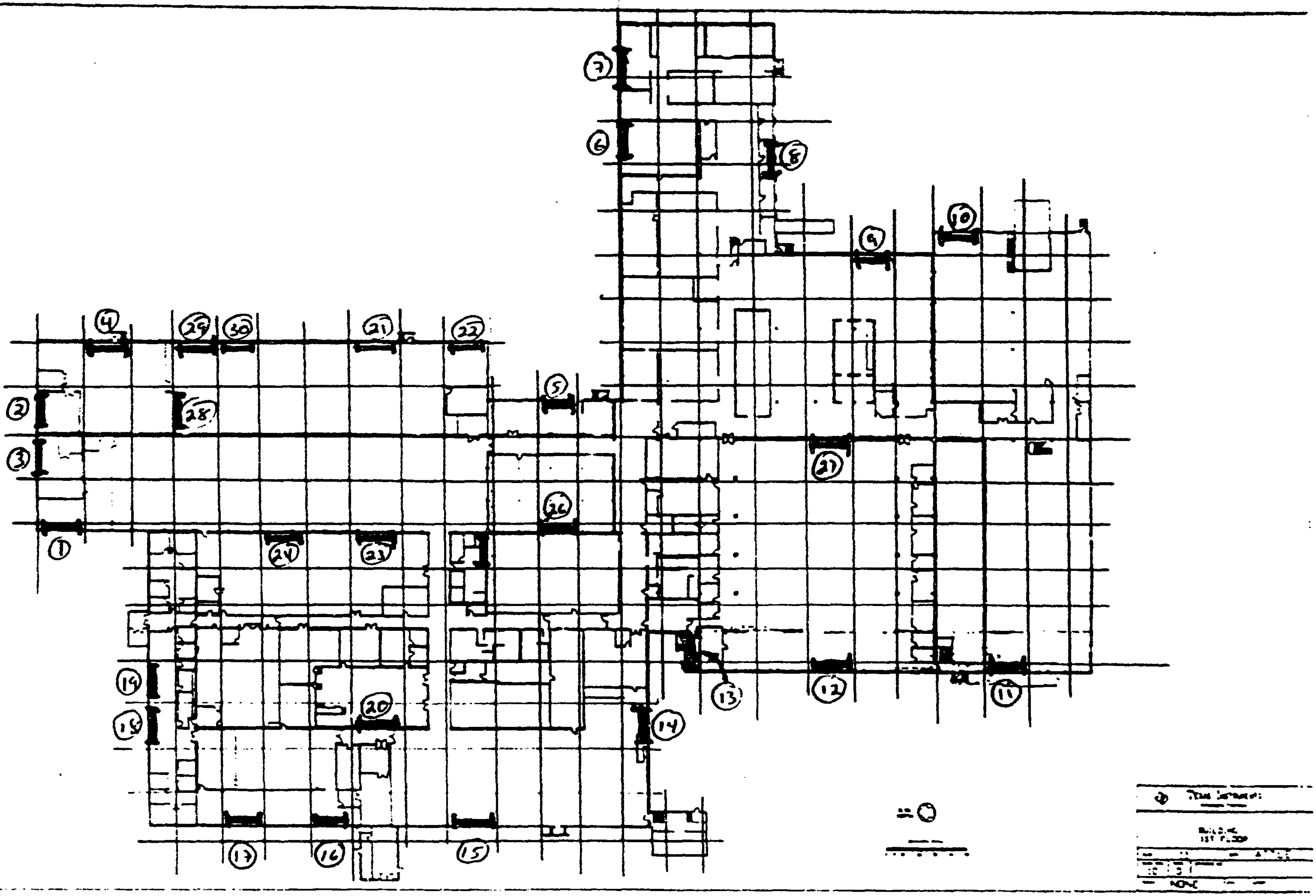
Appendix B-1-1: Grid Map and Survey Locations of Affected Area within Building 11



Appendix B-1-2

Grid Map and Survey Locations of Unaffected Areas within Building 11

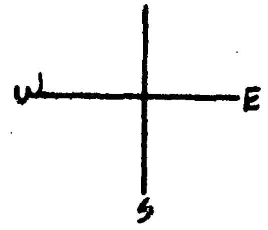
Appendix B-1-2: Grid Map and Survey Locations of Unaffected Areas within Building 11

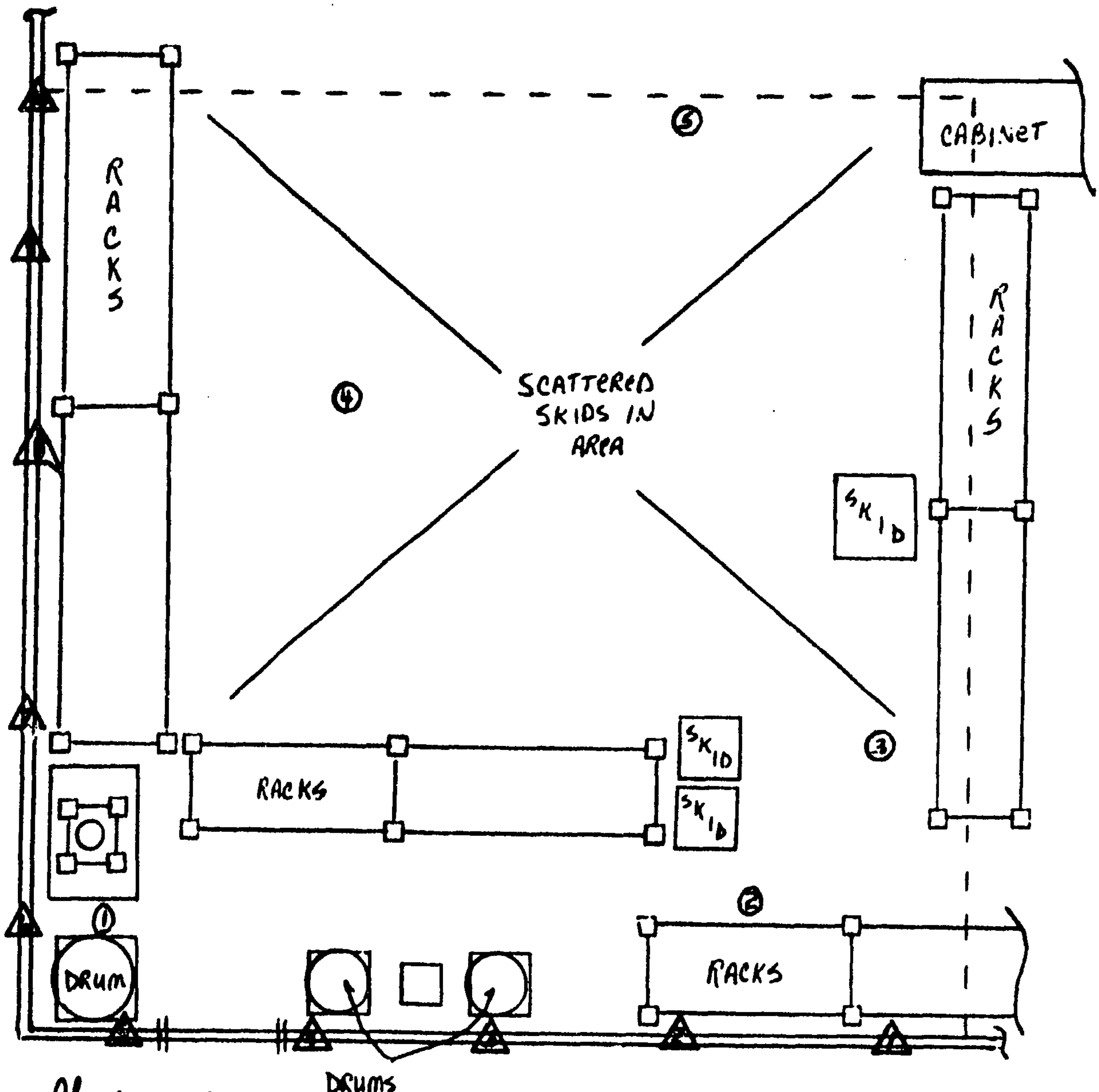


Appendix B-1-3

Individual grid detailed floor survey maps for affected area within Building 11

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'





△ denotes wall smears
(all smear's < bkg - bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115592 / "

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 80 cpm #2 80 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 100 cpm TECH #2 100 cpm

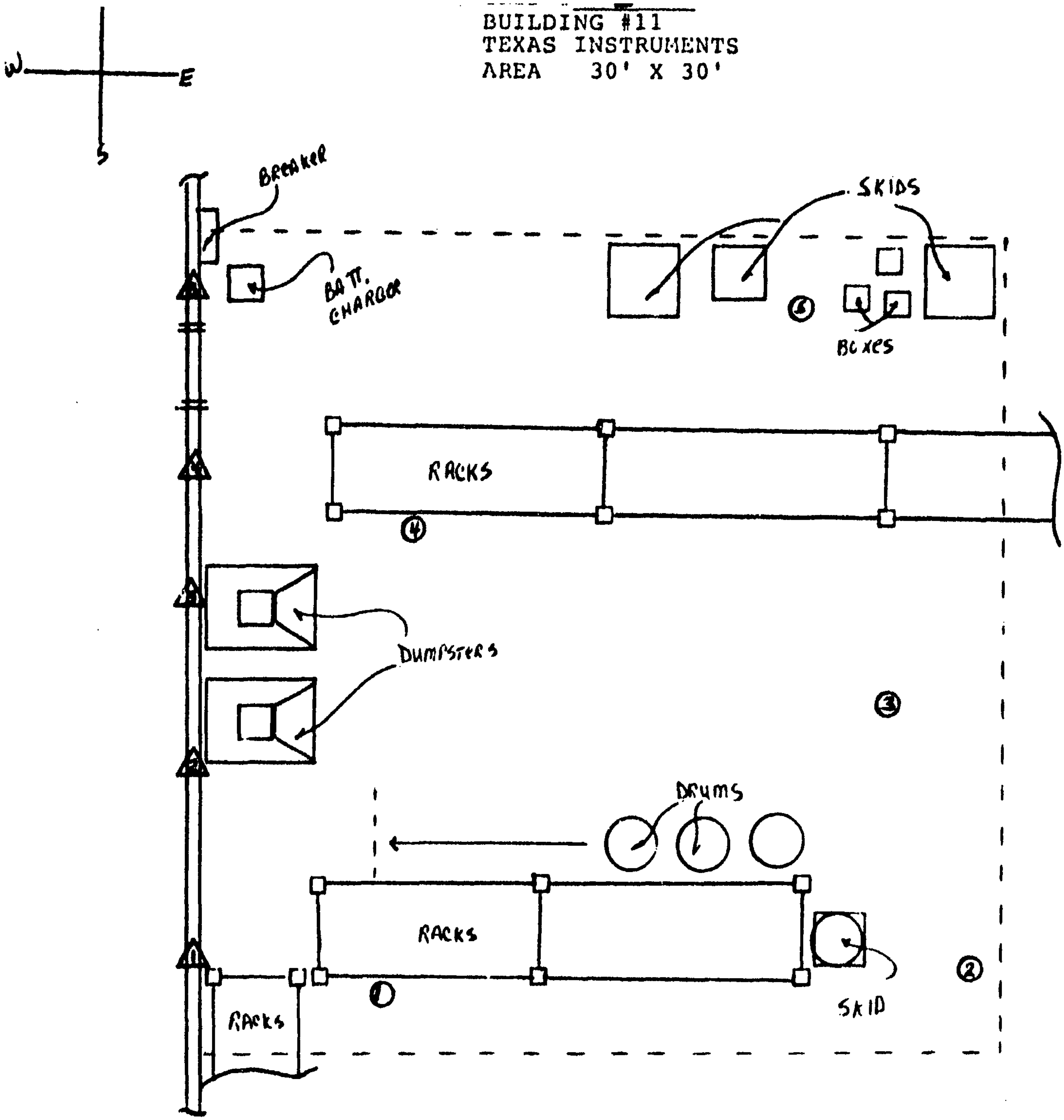
SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN
BACKGROUND 0 α 53 βγ

SMEAR #	RESULTS (CPM)	
1	1 α	70 βγ
2	0	65
3	0	65
4	0	60
5	0	54

* direct frisk of walls = < bkg.

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smears

all smears < bkg to 0 cpm = bkg

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 /

DATE 10-25-94
METER SCALER
SERIAL # 111677
COUNT TIME 1 min.
BACKGROUND 0 α 53 βγ

* direct frisk of walls < bkg.

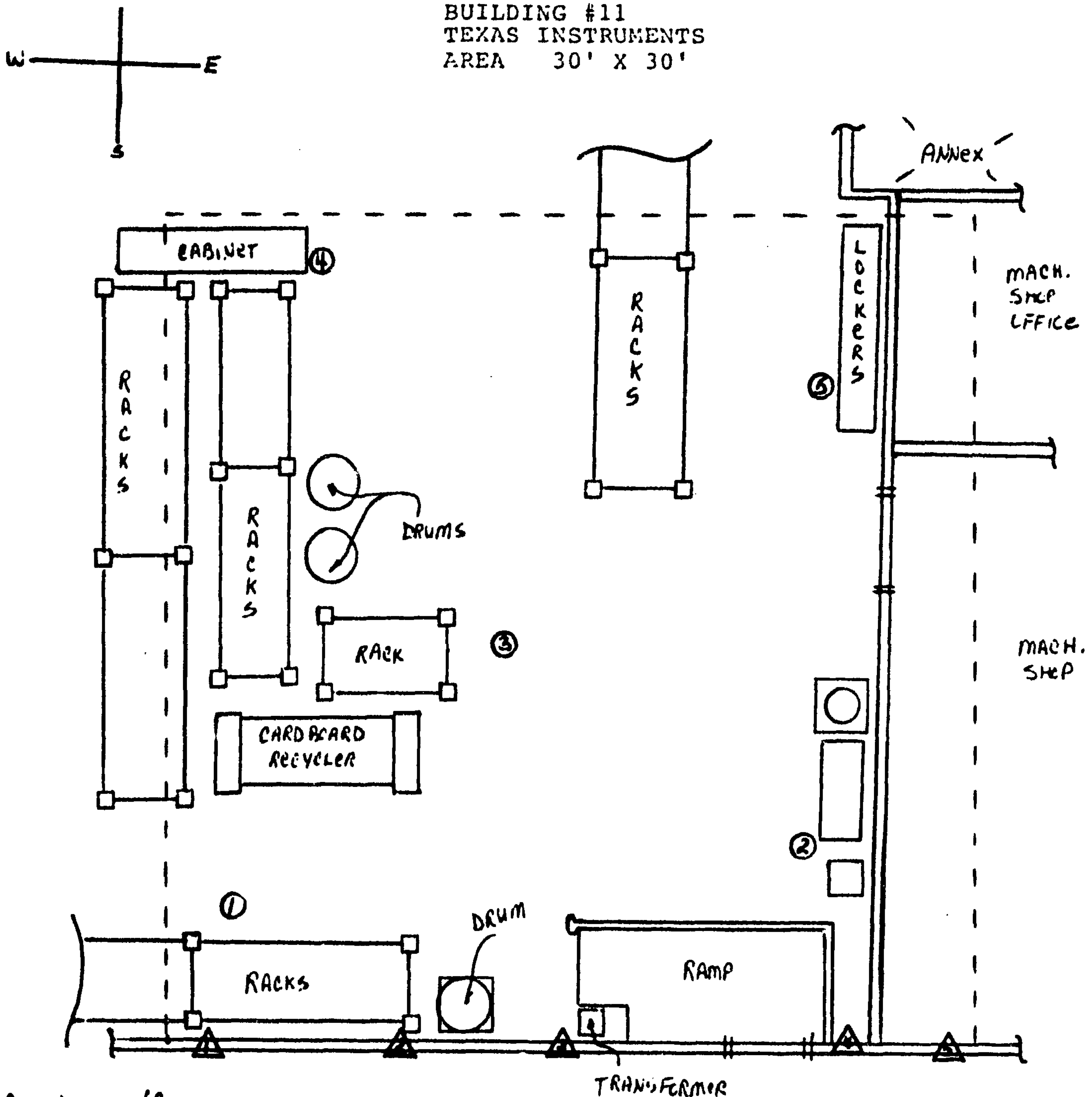
DIRECT FRISK RESULTS

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 80 cpm #2 80 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 100 cpm TECH #2 100 cpm

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM) α	RESULTS (CPM) βγ
1	1	50
2	0	64
3	0	60
4	0	44
5	0	55

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smears
(all smears are < bkg to bkg)

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTON
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115592 / ⟩

DIRECT FRISK RESULTS

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 8C cpm #2 8C cpm
QC SOURCE CHECK: #1 3CK #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 8C cpm TECH #2 8C cpm

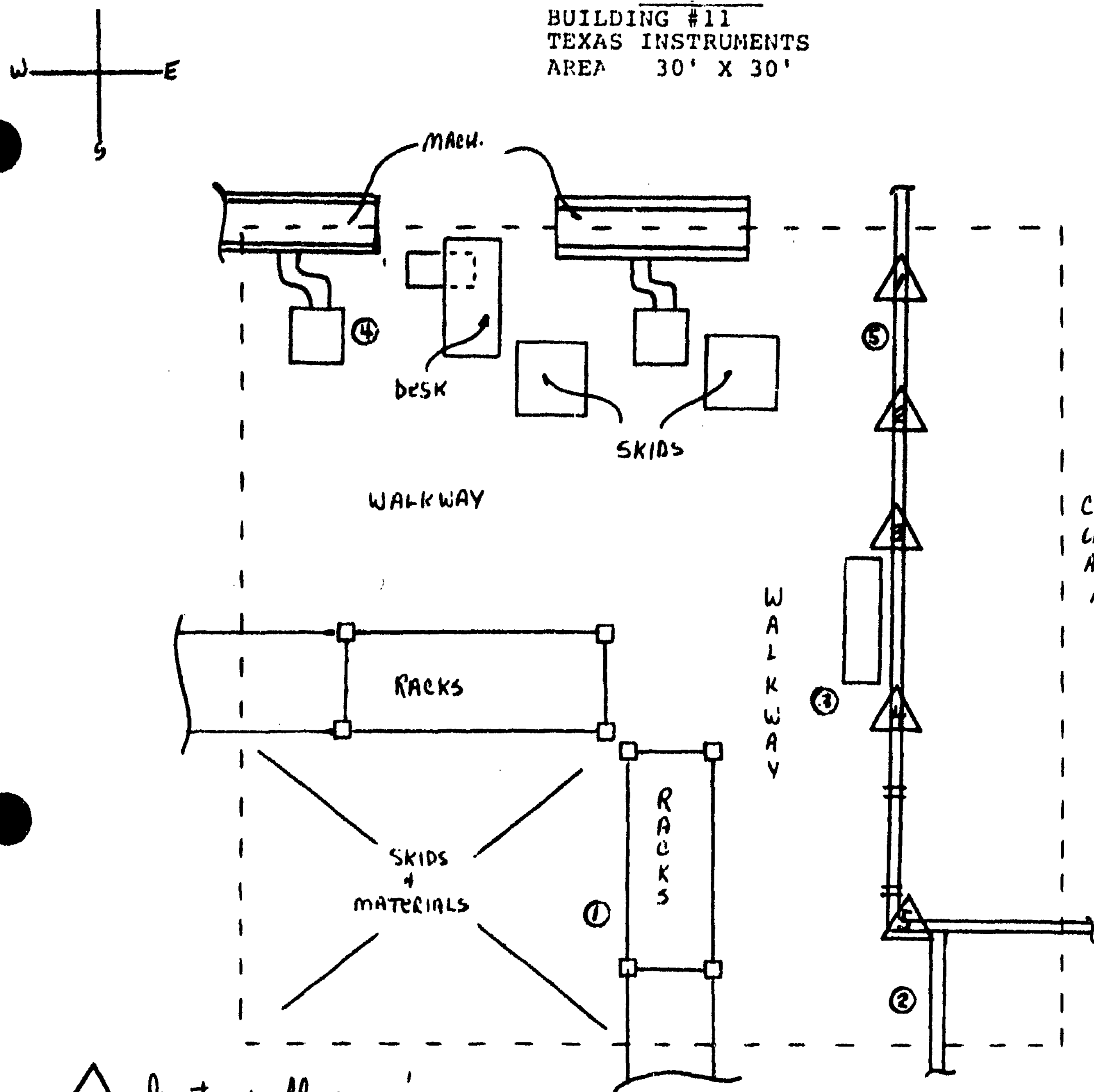
DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0 α 53 βγ

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	0 α	60 βγ
2	0	67
3	0	57
4	1	53
5	1	52

* direct frisk of walls < bkg

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smears
(all smears are < bkg to 10 cpm > bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M HUNTER
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 / ↓

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 80 cpm #2 80 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 80 cpm TECH #2 80 cpm

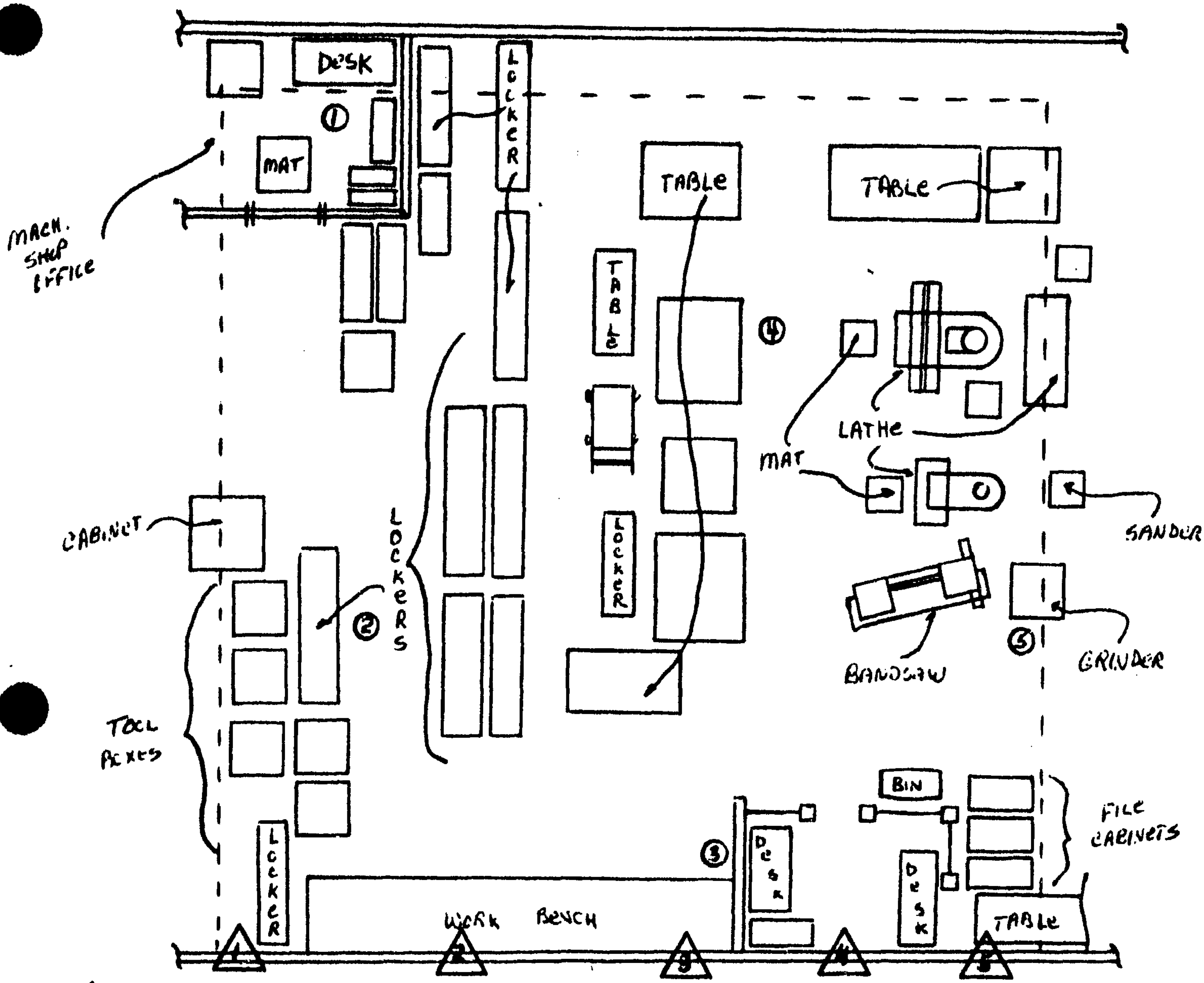
SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0α 53βγ

SMEAR #	RESULTS (CPM)	
1	0 α	52 βγ
2	0	72
3	0	62
4	0	63
5	2	61

* direct frisk of walls < bkg - bkg

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smear's
(all smears are < bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTON
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 / |

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 80 cpm #2 80 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 90 cpm TECH #2 80 cpm

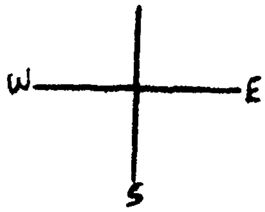
SMEAR SURVEY RESULTS

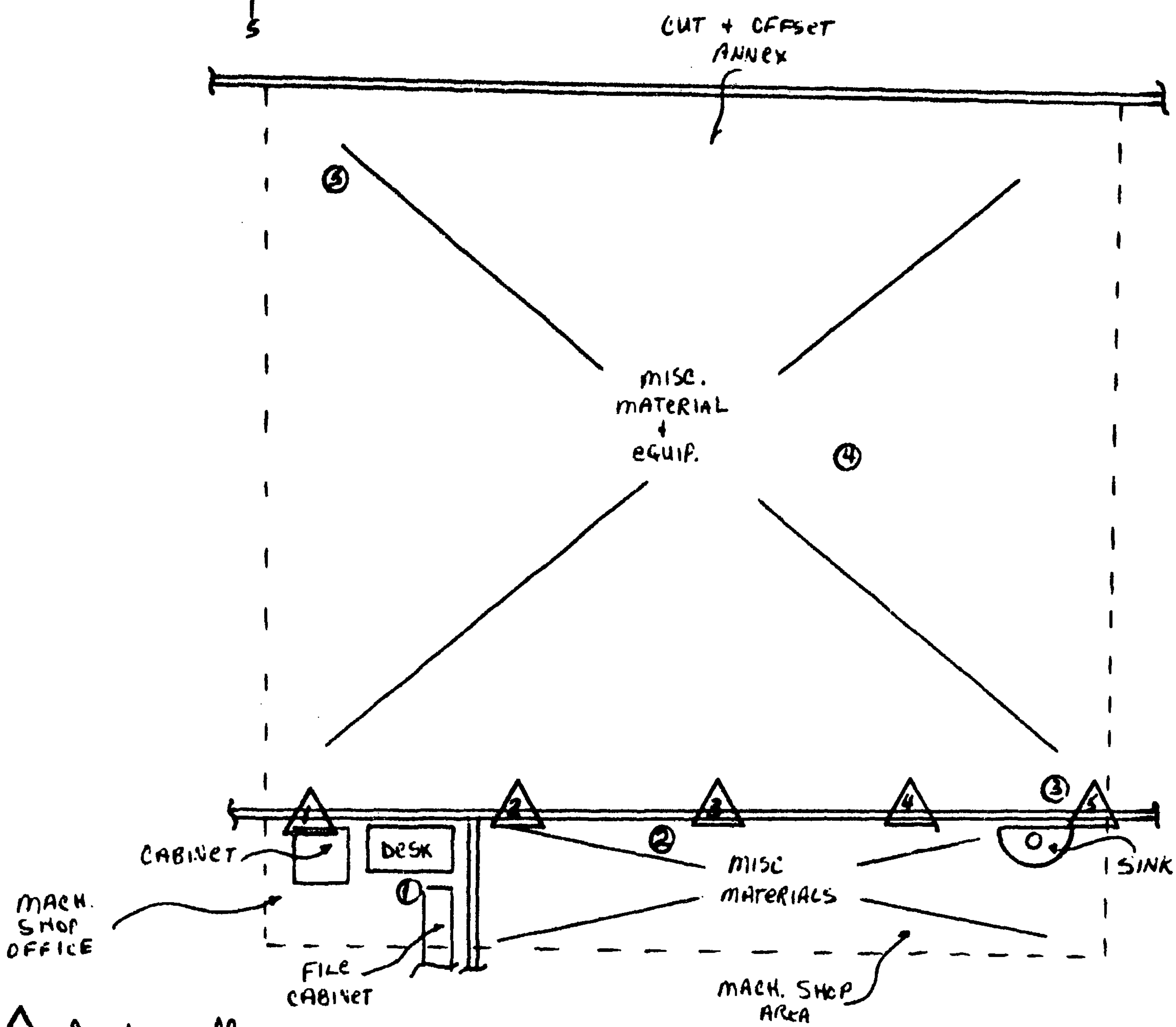
DATE 10-25-94
METER SCALER
SERIAL # 111677
COUNT TIME 1 MIN
BACKGROUND 0 α 53 β/γ

SMEAR #	RESULTS (CPM)	
1	0 α	61 β/γ
2	1	67
3	0	69
4	0	64
5	0	62

* direct frisk of walls < bkg to bkg

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'





△ denotes wall smears
(all smears are < bkg to 15cpm > bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 /

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 80 cpm #2 80 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 80 cpm TECH #2 80 cpm

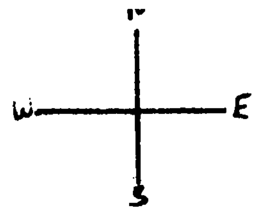
SMEAR SURVEY RESULTS

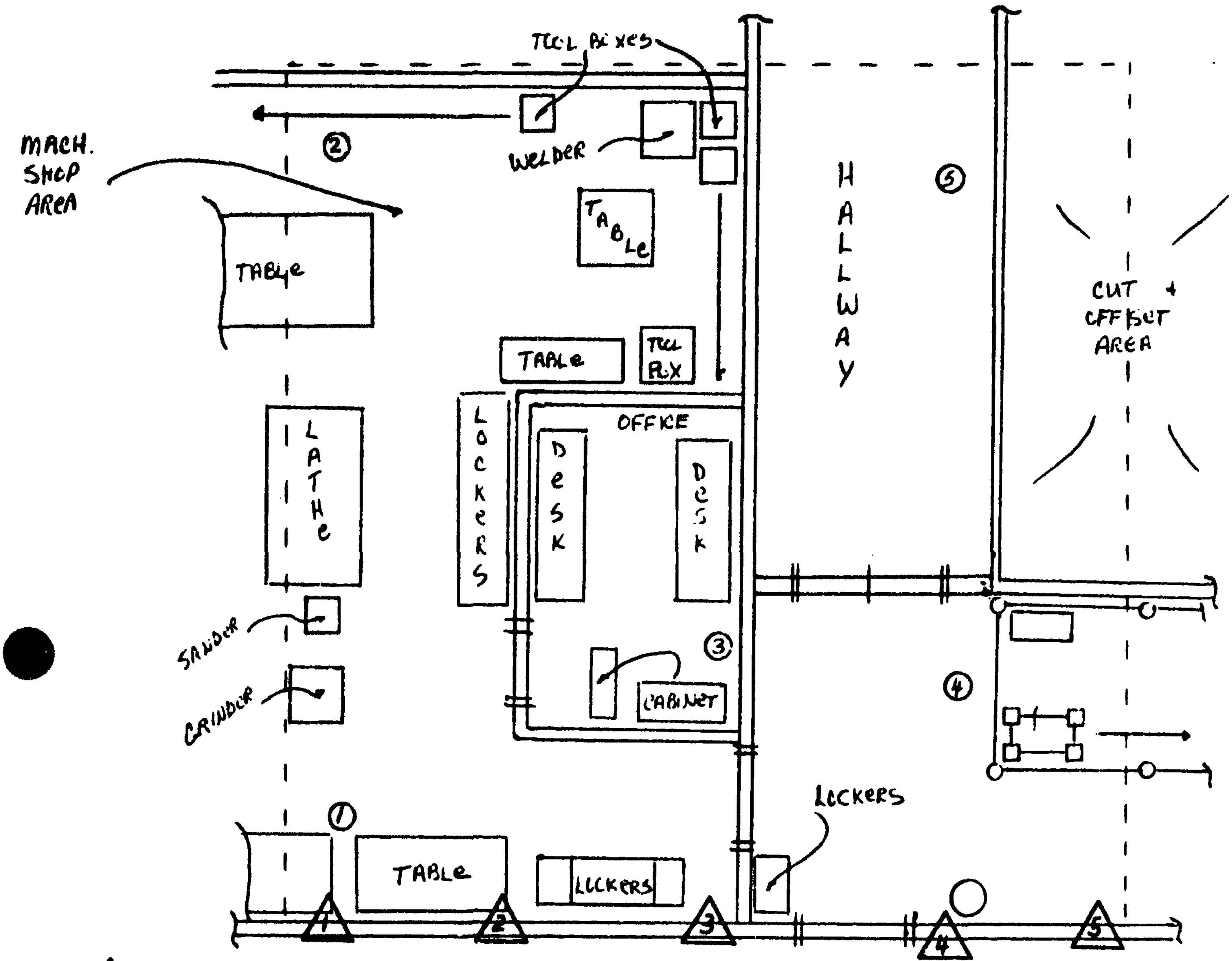
DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN
BACKGROUND 0 α 53 β

SMEAR #	RESULTS (CPM)	
1	1 α	73 β
2	0	52
3	0	56
4	1	54
5	0	64

* direct frisk of walls < bkg to bkg

GRID #
BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'





△ denotes wall smear's (all smears are < bkg)

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTAV
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115372 / ↓

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0α 53βγ

DIRECT FRISK RESULTS

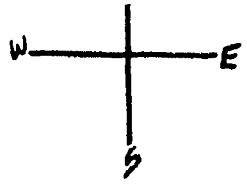
BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 EC cpm #2 EC cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 EC cpm TECH #2 EC cpm

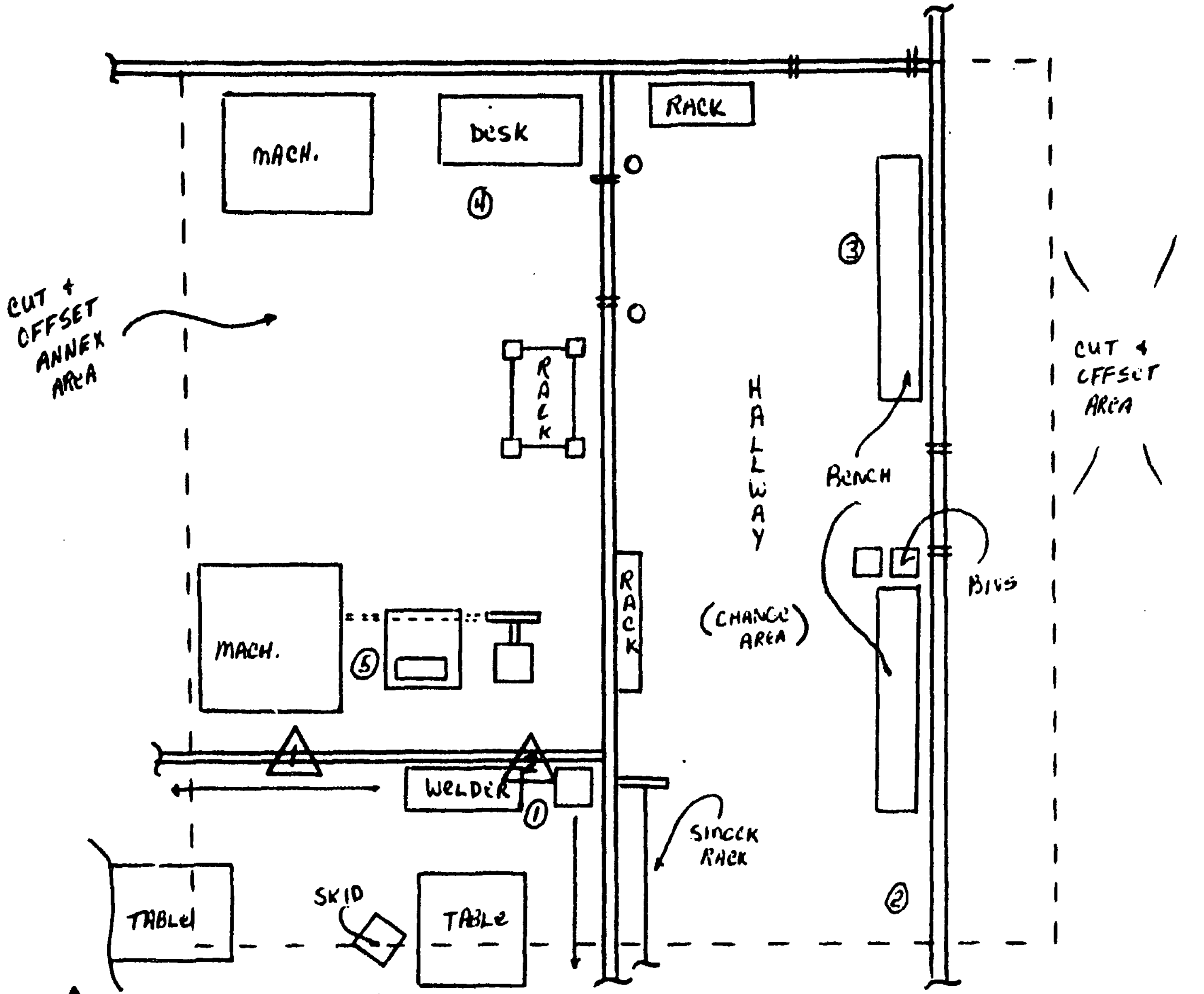
SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	0 α	63 βγ
2	0	61
3	0	70
4	0	75
5	1	53

* direct frisk of walls < bkg

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'





△ denotes wall smear's
(all smear's are < bkg)

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115592 / ↓

DIRECT FRISK RESULTS

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 80 cpm
QC SOURCE CHECK: #1 30k #2 32k
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 80 cpm

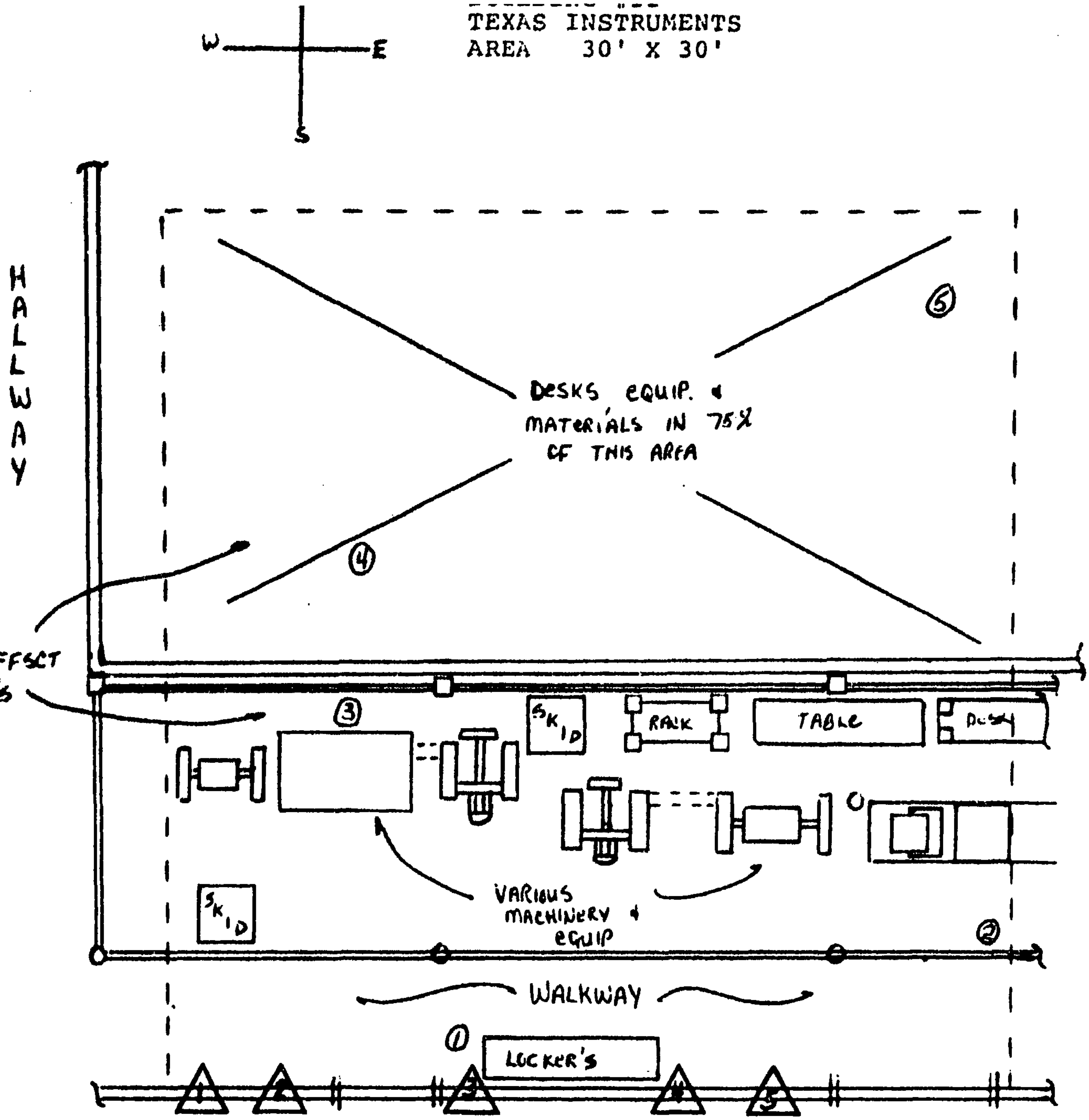
DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0 α 53 βγ

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	3 α	45 βγ
2	1	54
3	1	50
4	1	60
5	0	53

* direct frisk of walls < bkg to 10 cpm > bkg)

TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smear's
(all smear's are 10 cpm > bkg)

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTON
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 / ″

DIRECT FRISK RESULTS

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0α 53 βγ

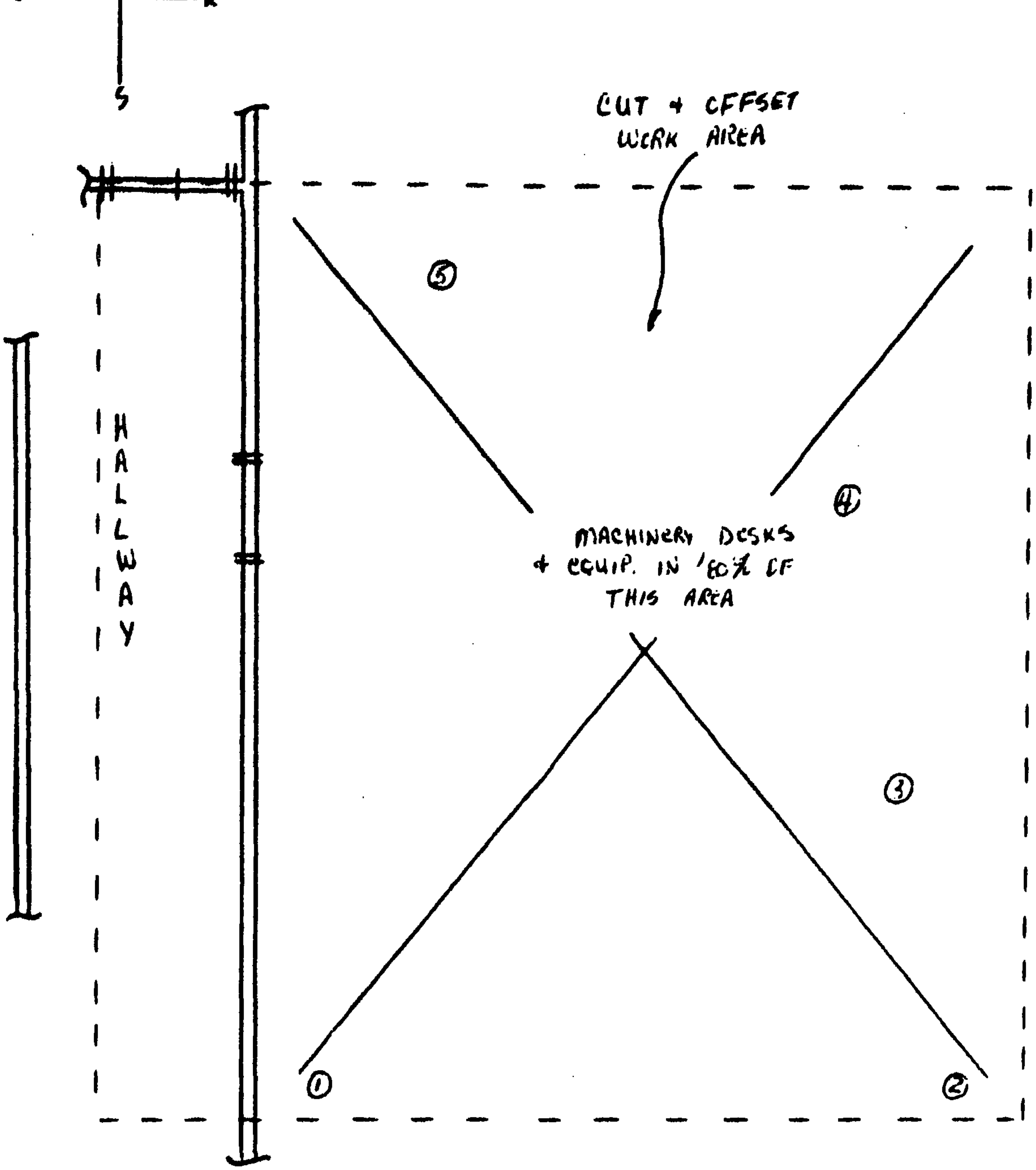
SMEAR #	RESULTS (CPM)	
1	0 α	57 βγ
2	0	62
3	0	67
4	0	56
5	0	62

* all direct frisks of walls are 10-15 cpm > bkg.

OFFICIAL RECORD COPY

118945

TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M HURTON
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 / ↓

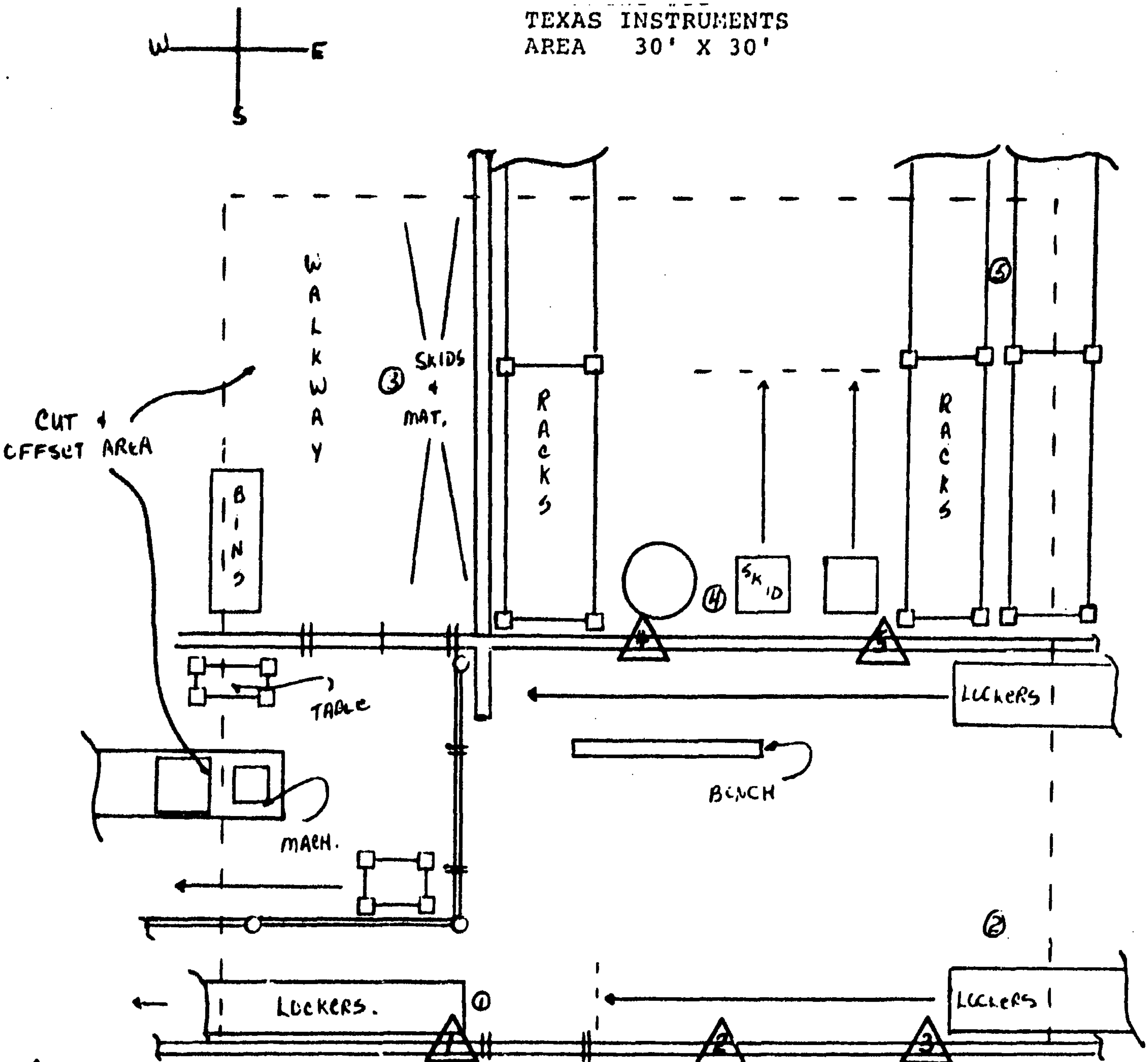
BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 80 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0 α 53 βγ

SMEAR #	RESULTS (CPM)	
1	0 α	67 βγ
2	1	66
3	0	51
4	1	56
5	0	71

TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smears
(all smears are < bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 /

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 3CK #2 3EK
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

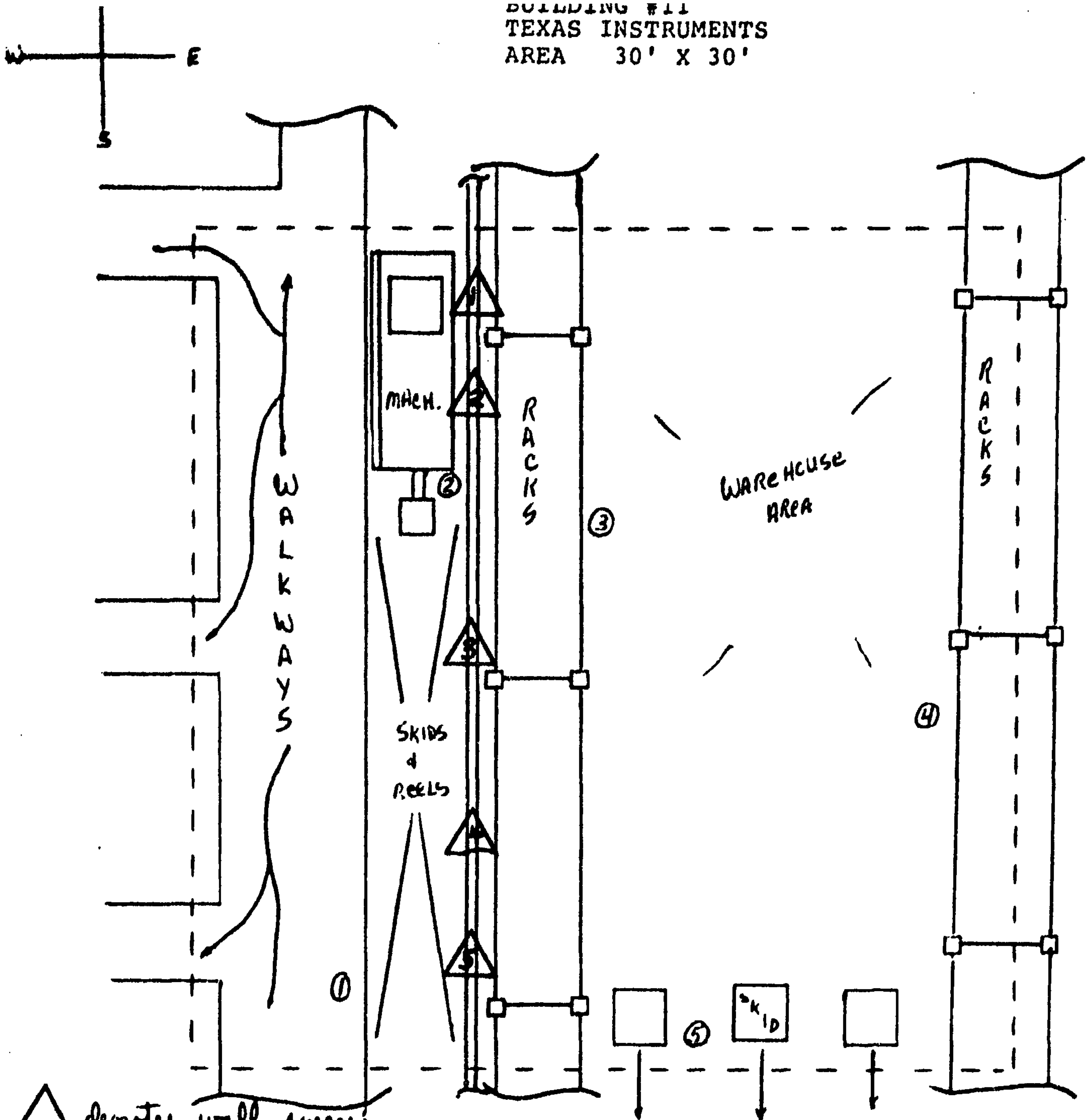
SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCHLER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0 α 53 βγ

SMEAR #	RESULTS (CPM)	
1	1 α	52 βγ
2	0	69
3	0	62
4	1	48
5	0	66

: direct frisk of walls < bkg to bkg.

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smears (all smears are < bkg to 5 cpm > bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115892 /

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 80 cpm TECH #2 80 cpm

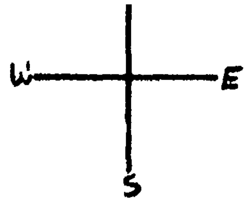
SMEAR SURVEY RESULTS

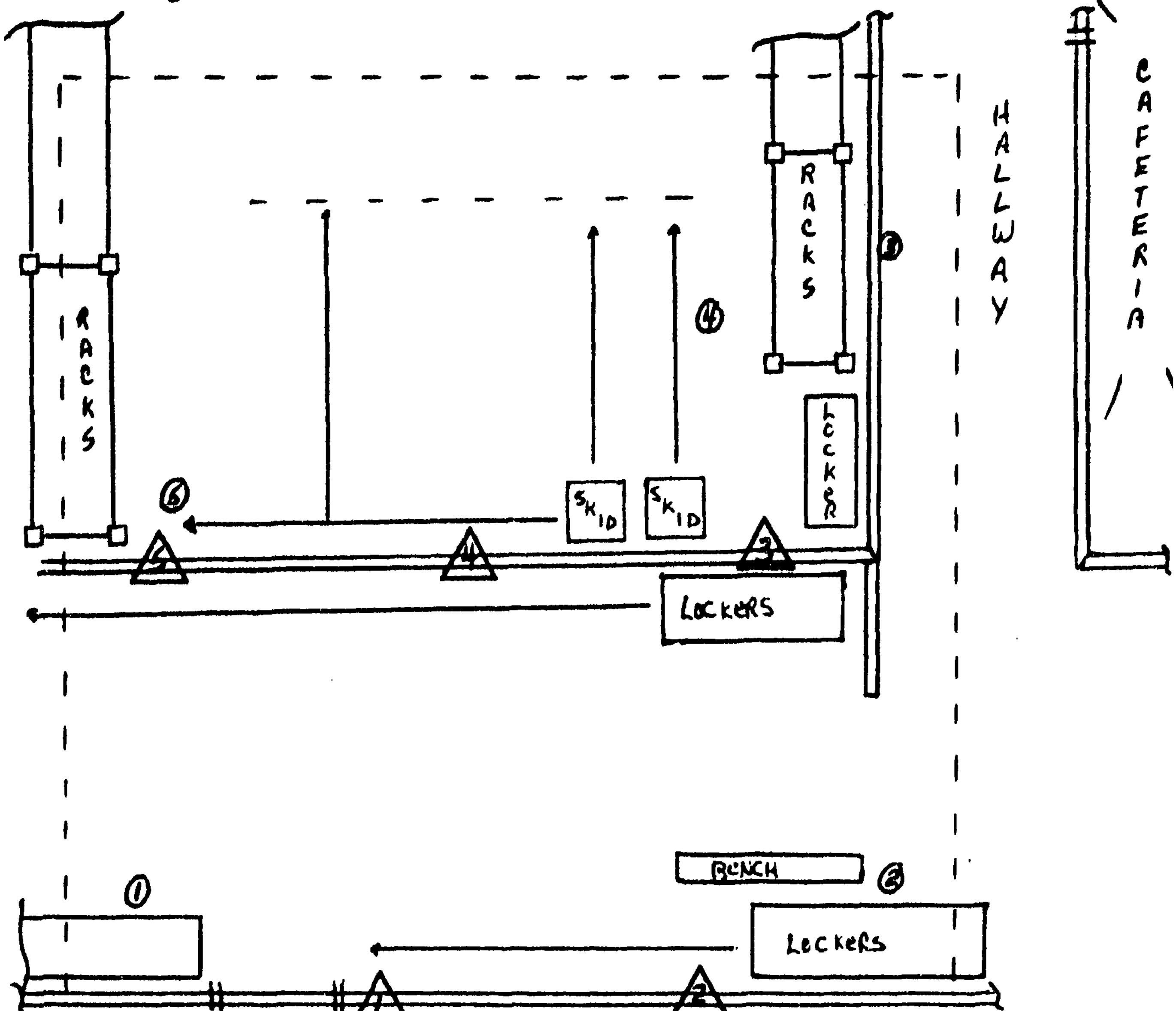
DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min.
BACKGROUND 0 α 53 β γ

SMEAR #	RESULTS (CPM)	
1	0 α	60 βγ
2	0	61
3	0	60
4	2	45
6	1	71

* direct frisk of walls < bkg.

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'





△ denotes wall smear's
(all smear's are < bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 / ↓

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 3CK #2 3CK
AVERAGE READING FOR GRID (CPM):
TECH #1 80 cpm TECH #2 70 cpm

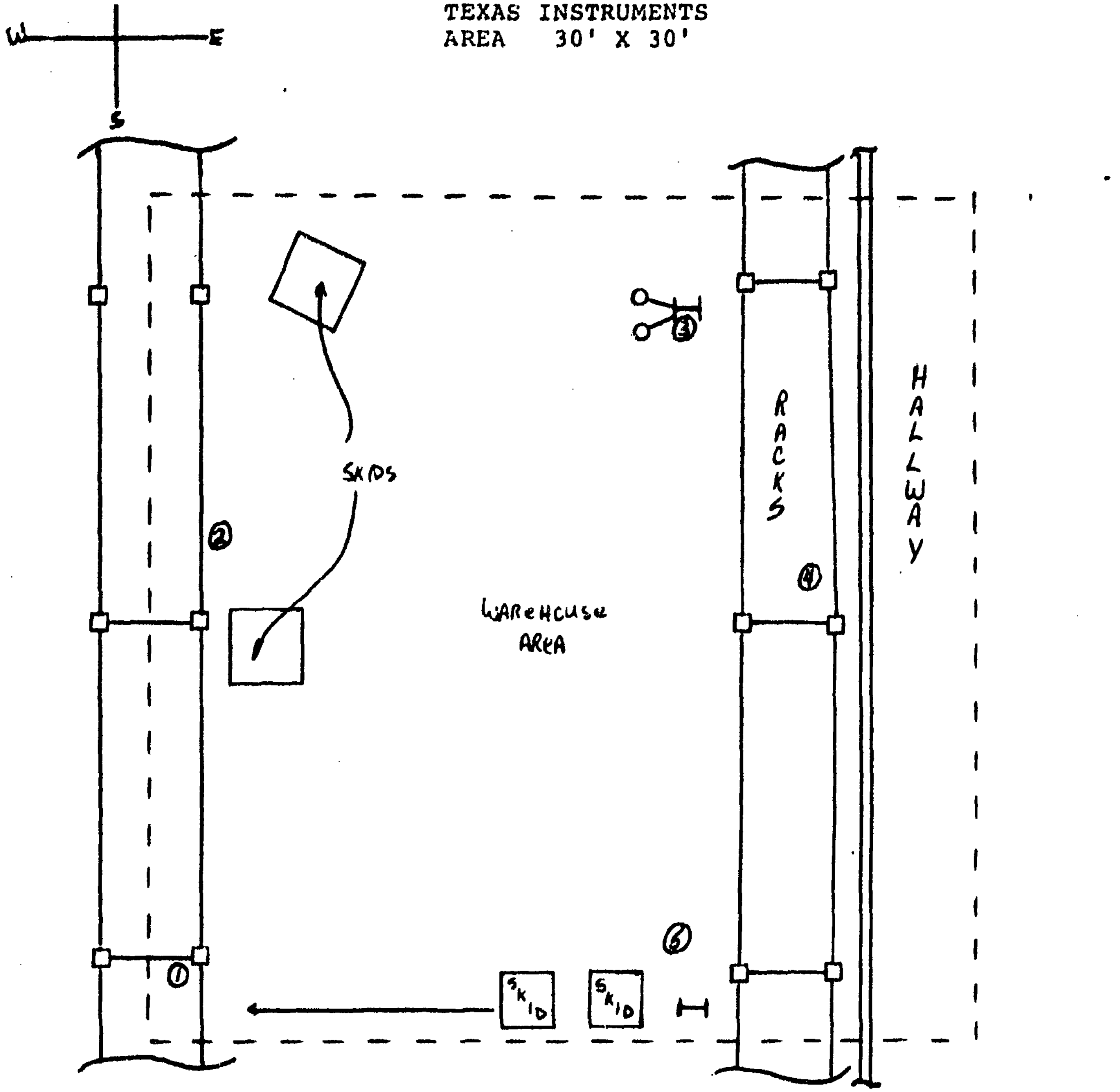
SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCHLER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0 α 53 βγ

SMEAR #	RESULTS (CPM)	
1	0 α	56 βγ
2	1	59
3	0	53
4	1	76
5	0	73

* direct frisk of walls < bkg to bkg.

TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTON
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 /

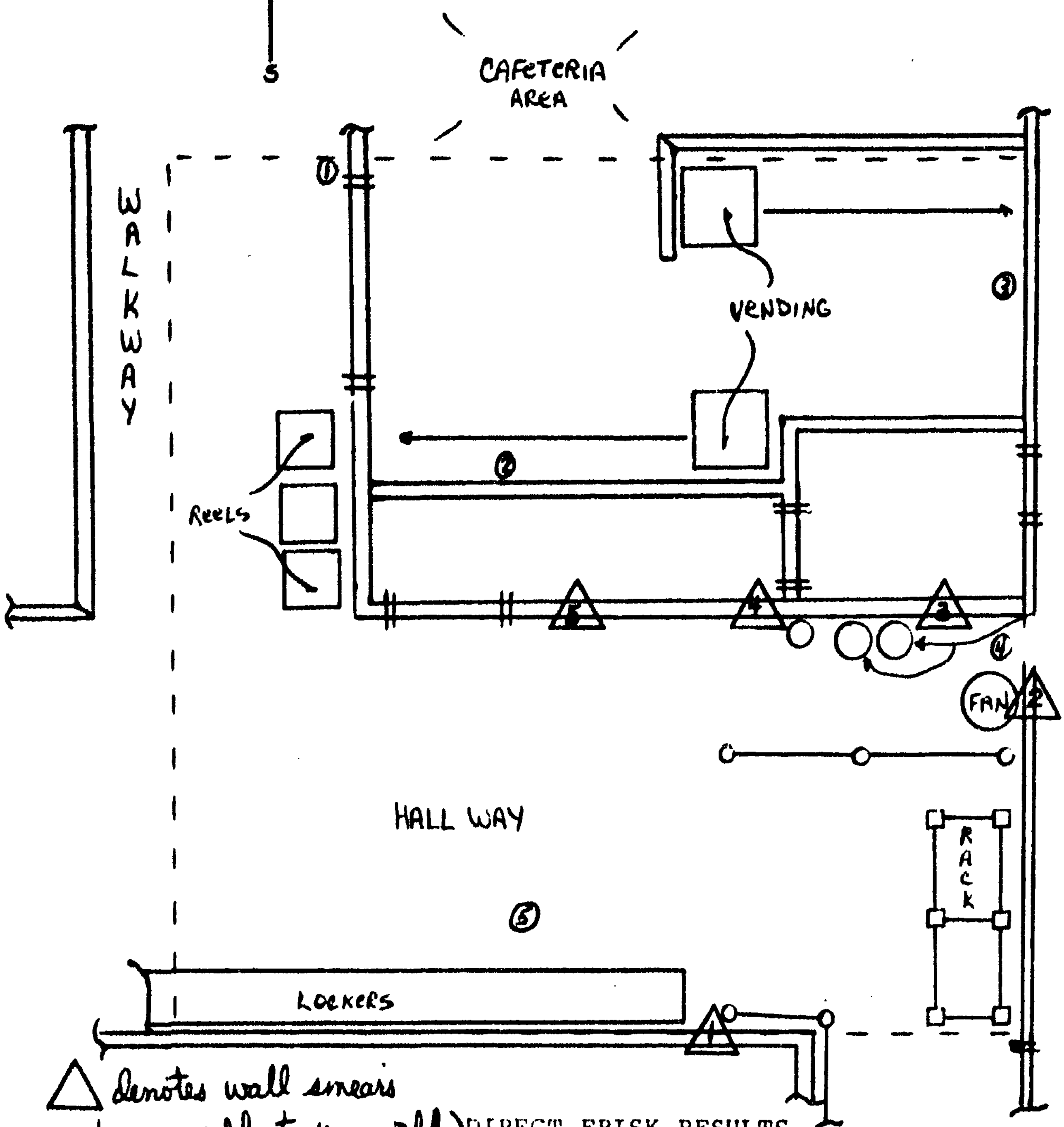
BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 30K #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111377
COUNT TIME 1 MIN.
BACKGROUND 0α 53 Bγ

SMEAR #	RESULTS (CPM)	
1	0 α	62 βγ
2	0	66
3	0	65
4	0	60
5	0	59

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



△ denotes wall smears
(all smears are < bkg to 10 cpm > bkg)

DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTON
METER/PROBE
SERIAL NUMBER
#1 110948 / NA
#2 115392 / 〃

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 30K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

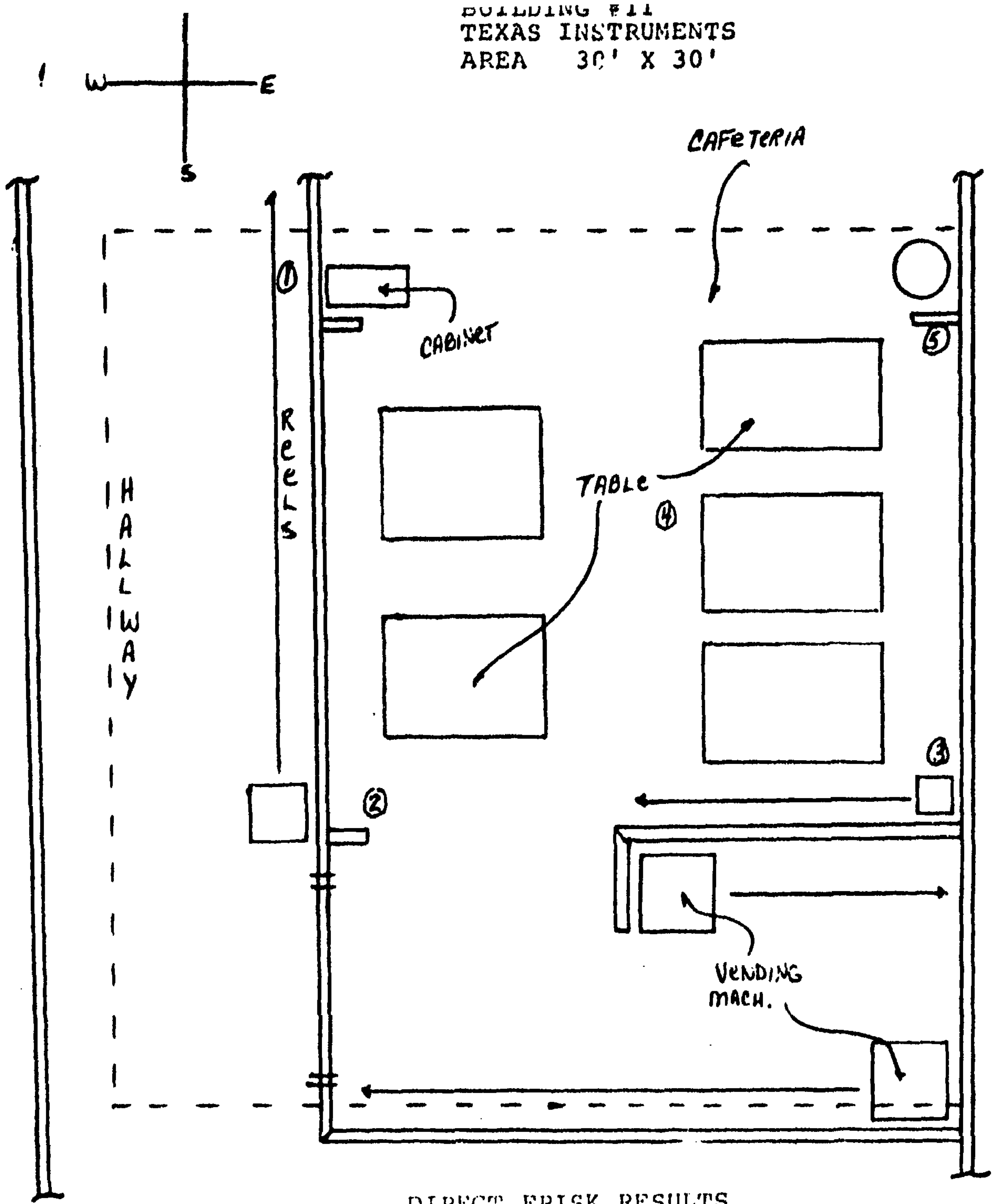
SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0 α 53 βγ

SMEAR #	RESULTS (CPM)	
1	0 α	72 βγ
2	0	51
3	1	57
4	0	59
5	1	61

* direct frisk of walls < bkg to bkg.

BUILDING #11
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-14-94
TECH #1 J. HALEY
TECH #2 M. HURTEN
METER/PROBE
SERIAL NUMBER
#1 110948 / N/A
#2 115392 / /

BATTERY CHECK: #1 OK #2 OK
BACKGROUND: #1 60 cpm #2 60 cpm
QC SOURCE CHECK: #1 3(K #2 32K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-25-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0α 53 βγ

SMEAR #	RESULTS (CPM)	
1	0 α	60 βγ
2	1	49
3	0	56
4	0	60
5	1	79

Appendix B-2

Building 11 Supplement Wall Swipe Measurements

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
Bldg 11 elect Area													
1	Wall	A	Nov-94	5	10	0	1	-2	587	10	53	1	-15.40541
1	Wall	B	Nov-94	5	10	1	1	2	587	10	71	1	33.24324
1	Wall	C	Nov-94	5	10	1	1	2	587	10	56	1	-7.297297
1	Wall	D	Nov-94	5	10	0	1	-2	587	10	62	1	8.918919
1	Wall	E	Nov-94	5	10	0	1	-2	587	10	64	1	14.32432
2	Wall	A	Nov-94	5	10	1	1	2	587	10	53	1	-15.40541
2	Wall	B	Nov-94	5	10	0	1	-2	587	10	51	1	-20.81081
2	Wall	C	Nov-94	5	10	0	1	-2	587	10	58	1	-1.891892
2	Wall	D	Nov-94	5	10	0	1	-2	587	10	59	1	0.810811
2	Wall	E	Nov-94	5	10	0	1	-2	587	10	52	1	-18.10811
3	Wall	A	Nov-94	5	10	0	1	-2	587	10	64	1	14.32432
3	Wall	B	Nov-94	5	10	1	1	2	587	10	66	1	19.72973
3	Wall	C	Nov-94	5	10	2	1	6	587	10	73	1	38.64865
3	Wall	D	Nov-94	5	10	0	1	-2	587	10	65	1	17.02703
3	Wall	E	Nov-94	5	10	1	1	2	587	10	63	1	11.62162
4	Wall	A	Nov-94	5	10	0	1	-2	587	10	66	1	19.72973
4	Wall	B	Nov-94	5	10	1	1	2	587	10	58	1	-1.891892
4	Wall	C	Nov-94	5	10	0	1	-2	587	10	53	1	-15.40541
4	Wall	D	Nov-94	5	10	0	1	-2	587	10	62	1	8.918919
4	Wall	E	Nov-94	5	10	0	1	-2	587	10	61	1	6.216216
5	Wall	A	Nov-94	5	10	1	1	2	587	10	54	1	-12.7027
5	Wall	B	Nov-94	5	10	1	1	2	587	10	58	1	-1.891892
5	Wall	C	Nov-94	5	10	0	1	-2	587	10	59	1	0.810811
5	Wall	D	Nov-94	5	10	1	1	2	587	10	50	1	-23.51351
5	Wall	E	Nov-94	5	10	0	1	-2	587	10	70	1	30.54054
6	Wall	A	Nov-94	5	10	0	1	-2	587	10	53	1	-15.40541
6	Wall	B	Nov-94	5	10	0	1	-2	587	10	52	1	-18.10811
6	Wall	C	Nov-94	5	10	0	1	-2	587	10	55	1	-10
6	Wall	D	Nov-94	5	10	0	1	-2	587	10	65	1	17.02703

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
6	Wall	E	Nov-94	5	10	0	1	-2	587	10	60	1	3.513514
7	Wall	A	Nov-94	5	10	0	1	-2	587	10	67	1	22.43243
7	Wall	B	Nov-94	5	10	1	1	2	587	10	50	1	-23.51351
7	Wall	C	Nov-94	5	10	0	1	-2	587	10	51	1	-20.81081
7	Wall	D	Nov-94	5	10	0	1	-2	587	10	52	1	-18.10811
7	Wall	E	Nov-94	5	10	0	1	-2	587	10	49	1	-26.21622
8	Wall	A	Nov-94	5	10	1	1	2	587	10	53	1	-15.40541
8	Wall	B	Nov-94	5	10	1	1	2	587	10	52	1	-18.10811
8	Wall	C	Nov-94	5	10	1	1	2	587	10	55	1	-10
8	Wall	D	Nov-94	5	10	1	1	2	587	10	58	1	-1.891892
8	Wall	E	Nov-94	5	10	0	1	-2	587	10	58	1	-1.891892
9	Wall	A	Nov-94	5	10	0	1	-2	587	10	62	1	8.918919
9	Wall	B	Nov-94	5	10	0	1	-2	587	10	54	1	-12.7027
9	Wall	C	Nov-94	5	10	2	1	6	587	10	60	1	3.513514
9	Wall	D	Nov-94	5	10	0	1	-2	587	10	62	1	8.918919
9	Wall	E	Nov-94	5	10	0	1	-2	587	10	58	1	-1.891892
11	Wall	A	Nov-94	5	10	0	1	-2	587	10	70	1	30.54054
11	Wall	B	Nov-94	5	10	1	1	2	587	10	51	1	-20.81081
11	Wall	C	Nov-94	5	10	0	1	-2	587	10	70	1	30.54054
11	Wall	D	Nov-94	5	10	0	1	-2	587	10	60	1	3.513514
11	Wall	E	Nov-94	5	10	1	1	2	587	10	58	1	-1.891892
12	Wall	A	Nov-94	5	10	0	1	-2	587	10	52	1	-18.10811
12	Wall	B	Nov-94	5	10	0	1	-2	587	10	51	1	-20.81081
12	Wall	C	Nov-94	5	10	0	1	-2	587	10	51	1	-20.81081
12	Wall	D	Nov-94	5	10	0	1	-2	587	10	57	1	-4.594595
12	Wall	E	Nov-94	5	10	1	1	2	587	10	63	1	11.62162
13	Wall	A	Nov-94	5	10	0	1	-2	587	10	65	1	17.02703
13	Wall	B	Nov-94	5	10	0	1	-2	587	10	56	1	-7.297297
13	Wall	C	Nov-94	5	10	1	1	2	587	10	53	1	-15.40541
13	Wall	D	Nov-94	5	10	0	1	-2	587	10	66	1	19.72973
13	Wall	E	Nov-94	5	10	0	1	-2	587	10	52	1	-18.10811
15	Wall	A	Nov-94	5	10	2	1	6	587	10	57	1	-4.594595

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
15	Wall	B	Nov-94	5	10	1	1	2	587	10	68	1	25.13514
15	Wall	C	Nov-94	5	10	0	1	-2	587	10	54	1	-12.7027
15	Wall	D	Nov-94	5	10	0	1	-2	587	10	71	1	33.24324
15	Wall	E	Nov-94	5	10	2	1	6	587	10	68	1	25.13514
Bldg 11 Random													
1	Wall	A	Jan-95	5	10	0	1	-2	603	10	50	1	-27.83784
1	Wall	B	Jan-95	5	10	1	1	2	603	10	43	1	-46.75676
1	Wall	C	Jan-95	5	10	1	1	2	603	10	67	1	18.10811
1	Wall	D	Jan-95	5	10	1	1	2	603	10	43	1	-46.75676
1	Wall	E	Jan-95	5	10	1	1	2	603	10	67	1	18.10811
2	Wall	A	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
2	Wall	B	Jan-95	5	10	1	1	2	603	10	68	1	20.81081
2	Wall	C	Jan-95	5	10	2	1	6	603	10	69	1	23.51351
2	Wall	D	Jan-95	5	10	0	1	-2	603	10	48	1	-33.24324
2	Wall	E	Jan-95	5	10	0	1	-2	603	10	58	1	-6.216216
3	Wall	A	Jan-95	5	10	0	1	-2	603	10	59	1	-3.513514
3	Wall	B	Jan-95	5	10	0	1	-2	603	10	44	1	-44.05405
3	Wall	C	Jan-95	5	10	0	1	-2	603	10	51	1	-25.13514
3	Wall	D	Jan-95	5	10	0	1	-2	603	10	65	1	12.7027
3	Wall	E	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
4	Wall	A	Jan-95	5	10	0	1	-2	603	10	61	1	1.891892
4	Wall	B	Jan-95	5	10	1	1	2	603	10	61	1	1.891892
4	Wall	C	Jan-95	5	10	0	1	-2	603	10	67	1	18.10811
4	Wall	D	Jan-95	5	10	0	1	-2	603	10	64	1	10
4	Wall	E	Jan-95	5	10	1	1	2	603	10	54	1	-17.02703
5	Wall	A	Jan-95	5	10	0	1	-2	603	10	49	1	-30.54054
5	Wall	B	Jan-95	5	10	0	1	-2	603	10	68	1	20.81081
5	Wall	C	Jan-95	5	10	1	1	2	603	10	61	1	1.891892
5	Wall	D	Jan-95	5	10	0	1	-2	603	10	66	1	15.40541
5	Wall	E	Jan-95	5	10	0	1	-2	603	10	58	1	-6.216216

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

Grid # / Location	Type of Sample	Description	Date	Alpha Background Count	Alpha Background Time	Alpha Sample Count	Alpha Sample Time	Alpha Activity dpm	Beta Background Count	Beta Background Time	Beta Sample Count	Beta Sample Time	Beta Activity
6	Wall	A	Jan-95	5	10	0	1	-2	603	10	55	1	-14.32432
6	Wall	B	Jan-95	5	10	0	1	-2	603	10	54	1	-17.02703
6	Wall	C	Jan-95	5	10	0	1	-2	603	10	69	1	23.51351
6	Wall	D	Jan-95	5	10	1	1	2	603	10	52	1	-22.43243
6	Wall	E	Jan-95	5	10	0	1	-2	603	10	61	1	1.891892
7	Wall	A	Jan-95	5	10	0	1	-2	603	10	61	1	1.891892
7	Wall	B	Jan-95	5	10	1	1	2	603	10	78	1	47.83784
7	Wall	C	Jan-95	5	10	0	1	-2	603	10	63	1	7.297297
7	Wall	D	Jan-95	5	10	1	1	2	603	10	72	1	31.62162
7	Wall	E	Jan-95	5	10	1	1	2	603	10	52	1	-22.43243
8	Wall	A	Jan-95	5	10	0	1	-2	603	10	55	1	-14.32432
8	Wall	B	Jan-95	5	10	0	1	-2	603	10	60	1	-0.810811
8	Wall	C	Jan-95	5	10	0	1	-2	603	10	65	1	12.7027
8	Wall	D	Jan-95	5	10	0	1	-2	603	10	61	1	1.891892
8	Wall	E	Jan-95	5	10	2	1	6	603	10	53	1	-19.72973
9	Wall	A	Jan-95	5	10	1	1	2	603	10	61	1	1.891892
9	Wall	B	Jan-95	5	10	0	1	-2	603	10	65	1	12.7027
9	Wall	C	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
9	Wall	D	Jan-95	5	10	0	1	-2	603	10	68	1	20.81081
9	Wall	E	Jan-95	5	10	2	1	6	603	10	62	1	4.594595
10	Wall	A	Jan-95	5	10	0	1	-2	603	10	53	1	-19.72973
10	Wall	B	Jan-95	5	10	1	1	2	603	10	70	1	26.21622
10	Wall	C	Jan-95	5	10	0	1	-2	603	10	57	1	-8.918919
10	Wall	D	Jan-95	5	10	2	1	6	603	10	61	1	1.891892
10	Wall	E	Jan-95	5	10	0	1	-2	603	10	59	1	-3.513514
11	Wall	A	Jan-95	5	10	0	1	-2	603	10	61	1	1.891892
11	Wall	B	Jan-95	5	10	1	1	2	603	10	65	1	12.7027
11	Wall	C	Jan-95	5	10	1	1	2	603	10	53	1	-19.72973
11	Wall	D	Jan-95	5	10	0	1	-2	603	10	62	1	4.594595
11	Wall	E	Jan-95	5	10	0	1	-2	603	10	67	1	18.10811
12	Wall	A	Jan-95	5	10	1	1	2	603	10	65	1	12.7027
12	Wall	B	Jan-95	5	10	0	1	-2	603	10	62	1	4.594595

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

Grid # / Location	Type of Sample	Description	Date	Alpha Background Count	Time	Alpha Sample Count	Time	Activity dpm	Beta Background Count	Time	Beta Sample Count	Time	Activity
12	Wall	C	Jan-95	5	10	1	1	2	603	10	50	1	-27.83784
12	Wall	D	Jan-95	5	10	1	1	2	603	10	71	1	28.91892
12	Wall	E	Jan-95	5	10	0	1	-2	603	10	58	1	-6.216216
13	Wall	A	Jan-95	5	10	2	1	6	603	10	45	1	-41.35135
13	Wall	B	Jan-95	5	10	1	1	2	603	10	55	1	-14.32432
13	Wall	C	Jan-95	5	10	0	1	-2	603	10	72	1	31.62162
13	Wall	D	Jan-95	5	10	2	1	6	603	10	66	1	15.40541
13	Wall	E	Jan-95	5	10	0	1	-2	603	10	64	1	10
14	Wall	A	Jan-95	5	10	0	1	-2	603	10	57	1	-8.918919
14	Wall	B	Jan-95	5	10	0	1	-2	603	10	69	1	23.51351
14	Wall	C	Jan-95	5	10	1	1	2	603	10	66	1	15.40541
14	Wall	D	Jan-95	5	10	0	1	-2	603	10	47	1	-35.94595
14	Wall	E	Jan-95	5	10	0	1	-2	603	10	50	1	-27.83784
15	Wall	A	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
15	Wall	B	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
15	Wall	C	Jan-95	5	10	2	1	6	603	10	73	1	34.32432
15	Wall	D	Jan-95	5	10	0	1	-2	603	10	50	1	-27.83784
15	Wall	E	Jan-95	5	10	0	1	-2	603	10	65	1	12.7027
16	Wall	A	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
16	Wall	B	Jan-95	5	10	0	1	-2	603	10	61	1	1.891892
16	Wall	C	Jan-95	5	10	0	1	-2	603	10	44	1	-44.05405
16	Wall	D	Jan-95	5	10	1	1	2	603	10	66	1	15.40541
16	Wall	E	Jan-95	5	10	2	1	6	603	10	60	1	-0.810811
17	Wall	A	Jan-95	5	10	0	1	-2	603	10	62	1	4.594595
17	Wall	B	Jan-95	5	10	1	1	2	603	10	51	1	-25.13514
17	Wall	C	Jan-95	5	10	0	1	-2	603	10	68	1	20.81081
17	Wall	D	Jan-95	5	10	0	1	-2	603	10	64	1	10
17	Wall	E	Jan-95	5	10	0	1	-2	603	10	67	1	18.10811
18	Wall	A	Jan-95	5	10	0	1	-2	603	10	59	1	-3.513514
18	Wall	B	Jan-95	5	10	2	1	6	603	10	76	1	42.43243
18	Wall	C	Jan-95	5	10	0	1	-2	603	10	52	1	-22.43243
18	Wall	D	Jan-95	5	10	0	1	-2	603	10	64	1	10

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
18	Wall	E	Jan-95	5	10	0	1	-2	603	10	81	1	55.94595
19	Wall	A	Jan-95	5	10	1	1	2	603	10	57	1	-8.918919
19	Wall	B	Jan-95	5	10	0	1	-2	603	10	56	1	-11.62162
19	Wall	C	Jan-95	5	10	0	1	-2	603	10	55	1	-14.32432
19	Wall	D	Jan-95	5	10	0	1	-2	603	10	55	1	-14.32432
19	Wall	E	Jan-95	5	10	1	1	2	603	10	51	1	-25.13514
20	Wall	A	Jan-95	2	10	0	1	-0.8	657	10	48	1	-47.83784
20	Wall	B	Jan-95	2	10	2	1	7.2	657	10	69	1	8.918919
20	Wall	C	Jan-95	2	10	2	1	7.2	657	10	64	1	-4.594595
20	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	65	1	-1.891892
20	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	60	1	-15.40541
21	Wall	A	Jan-95	2	10	1	1	3.2	657	10	66	1	0.810811
21	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	71	1	14.32432
21	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	60	1	-15.40541
21	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	67	1	3.513514
21	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	65	1	-1.891892
22	Wall	A	Jan-95	2	10	1	1	3.2	657	10	68	1	6.216216
22	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	62	1	-10
22	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	60	1	-15.40541
22	Wall	D	Jan-95	2	10	2	1	7.2	657	10	53	1	-34.32432
22	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	66	1	0.810811
23	Wall	A	Jan-95	2	10	1	1	3.2	657	10	53	1	-34.32432
23	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	55	1	-28.91892
23	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	70	1	11.62162
23	Wall	D	Jan-95	2	10	1	1	3.2	657	10	51	1	-39.72973
23	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	73	1	19.72973
24	Wall	A	Jan-95	2	10	1	1	3.2	657	10	55	1	-28.91892
24	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	49	1	-45.13514
24	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	67	1	3.513514
24	Wall	D	Jan-95	2	10	1	1	3.2	657	10	58	1	-20.81081
24	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	63	1	-7.297297
25	Wall	A	Jan-95	2	10	0	1	-0.8	657	10	66	1	0.810811

Appendix B-2: Building 11 Scoping Survey: Wall Swipe Measurements

Grid # / Location	Type of Sample	Description	Date	Alpha Background Count	Alpha Background Time	Alpha Sample Count	Alpha Sample Time	Alpha Activity dpm	Beta Background Count	Beta Background Time	Beta Sample Count	Beta Sample Time	Beta Activity
25	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	55	1	-28.91892
25	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	55	1	-28.91892
25	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	44	1	-58.64865
25	Wall	E	Jan-95	2	10	1	1	3.2	657	10	69	1	8.918919
26	Wall	A	Jan-95	2	10	0	1	-0.8	657	10	56	1	-26.21622
26	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	68	1	6.216216
26	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	64	1	-4.594595
26	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	61	1	-12.7027
26	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	57	1	-23.51351
27	Wall	A	Jan-95	2	10	0	1	-0.8	657	10	65	1	-1.891892
27	Wall	B	Jan-95	2	10	1	1	3.2	657	10	63	1	-7.297297
27	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	62	1	-10
27	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	50	1	-42.43243
27	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	65	1	-1.891892
28	Wall	A	Jan-95	2	10	0	1	-0.8	657	10	66	1	0.810811
28	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	61	1	-12.7027
28	Wall	C	Jan-95	2	10	1	1	3.2	657	10	72	1	17.02703
28	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	67	1	3.513514
28	Wall	E	Jan-95	2	10	2	1	7.2	657	10	50	1	-42.43243
29	Wall	A	Jan-95	2	10	2	1	7.2	657	10	54	1	-31.62162
29	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	69	1	8.918919
29	Wall	C	Jan-95	2	10	1	1	3.2	657	10	39	1	-72.16216
29	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	65	1	-1.891892
29	Wall	E	Jan-95	2	10	0	1	-0.8	657	10	54	1	-31.62162
30	Wall	A	Jan-95	2	10	0	1	-0.8	657	10	58	1	-20.81081
30	Wall	B	Jan-95	2	10	0	1	-0.8	657	10	45	1	-55.94595
30	Wall	C	Jan-95	2	10	0	1	-0.8	657	10	72	1	17.02703
30	Wall	D	Jan-95	2	10	0	1	-0.8	657	10	70	1	11.62162
30	Wall	E	Jan-95	2	10	1	1	3.2	657	10	44	1	-58.64865

Appendix C

Building 3 and 4 Upper Wall and Overhead Surveys

Appendix C

Building 3 and 4 Upper Walls and Overhead Surveys

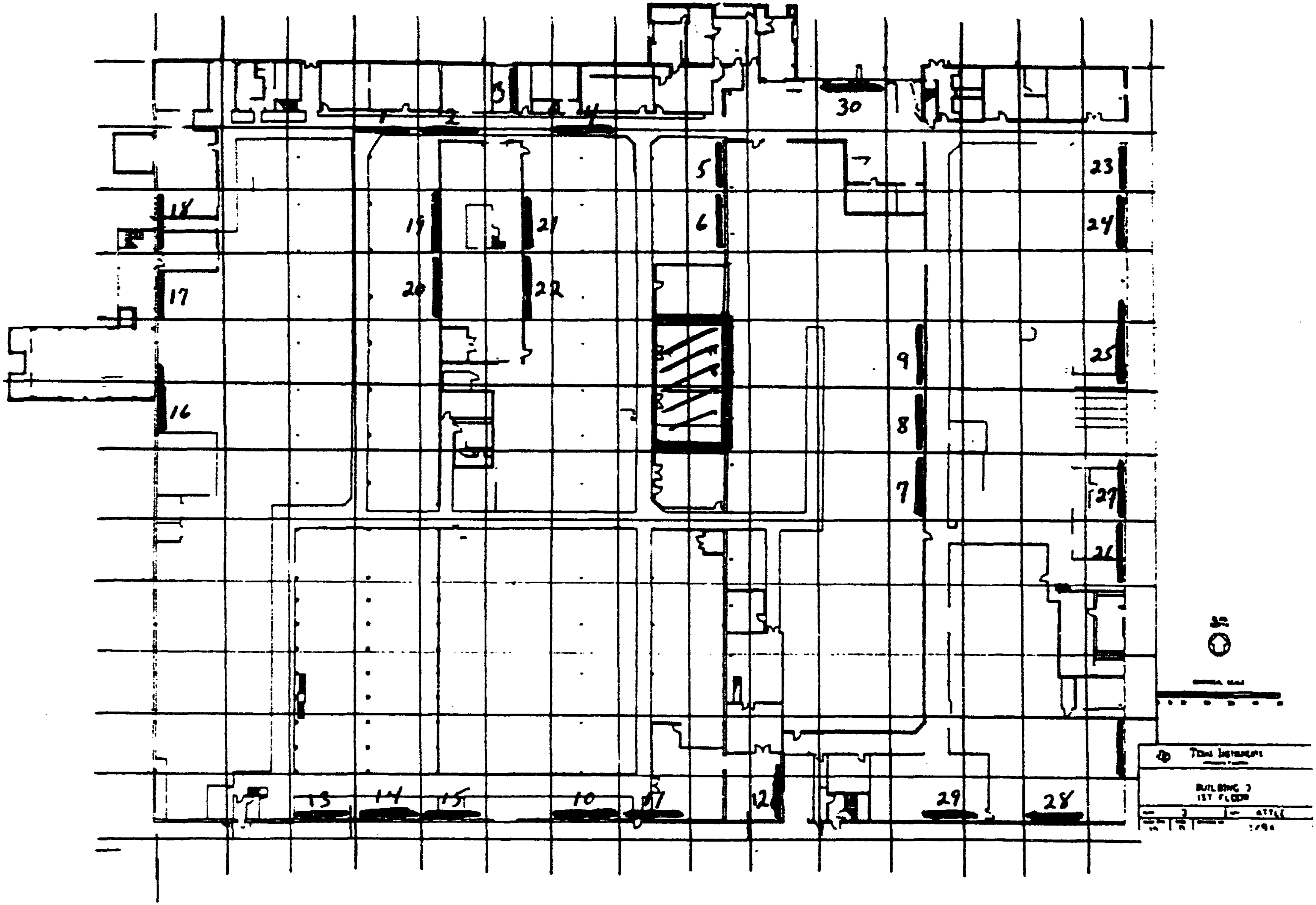
Appendix C-1

Building 3 Survey Maps

Appendix C-1-1

Grid Maps and Survey Locations of Affected and Unaffected Areas within Building 3

Appendix C-1-1:Grid Maps and Survey Locations of Affected and Unaffected Areas within Building 3

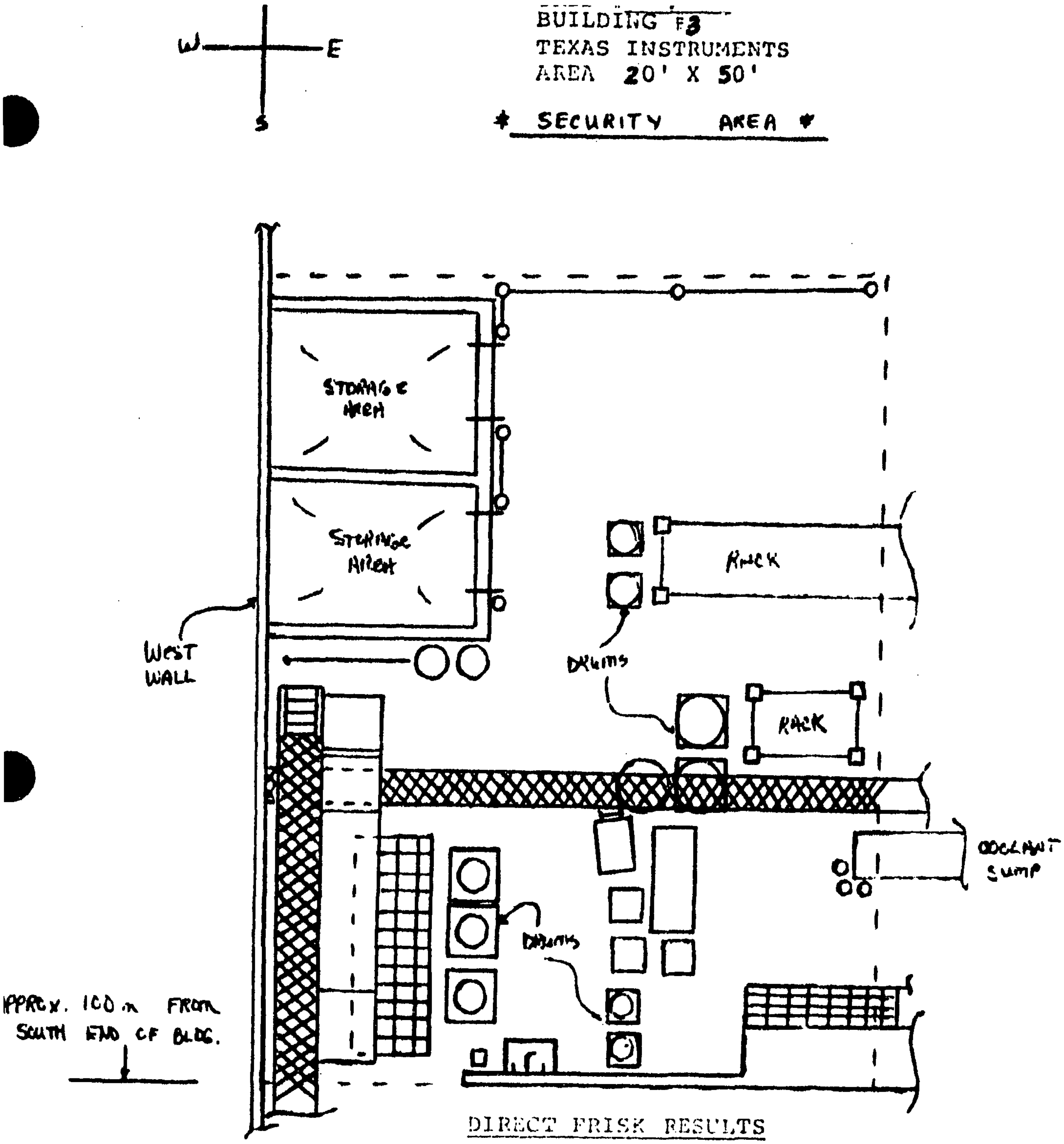


Appendix C-1-2

Individual Detailed Floor Survey Maps for Affected Area.

BUILDING F3
TEXAS INSTRUMENTS
AREA 20' X 50'

* SECURITY AREA *



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 George Morin
TECH #2 Mike Hurton
METER/PROBE
SERIAL NUMBER
#1 103363 / N/A
#2 TC948 / N/A

BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 70 cpm / #2 70 cpm
QC SOURCE CHECK: #1 32K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 110 cpm TECH #2 120 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 73 βγ

SMEAR #	RESULTS (CPM)	
1	0	62 βγ
2	0	65
3	0	76
4	0	61
5	0	66

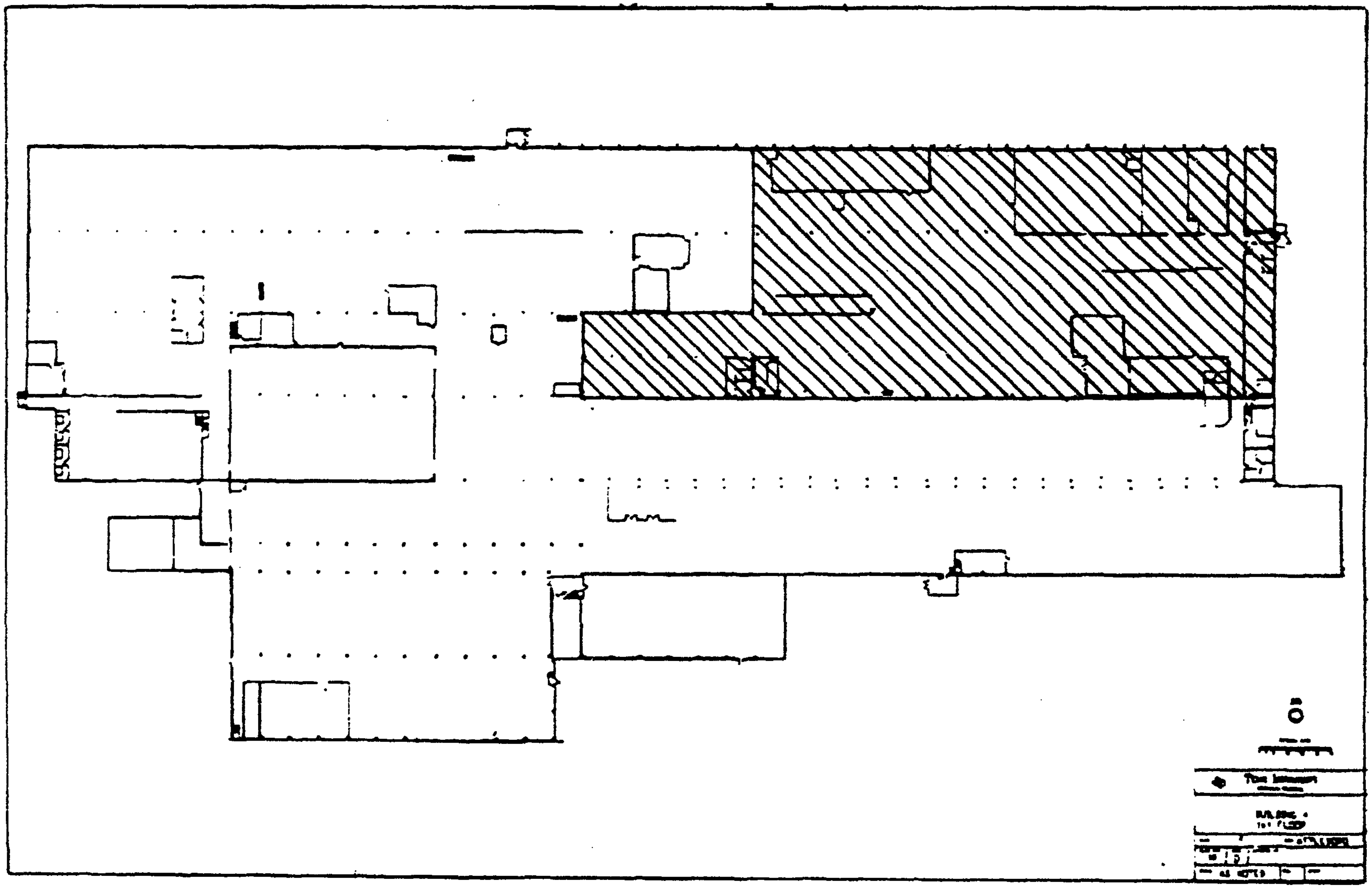
Appendix C-2

Building 4 Survey Maps

Appendix C-2-1

Building 4 Area Classifications

Appendix C-2-1: Building 4 Area Classifications



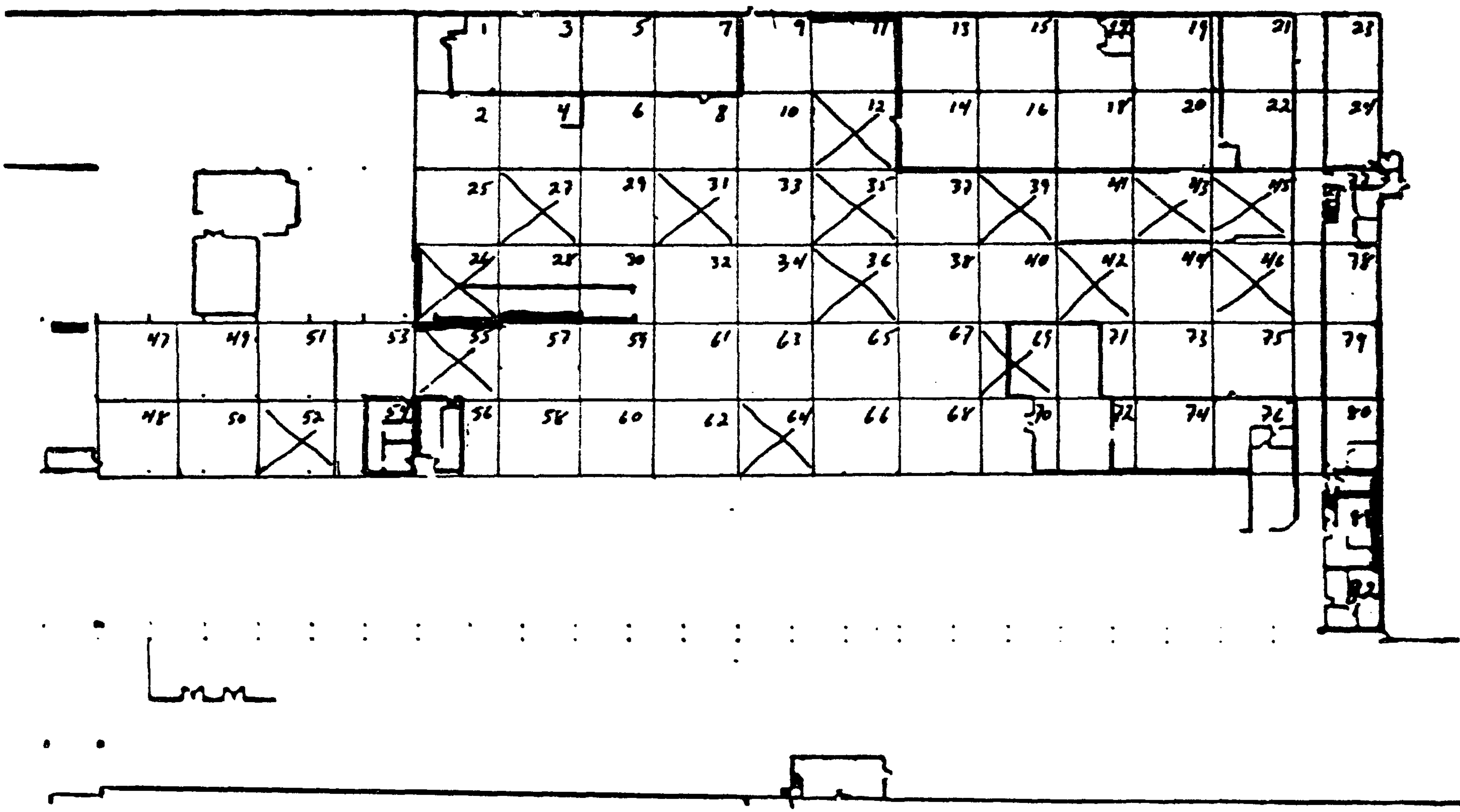
OFFICIAL RECORD COPY

118945

Appendix C-2-2

Building 4 Grid Map and Survey Locations

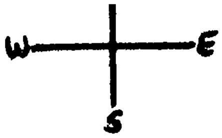
Appendix C-2-2: Building 4 Grid Map and Survey Locations

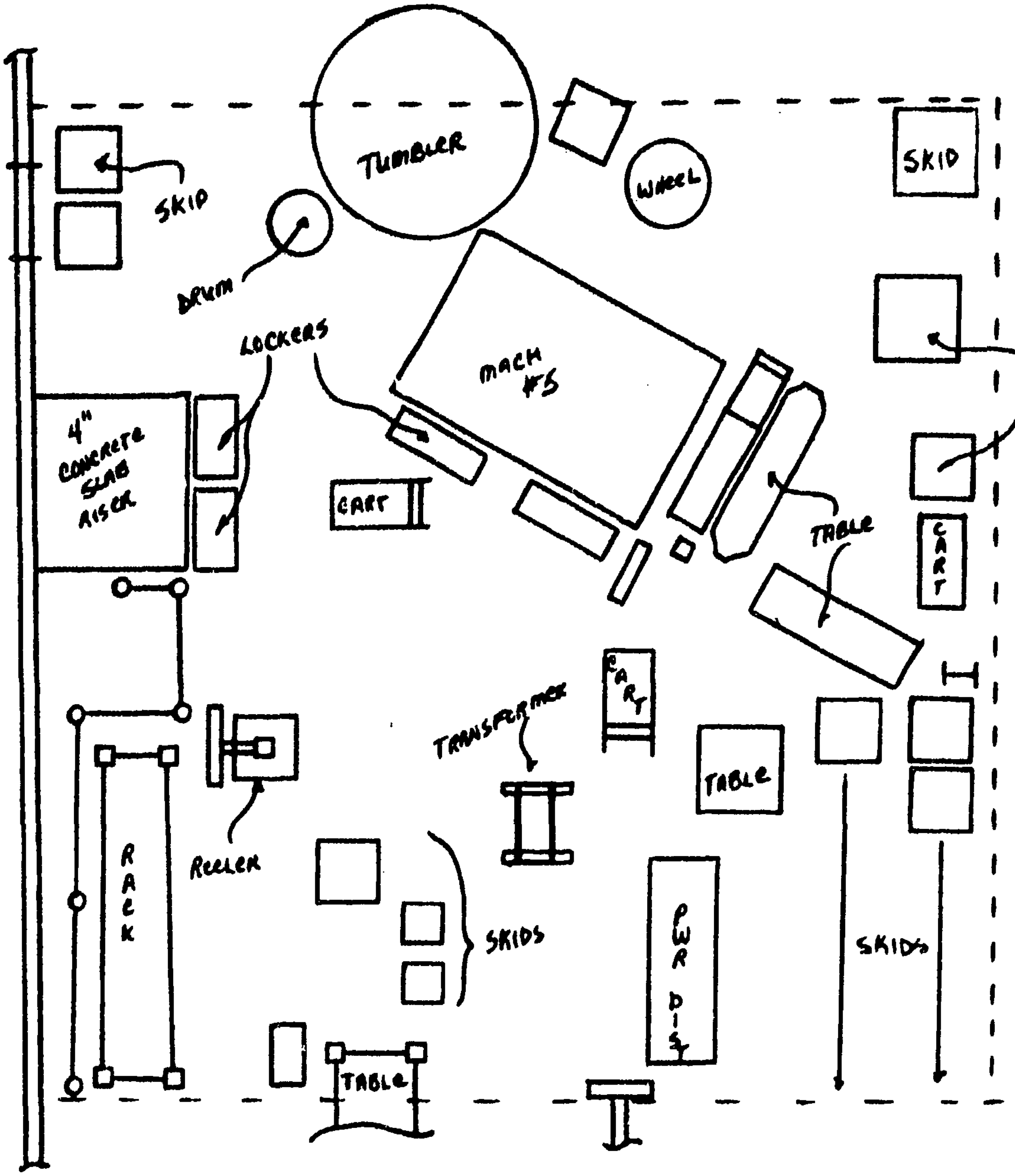


Appendix C-2-3

Individual Grid Detailed Floor Survey Maps for Random Grid Cells

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 George Morin
TECH #2 J. Heckman
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

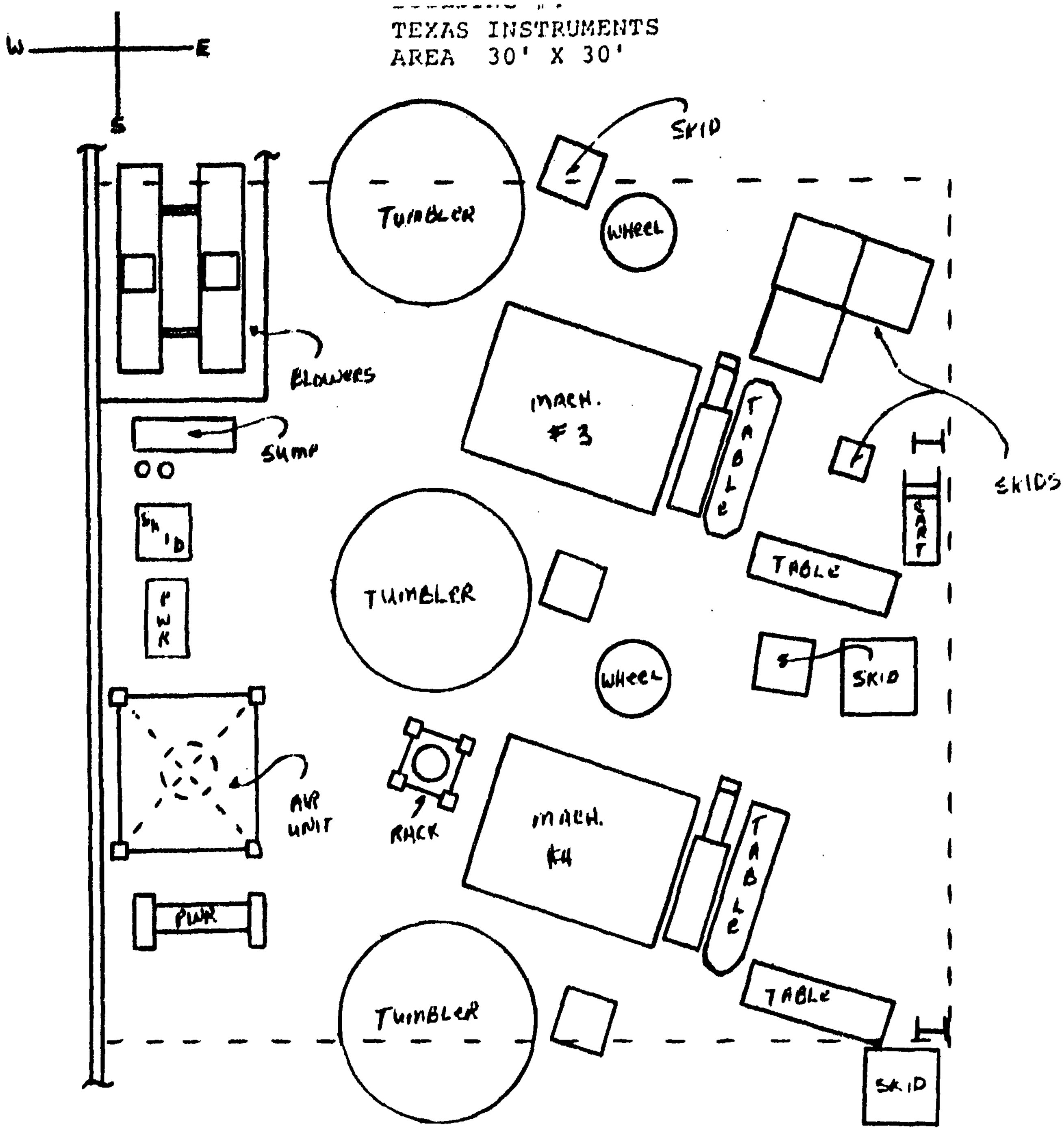
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 40 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER Scaler
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND α 73 βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2	"	"
3	"	"
4	"	"
5	"	"

TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-13-94
TECH #1 G. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115464 / N/A

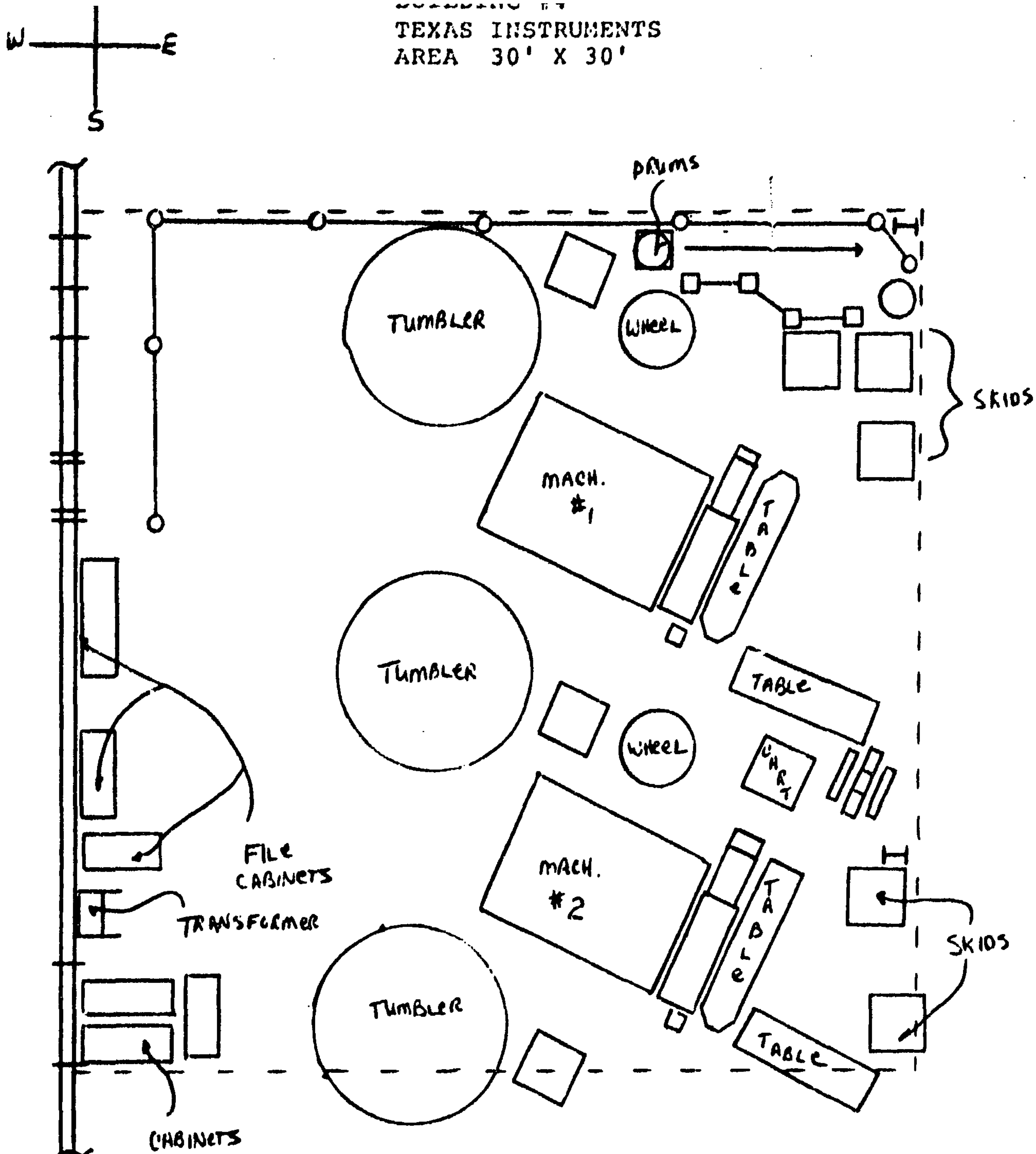
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 40 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 70 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 73 Bγ

SMEAR #	RESULTS (CPM) α	Bγ
1		
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

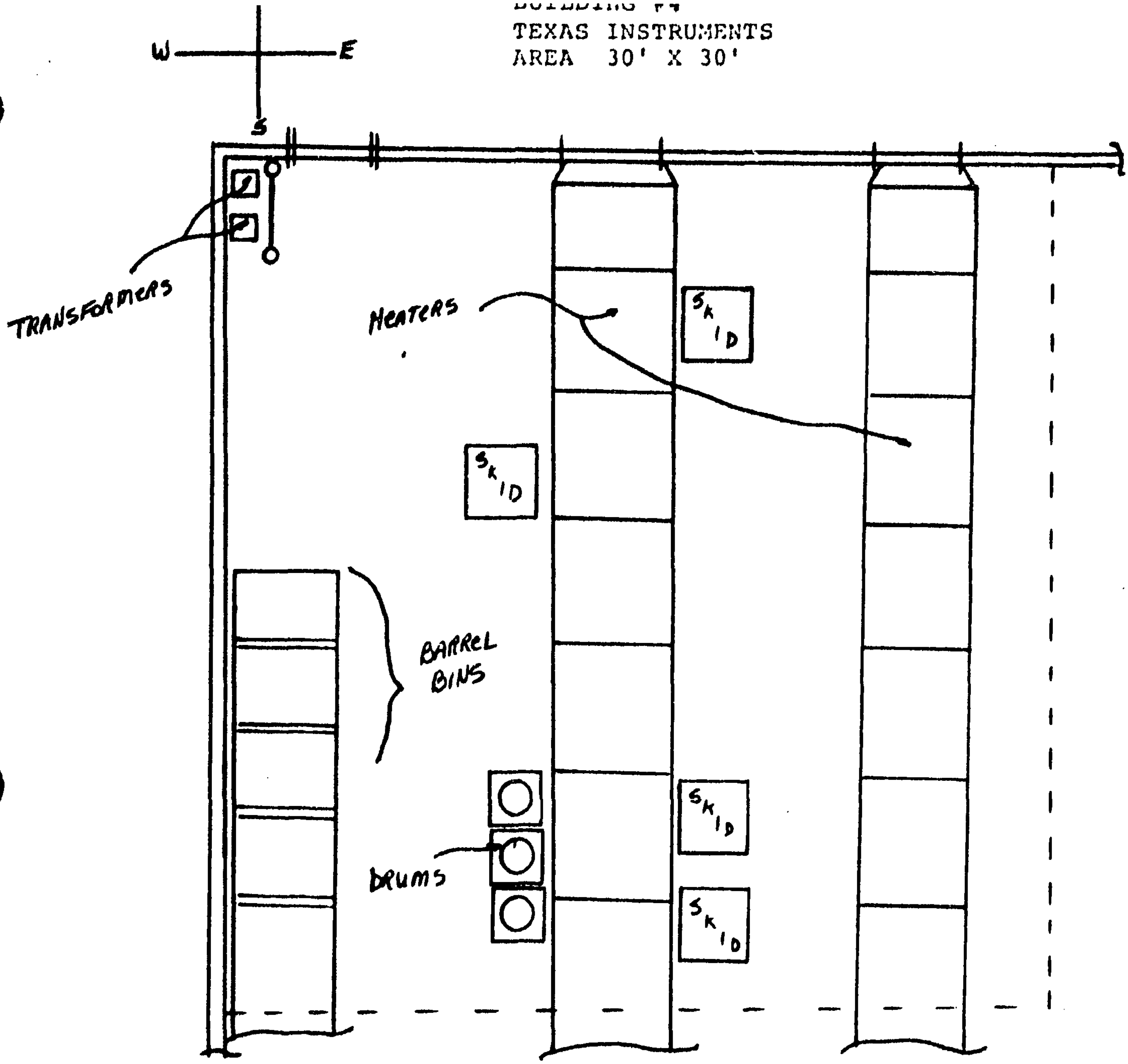
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30k / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 50cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER scaler
SERIAL # 111577
COUNT TIME 1min.
BACKGROUND 0 α 73 Bγ

SMEAR #	RESULTS (CPM)

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Marin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

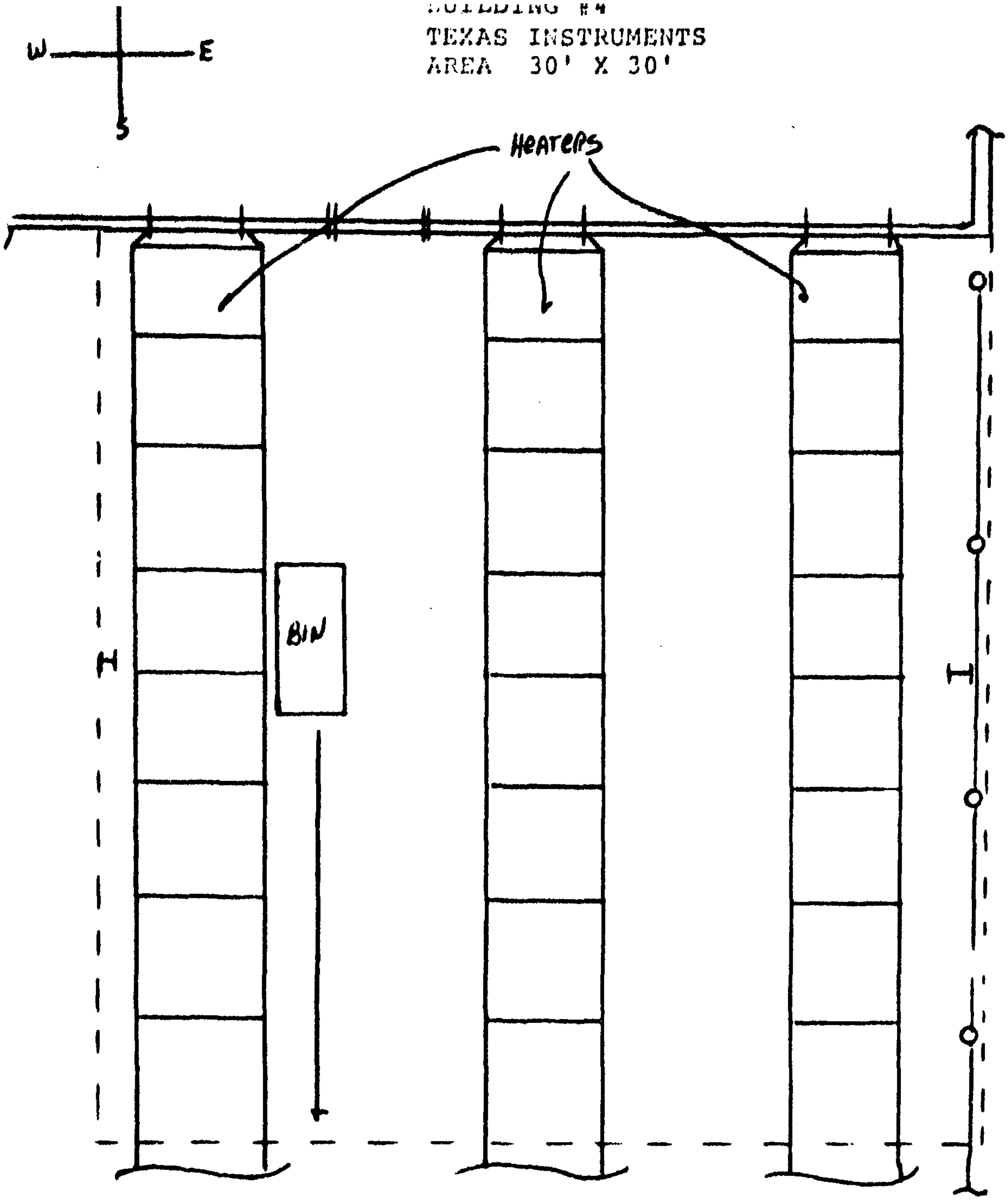
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 50cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0 α 73 Bγ

SMEAR #	RESULTS (CPM)

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 B. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

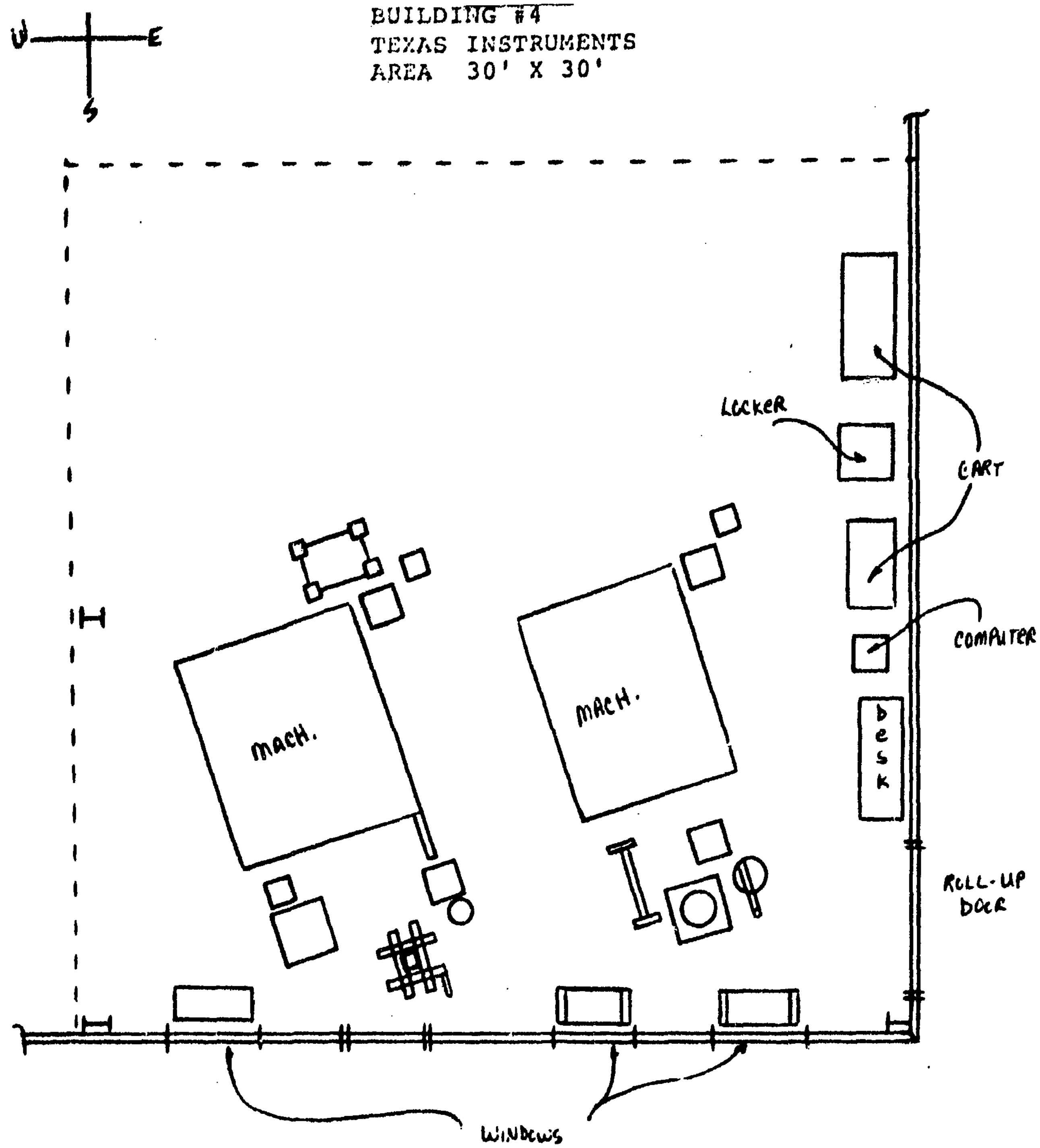
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 70cpm TECH #2 50cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Ssnler
SERIAL # 111577
COUNT TIME 1min
BACKGROUND 0 α 73 βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

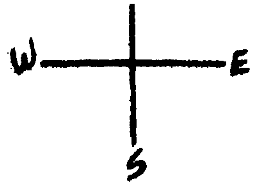
DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

BATTERY CHECK: #1 OK / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 40cpm

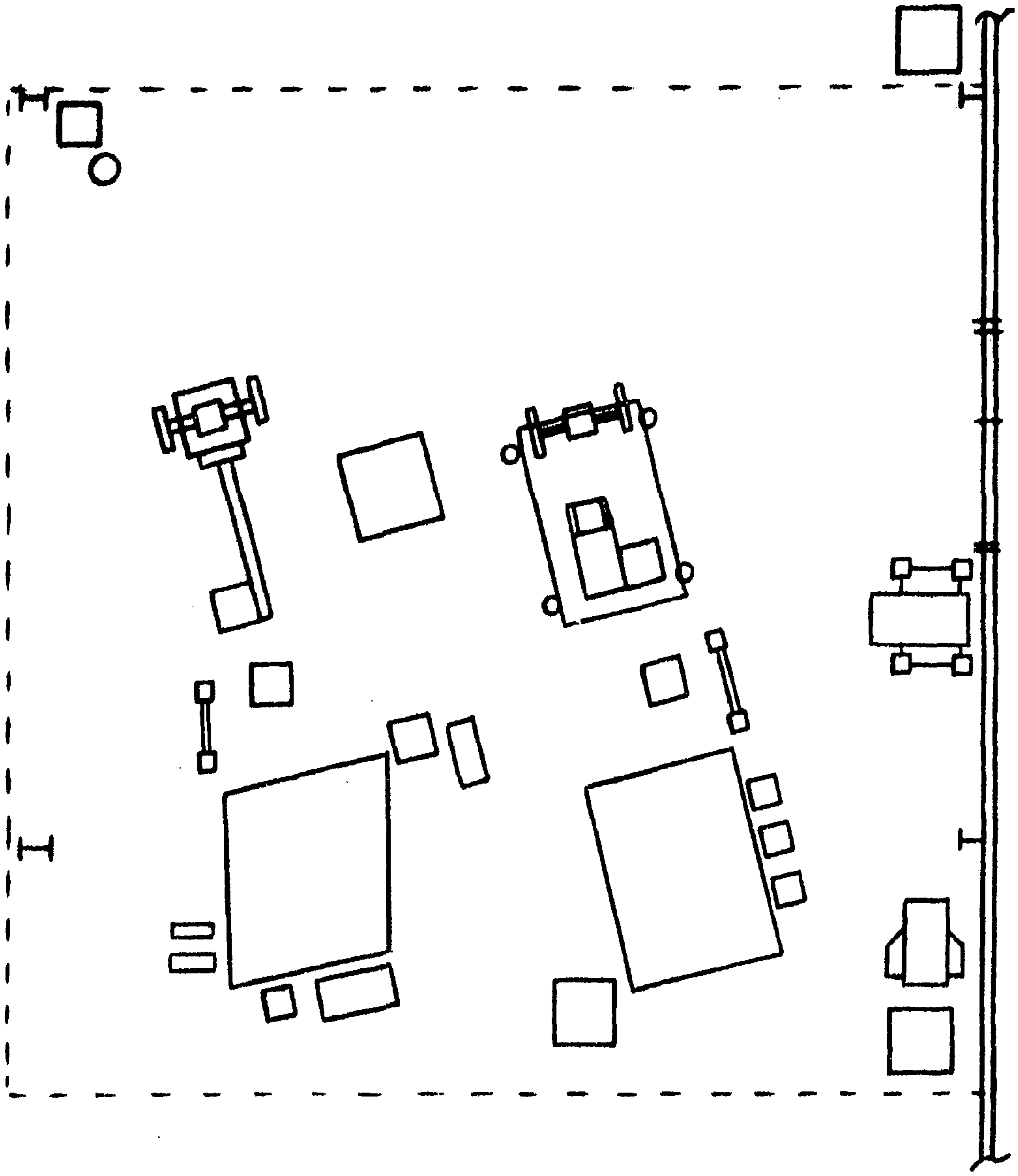
SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 115777
COUNT TIME 1min
BACKGROUND 0α 73Bγ

SMEAR #	RESULTS (CPM)	
	α	Bγ
1		
2		
3		
4		
5		



BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 [illegible]
TECH #2 G. [illegible]
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

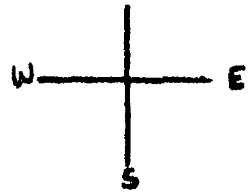
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 40cpm

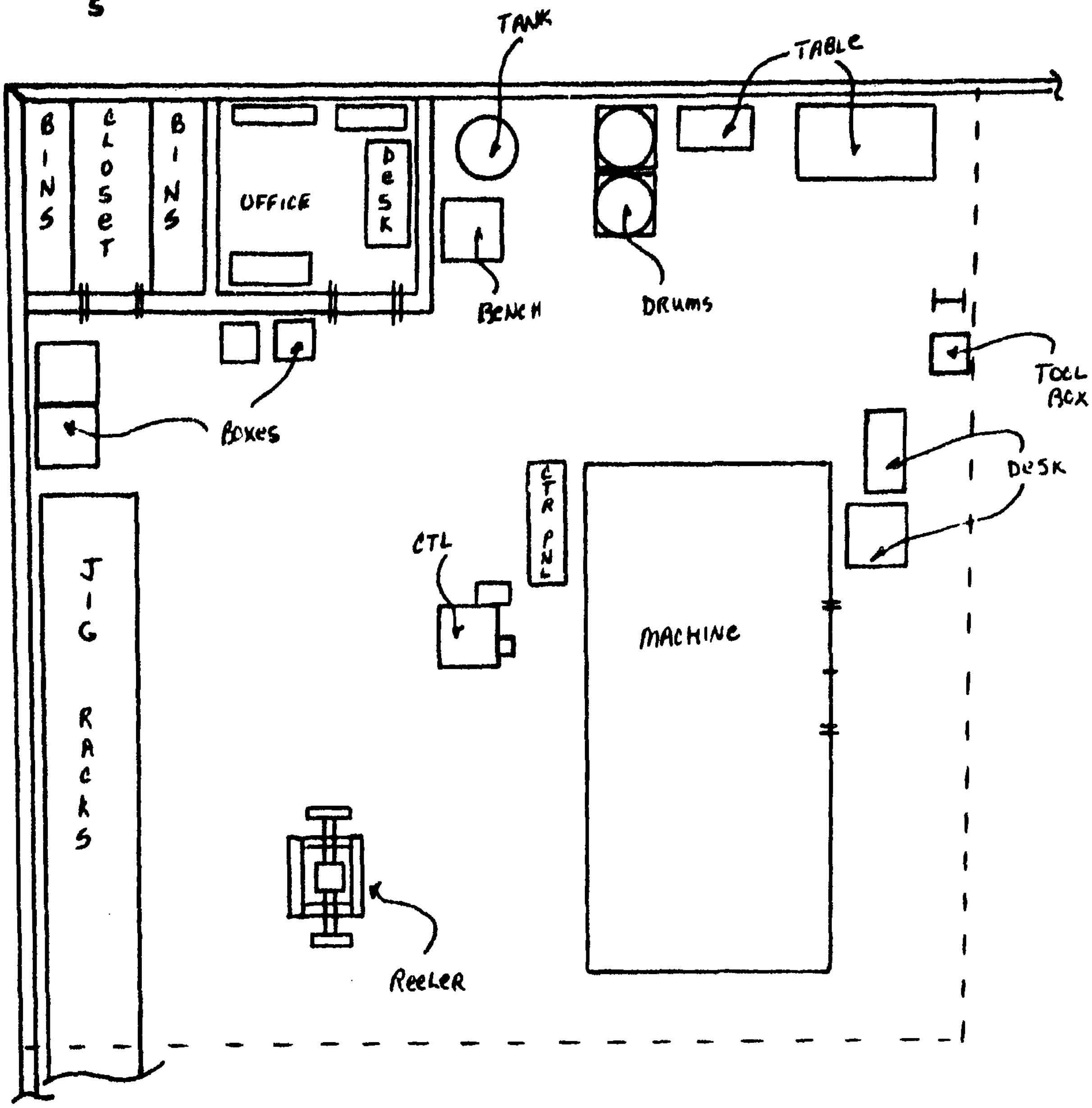
SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scalar
SERIAL # 111577
COUNT TIME 1min
BACKGROUND 0 α 23 βγ

SMEAR #	RESULTS (CPM)	
	α	βγ
1		
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

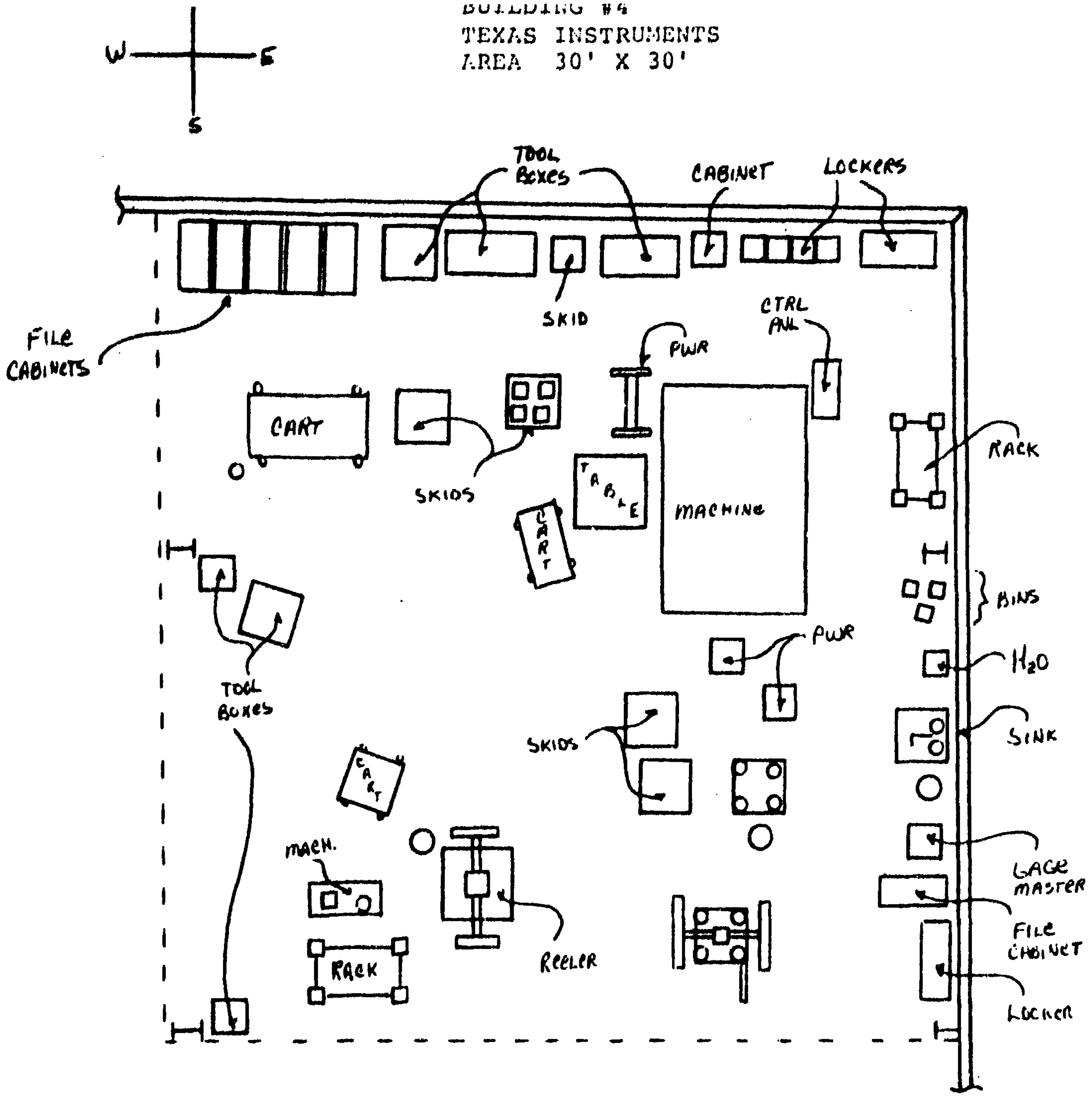
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30k / #2 30k
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 40cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 111577
COUNT TIME 1min
BACKGROUND 0α 73Bγ

SMEAR #	RESULTS (CPM)	
	α	βγ
1		
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

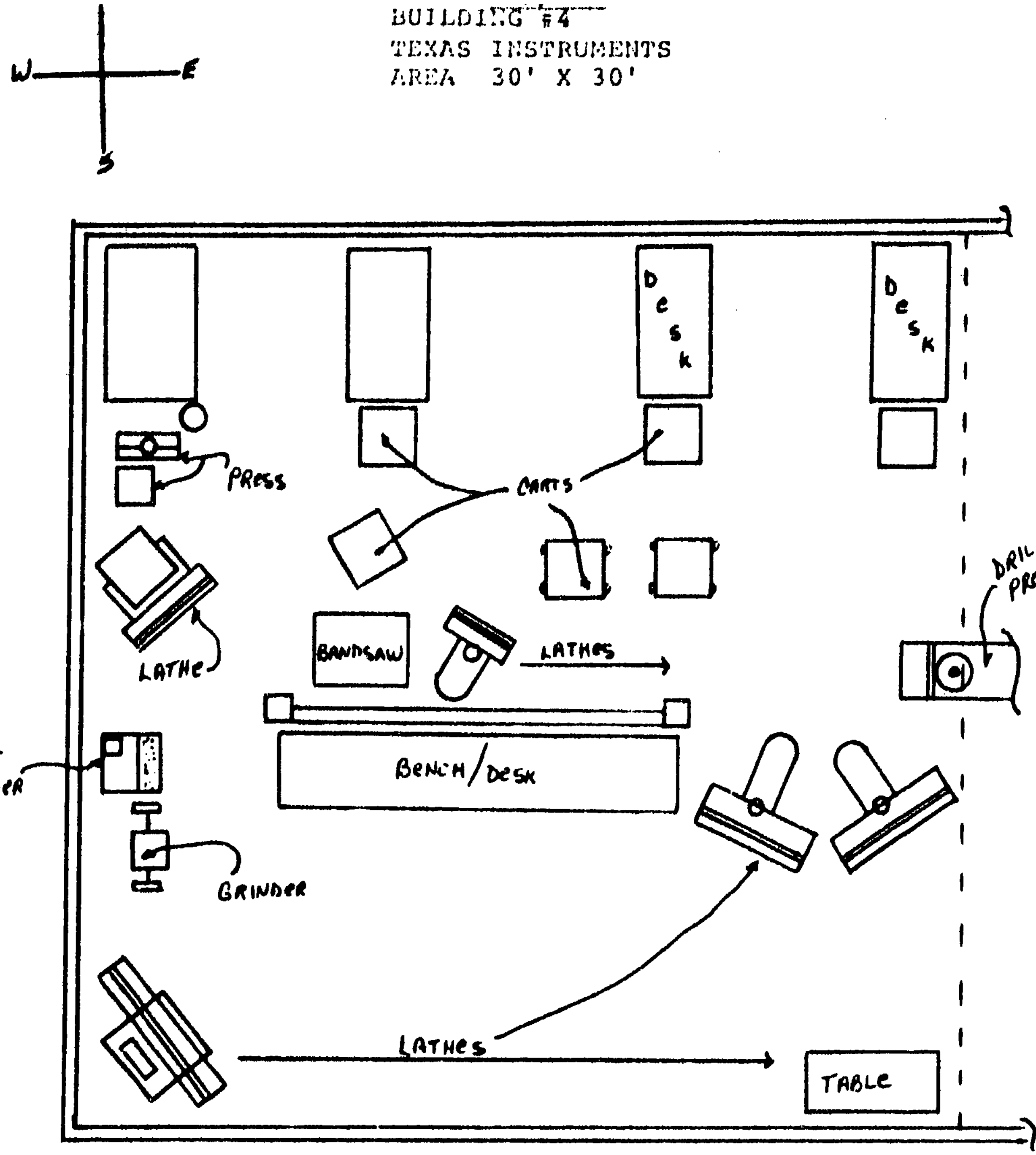
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 70cpm TECH #2 40cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 115577
COUNT TIME 1min
BACKGROUND 0α 73 Bγ

SMEAR #	RESULTS (CPM)	
1	α	Bγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Marin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

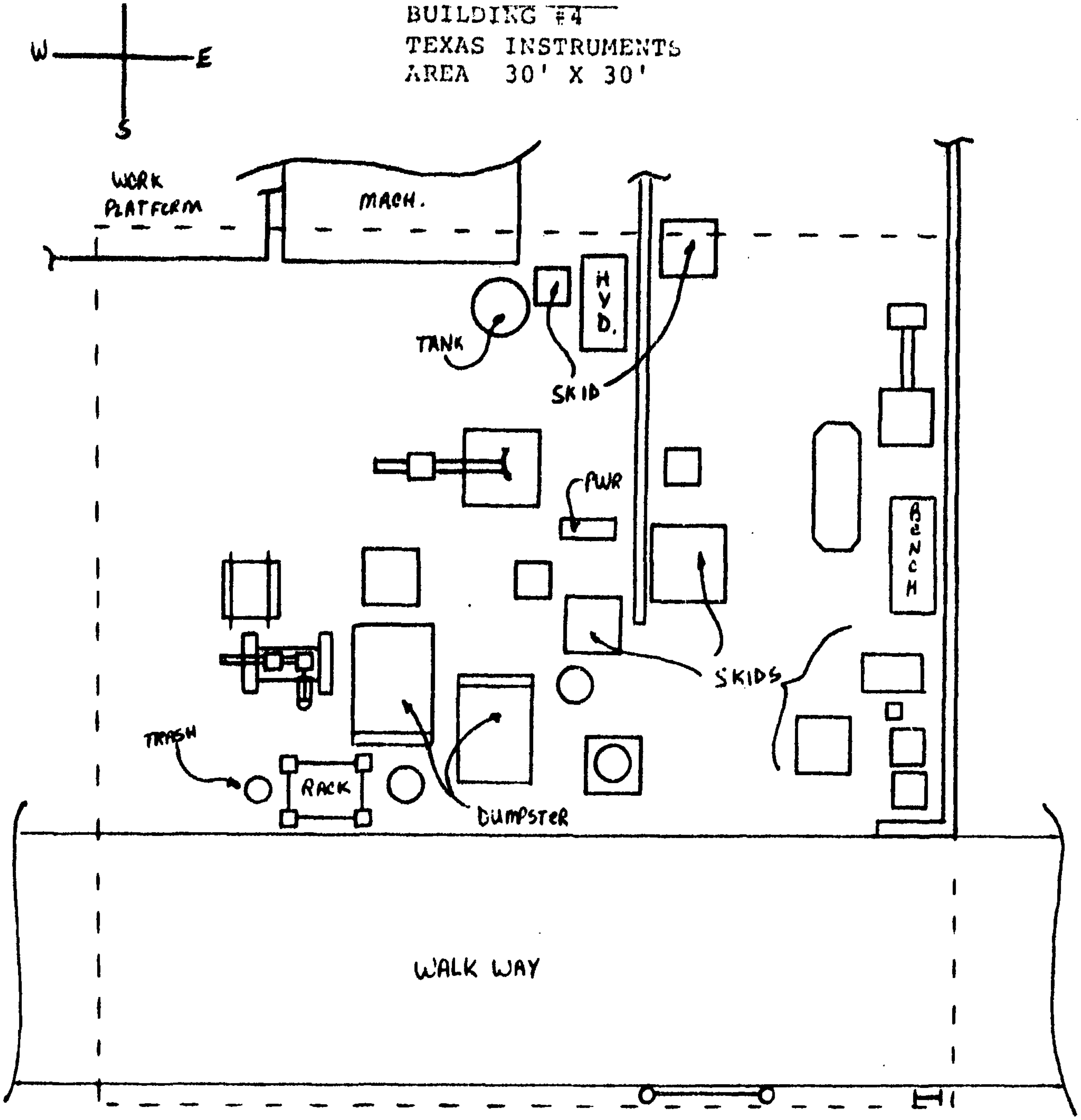
BATTERY CHECK: #1 ok #2 ok
BACKGROUND: #1 60 cpm / #2 40 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 50cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 111577
COUNT TIME 1min
BACKGROUND 0 α 73 Bγ

SMEAR #	RESULTS (CPM)	
	α	Bγ
1		
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Marin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

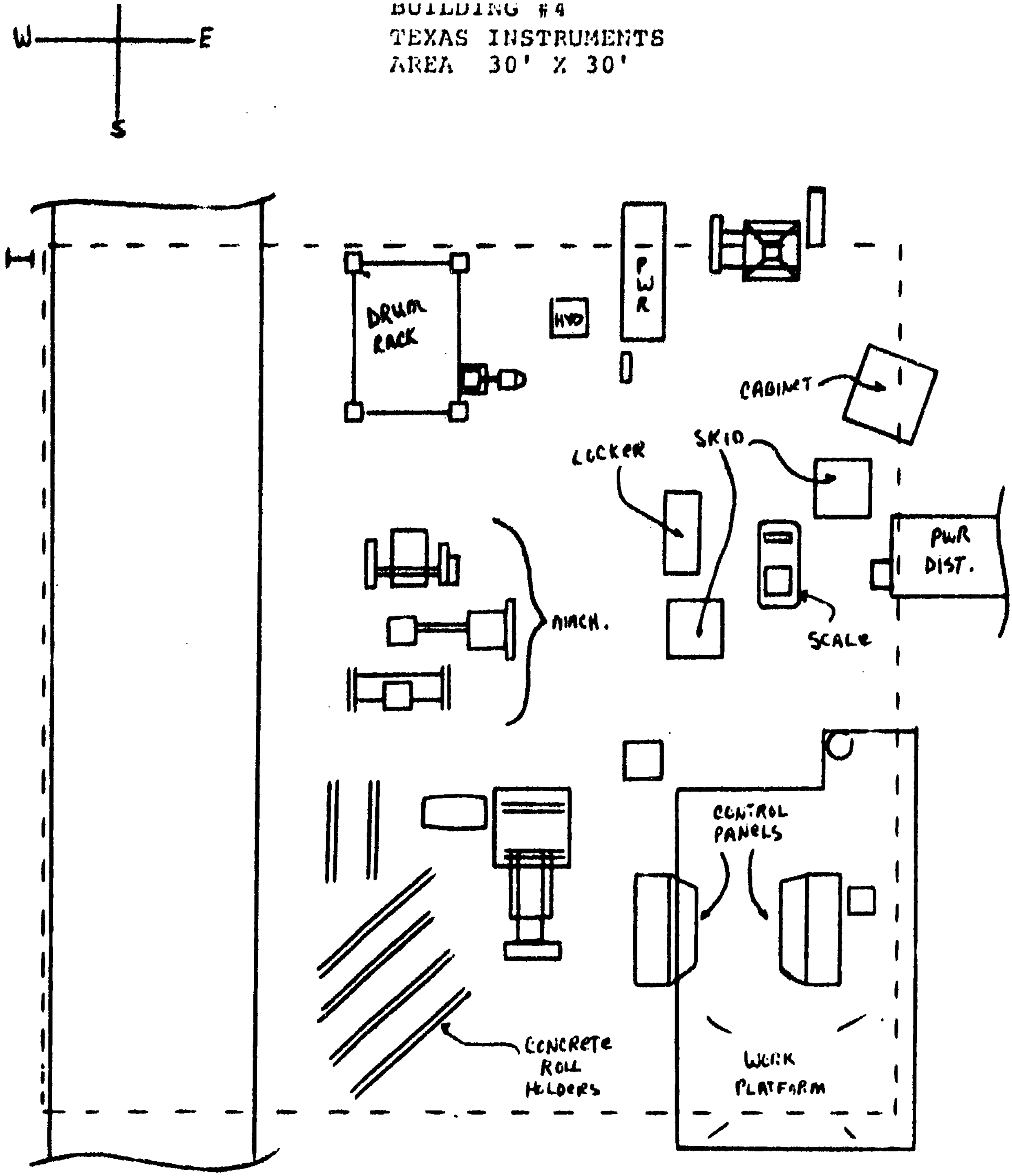
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60 cpm / #2 40 cpm
QC SOURCE CHECK: #1 30K cpm / #2 30K cpm
AVERAGE READING FOR GRID (CPM):
TECH #1 70 cpm TECH #2 50 cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 115577
COUNT TIME 1 min
BACKGROUND 0 α 73 βγ

SMEAR #	RESULTS (CPM)	
	α	βγ
1		
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G. McRIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

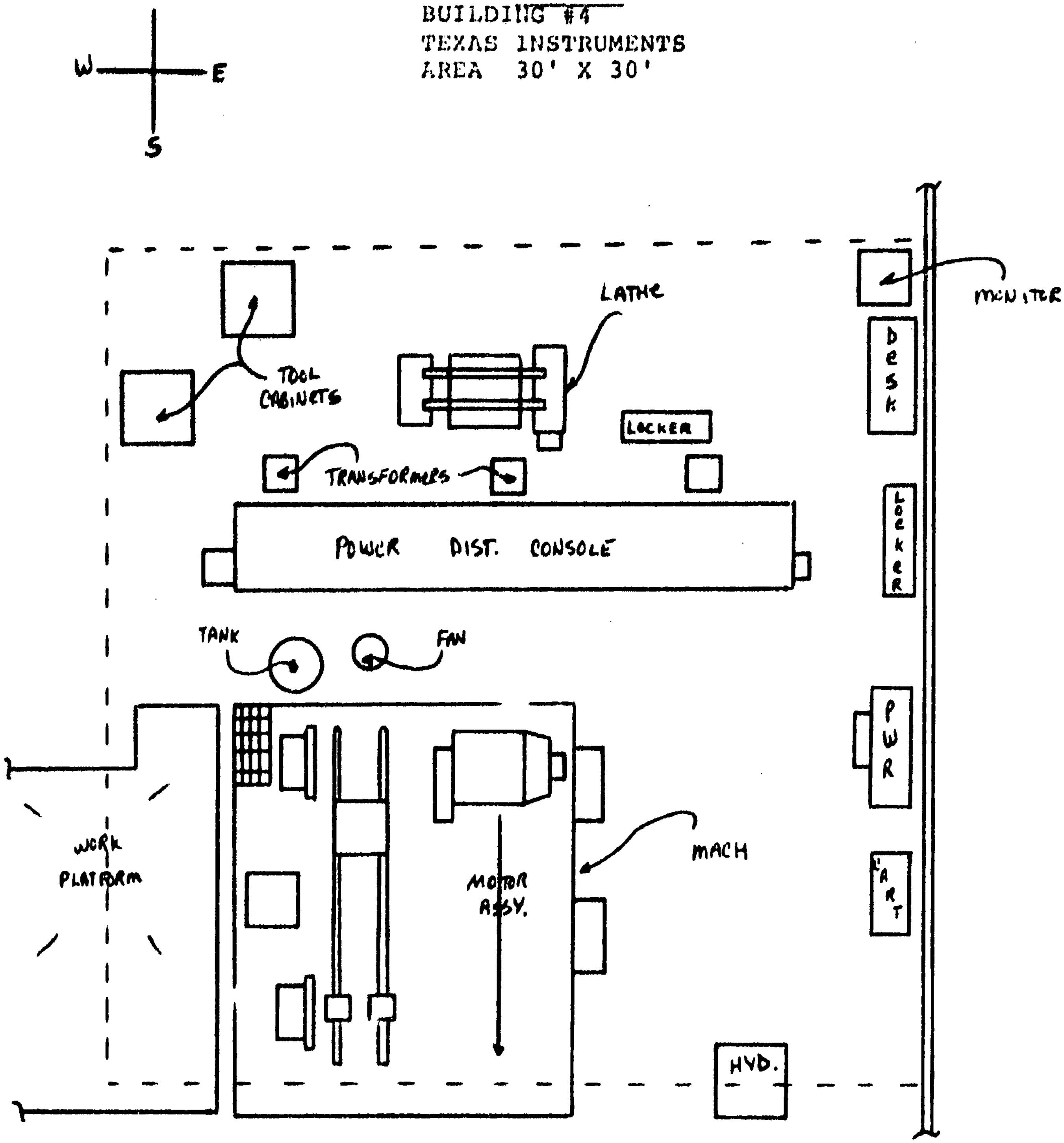
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 73 βγ

SMEAR #	RESULTS (CPM)	
1	0α	βγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G McKIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / NA
#2 115404 / N/A

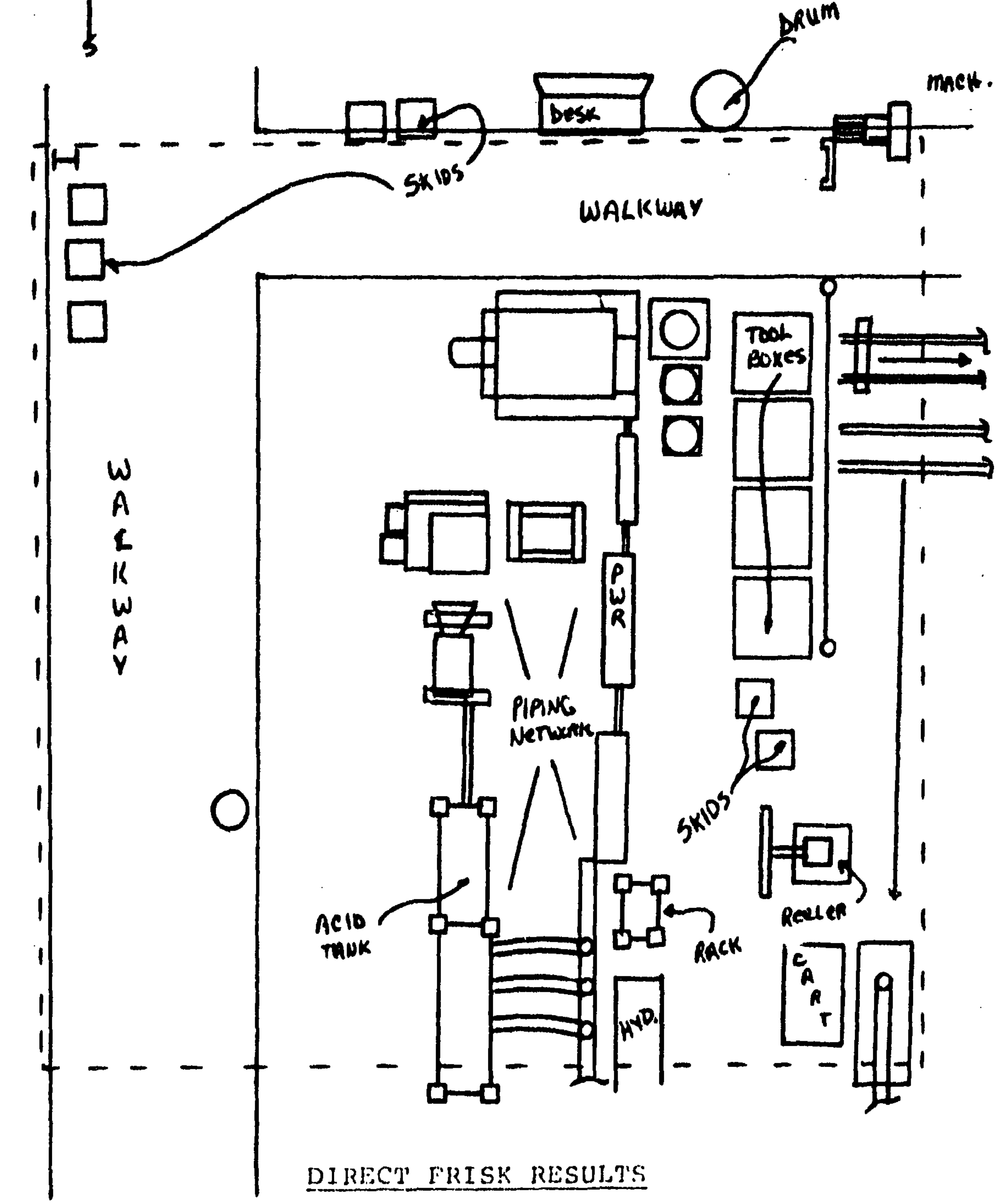
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 115507
COUNT TIME 1 min.
BACKGROUND Dec 73 BK

SMEAR #		RESULTS (CPM)
1		BK
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

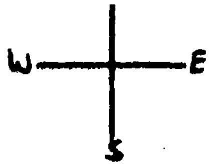
DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60 cpm / #2 40 cpm
QC SOURCE CHECK: #1 30k cpm / #2 30k cpm
AVERAGE READING FOR GRID (CPM):
TECH #1 70 cpm TECH #2 60 cpm

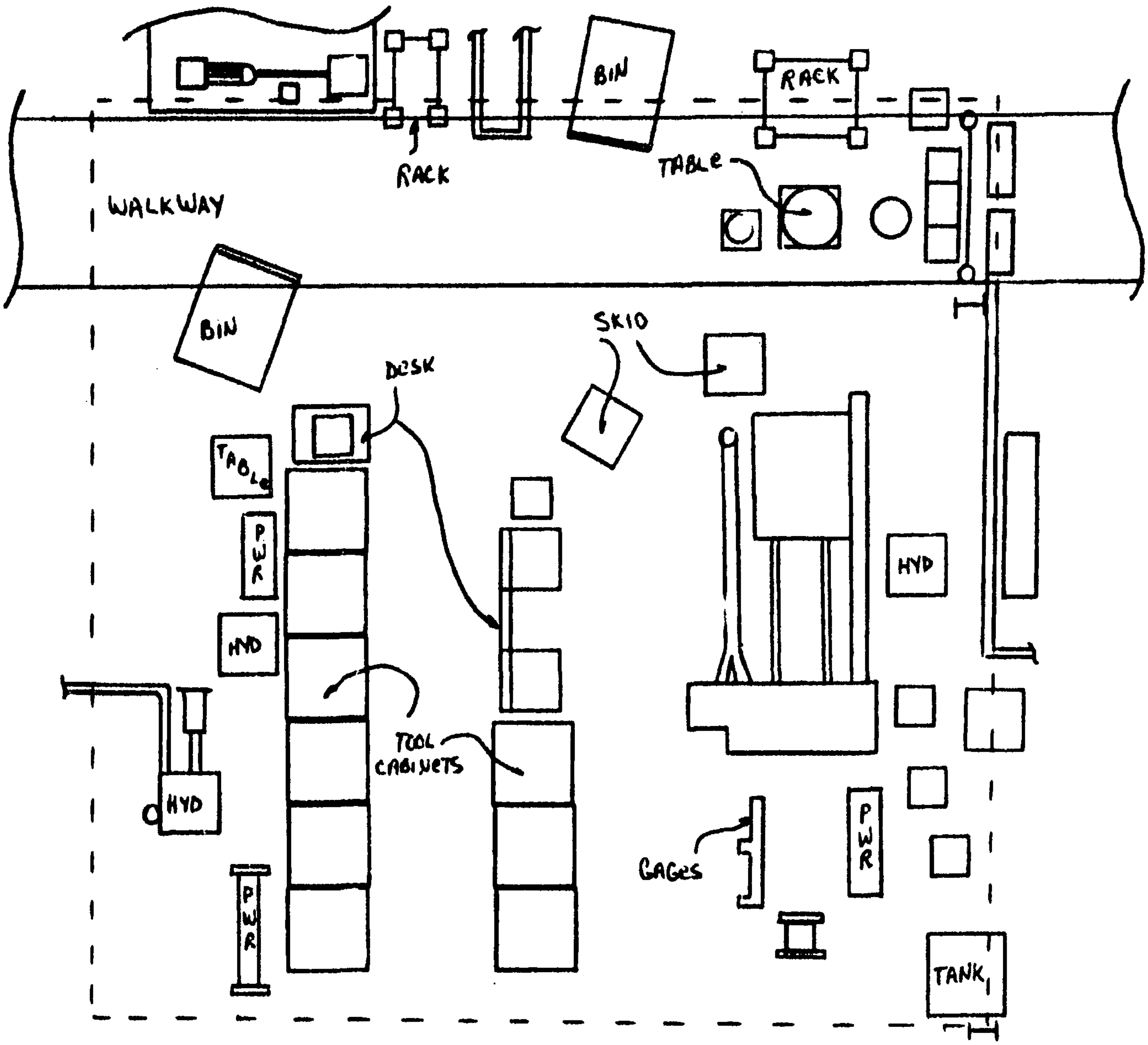
SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 115777
COUNT TIME 1 min
BACKGROUND 0 α 73 βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2	↓	↓
3	↓	↓
4	↓	↓
5	↓	↓



BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE *10/15/94*
TECH #1 *J Heckman*
TECH #2 *G. Morin*
METER/PROBE
SERIAL NUMBER
#1 *115404* / *N/A*
#2 *115507* / *N/A*

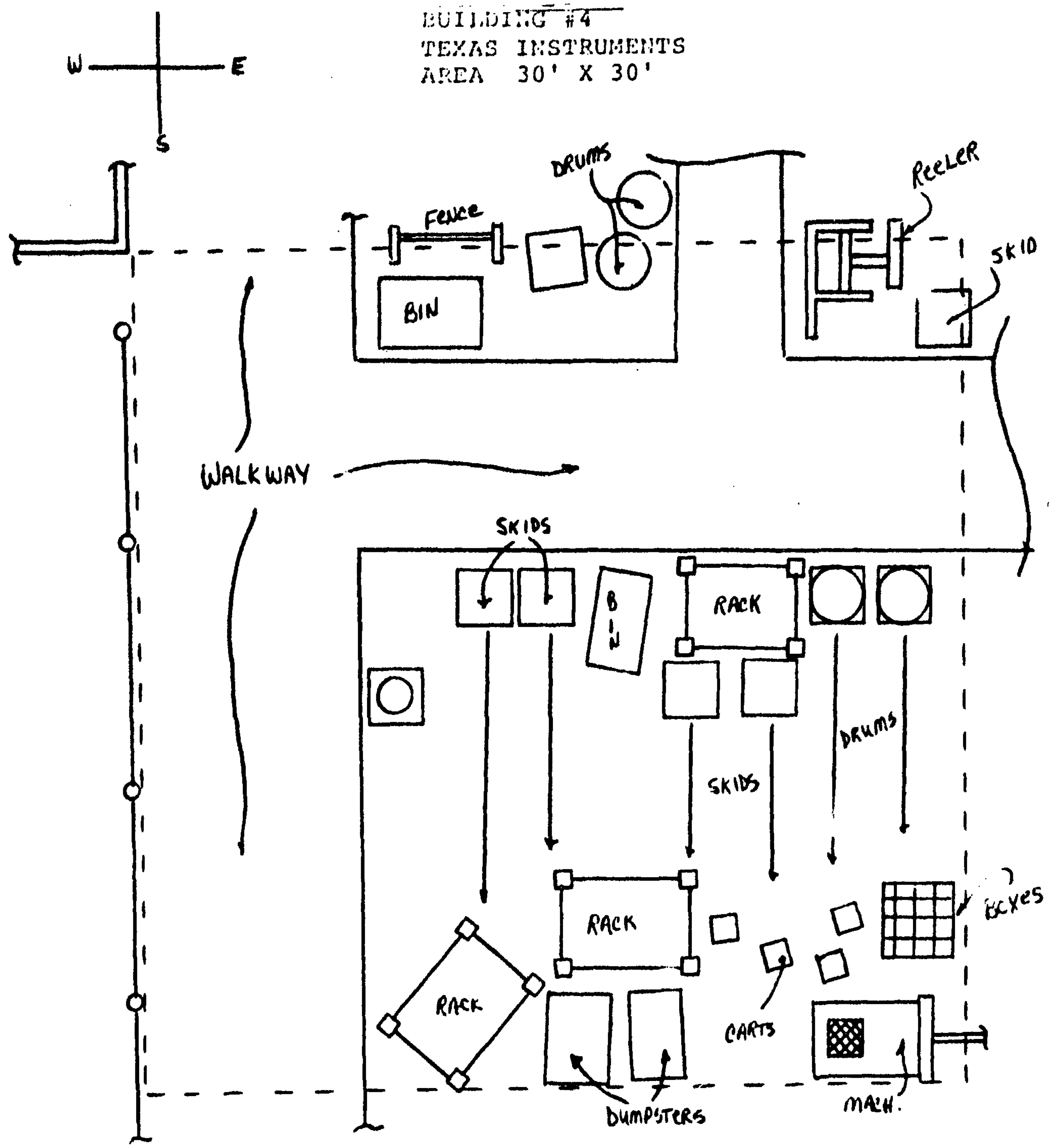
BATTERY CHECK: #1 *ok* / #2 *ok*
BACKGROUND: #1 *60cpm* / #2 *40cpm*
QC SOURCE CHECK: #1 *30k* / #2 *30k*
AVERAGE READING FOR GRID (CPM):
TECH #1 *60cpm* TECH #2 *40cpm*

SMEAR SURVEY RESULTS

DATE *10/24/94*
METER *Scaler*
SERIAL # *115777*
COUNT TIME *1min*
BACKGROUND *0α 73β*

SMEAR #	RESULTS (CPM)	
1	*α*	*β*
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Hackman
TECH #2 G. Nideiw
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

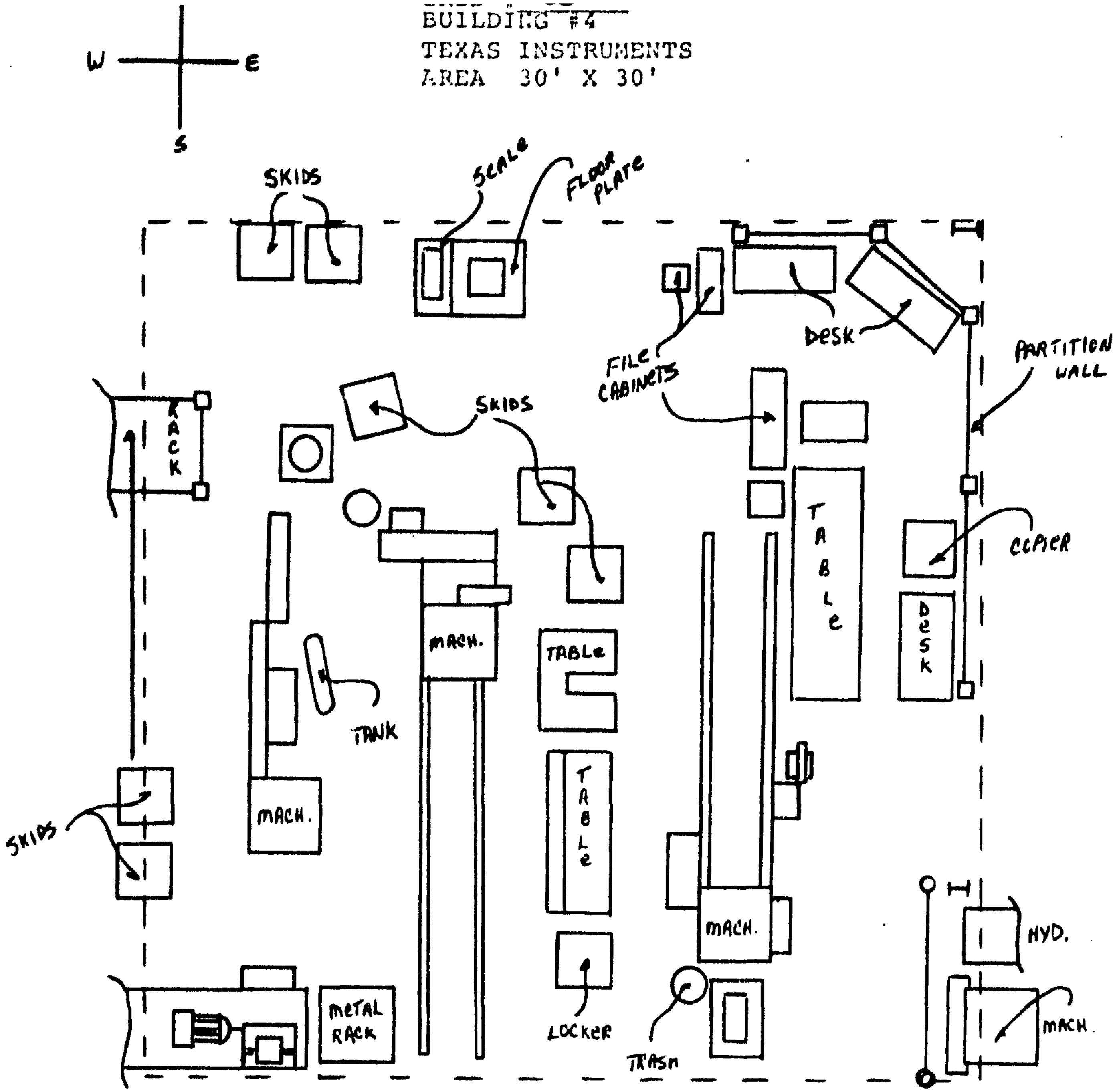
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 80cpm TECH #2 50cpm

DATE 10/24/94
METER Scaler
SERIAL # 115577
COUNT TIME 1 min
BACKGROUND 0 α Bγ

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	α	Bγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

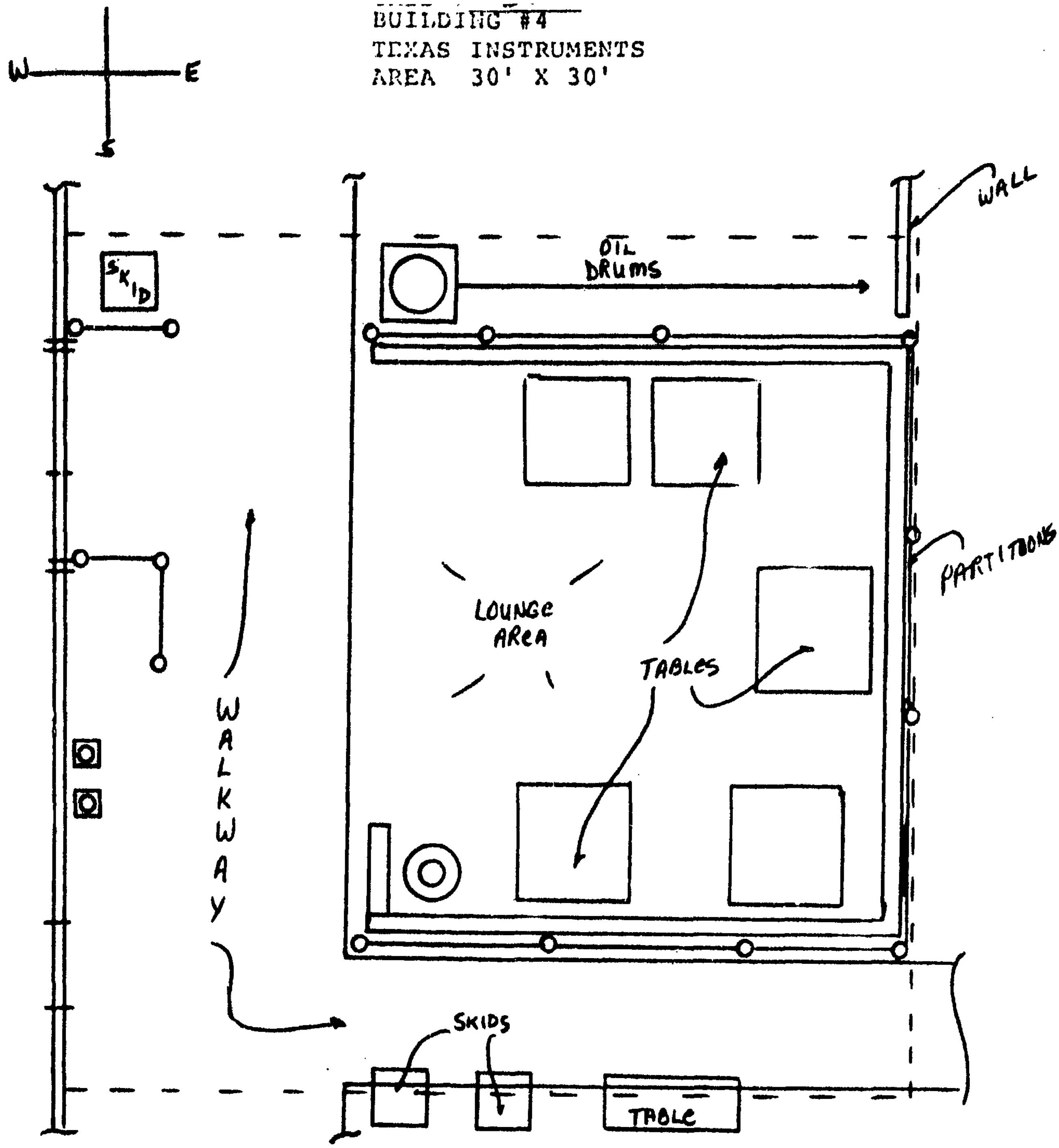
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30k / #2 30k
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 40cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 111577
COUNT TIME 1min
BACKGROUND 0α 73Bγ

SMEAR #	RESULTS (CPM)	
1	α	Bγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

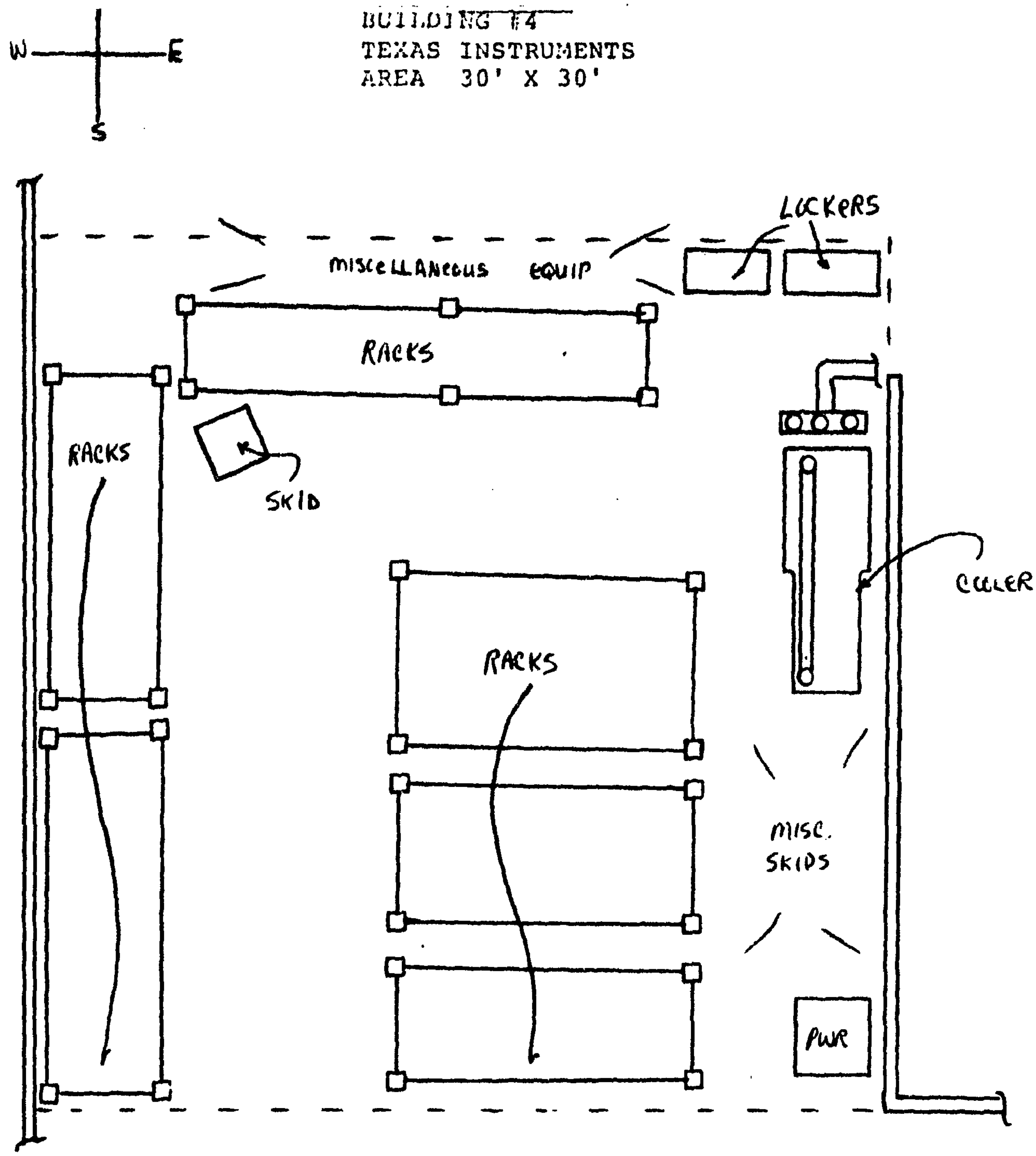
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 80cpm TECH #2 50cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 115507
COUNT TIME 1min
BACKGROUND 0 α 23 Br

SMEAR #	RESULTS (CPM)	
1	α	Bγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Harkman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115502 / N/A

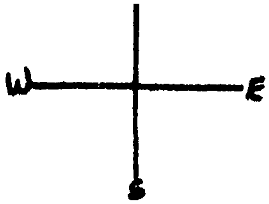
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 ok / #2 ok
AVERAGE READING FOR GRID (CPM):
TECH #1 70cpm TECH #2 50cpm

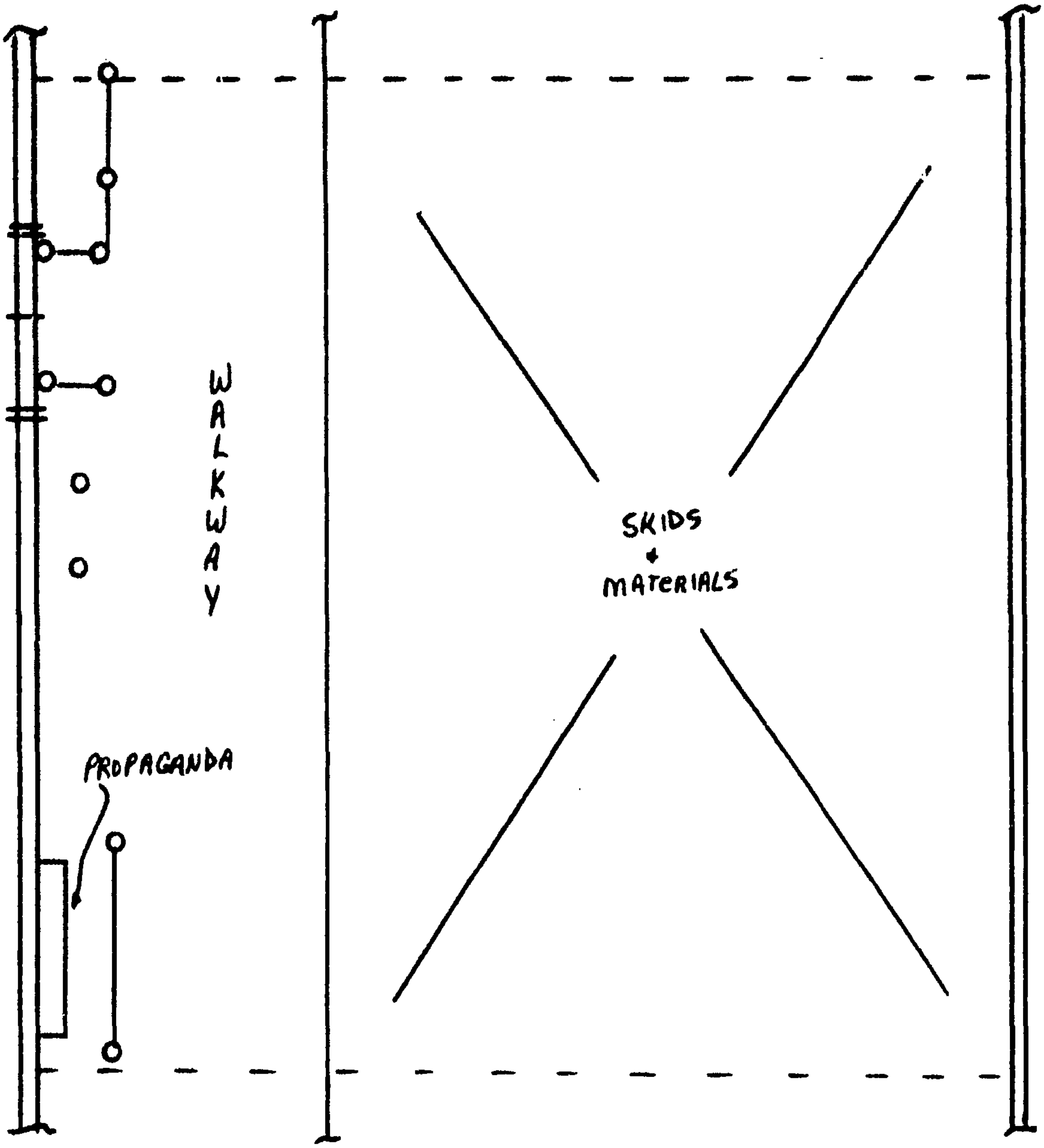
SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 115577
COUNT TIME 1min
BACKGROUND 0α 73βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE 10/15/94
TECH #1 J. Heckman
TECH #2 G. Morin
METER/PROBE
SERIAL NUMBER
#1 115404 / N/A
#2 115507 / N/A

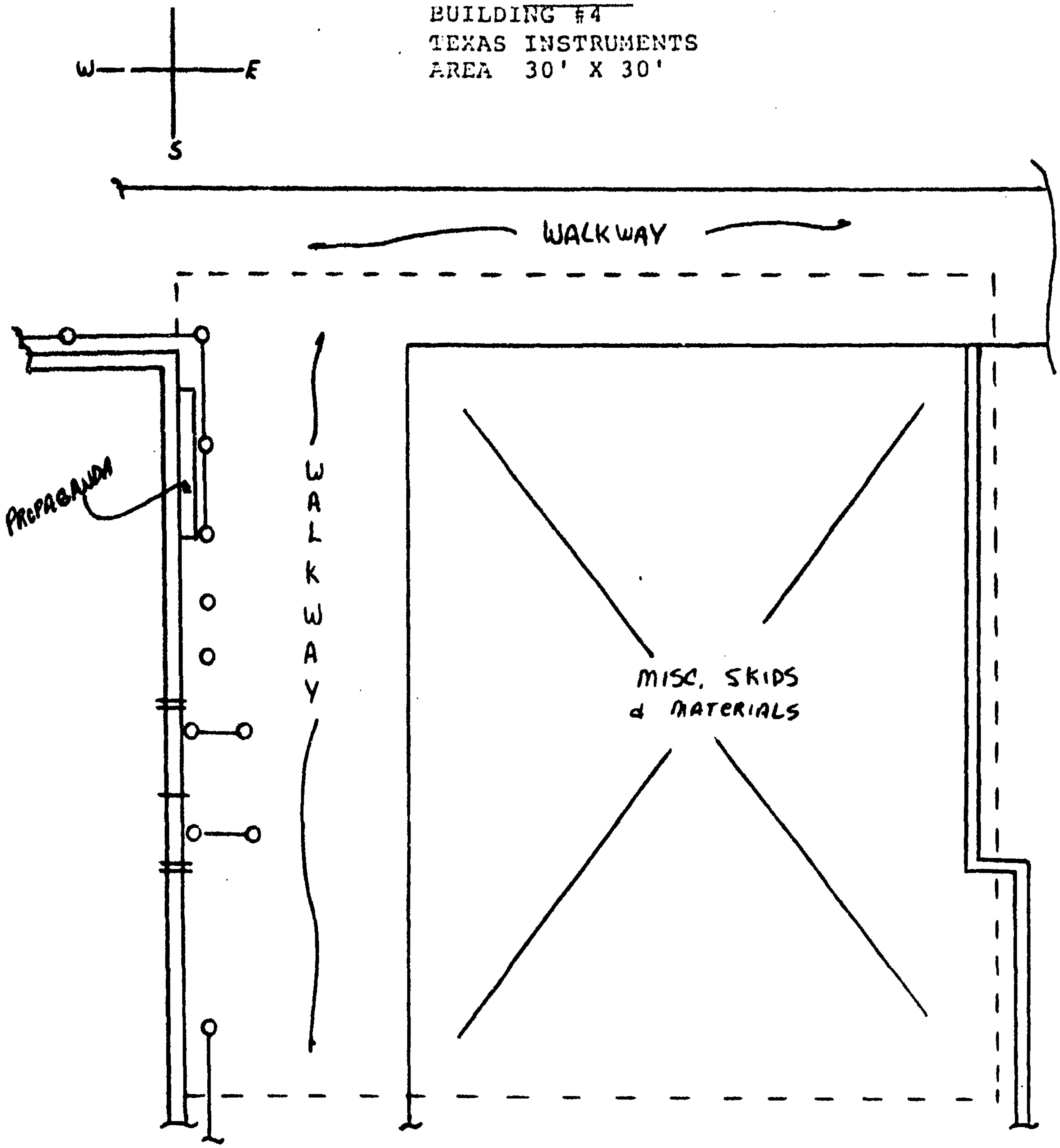
BATTERY CHECK: #1 ok / #2 ok
BACKGROUND: #1 60cpm / #2 40cpm
QC SOURCE CHECK: #1 30k / #2 30k
AVERAGE READING FOR GRID (CPM):
TECH #1 60cpm TECH #2 50cpm

SMEAR SURVEY RESULTS

DATE 10/24/94
METER Scaler
SERIAL # 111577
COUNT TIME 1min
BACKGROUND 0 α 73 βr

SMEAR #	RESULTS (CPM)	
1	0α	53βγ
2	↓	↓
3	↓	↓
4	↓	↓
5	↓	↓

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

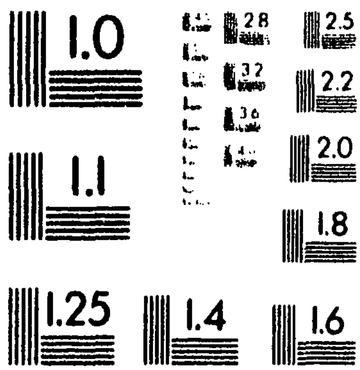
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 80 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 80 cpm TECH #2 70 cpm

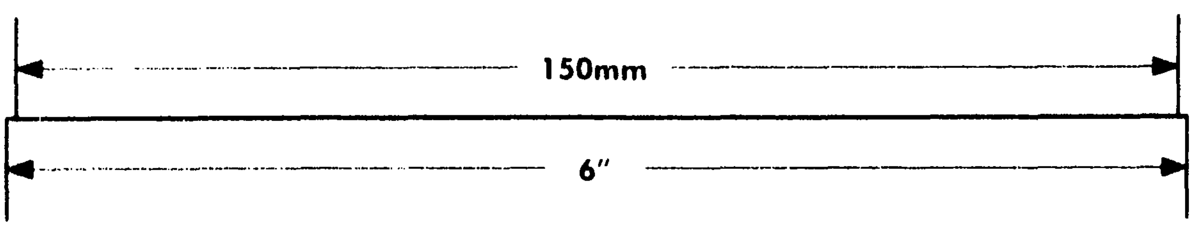
SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 73βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2		
3		
4		
5		

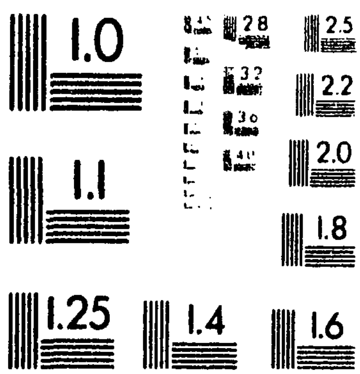
IMAGE EVALUATION TEST TARGET (MT-3)





PHOTOGRAPHIC SCIENCES CORPORATION
770 BASKET ROAD
P.O. BOX 338
WEBSTER, NEW YORK 14580

IMAGE EVALUATION TEST TARGET (MT-3)



150mm

6"

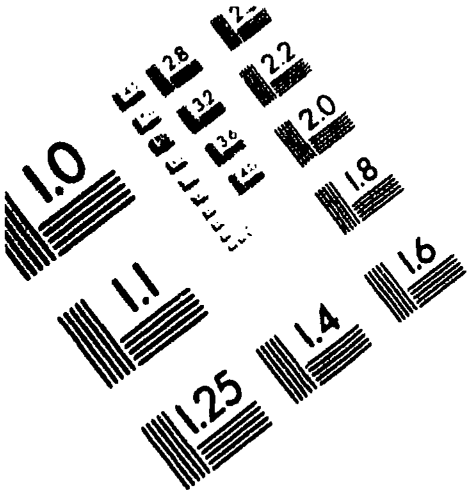
PHOTOGRAPHIC SCIENCES CORPORATION
770 BASKET ROAD
P.O. BOX 338
WEBSTER, NEW YORK 14580

IMAGE EVALUATION TEST TARGET (MT-3)

150mm

6"

PHOTOGRAPHIC SCIENCES CORPORATION
770 BASKET ROAD
P.O. BOX 338
WEBSTER, NEW YORK 14580



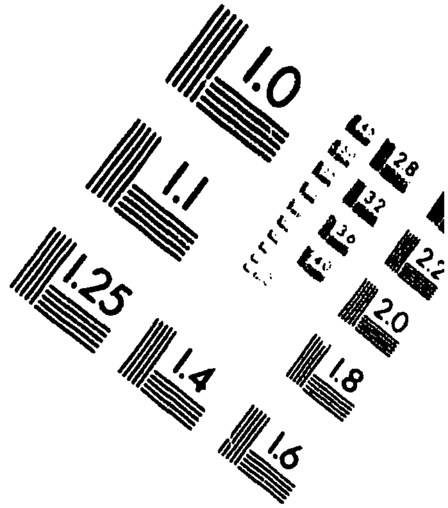
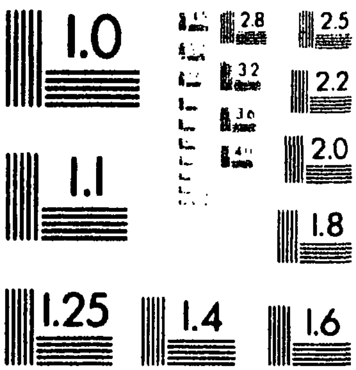
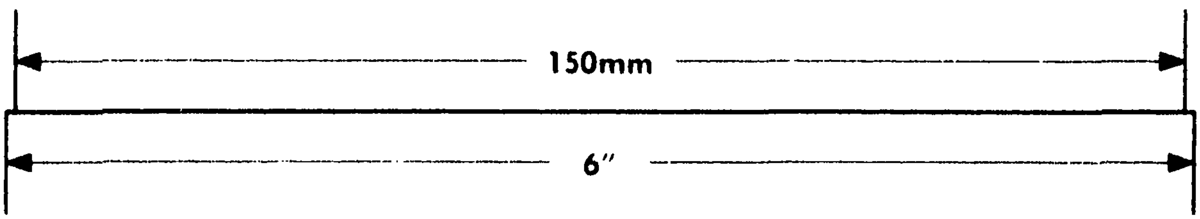
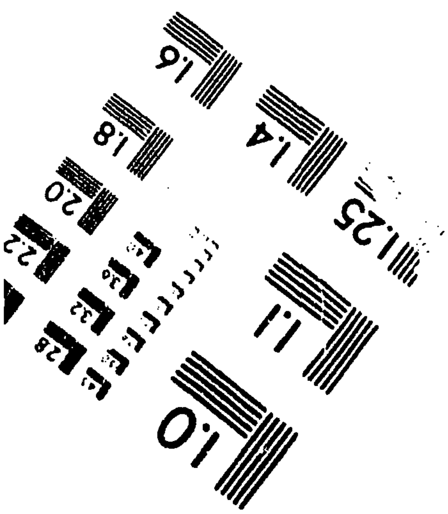
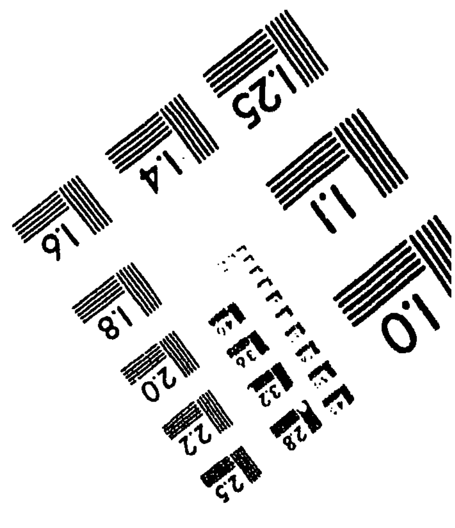


IMAGE EVALUATION TEST TARGET (MT-3)



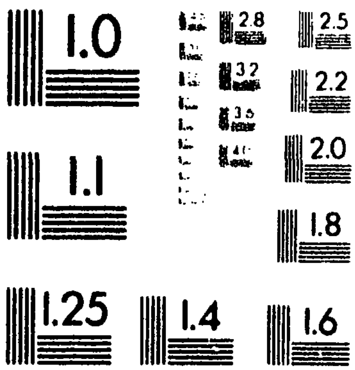


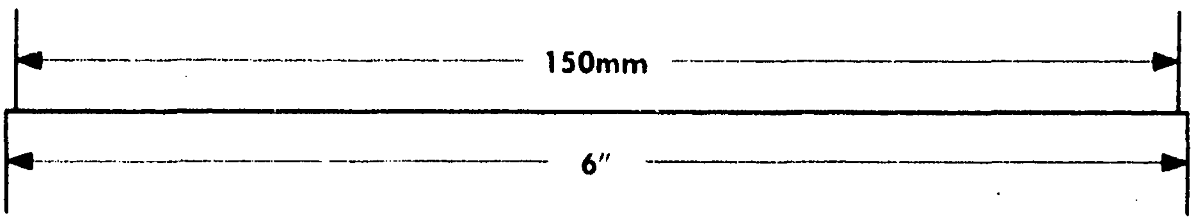




PHOTOGRAPHIC SCIENCES CORPORATION
770 BASKET ROAD
P.O. BOX 338
WEBSTER, NEW YORK 14580

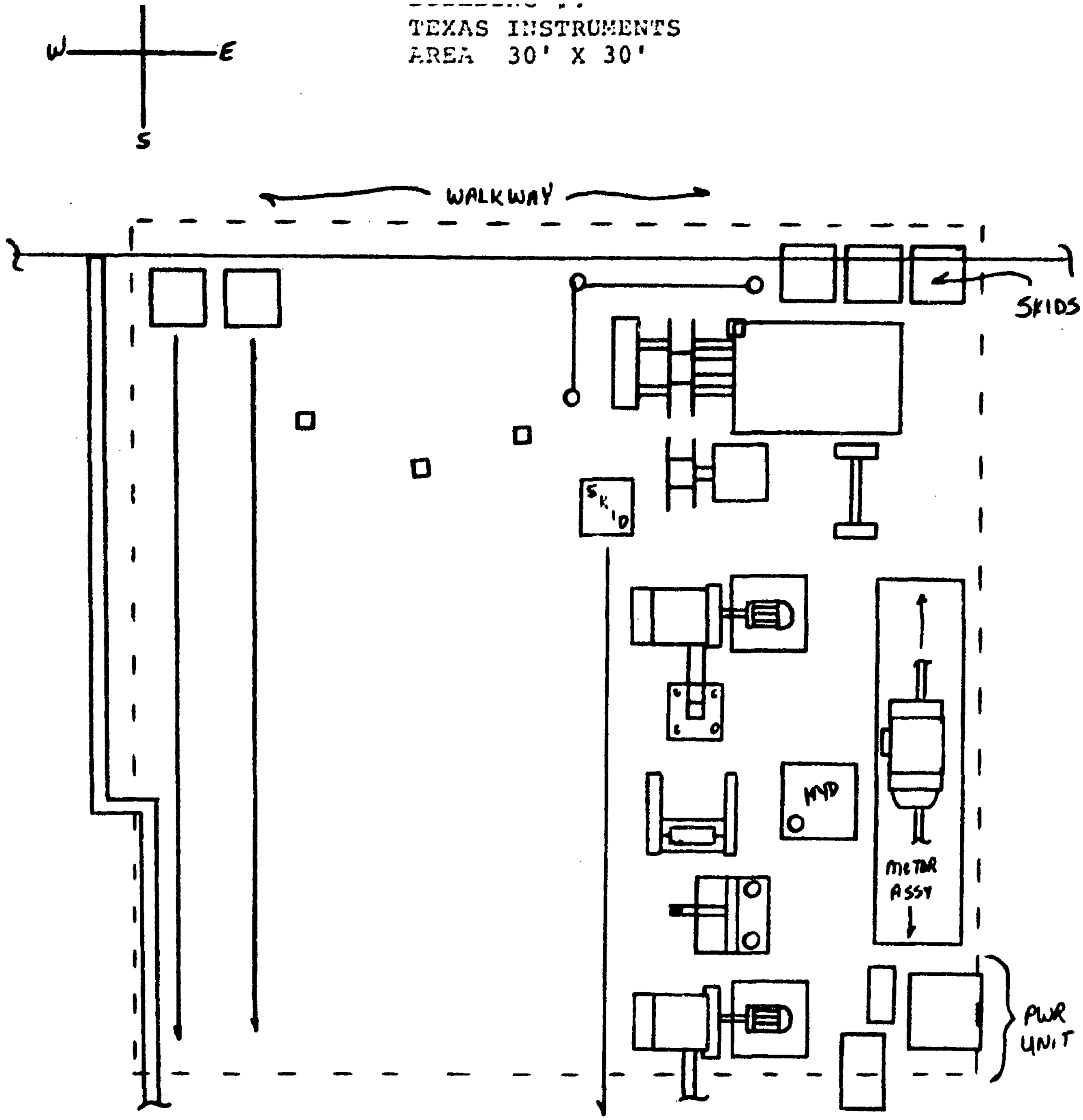
IMAGE EVALUATION TEST TARGET (MT-3)





PHOTOGRAPHIC SCIENCES CORPORATION
770 BASKET ROAD
P.O. BOX 338
WEBSTER, NEW YORK 14580

TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-16-94
TECH #1 C. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115567 / N/A
#2 115464 / N/A

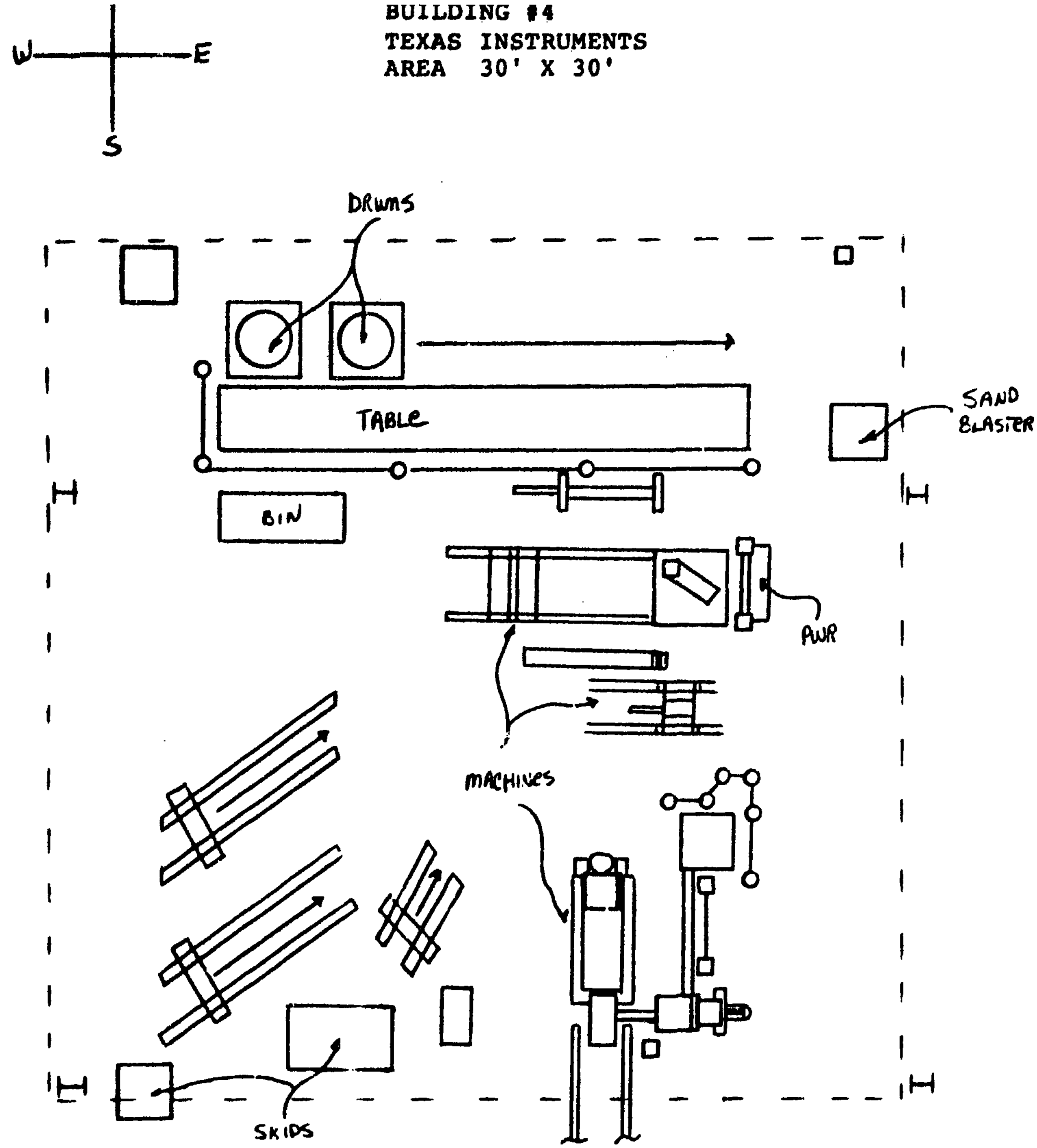
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 5CK / #2 5CK
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10 24 94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN
BACKGROUND 0α 73 βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 C. MIRIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

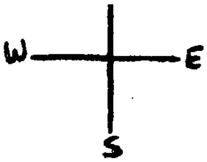
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 70 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 70 cpm

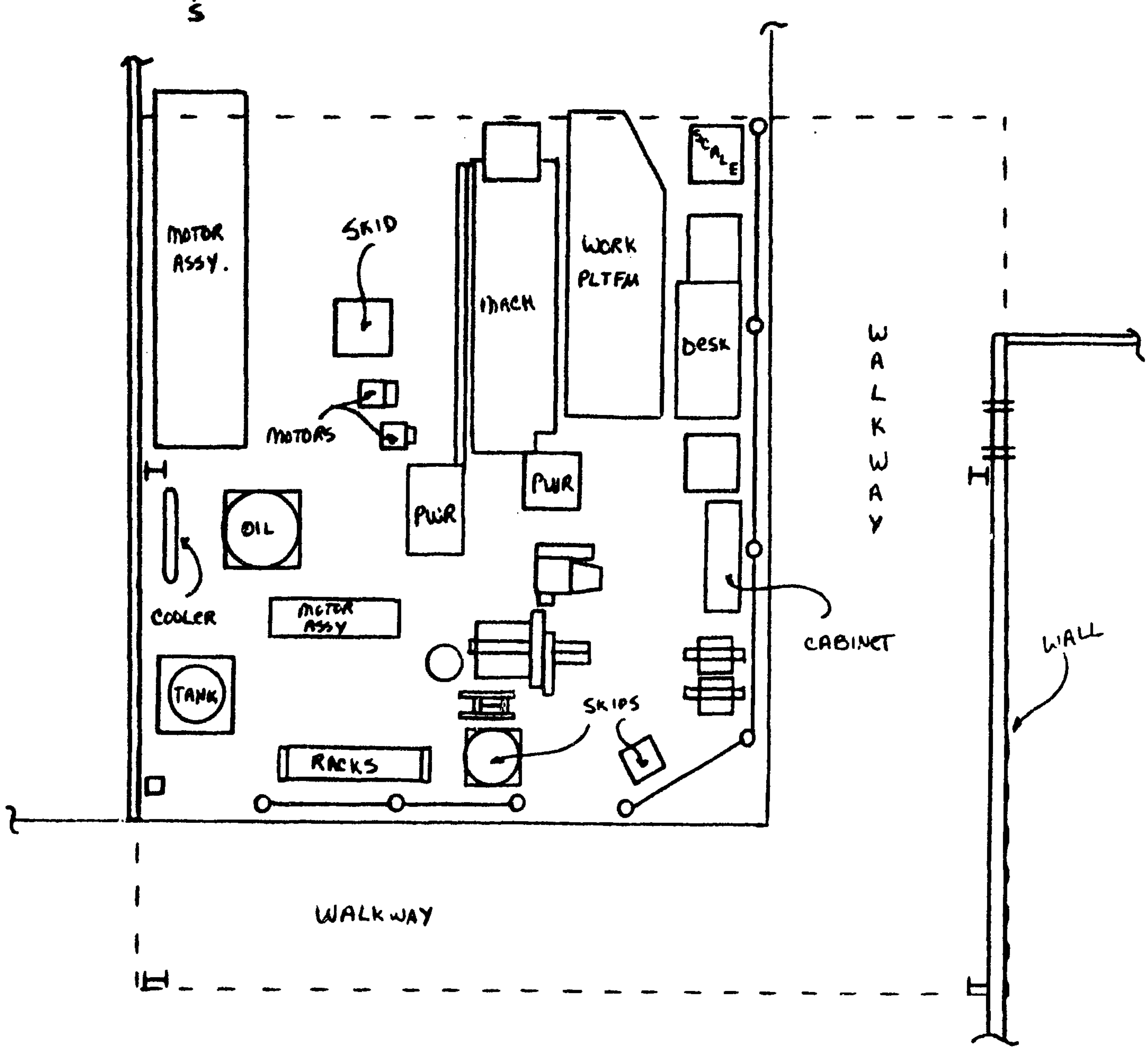
SMEAR SURVEY RESULTS

DATE 10-24-94
METER Scaler
SERIAL # 111517
COUNT TIME 1 min
BACKGROUND 0α .1 βγ

SMEAR #	RESULTS (CPM)	
1	α	βγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

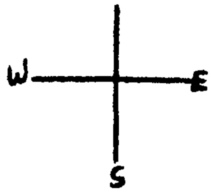
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 70 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

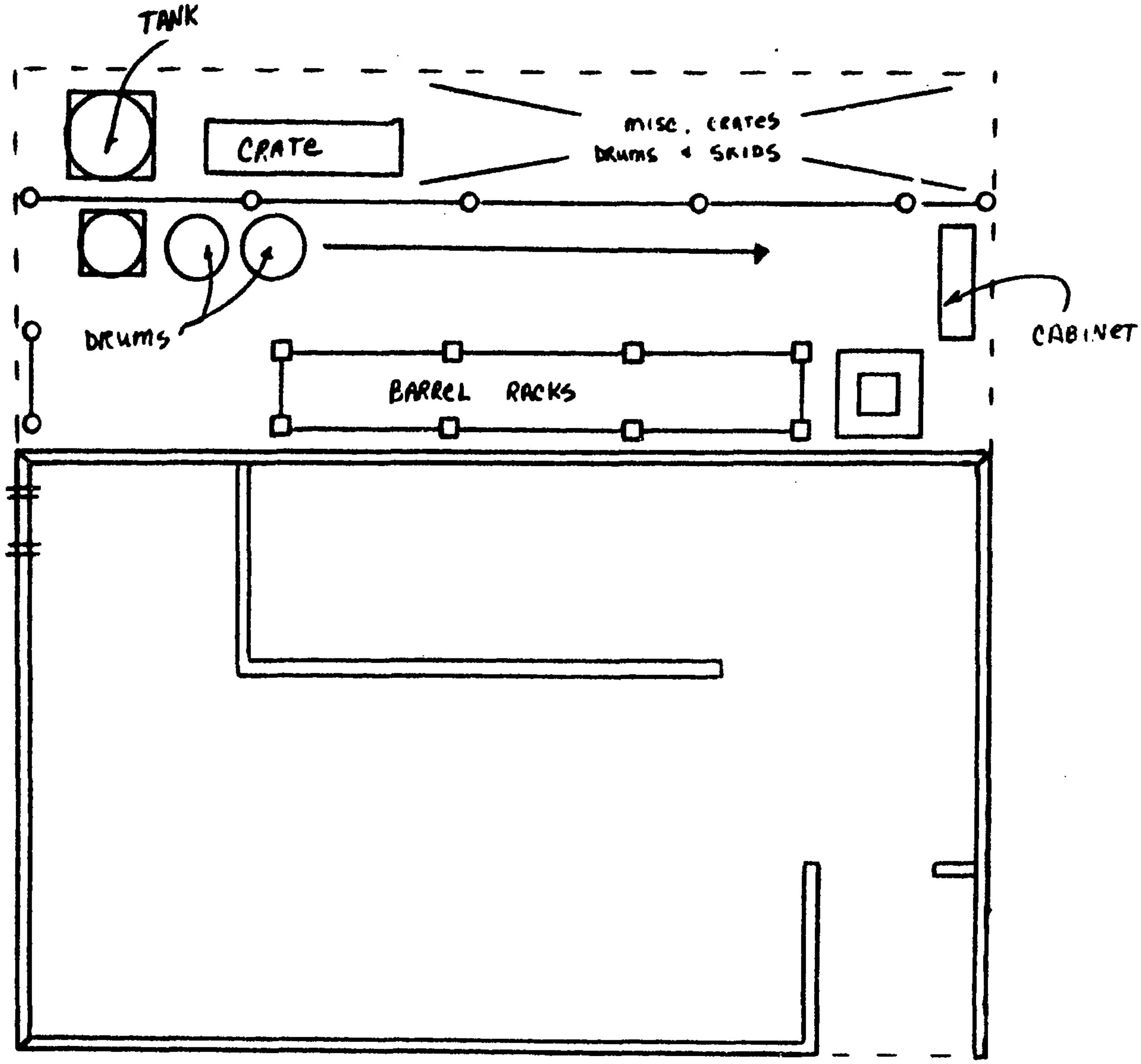
SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN
BACKGROUND 0α 75 βγ

SMEAR #	RESULTS (CPM)	
1	<	BG
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

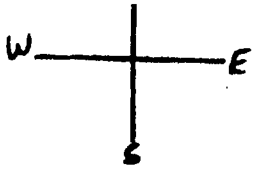
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 40 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

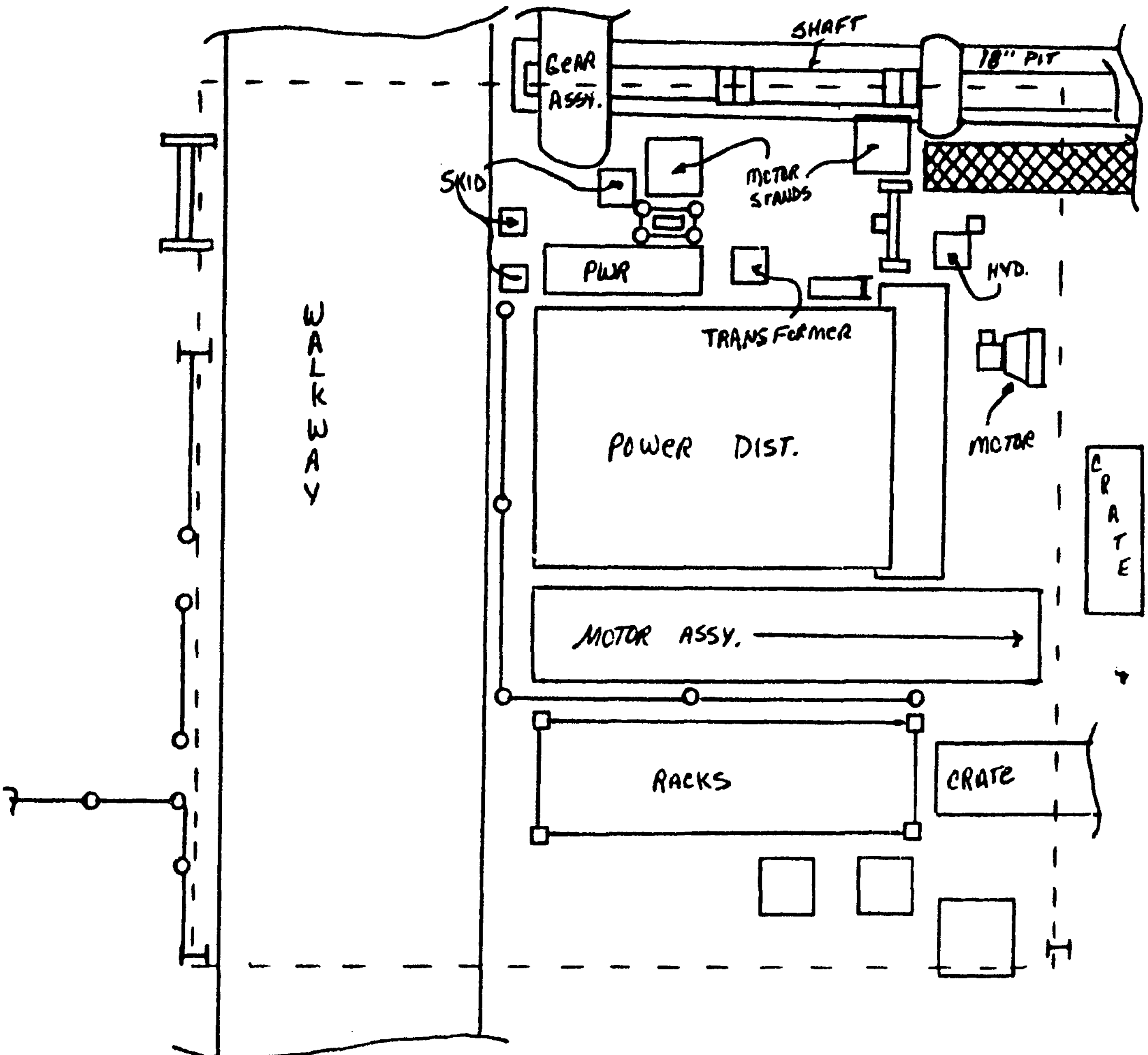
DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 73β

SMEAR SURVEY RESULTS

SMEAR #	RESULTS (CPM)	
1	α	β
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G. AKRIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

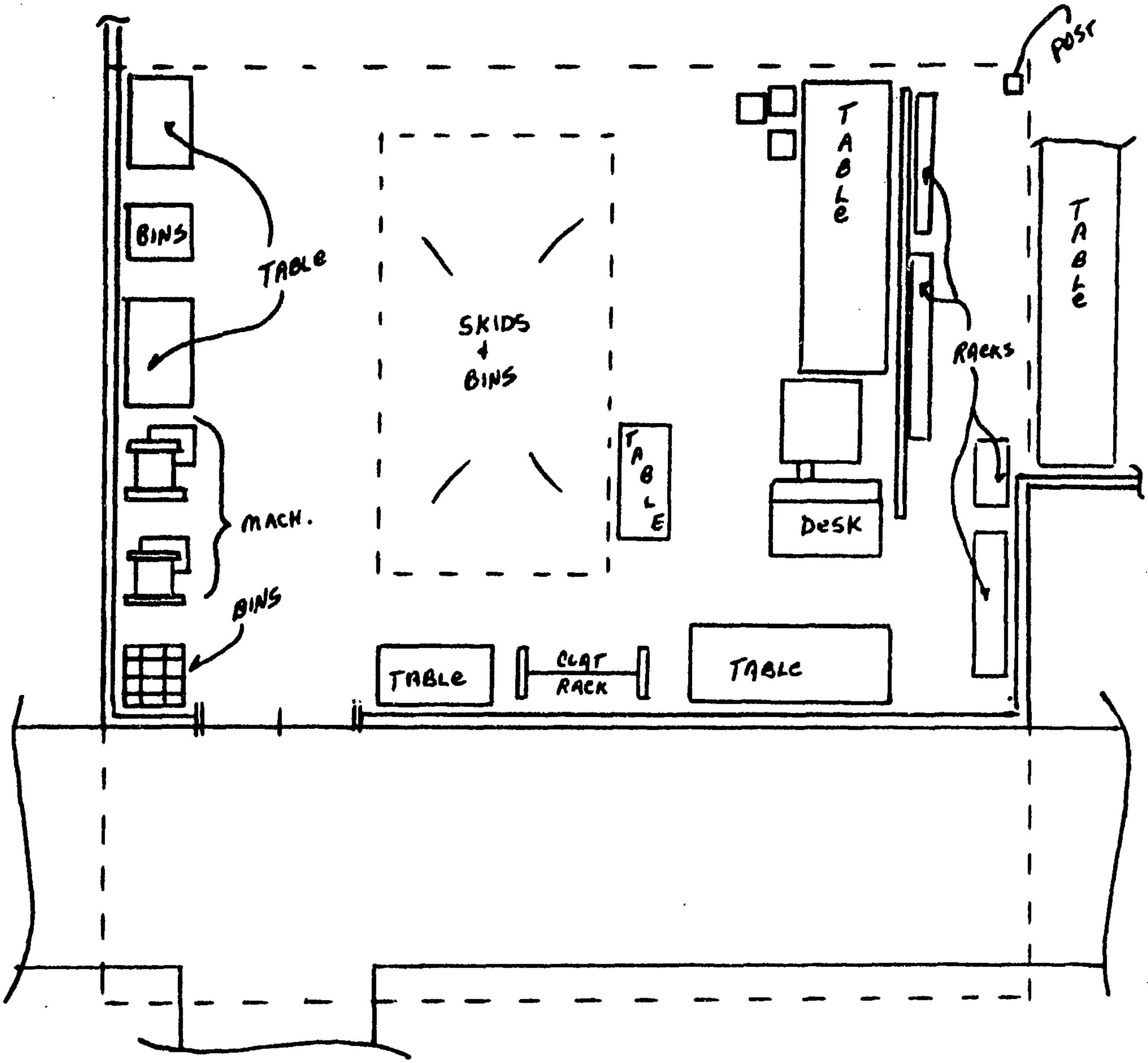
BATTERY CHECK: #1 Ok /#2 Ok
BACKGROUND: #1 60 cpm /#2 60 cpm
QC SOURCE CHECK: #1 3ck /#2 3ck
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN
BACKGROUND 0α/73β

SMEAR #	RESULTS (CPM)	
1	α	β
2	"	"
3	"	"
4	"	"
5	"	"

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 C. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

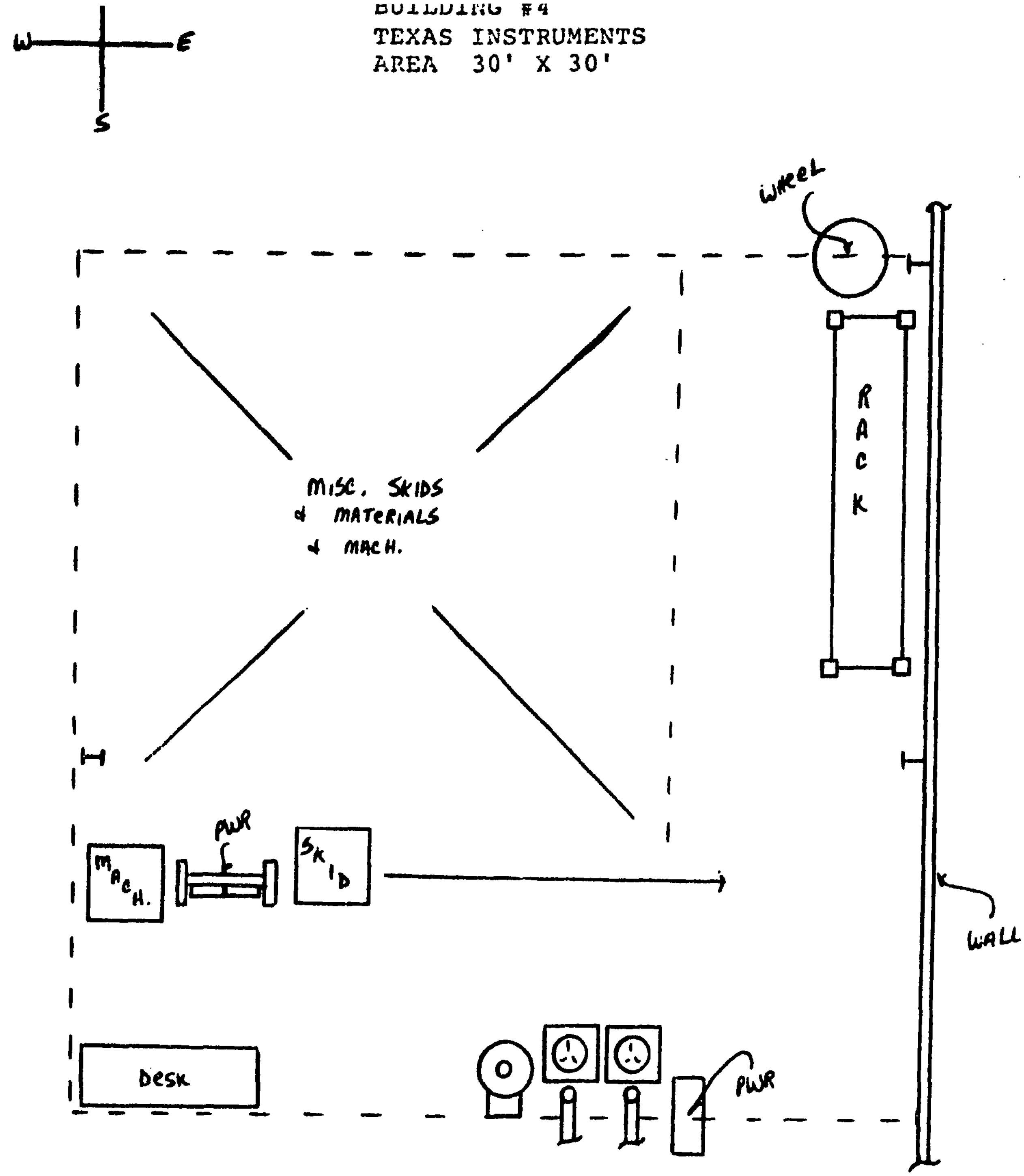
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 3CK / #2 3CK
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN
BACKGROUND 0α 73 Bγ

SMEAR #	RESULTS (CPM)	
1	α	Bγ
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-15-94
TECH #1 G. MERIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

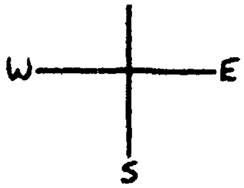
BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

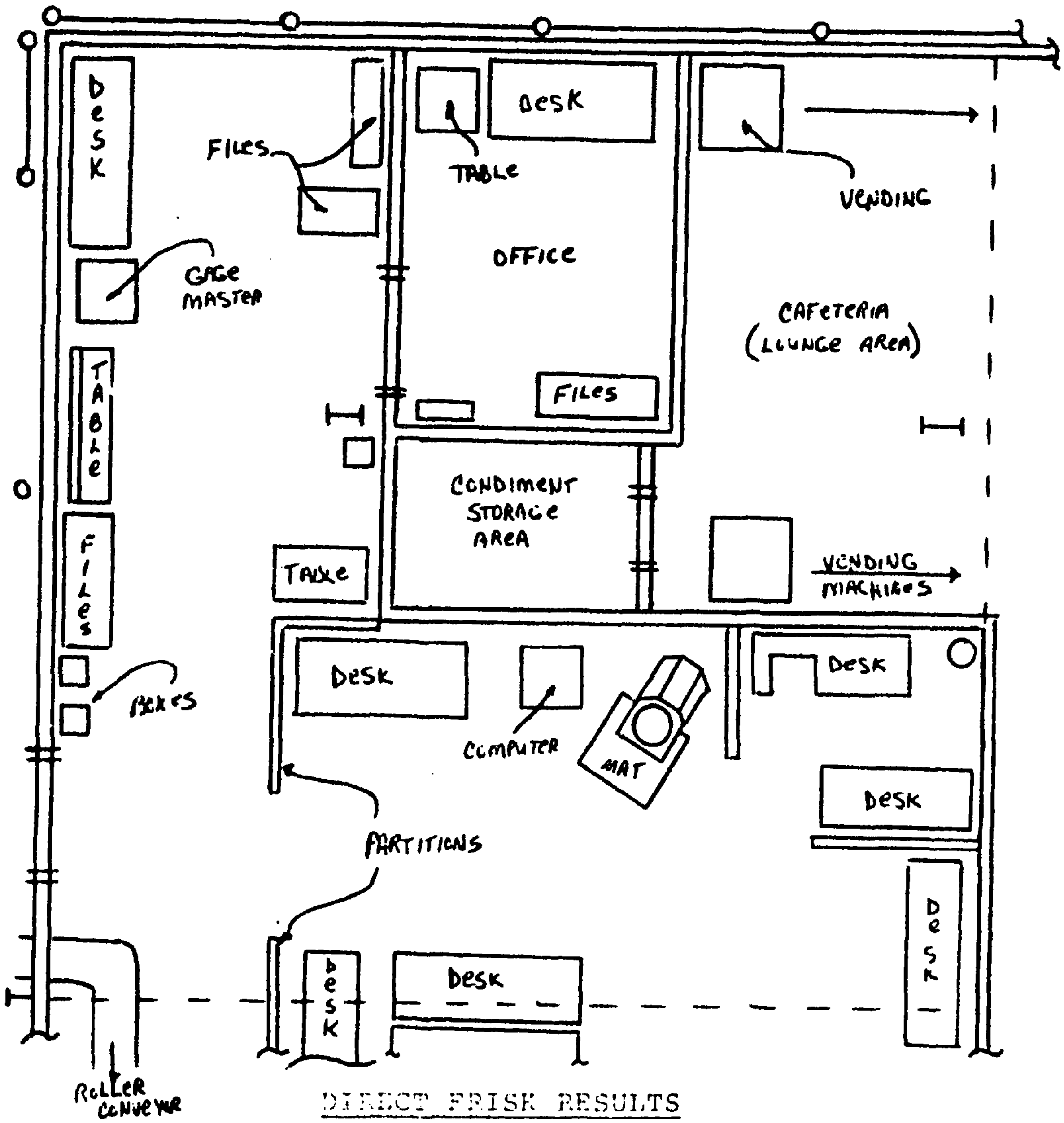
SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 MIN.
BACKGROUND 0α 73 βγ

SMEAR #	RESULTS (CPM)
1	~ BK
2	
3	
4	
5	

TEXAS INSTRUMENTS
AREA 30' X 30'





DIRECT FRISK RESULTS

DATE *10-15-94*
TECH #1 *C. MARIN*
TECH #2 *J. HECKMAN*
METER/PROBE
SERIAL NUMBER
#1 *115507* / *N/A*
#2 *115464* / *N/A*

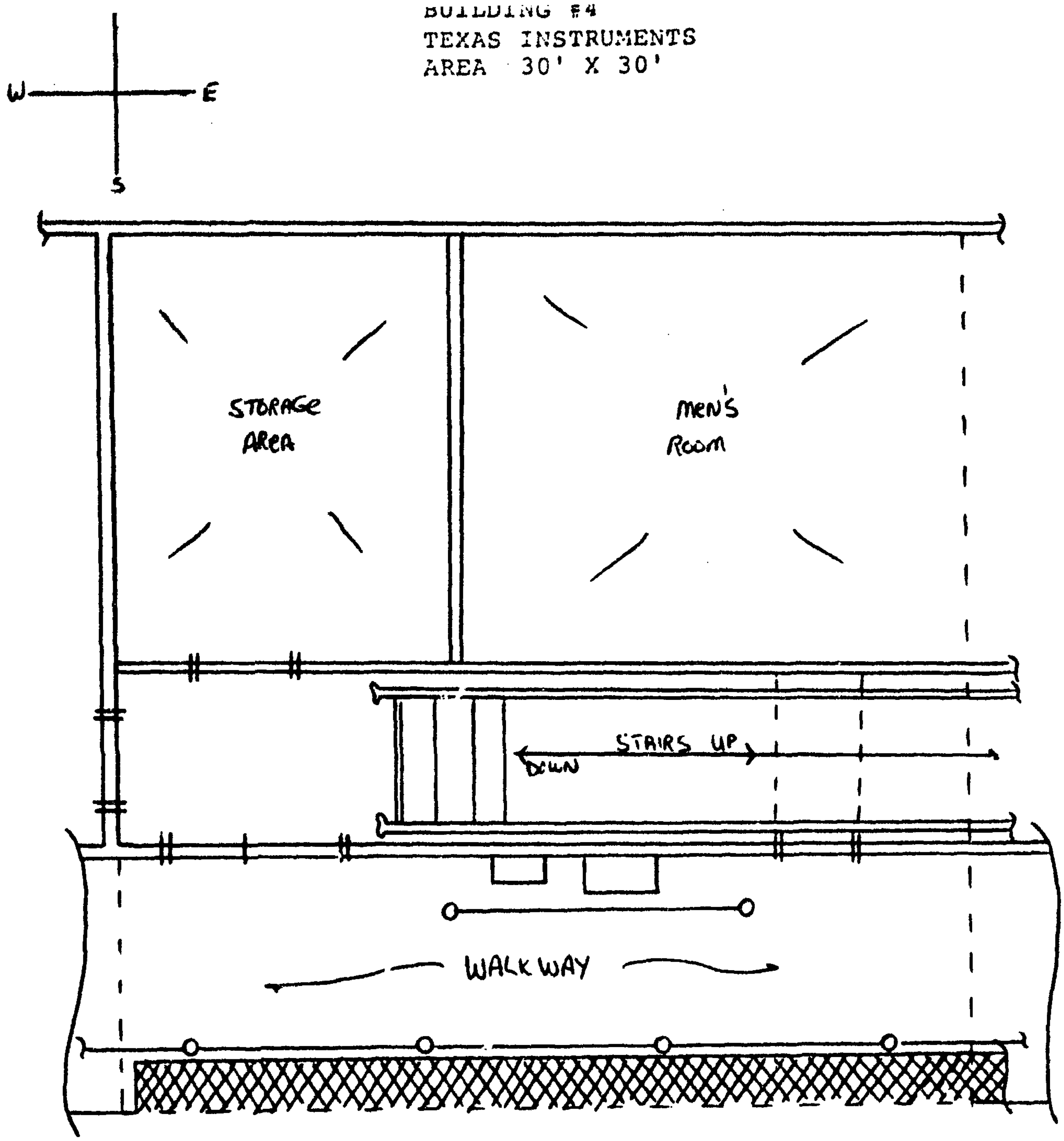
BATTERY CHECK: #1 *OK* / #2 *OK*
BACKGROUND: #1 *60 cpm* / #2 *60 cpm*
QC SOURCE CHECK: #1 *30K* / #2 *30K*
AVERAGE READING FOR GRID (CPM):
TECH #1 *60 cpm* TECH #2 *60 cpm*

SMEAR SURVEY RESULTS

DATE *10-24-94*
METER *SCALER*
SERIAL # *111577*
COUNT TIME *1 min*
BACKGROUND *0α 73β*

SMEAR #	RESULTS (CPM)	
1	*<α*	*<β*
2		
3		
4		
5		

BUILDING #4
TEXAS INSTRUMENTS
AREA 30' X 30'



DIRECT FRISK RESULTS

DATE 10-16-94
TECH #1 G. MORIN
TECH #2 J. HECKMAN
METER/PROBE
SERIAL NUMBER
#1 115507 / N/A
#2 115404 / N/A

BATTERY CHECK: #1 OK / #2 OK
BACKGROUND: #1 60 cpm / #2 60 cpm
QC SOURCE CHECK: #1 30K / #2 30K
AVERAGE READING FOR GRID (CPM):
TECH #1 60 cpm TECH #2 60 cpm

SMEAR SURVEY RESULTS

DATE 10-24-94
METER SCALER
SERIAL # 111577
COUNT TIME 1 min
BACKGROUND 0α 73 Bγ

SMEAR #	RESULTS (CPM)	
1	α	Bγ
2		
3		
4		
5		

Appendix C-3

Building 3 and 4 Scoping Survey Overhead Swipe Measurements

Appendix C-3: Building 3 and 4 Scoping Survey: Overhead Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	Description	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
Bldg 3													
Grid # 1	OH-1	NA	Oct-94	5	10	0	1	-2	520	10	55	1	8.108108
Grid # 1	OH-2	NA	Oct-94	5	10	0	1	-2	520	10	53	1	2.702703
Grid # 1	OH-3	NA	Oct-94	5	10	0	1	-2	520	10	78	1	70.27027
Grid # 1	OH-4	NA	Oct-94	5	10	0	1	-2	520	10	63	1	29.72973
Grid # 1	OH-5	NA	Oct-94	5	10	1	1	2	520	10	67	1	40.54054
Bldg 4													
12	OH-1	pipe	Nov-94	4	10	2	1	6.4	567	10	52	1	-12.7027
12	OH-1	ledge	Nov-94	4	10	3	1	10.4	567	10	61	1	11.62162
26	OH-1	eiling rafter	Nov-94	4	10	0	1	-1.6	567	10	60	1	8.918919
26	OH-2	pipe	Nov-94	4	10	0	1	-1.6	567	10	63	1	17.02703
26	OH-3	crane rail	Nov-94	4	10	0	1	-1.6	567	10	49	1	-20.81081
26	OH-4	angel iron	Nov-94	4	10	1	1	2.4	567	10	57	1	0.810811
27	OH-1	window	Nov-94	4	10	1	1	2.4	567	10	79	1	60.27027
27	OH-2	pipe	Nov-94	4	10	0	1	-1.6	567	10	73	1	44.05405
31	OH-1	window	Nov-94	4	10	0	1	-1.6	567	10	77	1	54.86486
31	OH-2	I-beam	Nov-94	4	10	0	1	-1.6	567	10	62	1	14.32432
31	OH-3	pipe	Nov-94	4	10	0	1	-1.6	567	10	64	1	19.72973
31	OH-4	I-beam	Nov-94	4	10	1	1	2.4	567	10	59	1	6.216216
35	OH-1	window	Nov-94	4	10	0	1	-1.6	567	10	62	1	14.32432
35	OH-2	light	Nov-94	4	10	1	1	2.4	567	10	67	1	27.83784
35	OH-3	angel iron	Nov-94	4	10	0	1	-1.6	567	10	54	1	-7.297297
35	OH-4	recirc.	Nov-94	4	10	0	1	-1.6	567	10	60	1	8.918919
36	OH-1	window	Nov-94	4	10	1	1	2.4	567	10	56	1	-1.891892
36	OH-2	I-beam	Nov-94	4	10	2	1	6.4	567	10	52	1	-12.7027
36	OH-3	angel iron	Nov-94	4	10	1	1	2.4	567	10	63	1	17.02703
39	OH-1	I-beam	Nov-94	4	10	0	1	-1.6	567	10	48	1	-23.51351
39	OH-2	pipe	Nov-94	4	10	0	1	-1.6	567	10	51	1	-15.40541
39	OH-3	ledge	Nov-94	4	10	1	1	2.4	567	10	59	1	6.216216

Appendix C-3: Building 3 and 4 Scoping Survey: Overhead Swipe Measurements

Grid # / Location	Type of Sample	Description	Date	Alpha Background Count	Alpha Background Time	Alpha Sample Count	Alpha Sample Time	Alpha Activity dpm	Beta Background Count	Beta Background Time	Beta Sample Count	Beta Sample Time	Beta Activity
39	OH-4	light	Nov-94	4	10	2	1	6.4	567	10	69	1	33.24324
42	OH-1	light	Nov-94	4	10	0	1	-1.6	567	10	50	1	-18.10811
42	OH-2	I-beam	Nov-94	4	10	0	1	-1.6	567	10	59	1	6.216216
42	OH-3	rafters	Nov-94	4	10	0	1	-1.6	567	10	44	1	-34.32432
42	OH-4	eiling brace	Nov-94	4	10	0	1	-1.6	567	10	59	1	6.216216
43	OH-1	I-beam	Nov-94	4	10	1	1	2.4	567	10	52	1	-12.7027
43	OH-2	pipe	Nov-94	4	10	2	1	6.4	567	10	71	1	38.64865
43	OH-3	pipe	Nov-94	4	10	0	1	-1.6	567	10	57	1	0.810811
43	OH-4	pipe	Nov-94	4	10	1	1	2.4	567	10	60	1	8.918919
45	OH-1	I-beam	Nov-94	4	10	0	1	-1.6	567	10	52	1	-12.7027
45	OH-2	I-beam	Nov-94	4	10	1	1	2.4	567	10	52	1	-12.7027
45	OH-3	I-beam	Nov-94	4	10	2	1	6.4	567	10	57	1	0.810811
45	OH-4	ledge	Nov-94	4	10	0	1	-1.6	567	10	60	1	8.918919
46	OH-1	heater	Nov-94	4	10	2	1	6.4	567	10	55	1	-4.594595
46	OH-2	I-beam	Nov-94	4	10	0	1	-1.6	567	10	65	1	22.43243
46	OH-3	I-beam	Nov-94	4	10	1	1	2.4	567	10	68	1	30.54054
46	OH-4	I-beam	Nov-94	4	10	1	1	2.4	567	10	57	1	0.810811
46	OH-5	pipe	Nov-94	4	10	1	1	2.4	567	10	56	1	-1.891892
52	OH-1	I-beam	Nov-94	4	10	2	1	6.4	567	10	70	1	35.94595
52	OH-2	ceiling sup	Nov-94	4	10	0	1	-1.6	567	10	50	1	-18.10811
52	OH-3	HVAC duct	Nov-94	4	10	0	1	-1.6	567	10	74	1	46.75676
52	OH-4	I-beam	Nov-94	4	10	2	1	6.4	567	10	68	1	30.54054
55	OH-1	ceiling sup	Nov-94	4	10	2	1	6.4	567	10	51	1	-15.40541
55	OH-2	pipe	Nov-94	4	10	1	1	2.4	567	10	47	1	-26.21622
55	OH-3	I-beam	Nov-94	4	10	0	1	-1.6	567	10	62	1	14.32432
55	OH-4	pipe	Nov-94	4	10	1	1	2.4	567	10	61	1	11.62162
64	OH-1	I-beam	Nov-94	4	10	0	1	-1.6	567	10	60	1	8.918919
64	OH-2	I-beam	Nov-94	4	10	0	1	-1.6	567	10	54	1	-7.297297
64	OH-3	I-beam	Nov-94	4	10	3	1	10.4	567	10	59	1	6.216216
64	OH-4	I-beam	Nov-94	4	10	1	1	2.4	567	10	60	1	8.918919
69	OH-1	angel iron	Nov-94	4	10	4	1	14.4	567	10	66	1	25.13514
69	OH-2	ceiling sup	Nov-94	4	10	7	1	26.4	567	10	67	1	27.83784

Appendix C-4

Building 3 and 4 Scoping Survey Wall Swipe Measurements

Appendix C-4: Building 3 and 4 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta					
Grid # / Location	Type of Sample	escription	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity	
Bldg 3														
Grid # 1	Wall	A	Oct-94	5	10	0	1	-2	561	10	65	1	24.05405	
Grid # 1	Wall	B	Oct-94	5	10	0	1	-2	561	10	64	1	21.35135	
Grid # 1	Wall	C	Oct-94	5	10	1	1	2	561	10	65	1	24.05405	
Grid # 1	Wall	D	Oct-94	5	10	0	1	-2	561	10	47	1	-24.59459	
Grid # 1	Wall	E	Oct-94	5	10	0	1	-2	561	10	65	1	24.05405	
Bldg 3 Random														
1	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351	
1	Wall	B	2/3/95	6	10	1	1	1.6	620	10	51	1	-29.72973	
1	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	51	1	-29.72973	
1	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	71	1	24.32432	
1	Wall	E	2/3/95	6	10	1	1	1.6	620	10	53	1	-24.32432	
2	Wall	A	2/3/95	6	[illegible]	0	1	-2.4	620	10	64	1	5.40540	
2	Wall	B	2/3/95	6	10	1	1	1.6	620	10	55	1	-18.91892	
2	Wall	C	2/3/95	6	10	1	1	1.6	620	10	69	1	1[illegible].91892	
2	Wall	D	2/3/95	6	10	0	1	-2.4	6[illegible]	10	49	1	-35.13[illegible]	
2	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081	
3	Wall	A	2/3/95	6	[illegible]	0	1	-2.4	620	10	42	1	-54.05405	
3	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	63	1	2.702703	
3	Wall	C	2/3/95	6	10	2	1	5.6	620	10	64	1	5.405405	
3	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351	
3	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	44	1	-48.64865	
4	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	55	1	-18.91892	
4	Wall	B	2/3/95	6	10	1	1	1.6	620	10	56	1	-16.21622	
4	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	51	1	-29.72973	
4	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	53	1	-24.32432	
4	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	66	1	10.81081	
5	Wall	A	2/3/95	6	[illegible]	1	1	1.6	620	10	57	1	-13.51351	
5	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	42	1	-54.05405	

Appendix C-4: Building 3 and 4 Scoping Survey: Wall Swipe Measurements

Grid # / Location	Type of Sample	escription	Date	Alpha Background Count	Time	Sample Count	Time	Activity dpm	Beta Background Count	Time	Sample Count	Time	Activity
5	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	61	1	-2.702703
5	Wall	D	2/3/95	6	10	1	1	1.6	620	10	42	1	-54.05405
5	Wall	E	2/3/95	6	10	1	1	1.6	620	10	51	1	-29.72973
6	Wall	A	2/3/95	6	10	1	1	1.6	620	10	65	1	8.108108
6	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351
6	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	53	1	-24.32432
6	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	68	1	16.21622
6	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
7	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	62	1	0
7	Wall	B	2/3/95	6	10	1	1	1.6	620	10	54	1	-21.62162
7	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
7	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	67	1	13.51351
7	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
8	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
8	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	61	1	-2.702703
8	Wall	C	2/3/95	6	10	1	1	1.6	620	10	64	1	5.405405
8	Wall	D	2/3/95	6	10	1	1	1.6	620	10	51	1	-29.72973
8	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
9	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	55	1	-18.91892
9	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	61	1	-2.702703
9	Wall	C	2/3/95	6	10	2	1	5.6	620	10	55	1	-18.91892
9	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
9	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	74	1	32.43243
10	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	66	1	10.81081
10	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	54	1	-21.62162
10	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
10	Wall	D	2/3/95	6	10	1	1	1.6	620	10	53	1	-24.32432
10	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
11	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	73	1	29.72973
11	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	50	1	-32.43243
11	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	70	1	21.62162
11	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	60	1	-5.405405

Appendix C-4: Building 3 and 4 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	escription	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
11	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
12	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
12	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	51	1	-29.72973
12	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
12	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351
12	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	63	1	2.702703
13	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	65	1	8.108108
13	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
13	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	55	1	-18.91892
13	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	66	1	10.81081
13	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
14	Wall	A	2/3/95	6	10	1	1	1.6	620	10	50	1	-32.43243
14	Wall	B	2/3/95	6	10	1	1	1.6	620	10	52	1	-27.02703
14	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	54	1	-21.62162
14	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	65	1	8.108108
14	Wall	E	2/3/95	6	10	1	1	1.6	620	10	56	1	-16.21622
15	Wall	A	2/3/95	6	10	2	1	5.6	620	10	57	1	-13.51351
15	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	68	1	16.21622
15	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	54	1	-21.62162
15	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	71	1	24.32432
15	Wall	E	2/3/95	6	10	2	1	5.6	620	10	68	1	16.21622
16	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	68	1	16.21622
16	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	72	1	27.02703
16	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	64	1	5.405405
16	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	42	1	-54.05405
16	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	53	1	-24.32432
17	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351
17	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	49	1	-35.13514
17	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	68	1	16.21622
17	Wall	D	2/3/95	6	10	1	1	1.6	620	10	65	1	8.108108
17	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	55	1	-18.91892
18	Wall	A	2/3/95	6	10	1	1	1.6	620	10	38	1	-64.86486

Appendix C-4: Building 3 and 4 Scoping Survey: Wall Swipe Measurements

Grid # / Location	Type of Sample	escription	Date	Alpha Background Count	Alpha Background Time	Alpha Sample Count	Alpha Sample Time	Alpha Activity dpm	Beta Background Count	Beta Background Time	Beta Sample Count	Beta Sample Time	Beta Activity
18	Wall	B	2/3/95	6	10	2	1	5.6	620	10	65	1	8.108108
18	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
18	Wall	D	2/3/95	6	10	1	1	1.6	620	10	55	1	-18.91892
18	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	67	1	13.51351
19	Wall	A	2/3/95	6	10	3	1	9.6	620	10	63	1	2.702703
19	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	67	1	13.51351
19	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351
19	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	77	1	40.54054
19	Wall	E	2/3/95	6	10	1	1	1.6	620	10	54	1	-21.62162
20	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	48	1	-37.83784
20	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	59	1	-8.108108
20	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
20	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	55	1	-18.91892
20	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	65	1	8.108108
21	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	64	1	5.405405
21	Wall	B	2/3/95	6	10	1	1	1.6	620	10	72	1	27.02703
21	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
21	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	63	1	2.702703
21	Wall	E	2/3/95	6	10	2	1	5.6	620	10	55	1	-18.91892
22	Wall	A	2/3/95	6	10	2	1	5.6	620	10	66	1	10.81081
22	Wall	B	2/3/95	6	10	1	1	1.6	620	10	61	1	-2.702703
22	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
22	Wall	D	2/3/95	6	10	2	1	5.6	620	10	55	1	-18.91892
22	Wall	E	2/3/95	6	10	1	1	1.6	620	10	56	1	-16.21622
23	Wall	A	2/3/95	6	10	1	1	1.6	620	10	54	1	-21.62162
23	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	53	1	-24.32432
23	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	48	1	-37.83784
23	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
23	Wall	E	2/3/95	6	10	1	1	1.6	620	10	51	1	-29.72973
24	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	52	1	-27.02703
24	Wall	B	2/3/95	6	10	1	1	1.6	620	10	53	1	-24.32432
24	Wall	C	2/3/95	6	10	1	1	1.6	620	10	66	1	10.81081

Appendix C-4: Building 3 and 4 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	escription	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
24	Wall	D	2/3/95	6	10	1	1	1.6	620	10	61	1	-2.702703
24	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	61	1	-2.702703
25	Wall	A	2/3/95	6	10	1	1	1.6	620	10	55	1	-18.91892
25	Wall	B	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
25	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	54	1	-21.62162
25	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	51	1	-29.72973
25	Wall	E	2/3/95	6	10	1	1	1.6	620	10	50	1	-32.43243
26	Wall	A	2/3/95	6	10	1	1	1.6	620	10	62	1	0
26	Wall	B	2/3/95	6	10	1	1	1.6	620	10	61	1	-2.702703
26	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	61	1	-2.702703
26	Wall	D	2/3/95	6	10	1	1	1.6	620	10	55	1	-18.91892
26	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	50	1	-32.43243
27	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
27	Wall	B	2/3/95	6	10	1	1	1.6	620	10	56	1	-16.21622
27	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	51	1	-29.72973
27	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	53	1	-24.32432
27	Wall	E	2/3/95	6	10	0	1	-2.4	620	10	54	1	-21.62162
28	Wall	A	2/3/95	6	10	1	1	1.6	620	10	58	1	-10.81081
28	Wall	B	2/3/95	6	10	2	1	5.6	620	10	61	1	-2.702703
28	Wall	C	2/3/95	6	10	1	1	1.6	620	10	62	1	0
28	Wall	D	2/3/95	6	10	3	1	9.6	620	10	66	1	10.81081
28	Wall	E	2/3/95	6	10	1	1	1.6	620	10	56	1	-16.21622
29	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	56	1	-16.21622
29	Wall	B	2/3/95	6	10	1	1	1.6	620	10	53	1	-24.32432
29	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	58	1	-10.81081
29	Wall	D	2/3/95	6	10	1	1	1.6	620	10	59	1	-8.108108
29	Wall	E	2/3/95	6	10	4	1	13.6	620	10	45	1	-45.94595
30	Wall	A	2/3/95	6	10	0	1	-2.4	620	10	62	1	0
30	Wall	B	2/3/95	6	10	1	1	1.6	620	10	71	1	24.32432
30	Wall	C	2/3/95	6	10	0	1	-2.4	620	10	63	1	2.702703
30	Wall	D	2/3/95	6	10	0	1	-2.4	620	10	57	1	-13.51351
30	Wall	E	2/3/95	6	10	1	1	1.6	620	10	50	1	-32.43243

OFFICIAL RECORD COPY VOL 10
118945 FEB 21 1997

Appendix C-4: Building 3 and 4 Scoping Survey: Wall Swipe Measurements

				Alpha					Beta				
Grid # / Location	Type of Sample	escription	Date	Background Count	Time	Sample Count	Time	Activity dpm	Background Count	Time	Sample Count	Time	Activity
Bldg 4 Access. Grids													
11	Wall	A	Nov-94	4	10	0	1	-1.6	537	10	63	1	25.13514
11	Wall	B	Nov-94	4	10	1	1	2.4	537	10	52	1	-4.594595
11	Wall	C	Nov-94	4	10	2	1	6.4	537	10	52	1	-4.594595
11	Wall	D	Nov-94	4	10	0	1	-1.6	537	10	51	1	-7.297297
11	Wall	E	Nov-94	4	10	1	1	2.4	537	10	58	1	11.62162
26	Wall	A	Nov-94	4	10	0	1	-1.6	537	10	53	1	-1.891892
26	Wall	B	Nov-94	4	10	0	1	-1.6	537	10	54	1	0.810811
26	Wall	C	Nov-94	4	10	1	1	2.4	537	10	56	1	6.216216
26	Wall	D	Nov-94	4	10	1	1	2.4	537	10	62	1	22.43243
26	Wall	E	Nov-94	4	10	1	1	2.4	537	10	64	1	27.83784
28	Wall	A	Nov-94	4	10	2	1	6.4	537	10	67	1	35.94595
28	Wall	B	Nov-94	4	10	1	1	2.4	537	10	58	1	11.62162
28	Wall	C	Nov-94	4	10	0	1	-1.6	537	10	53	1	-1.891892
28	Wall	D	Nov-94	4	10	1	1	2.4	537	10	51	1	-7.297297
28	Wall	E	Nov-94	4	10	3	1	10.4	537	10	52	1	-4.594595
55	Wall	A	Nov-94	4	10	1	1	2.4	537	10	60	1	17.02703
55	Wall	B	Nov-94	4	10	1	1	2.4	537	10	52	1	-4.594595
55	Wall	C	Nov-94	4	10	0	1	-1.6	537	10	51	1	-7.297297
55	Wall	D	Nov-94	4	10	1	1	2.4	537	10	56	1	6.216216
55	Wall	E	Nov-94	4	10	1	1	2.4	537	10	54	1	0.810811
81	Wall	A	Nov-94	4	10	0	1	-1.6	537	10	59	1	14.32432
81	Wall	B	Nov-94	4	10	0	1	-1.6	537	10	51	1	-7.297297
81	Wall	C	Nov-94	4	10	1	1	2.4	537	10	52	1	-4.594595
81	Wall	D	Nov-94	4	10	0	1	-1.6	537	10	54	1	0.810811
81	Wall	E	Nov-94	4	10	0	1	-1.6	537	10	51	1	-7.297297

ription	Th-234	Pa-234m	U-235
wn	1.33 ± 0.10	1.0 ± 0.6	0.38 ± 0.02
wn	1.45 ± 0.09	1.0 ± 0.6	1.13 ± 0.03
	7.4 ± 0.3	9.1 ± 0.9	1.05 ± 0.04
	2.0 ± 0.3	4.4 ± 1.0	0.43 ± 0.04
	4.88 ± 0.12	5.0 ± 0.8	0.39 ± 0.02
2	101.8 ± 0.7	111 ± 2	3.21 ± 0.06
	0.4 ± 0.3	< 2	< 0.1
	5.99 ± 0.11	6.7 ± 0.6	0.58 ± 0.03
	<0.5	1.2 ± 0.7	0.04 ± 0.02
	0.67 ± 0.09	1.3 ± 0.8	0.12 ± 0.02
12,	3.0 ± 0.2	2.5 ± 0.7	0.13 ± 0.03
	11.55 ± 0.11	11.3 ± 0.8	0.29 ± 0.02
wn	2.1 ± 0.3	3.6 ± 0.9	0.08 ± 0.03
metals p	2.16 ± 0.08	2.3 ± 0.6	0.73 ± 0.02
est Lawn	10.7 ± 0.4	12.1 ± 0.8	0.49 ± 0.03
awn	1.54 ± 0.11	1.3 ± 0.7	0.10 ± 0.02
	4.3 ± 0.3	5.7 0.8	0.25 ± 0.03
	1.45 ± 0.14	2.0 ± 1.0	0.48 ± 0.03
	1.1 ± 0.3	2.3 ± 0.6	0.14 ± 0.03
12 Loading	5.55 ± 0.09	5.2 ± 0.7	0.26 ± 0.02
	17.61 ± 0.13	18.7 ± 0.8	0.64 ± 0.03
wn	1.0 ± 0.3	1.4 ± 0.7	0.16 ± 0.03
	13.60 ± 0.12	13.7 ± 0.9	0.58 ± 0.03
a	2.54 ± 0.10	2.3 ± 0.6	0.16 ± 0.02
a	6.76 ± 0.13	4.6 ± 0.7	0.45 ± 0.03

025

0119-14A-3F-SS-03-06-00 TI-330	Building 4, Area 14	0.5
1130-12-6E-SS-01-06-00 TI-191	Building 10, Area 12	0.9
1211-12-5F-BSS South Composite	Building 10, Area 12	0.8
0227-BLDG5-SS-02-06-00 TI-465	Building 5	1.67
0111-05-5B-SS-03-06-00 TI-293	Building 10, Area 5	2.61
0111-05-6B-SS-04-06-00 TI-292	Building 10, Area 5	5.9
0104-12-5D-SS-03-06-00 TI-273	Building 10, Area 12	4.34
0104-12-5E-SS-02-06-00 TI-272	Building 10, Area 12	17.6
0110-06-6C-SS-04-06-00 TI-288	Building 10, Area 6	5.88
1026-08-7B-SS-01-06-00	Building 1C, Area 8	0.4
Building 12	Building 12 Lawn	1.21
Site Background	East of Building 12	0.72

Flow Floor Monitor - This system is utilized for integrated surface contamination measurements of all remaining concrete surfaces and contiguous wall surfaces to a height of 1 meter. Both detectors are operated in the beta region (recording both alpha and beta particle ionization within the detector volume. The surface contamination measurements may be converted to dpm/100 cm^2 and compared directly to the 5000 dpm/100 cm^2 (total)/1000 dpm/100 cm^2 equipment is detailed in SOP 8.0.

Ludlum Model 2000 Scaler/43-10 Alpha Tray Counter - This system is utilized for counting of smears for removable contamination, that must be taken when total contamination levels as measured in the field exceed 1000 dpm/100 cm^2. Smears also will be collected from exposed drain openings or similar subsurface features. The use and application of this equipment is detailed in SOP 11.0.

Ludlum Model 2221 Scaler-Ratemeter/44-1 Beta Scintillator - This system is utilized to perform integrated beta count measurements over 1 meter by 1 meter soil blocks that have been exposed as a result of the decontaminaiton process. Integrated counts are compared to the mean plus two stnadard deviations of the background as measured in a clean soil area. If measurements exceed this criteria, the exposed soils must be sample to the same frequency and profile as concret slabs (described in the PP).

Ludlum Model 2221 Scaler-Ratemeter/44-1 1-inch x 1-inch Sodium Iodide Detector - This detection system is utilized with and extended cable (up to 6 ft. in length) to survey drain pipes and traps to identify accumulation of radioactive material in pipe scale or collection points. The small size of the detector is ideal for this application.

3.0 PROCEDURES

The aforementioned logic flow chart should be consulted for each 10 meter by 10 meter grid block to determine the following procedures that are applicable.

3.1 Preparation

A. Obtain appropriate radiological monitoring equipment. Ensure current calibration and function check per SOP 10.0.

B. Ensure proper work area as designated by Site Health Physicist. Refer to site map for location and SOP 22.0 for sample location identification codes.

C. Ensure work areas are clear of equipment and other debris.

D. Obtain appropriate number of data forms 4.1 - 4.4. Sketch open areas (concrete sections) that have been removed and other features on the Raw Field Data Form.

3.2 Surface Contamination Measurements on Concrete Slabs and Wall Surfaces

A. Complete introductory sections of Termination Survey Equipment Information Form, Raw Field Data Form, and Final Soil Sampling Profile. Ensure that efficiency has been modified by EMF per SOP 10.0. System background may be recorded from daily function check forms.

B. Utilize Model 2221/Model 43-68 gas flow detector operating in scaler and ratemeter mode.

C. Consult with Site Health Physicist for the proper scaled count time. Program Model 2221 with this time.

D. Perform background survey measurement on designated 1 square meter concrete floor and cinder block wall surfaces. Survey should be performed by passing detector over surfaces at a constant rate of speed for the entire integrated count time. The surface to detector spacing should be approximately 1/4" - 1/2". Record integrated counts for each surface on Termination Survey Equipment Information Form.

E. Perform surface contamination surveys on designated 1 square meter grid blocks. Use the same technique as described in item D above. In addition, where the ratemeter response exceeds 20% of the area background, record value on relative location on Raw Field Data Form with a (m) designation. Record integrated count in appropriate grid block on Raw Field Data Form. Ensure top of form correlates to Plant North.

3.3 Integrated Beta Count over Exposed Soil Areas

A. Utilize Model 2221/Model 44-1 beta scintillator operating in scaler and ratemeter mode.

B Consult with Site Health Physicist for the proper scaled count time. Program Model 2221 with this time.

C. Complete remaining introductory sections of Termination Survey Equipment Form.

3.4 Removable Contamination Measurements on Concrete Slabs and Wall Surfaces

A. Utilizing Final Field Data Form, identify grid blocks exceeding 1000 dpm/100 cm^2 for removable contamination survey.

B. Obtain removable contamination smear from 100 cm^2 of each 1 meter square grid block. Analyze per SOP 11.0 and record on Raw Field Data Form.

4.0 APPENDICES

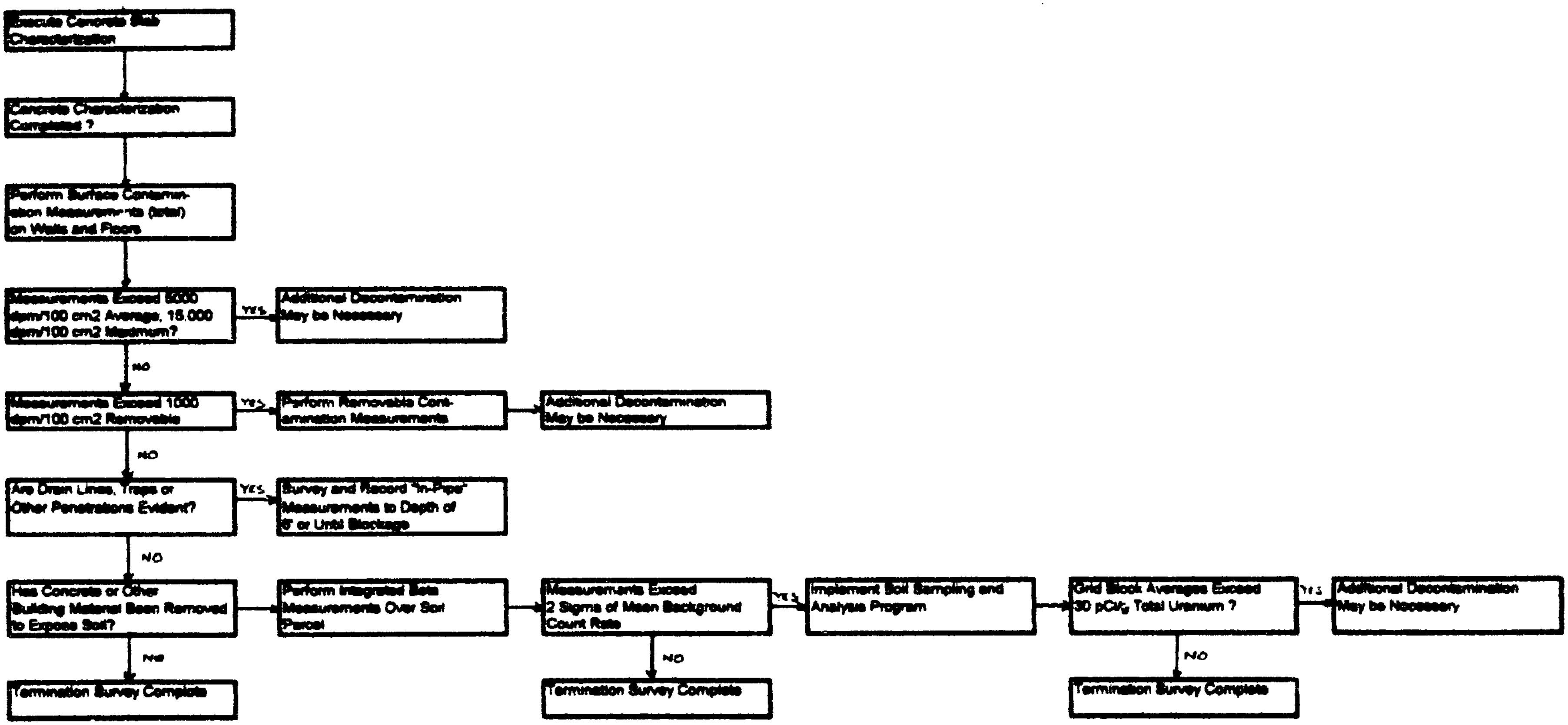
4.1 Termination Survey Equipment Information Form

4.2 Raw Field Data Form

4.3 Final Field Data Form

4.4 Final Soil Sampling Profile

Figure 1 Termination Survey Logic Flow Chart



APPENDIX 4.1
GRID BLOCK TERMINATION SURVEY
GENERAL INFORMATION

Grid Block Indentification #:	Date of Survey:

Gas Flow Floor Monitoring System

Scaler Model #:	Probe Model #:	Count Time (min):
Scaler Serial #:	Probe Serial #:	Efficiency (cpm/dpm):
Concrete Background Counts:		MDA (dpm/100 cm2):
Other Background Counts:		

Hand-Held Gas Flow Monitoring System

Scaler Model #:	Probe Model #:	Count Time (min):
Scaler Serial #:	Probe Serial #:	Efficiency (cpm/dpm):
Concrete Background Counts:		MDA (dpm/100 cm2):
Cinder Block Wall Background Counts:		
Other Background Counts:		

Beta Scintillator Soil Survey System

Scaler Model #:	Probe Model #:	Count Time (min):
Scaler Serial #:	Probe Serial #:	Efficiency (cpm/dpm):
Soil Background Counts:		Background CR + 2 sigma:

Surveyor Comments:
Surveyor Signature:

General Information:

* Floor monitoring system is to be used on complete floor grid blocks
* Hand-held monitoring system is to be used on partial floor grids and one meter wall grids
* Beta scintillator is used for integrated surveys over exposed soil grid blocks
* Raw Data Form entries are recorded as total integrated counts.
* Final Data Form entries for floor and wall surfaces are recorded in dpm/100 cm2.
* Final Data Form entries for exposed soil surfaces are recorded in net cpm.
* Final soil sample locations are designated by a "+"
* Final soil sample locations include systemmatic and biased locations

Grid Block Identification #: Date of Survey:

General Comments:

Surveyed By:

Reviewed By:

APPENDIX 4.3
GRID BLOCK TERMINATION SURVEY
FINAL FIELD DATA FORM

Grid Block Identification #: Date of Survey:

General Comments:

Surveyed By:

Reviewed By:

APPENDIX 4.4
GRID BLOCK TERMINATION SURVEY
FINAL FIELD DATA FORM

Grid Block Identification #:	Date of Survey:

Soil Sample Location ID Depth	Total Uranium Concentration (pCi/g)
1	
2	
3	
4	
5	
6	

General Comments:

Sampled By:

Reviewed By:

CERTIFICATE OF CALIBRATION

WESTON
6501 AMERICAS PARKWAY, N.E
SUITE 800
ALBUQUERQUE, NM 87110 1517
505 884 5050 • FAX 505 884 5388

BENCH TEST DATA FOR DETECTOR 43-68 **S/N** 126194

CUSTOMER : Texas Instruments **Work Order No.**

Counter 2221 **S/N** 117613 **Distance–Source to Detector** 3/8"

Count Time 1 minute **Counter Mode** Scaler **Counter Input Sensitivity**

Comments

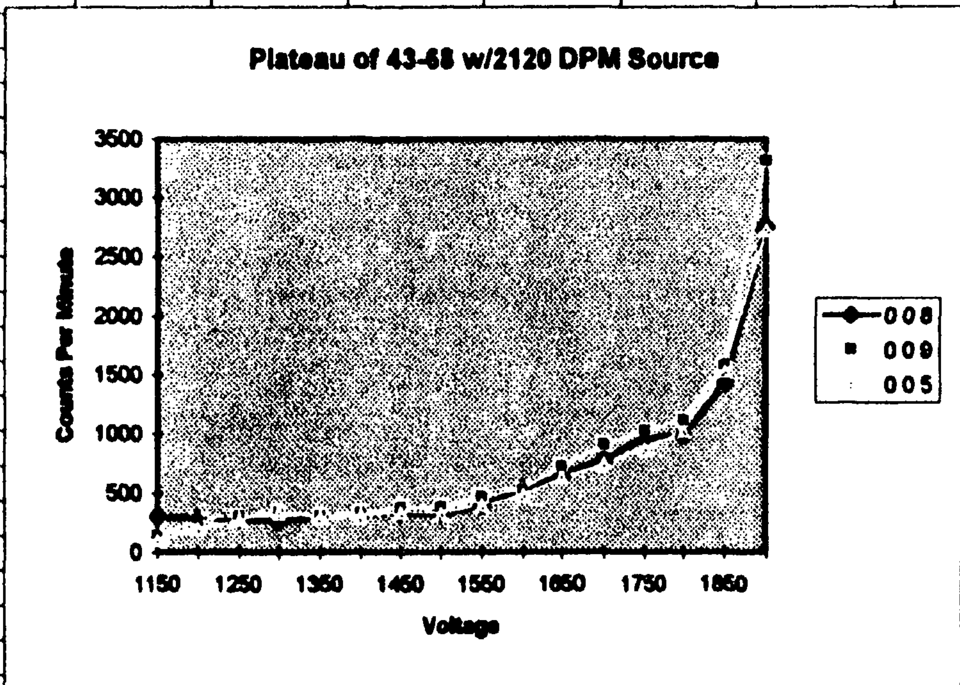
High Voltage (V) Plateau	Background Counts	Source S/N 9504700 Isotope NAT. U Activity 2120 dpm Gross Counts	Source S/N 9504700 Isotope NAT. U Activity 2120 dpm Gross Counts	Source S/N 9504700 Isotope NAT. U Activity 2120 dpm Gross Counts
1000	0	0	0	0
1050	0	0	0	0
1100	0	8	9	5
1150	0	110	144	101
1200	1	236	271	208
1250	3	273	310	284
1300	0	275	341	330
1350	0	302	315	295
1400	3	313	336	314
1450	2	340	383	344
1500	6	332	395	338
1550	16	413	486	420
1600	40	581	570	527
1650	84	724	812	721
1700	168	952	1076	918
1750	268	1234	1297	1145
1800	378	1368	1493	1398
1850	361	1793	1948	1888
1900	426	3177	3746	3151

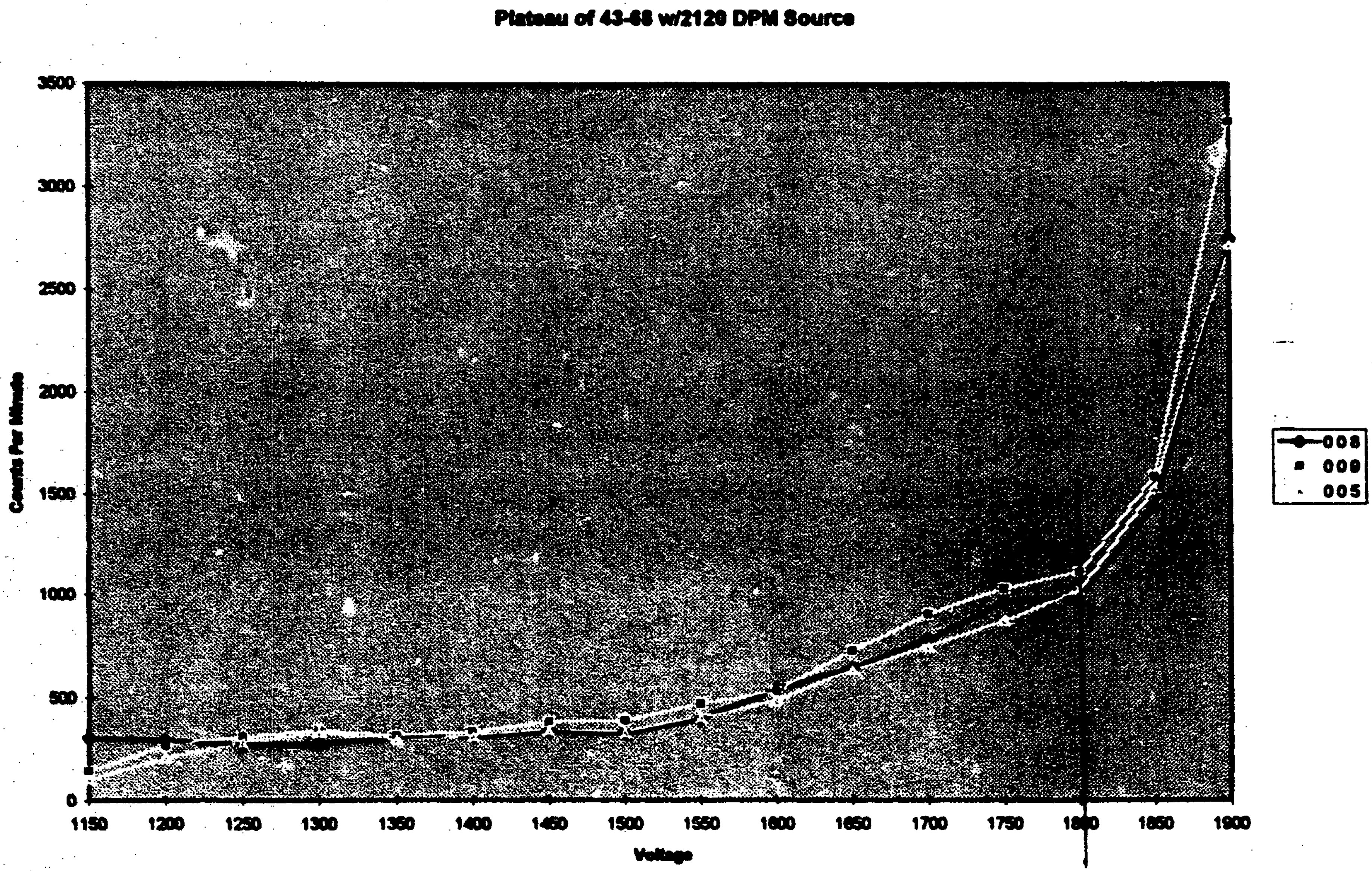
Detector Operating Voltage 1800 v **Detector Efficiency** 49.1 % **for** U NAT

Date 9 25 95 **Bench Test Performed by** Michael Lede **(Print)** **Signature** [signature]

Calibration Due 3/25/96 **Quality Control Review** [signature]

Plateu for Ludium 43-68 S/N: PR126794								
Source: U-Nat @ 2120 DPM S/N: 95U47003654								
Voltage	Bkg	Gross Counts			Voltage	Net Counts		
		left	middle	right		left	middle	right
1000	0	0	0	0	1000	0	0	0
1050	0	0	0	0	1050	0	0	0
1100	0	8	9	5	1100	8	9	5
1150	0	110	144	101	1150	305	144	101
1200	1	238	271	208	1200	291	270	207
1250	3	273	310	284	1250	270	307	281
1300	0	275	341	330	1300	275	341	330
1350	0	302	315	295	1350	302	315	295
1400	3	313	336	314	1400	310	333	311
1450	2	340	383	344	1450	338	381	342
1500	6	332	395	338	1500	326	389	332
1550	16	413	486	420	1550	397	470	404
1600	40	581	570	527	1600	541	530	487
1650	84	724	812	721	1650	640	728	637
1700	168	952	1076	918	1700	784	908	750
1750	268	1234	1297	1145	1750	966	1029	877
1800	378	1368	1493	1398	1800	990	1115	1020
1850	361	1793	1948	1888	1850	1432	1587	1527
1900	426	3177	3746	3151	1900	2751	3320	2725





118945

OFFICIAL RECORD COPY ML 10

STANDARD OPERATING PROCEDURE 10.0, REVISION 1
FUNCTION CHECK OF PORTABLE AND STATIONARY RADIATION DETECTION INSTRUMENTATION

TEXAS INSTRUMENTS ATTLEBORO FACILITY

1.0. PURPOSE

This procedure provides guidance on daily performance function checks of portable and stationary radiation detection instrumentation to be used in support of remediation and decontamination and decommissioning (D&D) activities at the Texas Instruments (TI) Attleboro Facility.

2.0. DISCUSSION

All equipment must be subject to a full reference calibration prior to field use and subsequent function checks.

To remain in service, radiation detection equipment must demonstrate a daily response within +/- 20 percent of a referenced calibration reading. The daily response is typically determined with a plated radionuclide source of known isotopic content and activity or a volumetric source of fixed geometry and known concentration of radioactive material. It is not necessary that the function check sources be certified by the National Institute of Standards and Technology (NIST).

The daily response is recorded on a time chart over the duration of the project. This chart is used to identify long-term trends in the detector response. The Roy F. Weston, Inc. (WESTON®), site health physicist (SHP) and site health and safety coordinator (SHSC) shall ensure adequate execution of this procedure. However, the response to a non-certified source must be documented and traceable back to the time of calibration.

2.1. Equipment Subject to This Procedure

Radiological equipment to be used at the TI Facility and subject to this procedure includes the following combinations:

- Ludlum Models 2221, 2300, 2000 ratemeter/scaler or equivalent with Ludlum Model 43-1 alpha scintillator.
- Ludlum Model 2000 scaler or equivalent with Ludlum Model 43-10 alpha tray counter.
- Ludlum Models 3 or 12 ratemeter with Ludlum Model 43-5 alpha scintillator.
- Ludlum Models 3 or 12 ratemeter with Ludlum Model 44-9 pancake Geiger-Mueller (G-M) detector or 44-40 shielded pancake G-M detector.
- Ludlum Model 2350 data logger or equivalent scaler/ratemeter and Ludlum Model 43-68 gas flow proportional detector.
- Ludlum Model 2350 data logger and Ludlum Model 43-37 gas flow floor monitor.
- Ludlum Model 19 uR meter.
- Ludlum Model 2221 ratemeter/scaler with Ludlum Model 44-1 beta scintillator
- Ludlum Model 2221 or equivalent ratemeter/scaler with Ludlum Model 44-10 sodium iodide (NaI) (2x2) detector (thalium [Tl])

Radiological check sources to be used at the TI Facility and subject to this procedure include the following combinations:

- Natural uranium — 47 millimeters (mm) diameter; 1,000 disintegrations per minute (dpm).
- Cesium-137 — 7.6 microcuries (μCi).
- Depleted uranium — 47 mm diameter; 452 dpm.
- Technetium — 99 47 mm diameter; approximately 21,000 dpm.

2.2. Related Standard Operating Procedures (SOPs), Requirements, and References

All surveying SOPs, specifically 3.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 13.0, 16.0, 17.0, 18.0, 19.0, 20.0, and 27.0.

2.3. Special Considerations Based on Uranium Enrichment

→ Beta detection systems calibrated to natural uranium sources will require an efficiency modification factor (EMF) based upon the average uranium enrichment encountered in the field. As the enrichment increases, the associated beta emission intensity decreases, resulting in a lower overall system efficiency. The EMF will be applied to termination surveys performed with gas-flow detection systems operating in the beta plateau region (defined in SOP 16.0). Average uranium enrichments exceeding 5 percent weight (uranium-235) will reduce beta intensity so that total alpha contamination surveys will require implementation.

3.0. PROCEDURE

3.1. Preparation

A. Ensure that all equipment to be used at the TI Attleboro Facility has been subject to full reference calibration. Copies should be maintained in the WESTON field trailer files.

B. Remove appropriate radiological check source from locked cabinet.

C. Obtain new or existing Equipment Function Check Records (Appendix 10.A) and Function Check Graph Logs (Appendix 10.B). Existing forms and logs will be maintained on a clipboard in the equipment storage area. Use only one form for each equipment configuration.

D. Consult with the SHP to determine the applicability of the EMF based on the detection system subject to function check.

3.2. Gas Flow Detector Preparation

CAUTION: *Connecting the P-10 gas supply to the detector without a quick release connector for an outlet (either vented to air or attached to a flowmeter) will damage the Mylar window and possibly the detector when the gas supply is turned on.*

A. Ludlum 43-68 (100 square centimeters [cm^2]) gas proportional detector linearity check and efficiency determination.

1. Ensure that the gas supply is turned off (fully clockwise) and attach the supply hose to the (in) flowmeter connector.

2. Attach a quick release connector to the outlet (out) flowmeter connector to allow gas to exhaust.

3. First connect the outlet flowmeter to a detector gas connector, then connect the inlet flowmeter to the other gas connector.

4. Position the detector vertically with the gas inlet at the bottom to ensure that the detector purges completely.

5. Turn the P-10 gas regulator control to the full counter-clockwise position and the flow control valve on the inlet to the closed position (full clockwise).

6. Open the P-10 gas valve, set the regulator for 5 pounds per square inch (psi), slowly increase the flow to 100 cubic centimeters per minute (cm^3/min) , and purge the 43-68 detector for 30 minutes.

7. During the purge period, compare the inlet and outlet flow rates to isolate detectors with possible holes in the Mylar window and gas leaks.

8. After 30 minutes, decrease the gas flow to 40 cm^3/min (manufacturer-allowed variance during operation is 30 to 50 cm^3/min).

B. Ludlum Model 43-37 (429 cm^2) large-area gas proportional detector linearity check and efficiency determination.

1. Attach regulator to the P-10 bottle with all valves closed.

2. Attach a quick release connector to the outlet (out) flowmeter connector to allow gas to exhaust.

3. Ensure that the gas supply is turned off (full clockwise) and attach the supply hose to the (in) flowmeter connector.

4. Turn the P-10 gas regulator control to the open position and the flow control valve on the inlet to the closed position (full clockwise).

5. Slowly adjust valves to set the regulator for 0.5 to 1 psi. Slowly increase the flow to 100 cm^3/min and flush the 43-37F detector for 5 minutes.

6. During the flush period, compare the inlet and outlet flow rates to isolate detectors with possible holes in the Mylar window and gas leaks.

7. After 5 minutes, decrease the gas flow to 25 cm^3/min (manufacturer-allowed variance during operation is 20 to 30 cm^3/min) and purge for 1 hour.

B. Enter the following on Appendix 10.B (Function Check Graph Log) or in the site field log book:

   a. Instrument model and identification number.

   b. Detector model and identification number.

   c. Source isotope and serial number.

   d. Source original activity and certification date.

3.3. Function Check

A. Complete all introductory information on the Equipment Function Check Record (Appendix 10.A).

B. For portable radiation detection instrumentation, perform a background measurement at designated location. For stationary closed counting systems, ensure that chambers are free of contamination and debris and perform a count. The count time for scaled counters should be determined by the SHP and should be based on the type of measurement and desired minimum detectable activity. Record the information on the Equipment Function Check Record (Appendix 10.A).

C. If designated by the SHP, record the EMF based on the average uranium enrichment onsite (typical for gas-flow detectors).

D. Place the radiological check source on designated jig or guide location, counting tray, or other configuration as designated by the SHP.

E. Place the probe over the source (all function checks will be performed at contact) or into the detector tray or housing.

F. For scaled alpha counters, perform the count over time as designated by the SHP. For ratemeter systems, leave the detector over the source until the response stabilizes.

G. Record the count rate or scaled counts on the Equipment Function Check Record (Appendix 10.A).

H. Calculate the detector efficiency, as shown on the form, and record. If necessary, modify by the EMF.

I. Record the efficiency on the Function Check Graph Log (Appendix 10.B) with the corresponding date.

J. Ensure that measured efficiency is within +/- 20 percent of the reference calibration efficiency.

K. If the measurement exceeds +/- 20 percent tolerance, repeat procedure. If a second failure is noted, tag instrument, "OUT OF SERVICE DO NOT USE," and contact the SHP or SHSC.

3.4. Calculation of Minimum Detectable Activity

A. Use applicable formula from Appendix 10.C (MDA Calculation Worksheet) to calculate the system minimum detectable activity (MDA).

B. Record MDA on Equipment Function Check Record (Appendix 10.A).

3.5. Documentation

A. The technician performing the function check must initial the proper column of the form.

B. Copy the completed form and place it in the WESTON field office files. Place the original with the other originals requiring SHP review and placement into permanent project files.

APPENDIX 4.1
EQUIPMENT FUNCTION CHECK RECORD

Note: Use only one form per equipment system.
Note: Ensure that all equipment has been calibrated within last year.
Note: MDAs may be calculated with formulas on attached sheets.
Note: Efficiency Modification Factor to be used with Gas Flow Detectors

Ratemeter/Scaler Model:	Detector Model:
Serial Number:	Serial Number:

Check Source: Geometry Description:	Activity: Efficiency Modification Factor:

Date	Count Time (R for rate)	Back. C.R (cpm)	Source Response (cpm)	E (cpm/dpm)	Modified E (cpm/dpm)	MDA (units)	Initials

Form Reviewed By:	Date:	

FUNCTION CHECK GRAPH LOG

Ratemeter/Scaler Model #:	Detector Model #:
Ratemeter/Scaler SN#:	Detector SN#:
Function Log Start Date:	

EFFICIENCY (CPM/DPM)

0.4

0.3

0.2

0.1

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Month Start:

Day Start:

›viewed By:
Date:

MDA CALCULATION WORKSHEET

Ludlum Model 3 or 12 with Model 43-5 Alpha Scintillator

Application:	Surface contamination surveys; frisking
Limitation No. 1:	Frisking speed not to exceed 2 cm/s
Limitation No. 2:	Audible increase in count rate is 3 x background

$$MDA = \frac{3xR_B}{Ex\frac{A_p}{100}}$$

where:

MDA	=	minimum detectable activity in dpm/100 cm^2
R_B	=	background count rate in cpm
E	=	counting efficiency in cpm/dpm
A_p	=	probe active area 79 cm^2

Ludlum Model 3 or 12 with Model 44-9 GM Detector

Application:	Surface contamination surveys; frisking
Limitation No. 1:	Frisking speed not to exceed 2 cm/s
Limitation No. 2:	Audible increase in count rate is 3 x background

$$MDA = \frac{3xR_B}{Ex\frac{A_p}{100}}$$

where:

MDA	=	minimum detectable activity in dpm/100 cm^2
R_B	=	background count rate in cpm
E	=	counting efficiency in cpm/dpm
A_p	=	probe active area 15 cm^2

Ludlum Model 2000 with Model 43-10 Alpha Tray Counter

Application:	Counting smears for removable contamination; air samples
Limitation No. 1:	Smears collected over 100 cm^2 area
Limitation No. 2:	Smear MDA must be < 1000 dpm/100 cm^2

$$SmearMDA = \frac{2.71+4.65\sqrt{R_B xt}}{txE}$$

where:

MDA	=	minimum detectable activity in dpm/100 cm^2
R_B	=	background count rate in cpm
t	=	count time in minutes
E	=	counting efficiency in cpm/dpm

$$AirSampleMDA = \frac{2.71 + 4.65\sqrt{R_B x t}}{t x E x V x 2.22E6}$$

where: MDA = minimum detectable activity in uCi/ml
R_B = background count rate in cpm
t = count time in minutes
E = counting efficiency in cpm/dpm
V = air sample volume in ml
2.22E6 = total dpm/uCi

Ludlum Model 2350 with Model 43-68 Gas Flow Proportional Counter

Application No. 1: Termination surveys over $1m^2$ using integrated count

Limitation No. 1: MDA of integrated measurement must be < 5000 dpm/100 cm^2, optimally 1000 dpm/100 cm^2

Limitation No. 2: Survey area factor is calculated as total area of survey divided by probe area.

$$MDA = \frac{4.65\sqrt{R_B x t}}{t x E x EMF x \frac{A}{100}}$$

where: MDA = minimum detectable activity in dpm/100 cm_2
R_B = background count rate in cpm
t = count time in minutes
E = counting efficiency in cpm/dpm
EMF = efficiency modification factor based on average uranium enrichment (0.566 at 2w%)

The user should apply the aforementioned equation to solve for t given a target MDA. This time t is the minimum count time required to achieve the MDA given the detector is held in a static position (100 cm^2). Since there are 100 elements of 100 cm^2 in a 1-meter-square grid block, it follows that the minimum count time for an integrated measurement over the entire block is the product of t and 100. This relationship is expressed as:

$$t_{min} = t \times f_A$$

where: t_{min} = minimum count time in minutes to achieve target MDA
t = minimum count time of static measurement in minutes (solved form previous equation)
F_A = survey area factor is given as 10,000 cm^2 (1 m^2)/probe area of 100 cm^2

Application No. 2: Termination surveys in ratemeter mode
Limitation No. 1: Must be used in audible mode.

$$MDA = \frac{2xR_B}{ExEMFx\frac{A}{100}}$$

where: MDA = minimum detectable activity in dpm/100 cm_2
R_B = background count rate in cpm
E = counting efficiency in cpm/dpm
EMF = efficiency modification factor based on average uranium enrichment (0.566 at 2w%)
A = probe surface area = 100 cm^2

Ludlum Model 2350 with Model 239-1F Floor Monitor/43-37 Gas Flow Proportional

Application No. 1: Termination surveys over $1 m^2$ areas using integrated count.

Limitation No. 1: MDA of integrated measurement must be < 5000 dpm/100 cm^2, optimally 1000 dpm/100 cm^2

Limitation No. 2: Survey area factor is calculated as total area of survey divided by probe area.

$$MDA = \frac{4.65\sqrt{R_B xt}}{txExEMFx\frac{A}{100}}$$

where: MDA = minimum detectable activity in dpm/100 cm_2
R_B = background count rate in cpm
t = count time in minutes
E = counting efficiency in cpm/dpm
EMF = efficiency modification factor based on average uranium enrichment (0.566 at 2w%)

The user should apply the aforementioned equation to solve for t given a target MDA. This time t is the minimum count time required to achieve the MDA given the floor monitor is maintained in a static position (425 cm^2). Since there are approximately 24 elements of 425 cm^2 in a 1-meter-square grid block, it follows that the minimum count time for an integrated measurement over the entire block is the product of t and 100. This relationship is expressed as:

$$t_{min} = t \times F_A$$

where: t_{min} = minimum count time in minutes to achieve target MDA,
t = minimum count time of static measurement in minutes (solved from previous equation)
F_A = survey area factor is given as 10,000 cm^2 (1 m^2)/probe area of 100 cm^2

Application No. 2: Termination surveys in ratemeter model identification of hot spots.

Limitation No. 1: Target maximum count rate must be audibly and/or statistically discernible from system background.

A primary concern is that a point source will suffer an amount of count rate "dilution" when divided surface area of the probe (if it greater than 100 cm^2). This leads to the qöestion of what is the minimum point source activity that can be discerned on the ratemeter element of the detection system, and is it less than the maximum surface contamination criteria of 15,000 dpm/100 cm^2?

This problem is addressed through scaling the target surface contamination criteria (15,000 dpm/100 cm^2) from the large-area detector active surface area to a 100 cm^2 basis. Scaling results in a gross count rate value that, upon application of efficiency and background factors, must be statistically and audibly discernible when compared to the background count rate over the entire detector. This relationship is demonstrated as:

$$\frac{X+B_R}{ExEMFx\frac{100}{A}} < 15{,}000 \text{ dpm/100 cm}^2$$

where: X = the minimum count rate in cpm that must be observed on the ratemeter to ensure compliance with the maximum surface contamination criteria of 15,000 dpm/100 cm^2

BR = the background count rate over the entire detector volume - 250 cpm

E = detector efficiency in cpm/dpm = 0.2 cpm/dpm as modified for 2% enrichment (see response to comment 2.3.3)

A = active probe area in cm^2 = 425 cm^2

Input of the aforementioned parameters yields a minimum count rate (X) of 706 cpm. It is obvious from the aforementioned inequality that as, the surface area of a detector increases, the dilution is increased. At such point where the minimum count rate is indistinguishable from detector background (over the entire volume), the detection system is inadequate to demonstrate compliance with the maximum surface contamination release criteria. Typical detector backgrounds for the entire volume ranges from 250-300 cpm and, subsequently, the target readout with the 43-37 system is audibly discernible.

Ludlum Model 2221, 2300, 2000, or Equivalent with Model 43-1 Alpha Scintillator

Application: Gross alpha counting of soil and concrete samples.

Limitation No. 1: A minimum detectable count rate should be calculated for each system used. The count rate is then correlated to an associated sample concentration. Correlations should be derived for each counting system.

$$MDC = \frac{4.65\sqrt{R_B x t}}{t}$$

where: MDC = minimum detectable count rate in cpm

R_B = background count rate in cpm

t = count time in minutes

Note: The MDC should be correlated to a total uranium sample concentration, limited to less than 30 pCi/g.

OFFICIAL RECORD COPY ML 10 FEB - 2 ... 118945

Texas Instruments Incorporated
Materials and Controls Group

070-00033
L8

TEXAS INSTRUMENTS

34 Forest Street
P.O. Box 2964
Attleboro, MA 02703-0964
(508) 236-3800

October 29, 1996

SNM No. 23
Docket No. 70-33
Control No. 118945
10 CFR 70.38 (j)

Mr. Mark Roberts
US Nuclear Regulatory Commission
Region I, Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406-1415

RE: Request for Termination of License

Dear Mr. Roberts,

Texas Instruments Incorporated, Materials & Controls Group (hereafter referred to as TI) has completed decontamination and decommissioning of its facility in Attleboro, Massachusetts and requests termination of its license number SNM-23. Decontamination was completed in October 1996 in accordance with the "Supplement to the 1992 Remediation Plan (December 1994)" that was approved by the US Nuclear Regulatory Commission, Region I - NMSS (hereafter referred to as NRC) on July 12, 1996. NRC licensed material from the Attleboro facility was dispositioned by transfer to other licensed facilities. A completed NRC Form 314 will be forwarded under separate cover.

A radiation survey was conducted of each part of the facility where NRC licensed activities were carried out, and the survey results have been documented in a series of reports. All but two of these reports have been previously submitted to the NRC. Enclosed is one of the two remaining reports, the final report for the Building Interior Decommissioning Project entitled "Remediation of Building Interiors - Buildings 4, 5 and 10." We are submitting under a separate cover the other remaining report, the final report for the Metals Recovery Area Decommissioning Project entitled "Remediation of the Metals Recovery Area."

118945
OCT 31 1996

OFFICIAL RECORD COPY ML 10

The survey reports provide the levels of residual gamma radiation and radioactivity, and specify the survey instruments used. Each survey instrument relied upon in the final survey was properly calibrated and tested. Taken together, the survey reports demonstrate that TI has completed all decommissioning activities identified in its approved decommissioning plan and that the site has achieved the NRC guideline criteria for unrestricted release. Therefore, TI is respectfully requesting that the NRC terminate TI's special nuclear materials license number SNM-23 thus releasing the entire facility and site for unrestricted use, and that the NRC remove TI from the Site Decommissioning Management plan.

TI looks forward to timely execution of its license termination. If there is anything further TI can do to expedite such an outcome, please do not hesitate to contact me. I can be reached at (508) 236-1809.

Sincerely yours,

Materials & Controls Group

Michael J. Elliott
Environmental Manager

cc: Mr. Richard L. Joosten, Esq. - TI Corporate Legal
Mr. Francis J. Veale Jr., Esq. - TI Attleboro

Attachments

(FOR LFMS USE)
INFORMATION FROM LTS

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

PROGRAM CODE: 22200
STATUS CODE: 0
FEE CATEGORY: 14
EXP. DATE: 20111111
FEE COMMENTS: V
DECOM FIN ASSUR REQD: Y

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
   APPLICANT/LICENSEE: TEXAS INSTRUMENTS, INC.
   RECEIVED DATE: 931105
   DOCKET NO: 7000157
   CONTROL NO.: 116945
   LICENSE NO.: SNM-23
   ACTION TYPE: TERMINATION

2. FEE ATTACHED
   AMOUNT: ---------
   CHECK NO.: ---------

3. COMMENTS

SIGNED Rebecca J. Brown
DATE 03/21/97

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED /__✓)

1. FEE CATEGORY AND AMOUNT: 14 — Term

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:
   AMENDMENT ------------
   RENEWAL ------------
   LICENSE ------------

3. OTHER ------------------------------

SIGNED ------------------------------
DATE ------------------------------

11/19/97
Nov 12
KK
11/19/97
63117 for 11/18/97

October 30, 1996

SNM No. 23
Docket No. 70-33
Control No. 118945
10 CFR 70.38 (j)

Mr. Mark Roberts
US Nuclear Regulatory Commission
Region I, Nuclear Material Section B
475 Allendale Road
King of Prussia, PA 19406-1415

RE: Transmittal of Metals Recovery Area Final Report

Dear Mr. Roberts,

In a cover letter from Texas Instruments Incorporated, Materials & Controls Group (TI) to the U S. Nuclear Regulatory Commission (NRC) dated October 29, 1996 that requested termination of its special nuclear materials license number SNM-23, TI indicated that all but two of a series of final survey reports had been previously submitted to the NRC. One of the remaining reports, the Building Interiors Final Report, accompanied the license termination request letter of October 29. This transmittal provides the one other remaining report pertaining to the Metals Recovery Area Remediation that was conducted in 1994.

Please recall that the Metals Recovery Final report is not limited strictly to final survey data. It also includes a fair amount of "Supplemental Radiological Survey Data" that was used to characterize the bounds of the excavation. The inclusion of such additional data accounts for the voluminous nature of the report as compared to the final reports for work conducted in 1995 and 1996.

Having thus submitted this Metals Recovery Area final report, TI has fulfilled all its obligations as defined in the "Supplement to the 1992 Remediation Plan (December 1994)" that was approved by NRC on July 12, 1996. Accordingly, NRC should be able to proceed with license termination activities as TI requested in its letter of October 29.

OFFICIAL RECORD COPY ML 10

118945

If there would be any benefit gained from a formal presentation to NRC Region I staff describing the survey results of the two most recently submitted reports or their predecessors, I would be more than willing to make a visit to your offices. Please do not hesitate to contact me if I can be of further assistance on this matter. I can be reached at (508) 236-1809.

Sincerely yours,

Materials & Controls Group

M. J. Elliott

Michael J. Elliott
Environmental Manager

cc: Mr. Richard L. Joosten, Esq. - TI Corporate Legal
Mr. Francis J. Veale Jr., Esq. - TI Attleboro

Attachments:

SNM-23
L8

Appendix F

BoreHole Logs

1 1 8 9 4 5

OFFICIAL RECORD COPY ML 10

OCT 31 1996

Appendix F

BoreHole Logs

1 1 8 9 4 5

OCT 31 1995

OFFICIAL RECORD COPY. MIL 10

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Boring Data - Low Level Radiation Investigation - Bldg. #5

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-261 **Your Project or Contract No.**

Date: March 28, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 03703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
3	Boring Reports: 5 through 26.

SAMPLES: Taken at Site.

Remarks: Project complete.

By: ______________________

L. L. MORRIS

cc:

OCT 3 1 1996

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation Invest
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Bldg. #5
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-261

DATE	
HOLE NO.	5
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	2	5	27			Brown fine SAND, some silt,	1	24"	18"
						22			cobbles			
		2'-3'	D	17	28					2	12"	12"
		3'-4'	D	32	67					3	12"	6"
		4'-4'7"	D	45	100/1"			4'7"		4	7"	7"
									Refusal - Bottom of Boring 4'7"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff

SUMMARY
Earth Boring 4'7"
Rock Coring ______
Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. 6
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		S/S	
	Size I D		3"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/26/94	
COMPLETE	3/26/94	
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	2	6	22			Brown fine SAND, some silt,	1	24'	20'
						24			cobbles			
		2'-3'	D	23	47				" big cobbles	2	12'	12'
		3'-4'	D	42	36				Broken Boulders, some fine to medium sand, cobbles	3	12'	12'
	*	4'-5'	D	17	38				Broken Boulders, trace fine to medium sand	4	12'	8'
								5'				
									Bottom of Boring 5'			
									* denotes 1-3/8" Spoon			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 5'
Rock Coring
Samples 4

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 7
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	2	12	66			Brown fine SAND, Cobbles	1	24"	12"
						110			Small Boulder at 18" - Pushed			
								2'	to 2'			
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 2'
Rock Coring
Samples 1

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

DATE
HOLE NO. 8
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	6	12	37			Brown fine SAND, Cobbles,	1	24"	14"
						49			some silt			
		2'-3'	D	87	53				Broken Boulders, little	2	12"	10"
									fine to medium sand &			
		3'-4'	D	57	33			4'	gravel	3	12"	10"
									Bottom of Boring 4'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type	Proportions Used	140 lb Wt x 30" fall on 2" O.D. Sampler		SUMMARY
D Dry C Cored W Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 4'
UP Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP Test Pit A Auger V Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 3
		30-60 Dense	8-15 Stiff	

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 8A
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec.
		0'-2'	D	2	11	11			Brown fine SAND & Silt,	1	24"	18"
						22			Cobbles			
		2'-3'	D	32	37				Broken Cobbles & Boulders,	2	12"	8"
								3'	some fine sand			
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test
UT Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense
50 + Very Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff
15-30 V-Stiff

SUMMARY
Earth Boring 3'
Rock Coring ______
Samples 2

HOLE NO. 8A

100 WATER STREET EAST PROVIDENCE, R. I.

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation Invest	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Bldg. #5	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-261

DATE

HOLE NO. 9

LINE & STA.

OFFSET

SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I.D.		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.

TOTAL HRS.

BORING FOREMAN M. Fisher

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	3	5	9			Brown fine to medium SAND,	1	24'	24'
						7			some coarse gravel, cobbles			
		2'-3'	D	11	17				Brown fine SAND, Cobbles	2	12'	6'
								3'				
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 3'
Rock Coring
Samples 2

HOLE NO. 9

100 WATER STREET EAST PROVIDENCE, R. I.

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation Invest
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Bldg. #5
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-261
DATE	
HOLE NO.	10
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	
COMPLETE	3/26/94	
TOTAL HRS.		

BORING FOREMAN M. Fisher

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
		0'-2'	D	2	10	28			Brown fine to coarse SAND,	1	24"	1[illegible]
						30			small boulders, cobbles			
		2'-3'	D	61	77					2	12"	1
		3'-4'	D	38	72			4'		3	12"	8
									Bottom of Boring 4'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
		30 +	Hard

SUMMARY
Earth Boring 4'
Rock Coring ______
Samples 3

HOLE NO. 10

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 11
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	4	11	23			Brown fine to medium SAND,	1	24"	24"
						27			cobbles & small boulders			
		2'-3'	D	51	56				Cobbles, some fine to med.	2	12"	12"
								3'	sand, small boulders			
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test
UT = Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY
Earth Boring 3'
Rock Coring ______
Samples 2

HOLE NO 11

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

DATE
HOLE NO. 12
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I.D.		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	
COMPLETE	3/26/94	

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	4	7	47			Brown fine SAND & Silt,	1	24'	24'
						104			some coarse to fine gravel,			
		2'-3'	D	137	86			3'	cobbles	2	12'	8'
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation Invest
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Bldg. #5
PROJ. NO.:
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-261

DATE:
HOLE NO.: 13
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.

TOTAL HRS.:
BORING FOREMAN: M. Fisher
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	4	11	23			Brown fine to medium SAND,	1	24"	24"
						28			some silt, cobbles, roots			
		2'-3'	D	22	37			3'		2	12"	12"
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'
Rock Coring ______
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 14
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type		S/S	
	Size I.D.		3"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	6	16	29			Brown fine SAND & Silt,	1	24"	16
						100			Cobbles & Boulders			
		2'-3'	D	58	89			3'		2	12"	8"
									Bottom of Boring 3'			

Note: Refusal on 3" Spoon at 2'
1-3/8" spoon driven between boulders

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY
Earth Boring 3'
Rock Coring
Samples 2

HOLE NO. 14

100 WATER STREET EAST PROVIDENCE, R I

DATE
HOLE NO. 15
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	a.m. p.m.
COMPLETE	3/26/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	7	24	98			Brown fine SAND & Silt,	1	24"	24"
						76			Cobbles & Boulders			
		2'-2'6"	D	150				2'6"		2	6"	0"
									Refusal - Bottom of Boring 2'6"			
									Boulder or footing from Building			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	V-Stiff
		30 +	Hard

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO 15

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

DATE
HOLE NO. 15A
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/26/94	
COMPLETE	3/26/94	

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	9	12	23			Brown fine SAND & Silt,	1	24"	24"
						37			Cobbles & Boulders			
		2'-3'	D	57	59					2	12'	10'
		3'-3'6"	D	132				3'6"		3	6"	6'
									Refusal - Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

HOLE NO. 15A

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest.
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

DATE
HOLE NO. 16
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type		S/S	
	Size I D		3"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/27/94	a.m. p.m.
COMPLETE	3/27/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	9	22				Brown fine SAND, Cobbles & Boulders	1	12"	10
		1'-2'	D	15	14			2'	Boulders	2	12"	0"
									Bottom of Boring 2'			
									(Moved ahead 2' & did 16A)			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

HOLE NO. 16

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___
DATE ___
HOLE NO. 16A
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO Texas Instruments — ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest — LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 — PROJ. NO. ___
SAMPLES SENT TO Taken at Site — OUR JOB NO. 94-261

GROUND WATER OBSERVATIONS
At ___ after ___ Hours
At ___ after ___ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	a.m. p.m.
COMPLETE	3/27/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
	*	0'-2'	D	10	14	16			Brown fine SAND, Cobbles	1	24"	12"
						22		2'	Black Asphalt, Boulders			
									Bottom of Boring 2'			
									* denotes 1-3/8" Spoon			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type: D=Dry C=Cored W=Washed; UP=Undisturbed Piston; TP=Test Pit A=Auger V=Vane Test

Proportions Used: trace 0 to 10%; little 10 to 20%; some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY
Earth Boring 2'
Rock Coring ___
Samples 1

100 WATER STREET EAST PROVIDENCE, R. I.

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation Invest.
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Bldg. #5
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-261
DATE	
HOLE NO.	17
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	a.m. p.m.
COMPLETE	3/27/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	9	12				Brown fine SAND, Cobbles	1	12'	12'
		1'-2'	D	16	29				& Boulders	2	12'	12'
		2'-3'	D	50	120			3'		3	12'	6'
									Refusal - Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense
50+ Very Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
15-30 V-Stiff
30+ Hard

SUMMARY
Earth Boring 3'
Rock Coring
Samples 3

HOLE NO. 17

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

DATE
HOLE NO. 18
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	
COMPLETE	3/27/94	
TOTAL HRS.		

BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	11	16				Brown fine SAND & Silt,	1	12"	12
		1'-2'	D	32	34			2'	Cobbles & coarse Gravel	2	12"	1
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	V-Stiff
		30 +	Hard

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

HOLE NO 18

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 19
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ___ after ___ Hours	Type		S/S	
	Size I D		3"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/27/94	
COMPLETE	3/27/94	

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	10	53				Brown fine to medium SAND, Cobbles & Boulders	1	12"	12
		1'-2'	D	97	135					2	12"	8'
	*	2'-3'	D	47	76					3	12"	10
	*	3'-4'	D	84	112			4'		4	12"	4'
									Bottom of Boring 4'			
									* denotes 1-3/8" Spoon			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 4'
Rock Coring
Samples 4

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

DATE
HOLE NO. 20
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type		S/S	
	Size I D		3"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/27/94	a.m. p.m.
COMPLETE	3/27/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	6	12				Brown fine SAND, Cobbles & Boulders	1	12'	12'
		1'-2'	D	14	18					2	12'	12'
		2'-3'	D	24	28				Brown fine SAND, some silt, little coarse to fine gravel, cobbles	3	12'	12'
								3'				
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 3'
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.

REPORT SENT TO above / Bldg. #5 | PROJ. NO.

SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE

HOLE NO. 21

LINE & STA.

OFFSET

SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type		S/S	
	Size I D		3"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/27/94	a.m. p.m.
COMPLETE	3/27/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	12	18				Brown fine SAND, some silt,	1	12"	12"
	*	1'-2'	D	14	17			2'	cobbles & boulders	2	12"	12"
									Bottom of Boring 2'			
									* denotes 1-3/8" Spoon			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test
UT-Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2.

HOLE NO 21

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-261

DATE
HOLE NO. 22
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	a.m. p.m.
COMPLETE	3/27/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	5	32				Brown fine SAND & Silt,	1	12"	6"
	*	1'-2'	D	12	22				Cobbles	2	12"	12"
	*	2'-3'	D	44	98			3'2"	Boulders	3	12"	8"
	*	3'-3'2"	D	100/2"						4	2"	2"
									Refusal - Bottom of Boring 3'2"			
									* denotes 1-3/8" Spoon			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'2"
Rock Coring
Samples 4

HOLE NO. 22

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 23
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type		S/S	
	Size I D		3"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		30"	

	Date	Time
START	3/27/94	
COMPLETE	3/27/94	
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	10	16				Brown fine SAND & Silt Cobbles & Boulders	1	12"	1[illegible]
	*	1'-2'	D	12	17					2	12"	1[illegible]
		2'-3'	D	14	95			3'		3	12"	6'
									Bottom of Boring 3'			
									(Concrete PVC & Black Conduit - Hit a Utility)			
									* denotes 1-3/8" Spoon			

GROUND SURFACE TO ... USED ... CASING THEN ...

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense; 30-50 Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 8-15 Stiff; 30 + Hard

SUMMARY
Earth Boring 3'
Rock Coring
Samples 3

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-261

DATE
HOLE NO. 24
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ____ after ____ Hours
At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I.D.		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	
COMPLETE	3/27/94	

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	4	9				Brown fine SAND, some silt & coarse to fine gravel, cobbles & boulders	1	12"	12
		1'-2'	D	10	12					2	12"	12
		2'-3'	D	23	28					3	12"	8'
		3'-4'	D	30	22					4	12"	12
	*	4'-5'	D	14	22					5	12"	8'
		5'-6'	D	28	44			6'		6	12"	6'
									Bottom of Boring 6'			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense; 30-50 Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 8-15 Stiff; 30 + Hard

SUMMARY
Earth Boring 6'
Rock Coring
Samples 6

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-261

DATE
HOLE NO. 25
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	
COMPLETE	3/27/94	

TOTAL HRS.
BORING FOREMAN M. Fisher
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	6	14				Brown fine SAND, Cobbles	1	12"	10
		1'-2'	D	Blows not Recorded						2	12"	--
		2'-3'	D	"	"	"				3	12"	--
		3'-4'	D	"	"	"				4	12"	--
		4'-5'	D	"	"	"		5'		5	12"	--
									Bottom of Boring 5'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 5'
Rock Coring
Samples 5

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation Invest
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Bldg. #5
PROJ NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO	94-261
HOLE NO.	26
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		30"	

	Date	Time
START	3/27/94	
COMPLETE	3/27/94	
TOTAL HRS.		
BORING FOREMAN	M. Fisher	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-2'	D	6	10	38			Brown fine SAND & Silt,	1	24"	14
						52		2'	Cobbles & Boulders			
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D Dry C Cored W Washing
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test
UT Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density	
0-10	Loose
10-30	Med Dense
30-50	Dense
50 +	Very Dense

Cohesive Consistency		
0-4	Soft	30 + Hard
4-8	M/Stiff	
8-15	Stiff	
15-30	V-Stiff	

SUMMARY

Earth Boring	2'
Rock Coring	
Samples	1

HOLE NO 26

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-286

Your Project or Contract No.

Date: April 22, 1994

Via: fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
3	7 Boring Reports 2 Probe Sheets

SAMPLES: Taken at Site.

Remarks: Project complete.

By: ______________________
L. L. MORRIS

cc:

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ. NO	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-286
DATE	
HOLE NO.	00
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

No Water

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type	NW	S/S	
Size I.D.	3"	2"	
Hammer Wt	300#	300#	BIT
Hammer Fall	24"	24"	

	Date	Time
START	4/20/94	
COMPLETE	4/20/94	
TOTAL HRS.		

BORING FOREMAN J. Medeiros
INSPECTOR F. McWilliams
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								3"	Black Top			
		1.5'-2.5'	D	No Blows Required				2.5'	FILL	1	24"	13
									Hit Obstruction at 2.5'			

GROUND SURFACE TO 1.5' USED NW CASING THEN S/S to 2.5'

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

400# Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2.5'
Rock Coring
Samples 1

HOLE NO. 00

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-286

DATE
HOLE NO. 2 Meters
[struck out] West
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
No Water
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type	NW	S/S	
Size I D	3"	2"	
Hammer Wt	300#	300#	BIT
Hammer Fall	24"	24"	

	Date	Time
START	4/20/94	
COMPLETE	4/20/94	

TOTAL HRS.
BORING FOREMAN J. Medeiros
INSPECTOR F. McWilliams
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								3"	Black Top			
		1.5'-2.5'	D	No Blows Required					FILL	1	12"	6'
		2.5'-3.5'	D	"	"	"				2	12"	4'
								4'				
									Bottom of Boring 4'			

GROUND SURFACE TO 4' USED NW CASING THEN

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 4'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. 9 Meters
[illegible]. East
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attlebbro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-286

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ___ after ___ Hours	Type		S/S	
No Water	Size I D		3"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		24"	

	Date	Time
START	4/20/94	a.m. p.m.
COMPLETE	4/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN J. Medeiros
INSPECTOR F. McWilliams
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								3"	Black Top			
		0.5'-2.5'	D	No Blows Required					FILL	1	24"	15
		2.5'-4'	D	"	"	"		4'		2	18"	12
									Bottom of Boring 4'			

GROUND SURFACE TO 4' USED Spoon. [illegible] THEN

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 4'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-286

DATE
HOLE NO. 9 Meters
[redacted] North
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		S/S	
No Water	Size I D		3"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		24"	

	Date	Time
START	4/20/94	
COMPLETE	4/20/94	
TOTAL HRS.		

BORING FOREMAN J. Medeiros
INSPECTOR F. McWilliams
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								3"	Black Top			
		0.5'-2.5'	D	No Blows Required				2.5'	FILL	1	24"	11
									Obstruction at 2.5'			

GROUND SURFACE TO 2.5' USED Spoon ~~CASING~~ THEN

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30+ Hard
4-8 M/Stiff

SUMMARY
Earth Boring 2.5'
Rock Coring
Samples 1

100 WATER STREET EAST PROVIDENCE, R. I.

TO	Texas Instruments
PROJECT NAME	Low Level Radiation Investigation
REPORT SENT TO	above
SAMPLES SENT TO	Taken at Site
ADDRESS	Attlebbro, Mass.
LOCATION	Attleboro, Mass.
PROJ. NO.	
OUR JOB NO.	94-286
DATE	
HOLE NO.	9 Meters
[illegible]	South
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

No Water

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		24"	

	Date	Time
START	4/20/94	a.m. / p.m.
COMPLETE	4/20/94	a.m. / p.m.
TOTAL HRS.		

BORING FOREMAN J. Medeiros

INSPECTOR F. McWilliams

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								3"	Black Top			
		0.5'-2.5'	D	No Blows Required					FILL	1	24"	16
		2.5'-4'	D	"	"	"		4'		2	18"	14
									Bottom of Boring 4'			

GROUND SURFACE TO 4' USED Spoon [illegible] THEN

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY

Earth Boring 4'

Rock Coring

Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attlebbro, Mass.

PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation | PROJ. NO.

SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-286

DATE

HOLE NO. 12 Meters

XXXXXXX West

OFFSET

SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type		S/S	
No Water	Size I D		3"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		24"	

	Date	Time
START	4/20/94	a.m. p.m.
COMPLETE	4/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN J. Medeiros

INSPECTOR F. McWilliams

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								3"	Black Top			
		0.5'-2.5'	D	No Blows Required				2.5'	FILL	1	24"	18
									Refusal at 2.5'			

GROUND SURFACE TO 2.5' USED Spoon XXXXX THEN

Sample Type	Proportions Used	140 lb Wt x 30" fall on 2" O.D. Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2.5'
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 1

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-286

DATE
HOLE NO. 14 Meters
[illegible]. East
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

No Water

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3"	
Hammer Wt		300#	BIT
Hammer Fall		24"	

	Date	Time
START	4/20/94	a.m. p.m.
COMPLETE	4/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN J. Medeiros
INSPECTOR F. McWilliams
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								3"	Black Top			
		0.5'-2.5'	D	No Blows Required					FILL	1	24"	16
		2.5'-4'	D	"	"	"		4'		2	18"	14
									Bottom of Boring 4'			

GROUND SURFACE TO 4' USED Spoon [illegible] THEN

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY
D=Dry C=Cored A=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 4'
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2
		30-50 Dense	8-15 Stiff	HOLE NO. 14

OLE NO.		1	2	3	4	5	6	7	8	9	10	Total Footage
P-1		---	-----									2'
P-2		---	-----									2'
P-3		---	-----									2'
P-4		---	-----									2'
P-5		---	-----									2'
P-6		---	-----									2'
P-7		---	-----									2'
P-8		---	-----									2'
P-9		---	---									1'6"
[illegible]		---	---									1'6"
P-11		---	---									1'6"
P-12		---	---									1'6"
-13		---	---									1'6"
-14		---	-----	--								2'6"
-15		---	---									1'6"
-16		---	---									1'6"
-17		---	---									1'6"
-18		---	---									1'6"
-19		---	---									1'6"
-20		---	---									1'6"
-21		---	---									1'6"
-22		---	---									1'6"

GUILD DRILLING CO., INC. — 100 WATER STREET - EAST PROVIDENCE, R.I.

Size OD: Auger 3¼" HAMMER WEIGHT ______ HAMMER FALL ______ DATE 4/20-21/94 JOB NO. 94-286

CLIENT: Texas Instruments LOCATION Attleboro, Mass. DRILLER J. Medeiros

PROJECT: Low Level Radiation Investigation
Note: All Probes have 3" of Black Top

HOLE NO.		1	2	3	4	5	6	7	8	9	10	Total Footage
6 Meters West		----	---									1'6"
8 Meters West		----	---									1'6"
1 Meters North		----	---									1'6"
4 Meters North		----	---									1'6"
1 Meters North by 9 Meters West		----	---									1'6"
6 Meters North		----	---									1'6"
6 Meters East		----	---									1'6"
4 Meters South by 4 Meters East		----	---									1'6"
9 Meters South by 9 Meters East		----	---									1'6"
9 Meters South by [illegible] Meters East		----	---									1'6"
1 Meters South by 4 Meters East		----	---									1'6"
1 Meters South by 9 Meters East		----	---									1'6"
4 Meters South by 6 Meters West		----	---									1'6"
7 Meters North by 4 Meters West		----	---									1'6"
8 Meters South by 2 Meters West		----	---									1'6"
6 Meters North by 4 Meters West		----	---									1'6"
8 Meters North by 2 Meters East		----	---									1'6"
1 Meters North by 4 Meters East		----	---									1'6"
1 Meters South by 6 Meters East		----	---									1'6"

GUILD DRILLING CO., INC. — 100 WATER STREET - EAST PROVIDENCE, R.I.

Size OD: Auger 3¼" HAMMER WEIGHT ________ HAMMER FALL ________ DATE 4/20-21/94 JOB NO. 94-286

CLIENT: Texas Instruments LOCATION Attleboro, Mass. DRILLER J. Medeiros

PROJECT: Low Level Radiation Investigation

Note: All Probes have 3" of Black Top

HOLE NO.		1	2	3	4	5	6	7	8	9	10	Total Footage
P-1		----	------									2'
P-2		----	------									2'
P-3		----	------									2'
P-4		----	------									2'
P-5		----	------									2'
P-6		----	------									2'
P-7		----	------									2'
P-8		----	------									2'
P-9		----	---									1'6"
[illegible]0		----	---									1'6"
P-11		----	---									1'6"
P-12		----	---									1'6"
P-13		----	---									1'6"
P-14		----	------	---								2'6"
P-15		----	---									1'6"
P-16		----	---									1'6"
P-17		----	---									1'6"
P-18		----	---									1'6"
P-19		----	---									1'6"
P-20		----	---									1'6"
P-21		----	---									1'6"
P-22		----	---									1'6"

GUILD DRILLING CO., INC. 100 WATER STREET - EAST PROVIDENCE, R.I.

Size OD: Auger 3¼" HAMMER WEIGHT ______ HAMMER FALL ______ DATE 4/20-21/94 JOB NO. 94-286

CLIENT: Texas Instruments LOCATION Attleboro, Mass. DRILLER J. Medeiros

PROJECT: Low Level Radiation Investigation
Note: All Probes have 3" of Black Top

HOLE NO.	1	2	3	4	5	6	7	8	9	10	Total Footage
5 Meters West	----	---									1'6"
3 Meters West	----	---									1'6"
1 Meters North	----	---									1'6"
4 Meters North	----	---									1'6"
1 Meters North by 9 Meters West	----	---									1'6"
5 Meters North	----	---									1'6"
5 Meters East	----	---									1'6"
Meters South by Meters East	----	---									1'6"
Meters South by Meters East	----	---									1'6"
Meters South by Meters East	----	---									1'6"
Meters South by Meters East	----	---									1'6"
Meters South by Meters East	----	---									1'6"
Meters South by Meters West	----	---									1'6"
Meters North by Meters West	----	---									1'6"
Meters South by Meters West	----	---									1'6"
Meters North by Meters West	----	---									1'6"
Meters North by Meters East	----	---									1'6"
Meters North by Meters East	----	---									1'6"
Meters South by Meters East	----	---									1'6"

GUILD DRILLING CO., INC. 100 WATER STREET - EAST PROVIDENCE, R.I.

Size OD: Auger 3½" HAMMER WEIGHT ______ HAMMER FALL ______ DATE 4/20-21/94 JOB NO. 94-286

CLIENT: Texas Instruments LOCATION Attleboro, Mass. DRILLER J. Medeiros

PROJECT: Low Level Radiation Investigation

Note: All Probes have 3" of Black Top

HOLE NO.		1	2	3	4	5	6	7	8	9	10	Total Footage
P-1		---	-----									2'
P-2		---	-----									2'
P-3		---	-----									2'
P-4		---	-----									2'
P-5		---	-----									2'
P-6		---	-----									2'
P-7		---	-----									2'
P-8		---	-----									2'
P-9		---	---									1'6"
[illegible]		---	---									1'6"
P-11		---	---									1'6"
P-12		---	---									1'6"
-13		---	---									1'6"
-14		---	-----	--								2'6"
-15		---	---									1'6"
-16		---	---									1'6"
-17		---	---									1'6"
-18		---	---									1'6"
-19		---	---									1'6"
-20		---	---									1'6"
-21		---	---									1'6"
-22		---	---									1'6"

[illegible] | 100 WATER STREET - EAST PROVIDENCE, R.I.

Auger
Size OD: 3½" HAMMER WEIGHT ________ HAMMER FALL ________ DATE 4/20-21/94 JOB NO. 94-286

CLIENT: Texas Instruments LOCATION Attleboro, Mass. DRILLER J. Medeiros

PROJECT: Low Level Radiation Investigation
Note: All Probes have 3" of Black Top

HOLE NO.	1	2	3	4	5	6	7	8	9	10	Total Footage
16 Meters West	----	---									1'6"
18 Meters West	----	---									1'6"
11 Meters North	----	---									1'6"
14 Meters North	----	---									1'6"
11 Meters North by 9 Meters West	----	---									1'6"
16 Meters North	----	---									1'6"
16 Meters East	----	---									1'6"
4 Meters South by 14 Meters East	----	---									1'6"
9 Meters South by 9 Meters East	----	---									1'6"
9 Meters South by [illegible] Meters East	----	---									1'6"
[illegible] Meters South by 4 Meters East	----	---									1'6"
11 Meters South by 9 Meters East	----	---									1'6"
4 Meters South by 16 Meters West	----	---									1'6"
7 Meters North by 14 Meters West	----	---									1'6"
8 Meters South by 12 Meters West	----	---									1'6"
8 Meters North by 4 Meters West	----	---									1'6"
8 Meters North by 12 Meters East	----	---									1'6"
11 Meters North by 4 Meters East	----	---									1'6"
11 Meters South by 16 Meters East	----	---									1'6"

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312 | **Your Project or Contract No.**

Date: May 13, 1994 | **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
	Boring Reports: B-1 through B-9. NE of RR Spur

SAMPLES: Taken at Site.

Remarks: Project complete.

By: ______________________

L. L. MORRIS

cc:

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	Above / Investigation	PROJ NO	
SAMPLES SENT TO	Taken at Site	OUR JOB NO	94-312

DATE
HOLE NO. B-1
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ____ Hours

At ______ after ____ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

HOLE NO. B-1

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

DATE
HOLE NO. B-2
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12'	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
		30 +	Hard

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET ___ OF ___
DATE ___
HOLE NO. B-3
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ NO: ___
SAMPLES SENT TO: Taken at Site
OUR JOB NO: 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. / p.m.
COMPLETE	5/12/94	a.m. / p.m.
TOTAL HRS.		

BORING FOREMAN: P. Vieira
INSPECTOR: ___
SOILS ENGR. ___

LOCATION OF BORING ___

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
... 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring ___
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation | PROJ. NO.

SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-4
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
U=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass. | DATE | HOLE NO. B-5
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass. | LINE & STA.
REPORT SENT TO above / Investigation | PROJ. NO. | OFFSET
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312 | SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12'	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med. Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		
50 +	Very Dense	15-30	V-Stiff		

SUMMARY
Earth Boring 3'6"
Rock Coring ______
Samples 3

HOLE NO. B-5

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-312
DATE	
HOLE NO.	B-6
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 3'6"
Rock Coring ______
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-312
DATE	
HOLE NO.	B-7
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	0"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density	
0-10	Loose
10-30	Med Dense
30-50	Dense

Cohesive Consistency		
0-4	Soft	30 + Hard
4-8	M/Stiff	
8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring ______
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments	ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation	LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation	PROJ. NO.
SAMPLES SENT TO:	OUR JOB NO. 94-312

DATE
HOLE NO. B-8
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		S/S	
	Size I D		3½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/12/94	a.m. p.m.
COMPLETE	5/12/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'	D	Blows not Taken (3½")					Hit Refusal @ 6" - Moved 2' back	1	6"	0"
									Bottom of Boring 1'			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 1'
Rock Coring
Samples

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ. NO.	
SAMPLES SENT TO	
OUR JOB NO.	94-312

DATE	
HOLE NO.	B-8A
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type		S/S	
Size I D		3½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	
COMPLETE	5/12/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'	D	Blows not Taken					Refusal at 1'	1	6"	0

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type

D: Dry C: Cored W: Washed

UP: Undisturbed Piston

TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY

Earth Boring 1'

Rock Coring

Samples

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO B-9
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/12/94	
COMPLETE	5/12/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	12'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	0'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

TRANSMITTAL SHEET

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Additional Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312 **Your Project or Contract No.**

Date: May 19, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
	Boring Reports: B-1 through B-20.

SAMPLES:

Remarks: More reports to follow.

By: ______________________
L. L. MORRIS

cc:

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___
DATE ___
HOLE NO. B-1
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO. ___
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS
At ___ after ___ Hours
At ___ after ___ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	a.m. p.m.
COMPLETE	5/16/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR ___
SOILS ENGR. ___

LOCATION OF BORING ___

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown Yellow medium SAND & Gravel	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	8'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	5'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb. wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring ___
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-2
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	a.m. p.m.
COMPLETE	5/16/94	a.m. p.m.

TOTAL HRS
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown Yellow medium to fine SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	11"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	5"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
PROJECT NAME	Low Level Radiation
REPORT SENT TO	above / Investigation
SAMPLES SENT TO	Taken at Site
ADDRESS	Attleboro, Mass.
LOCATION	Attleboro, Mass.
PROJ. NO.	
OUR JOB NO.	94-312
DATE	
HOLE NO.	B-3
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	
COMPLETE	5/16/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown Yellow medium to fine SAND & Gravel	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	6"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring ______
Samples 3

HOLE NO. B-3

100 WATER STREET EAST PROVIDENCE, R. I.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ NO:
SAMPLES SENT TO: Taken at Site
OUR JOB NO: 94-312

DATE:
HOLE NO.: B-4
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I.D.		1-3/8"	
Hammer Wt.		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	
COMPLETE	5/16/94	
TOTAL HRS.		

BORING FOREMAN: P. Vieira
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown Yellow medium to fine SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	12"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 3'6"
Rock Coring ______
Samples 3

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___
DATE ___
HOLE NO. B-5
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO ___
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/16/94	a.m. p.m.
COMPLETE	5/16/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown Yellow medium to fine SAND & Gravel	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	10'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	4'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring ___
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-6
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/16/94	a.m. p.m.
COMPLETE	5/16/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown Yellow medium to fine SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	10"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	5"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit ...

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2 O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments
PROJECT NAME: Low Level Radiation
REPORT SENT TO: above / Investigation
SAMPLES SENT TO: Taken at Site

ADDRESS: Attleboro, Mass.
LOCATION: Attleboro, Mass.
PROJ. NO.
OUR JOB NO.: 94-312

DATE
HOLE NO.: B-7
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/16/94	a.m. p.m.
COMPLETE	5/16/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Gray medium to coarse SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	10"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	6"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ____ USED ____ " CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med. Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 3'6"
Rock Coring ____
Samples 3

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ NO	
SAMPLES SENT TO	Taken at Site	OUR JOB NO	94-312

DATE
HOLE NO. B-8
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I.D.		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	
COMPLETE	5/16/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Gray medium to coarse SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	10"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	4"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30+ Hard
4-8 M/Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring ______
Samples 3

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-9
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	
COMPLETE	5/16/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Gray medium to fine SAND & Gravel, Cobbles	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	7.'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	5'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R. I.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ. NO.
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-312

DATE
HOLE NO.: B-10
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS	
At ____ after ____ Hours	
At ____ after ____ Hours	

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	
COMPLETE	5/16/94	
TOTAL HRS.		

BORING FOREMAN: P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Gray fine to medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	2"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ____ USED ____ " CASING THEN

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 3'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples 3
		30-50 Dense	8-15 Stiff	

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-11
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I.D.		1-3/8"	
Hammer Wt.		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/16/94	
COMPLETE	5/16/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Gray Yellow fine to medium SAND & Gravel, Cobbles	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	10'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	4'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments	ADDRESS: Attleboro, Mass.		DATE:
PROJECT NAME: Low Level Radiation	LOCATION: Attleboro, Mass.		HOLE NO.: B-12
REPORT SENT TO: above / Investigation	PROJ. NO.:		LINE & STA.:
SAMPLES SENT TO: Taken at Site	OUR JOB NO.: 94-312		OFFSET:
			SURF. ELEV.:

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/17/94	
COMPLETE	5/17/94	
TOTAL HRS		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium to fine SAND & Gravel, Cobbles	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	-
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	-
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Investigation
LOCATION Attleboro, Mass.
REPORT SENT TO above
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-13
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS	
At ______	after ______ Hours
At ______	after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to fine SAND & Gravel, Cobbles	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	7'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	5'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density	
0-10	Loose
10-30	Med Dense
30-50	Dense

Cohesive Consistency		
0-4	Soft	30 + Hard
4-8	M/Stiff	
8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

HOLE NO.

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

DATE
HOLE NO. B-14
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	
COMPLETE	5/17/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium to fine SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	1[illegible]
		2'6"-4'6"	D	"	"	"	(1-3/8")	4'6"		3	24"	1[illegible]
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 3

HOLE NO.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-15
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ___ after ___ Hours	Type			
	Size I D		3½"-2½"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/17/94	
COMPLETE	5/17/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ___ USED ___ CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-16
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	9"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ NO.
OUR JOB NO. 94-312

SHEET ___ OF ___
DATE
HOLE NO. B-17
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt.		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

DATE	
HOLE NO.	B-18
LINE & STA.	
OFFSET	
SURF. ELEV.	

TO Texas Instruments | ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation | PROJ. NO.

SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		5"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to fine SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff

SUMMARY
Earth Boring 2'6"
Rock Coring ______
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-19
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium to fine SAND & Gravel, Cobbles	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type	Proportions Used	140 lb Wt x 30" fall on 2" O.D. Sampler Cohesionless Density	Cohesive Consistency	SUMMARY
D - Dry C - Cored W - Washed	trace 0 to 10%	0-10 Loose	0-4 Soft 30 + Hard	Earth Boring 2'6"
UP - Undisturbed Piston	little 10 to 20%	10-30 Med Dense	4-8 M/Stiff	Rock Coring
TP - Test Pit A - Auger V - Vane Test	some 20 to 35%	30-50 Dense	8-15 Stiff	Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-20
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	
COMPLETE	5/17/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium to fine SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Additional Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312

Your Project or Contract No.

Date: May 20, 1994

Via: fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
3	Boring Reports: B-21 through B-40.

SAMPLES:

Remarks: More reports to follow.

By: ______________________________
L. L. MORRIS

cc:

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

DATE
HOLE NO. B-21
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt.		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium to fine SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ NO.
OUR JOB NO. 94-312

SHEET ___ OF ___
DATE
HOLE NO. B-22
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS			CASING	SAMPLER	CORE BAR.
At ___ after ___ Hours		Type			
		Size I D		3½"-2½"	
At ___ after ___ Hours		Hammer Wt		300#	BIT
		Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to fine SAND & Gravel, Cobbles	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	8
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-23
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D	— —	3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	
COMPLETE	5/17/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium to fine SAND & Gravel, Cobbles	1	12"	
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ. NO.:
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-312

SHEET ___ OF ___
DATE:
HOLE NO.: B-24
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS
At ______ after ____ Hours
At ______ after ____ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START		a.m. p.m.
COMPLETE		a.m. p.m.

TOTAL HRS.
BORING FOREMAN: P. Vieira
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	7"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
		30 +	Hard

SUMMARY
Earth Boring 2'6"
Rock Coring ____
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

DATE
HOLE NO. B-25
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type			
	Size I D		3½"-2½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring ______
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO. B-26
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	a.m. p.m.
COMPLETE	5/17/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Cobbles, Metals, Gray Sand	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Gray medium to fine SAND & Gravel	2	12"	12
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-26

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

DATE
HOLE NO. B-27
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/17/94	
COMPLETE	5/17/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Gray Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	7"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-27

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-28
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/18/94	
COMPLETE	5/18/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown Gray medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")		Big Cobbles	2	12"	0"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"	" "	3	12"	0"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type	Proportions Used		140 lb Wt. x 30" fall on 2" O.D. Sampler				SUMMARY	
D=Dry C=Cored W=Washed	trace	0 to 10%	Cohesionless Density		Cohesive Consistency		Earth Boring	3'6"
UP=Undisturbed Piston	little	10 to 20%	0-10	Loose	0-4 Soft	30 + Hard	Rock Coring	
TP=Test Pit A=Auger V=Vane Test	some	20 to 35%	10-30	Med Dense	4-8 M/Stiff		Samples	3
			30-50	Dense	8-15 Stiff			

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-29
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown Gray medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-29

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ NO.
OUR JOB NO. 94-312

DATE
HOLE NO B-30
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Gray Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	11"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-31
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours	Type			
At ____ after ____ Hours	Size I D		3½"-2½"	
	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown Gray medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	12"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ____ USED ____ "CASING THEN ____

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-31

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation | PROJ NO

SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

SHEET ___ OF ___

DATE

HOLE NO. B-32

LINE & STA.

OFFSET

SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown Gray medium SAND, some gravel, cobbles	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY:
Earth Boring 2'6"
Rock Coring ______
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-33
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS
At ______ after ____ Hours
At ______ after ____ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	6'
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	7'
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ ' CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt. x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO	94-312

DATE
HOLE NO. B-34
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Cobbles, Brown medium Sand & Gravel	1	12"	4"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	8"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

DATE
HOLE NO. B-35
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Cobbles	1	12"	6'
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown medium SAND & Gravel	2	12"	10'
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET	1 OF 1
DATE	
HOLE NO.	B-36
LINE & STA.	
OFFSET	
SURF. ELEV.	

TO Texas Instruments — ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation — LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation — PROJ. NO.

SAMPLES SENT TO Taken at Site — OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken (3½")					Brown medium SAND & Gravel Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	7"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type	Proportions Used	140 lb Wt x 30" fall on 2" O D Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	[illegible]	10-30 Med Dense	4-8 M/Stiff	Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-37
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	8"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-38
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		COBBLES, some Brown sand	1	12"	7"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	COBBLES, some Brown sand & gravel	2	12"	5"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-38

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-39
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS	
At ______	after ______ Hours
At ______	after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	a.m. p.m.
COMPLETE	5/18/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	7"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type	Proportions Used	140 lb Wt x 30" fall on 2" O.D. Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-40
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/18/94	
COMPLETE	5/18/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken			Brown medium SAND, Cobbles & Gravel	1	12"	-
		1'6"-1'10"	D	"	"	"		1'10"	Brown medium SAND, Cobbles	2	4"	4
									Bottom of Boring 1'10"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2 O D Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 1'10"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Additional Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312 **Your Project or Contract No.**

Date: May 24, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
3	Boring Reports: B-41 through B-60.

SAMPLES:

Remarks: More reports to follow.

By: ______________________________

L. L. MORRIS

cc:

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___

DATE ___

HOLE NO. B-41

LINE & STA. ___

OFFSET ___

SURF. ELEV. ___

TO Texas Instruments ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation PROJ. NO. ___

SAMPLES SENT TO Taken at Site OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/19/94	a.m. p.m.
COMPLETE	5/19/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING ___

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12"
		2'6"-4'6"	D	"	"	"	(1-3/8")			3	24"	14"
		4'6"-6'	D	"	"	"	"	6'	Brown medium SAND & Gravel	4	18"	11"
									Bottom of Boring 6'			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 6'
Rock Coring ___
Samples 4

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO. B-42
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ____ Hours
At ______ after ____ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	
COMPLETE	5/19/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-2'6"	D	Blows	not	Taken	(3½")		Brown SAND, Cobbles & Gravel	1	24"	14"
		2'6"-4'6"	D	"	"	"	(2½")			2	24"	7"
		4'6"-6'6"	D	"	"	"	(1-3/8")	6'6"	Brown medium SAND & Gravel	3	24"	16"
									Bottom of Boring 6'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense
Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 6'6"
Rock Coring
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO. B-43
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	
COMPLETE	5/19/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-2'6"	D	Blows not Taken			(3½")		Brown medium SAND, Cobbles & Gravel	1	24"	14
		2'6"-4'6"	D	"	"	"	(2½")			2	24"	8
		4'6"-6'6"	D	"	"	"	(1-3/8")	6'6"	Brown medium SAND & Gravel	3	24"	10
									Bottom of Boring 6'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type: D-Dry C-Cored W-Washed; UP-Undisturbed Piston; TP-Test Pit A-Auger ... Vane Test

Proportions Used: trace 0 to 10%; little 10 to 20%; some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density: 0-10 Loose; 10-30 Med Dense

Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY
Earth Boring 6'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

DATE
HOLE NO. B-44
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		3½"-2½"	
	Size D		1-3/8"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/19/94	
COMPLETE	5/19/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-2'6"	D	Blows not	Taken		(3½")		Brown medium SAND, Cobbles & Gravel	1	24'	14
		2'6"-4'6"	D	"	"	"	(2½")			2	24'	16
		4'6"-6'4"	D	"	"	"	(1-3/8")	6'4"		3	22'	12
									Bottom of Boring 6'4"			

OFFICIAL RECORD COPY ML 10

118945

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 6'4
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

DATE
HOLE NO. B-45
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type			
	Size I D		3½"-2½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/19/94	a.m. p.m.
COMPLETE	5/19/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken (3½")					Brown medium to fine SAND, Cobbles	1	12"	12"
		1'-2'	D	"	"	"	(2½")	2'	" & Gravel	2	12"	6"
									Refusal at 2'			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO B-45A
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	a.m. p.m.
COMPLETE	5/19/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	Sample No	Pen	Rec
		0'-2'	D	Blows	not	Taken	(3½")		Brown medium to fine SAND	1	24"	24"
		2'-3'	D	"	"	"	(2½")	3'	Brown medium to coarse SAND & Gravel	2	12"	6"
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING ______ THEN

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 3'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

DATE
HOLE NO. B-46
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I.D.		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	am / pm
COMPLETE	5/19/94	am / pm

TOTAL HRS
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Brown medium to fine SAND	1	12"	10'
		1'-2'	D	"	"	"	(2½")		Brown Sand, Gravel & Cobbles	2	12"	3'
		2'-3'	D	"	"	"	(1-3/8")	3'	Brown medium SAND, PEAT	3	12"	5'
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING ______ THEN

Sample Type
D Dry C Cored A Ashed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 3'
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

DATE
HOLE NO. B-47
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I.D.		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	
COMPLETE	5/19/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Brown fine to medium SAND	1	12'	10'
		1'-2'	D	"	"	"	(2½")		Brown medium SAND & Gravel, Cobbles	2	12'	6'
		2'-3'	D	"	"	"	(1-3/8")	3'	Brown medium SAND & Gravel, some peat	3	2'	8'
									Bottom of Boring 3'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density	
0-10	Loose
10-30	Med Dense
30-50	Dense

Cohesive Consistency		
0-4	Soft	30 + Hard
4-8	M/Stiff	
8-15	Stiff	

SUMMARY
Earth Boring 3'
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above ' Investigation
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-312
DATE	
HOLE NO.	B-48
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	
COMPLETE	5/19/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown fine to medium SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")		Brown medium SAND & Gravel	2	12"	-
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	-
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-49
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/19/94	a.m. p.m.
COMPLETE	5/19/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to coarse SAND, Cobbles & Gravel	1	12'	-
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	-
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	-
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

HOLE NO. B-49

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO B-50
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/19/94	a.m. p.m.
COMPLETE	5/19/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium to fine SAND & Gravel	1	12'	-
		1'6"-2'6"	D	"	"	"	(2½")			2	12'	0
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	0
									Bottom of Boring 3'6"			
									Note: Moved 2' up for Hole No. B-50A			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type	Proportions Used	140lb Wt x 30" fall on 2" O D Sampler		SUMMARY
D-Dry C-Cored W-Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 3'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 3
		30-50 Dense	8-15 Stiff	

HOLE NO B-50

100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ NO.:
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-312

DATE:
HOLE NO.: B-50A
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS

At ____ after ____ Hours

At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR
Type		3½"-2½"	
Size I D		1-3/8"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN: P. Vieira
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND	1	12'	12'
		1'6"-2'6"	D	"	"	"	(2½")		Brown medium SAND & Gravel	2	12'	10'
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12'	10'
									Bottom of Boring 3'6"			

GROUND SURFACE TO ____ USED ____ " CASING THEN ____

Sample Type	Proportions Used		140 lb Wt. x 30" fall on 2 O D Sampler Cohesionless Density		Cohesive Consistency			SUMMARY	
D: Dry C: Cored W: Washed	trace	0 to 10%	0-10	Loose	0-4	Soft	30 + Hard	Earth Boring	3'6"
UP: Undisturbed Piston	little	10 to 20%	10-30	Med. Dense	4-8	M/Stiff		Rock Coring	
TP: Test Pit A: Auger V: Vane Test	some	20 to 35%	30-50	Dense	8-15	Stiff		Samples	3

100 WATER STREET EAST PROVIDENCE, R I

DATE	
HOLE NO.	B-51
LINE & STA.	
OFFSET	
SURF. ELEV.	

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO bove / Investigation
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. / p.m.
COMPLETE	5/20/94	a.m. / p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	12"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 2'6"
Rock Coring ______
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ. NO.
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-312

DATE
HOLE NO.: B-52
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	
COMPLETE	5/20/94	

TOTAL HRS.
BORING FOREMAN: P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	4
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-312

DATE
HOLE NO. B-53
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No.	Pen	Rec.
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-54
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'	D	"	"	"	(2½")	2'		2	6"	0"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2
		30-50 Dense	8-15 Stiff	

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ NO.
OUR JOB NO 94-312

DATE
HOLE NO. B-55
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	
COMPLETE	5/20/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___
DATE ___
HOLE NO. B-56
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO. ___
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

GROUND WATER OBSERVATIONS

At ___ after ___ Hours

At ___ after ___ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR ___
SOILS ENGR. ___

LOCATION OF BORING ___

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler (From - To) 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Dark Gray Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'	D	"	"	"	(2½")	2'		2	6"	6"
									Bottom of Boring 2'			

GROUND SURFACE TO ___ USED ___ " CASING THEN ___

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY:
Earth Boring 2'
Rock Coring ___
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-57
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec.
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	7"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-58
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type			
	Size I D		3½"-2½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/20/94	
COMPLETE	5/20/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Black Brown medium SAND & Gravel	2	12"	7"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ____ USED ____ "CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET ___ OF ___
DATE
HOLE NO. B-59
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown SAND, some medium gravel	1	12"	12"
		1'6"-1'10"	D	"	"	"	(2½")	1'10"		2	4"	4"
									Bottom of Boring 1'10"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
		30+	Hard

SUMMARY
Earth Boring 1'10"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
PROJECT NAME	Low Level Radiation
REPORT SENT TO	above / Investigation
SAMPLES SENT TO	Taken at Site
ADDRESS	Attleboro, Mass.
LOCATION	Attleboro, Mass.
PROJ. NO.	
OUR JOB NO.	94-312
DATE	
HOLE NO.	B-60
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ________ after ______ Hours

At ________ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	
COMPLETE	5/20/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown & Light Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ________ USED ________ " CASING THEN ________

Sample Type

D: Dry C: Cored W: Washed

UP: Undisturbed Piston

TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:

Earth Boring 2'6"

Rock Coring ________

Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Additional Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312 **Your Project or Contract No.**

Date: May 27, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
3	Boring Reports: B-61 through B-92.

SAMPLES: Taken at Site.

Remarks: Project complete.

By: ______________________

L. L. MORRIS

cc:

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-61
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Light Brown medium SAND & Gravel	2	12"	10
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO 94-312

DATE
HOLE NO. B-62
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type			
At ____ after ____ Hours	Size I D		3½"-2½"	
	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/20/94	
COMPLETE	5/20/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Black Brown SAND & Gravel (Wet Soil)	1	12"	12
		1'6"-2'	D	"	"	"	(2½")	2'		2	12"	10
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-63
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type			
	Size I D		3½"-2½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	Sample No	Pen	Rec
		0'-1'	D	Blows not Taken					Cobble	1	12"	0"
Moved 1'		6"-1'6"	D	"	"	"	(3½")		Brown SAND & Gravel (Wet)	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	12"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density	
0-10	Loose
10-30	Med Dense

Cohesive Consistency		
0-4	Soft	30 + Hard
4-8	M/Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation PROJ. NO.

SAMPLES SENT TO Taken at Site OUR JOB NO. 94-312

DATE

HOLE NO. B-64

LINE & STA.

OFFSET

SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/20/94	a.m. p.m.
COMPLETE	5/20/94	a.m. p.m.

TOTAL HRS.

BORING FOREMAN P. Vieira

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	12-18 To	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")			1	12"	0"
									Brown GRAVEL - Fill	1A	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown medium SAND - (Wet)	2	12"	12"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		
30-50	Dense	8-15	Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-64

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-65
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	
COMPLETE	5/23/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments	ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation	LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation	PROJ. NO.
SAMPLES SENT TO: Taken at Site	OUR JOB NO. 94-312

DATE
HOLE NO. B-66
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	
COMPLETE	5/23/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	(Wet at 2')	2	12"	7
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
O: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ NO	
SAMPLES SENT TO	Taken at Site	OUR JOB NO	94-312

DATE
HOLE NO. B-67
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	a.m. p.m.
COMPLETE	5/23/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel (Wet at 2')	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown medium SAND, some gravel (Wet at 2'6")	2	12"	12"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-68
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type			
	Size I D		3½"-2½"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/23/94	
COMPLETE	5/23/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	12-18 To	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
		0'-1'	D	Blows not Taken					Brown medium SAND, Topsoil & Gravel	1	12"	12
		1'-2'	D	"	"	"			Brown SAND & Gravel	2	12"	12
								2'				
									Bottom of Boring 2'			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type	Proportions Used	140 lb Wt x 30 fall on 2 O.D. Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO	94-312

DATE	
HOLE NO.	B-69
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	a.m. p.m.
COMPLETE	5/23/94	a.m. p.m.
TOTAL HRS		

BORING FOREMAN P. Vieira

INSPECTOR

SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	12-18 To	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	12"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston
TP = Test Pit A = Auger V = Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring ______
Samples 2

HOLE NO. B-69

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

HOLE NO. B-70
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	a.m. p.m.
COMPLETE	5/23/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	12
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring ___
Samples 2

HOLE NO B-70

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-71
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type			
	Size · D		3½"-2½"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/23/94	a.m. p.m.
COMPLETE	5/23/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	12"
								2'				
		1'6"-2'6"	D	"	"	"	(2½")		Gray fine to medium SAND	2	12"	12"
								2'6"				
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-71

100 WATER STREET EAST PROVIDENCE, R I

DATE	
HOLE NO.	B-72
LINE & STA.	
OFFSET	
SURF. ELEV.	

TO Texas Instruments ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation PROJ NO.
SAMPLES SENT TO Taken at Site OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	a.m. p.m.
COMPLETE	5/23/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to fine SAND & Gravel	1	12"	12
								2'	Brown medium SAND			
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	12
								2'6"	Gray fine SAND			
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type	Proportions Used		140lb Wt x 30" fall on 2" O.D. Sampler				SUMMARY	
D=Dry C=Cored W=Washed	trace	0 to 10%	Cohesionless Density		Cohesive Consistency		Earth Boring	2'6"
UP=Undisturbed Piston	little	10 to 20%	0-10	Loose	0-4 Soft	30 + Hard	Rock Coring	
TP=Test Pit A=Auger V=Vane Test	some	20 to 35%	10-30	Med. Dense	4-8 M/Stiff		Samples	2
			30-50	Dense	8-15 Stiff			

HOLE NO. B-72

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-73
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ____ Hours

At ______ after ____ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/23/94	a.m. p.m.
COMPLETE	5/23/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	COBBLES, Gray medium Sand & Gravel	2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass. | DATE
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass. | HOLE NO. B-74
REPORT SENT TO above / Investigation | PROJ NO | LINE & STA.
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312 | OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		

BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	R
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	8
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	8
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	4
									Bottom of Boring 3'6"			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 3'6"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-75
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		3½"-2½"	
	Size I D		1-3/8"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		

BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	10"
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	8"
		2'6"-3'6"	D	"	"	"	(1-3/8")	3'6"		3	12"	4"
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ "CASING THEN

Sample Type	Proportions Used	140lb Wt x 30" fall on 2" O D Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 3'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 3
UT: Undisturbed Thinwall		30-50 Dense	8-15 Stiff	

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-76
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type			
	Size I D		3½"-2½"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		

BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								4"	Asphalt			
		4"-1'4"	D	Blows not Taken			(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	6
		1'4"-2'4"	D	"	"	"	(2½")		(Wet)	2	12"	6
								2'4"				
									Bottom of Boring 2'4"			

GROUND SURFACE TO ___ USED ___ " CASING THEN ___

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY:
Earth Boring 2'4"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-77
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		

BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								4"	Asphalt			
		4"-1'4"	D	Blows not Taken			(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	6"
		1'4"-2'4"	D	"	"	"	(2½")		(Wet)	2	12"	6"
								2'4"				
									Bottom of Boring 2'4"			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY:
Earth Boring 2'4"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments	ADDRESS Attleboro, Mass.	DATE	
PROJECT NAME Low Level Radiation	LOCATION Attleboro, Mass.	HOLE NO. B-78	
REPORT SENT TO above / Investigation	PROJ NO.	LINE & STA.	
SAMPLES SENT TO Taken at Site	OUR JOB NO. 94-312	OFFSET	
		SURF. ELEV.	

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR		Date	Time
At ___ after ___ Hours	Type				START	5/24/94	
	Size I D		3½"-2½"		COMPLETE	5/24/94	
At ___ after ___ Hours	Hammer Wt		300#	BIT	TOTAL HRS.		
	Hammer Fall		12"		BORING FOREMAN	J. Souza	
					INSPECTOR		
					SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								4"	Asphalt			
		4"-1'4"	D	Blows not	Taken		(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	6
		1'4"-2'4"	D	"	"	"	(2½")		(Wet)	2	12"	4
								2'4"				
									Bottom of Boring 2'4"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY:
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'4"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2
		30-50 Dense	8-15 Stiff	

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-79
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	

TOTAL HRS.
BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
		0'-1'	D	Blows not Taken			(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	1[illegible]
		1'-2'	D	"	"	"	(2½")	2'	(Moist)	2	12"	8'
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___
DATE ___
HOLE NO. B-80
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO. ___
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS
At ___ after ___ Hours
At ___ after ___ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		
BORING FOREMAN	J. Souza	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING ___

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
		0'-1'	D	Blows not Taken					Brown medium to coarse GRAVEL (Dry)	1	12"	8"
		1'-2'	D	"	"	"		2'	(Moist)	2	12"	4"
									Bottom of Boring 2'			

GROUND SURFACE TO ___ USED ___ " CASING THEN ___

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	

SUMMARY
Earth Boring 2'
Rock Coring ___
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

DATE
HOLE NO. B-81
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		

BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								4"	Asphalt			
		4"-1'4"	D	Blows not Taken			(3½")		Brown medium to coarse GRAVEL (Dry)	1	12"	12
		1'4"-2'4"	D	"	"	"	(2½")	2'4"	" color change to Gray	2	12"	6"
									Bottom of Boring 2'4"			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 2'4"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest.
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

DATE
HOLE NO. 115
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/8/94	a.m. p.m.
COMPLETE	7/8/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Gray Brown coarse SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry coarse GRAVEL, Cobbles	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		(No Recovery)	3	12"	0
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	Dark Brown SAND & Gravel	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest. LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 PROJ. NO.
SAMPLES SENT TO Taken at Site OUR JOB NO. 95-41

DATE
HOLE NO. 116
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size D		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/8/94	a.m. p.m.
COMPLETE	7/8/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry Brown coarse SAND, medium Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry Brown Gray medium to coarse GRAVEL	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		(No Recovery)	3	12"	0
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	SAND & Gravel, Moist Organics	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO 117
LINE & STA
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/8/94	
COMPLETE	7/8/94	
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown coarse GRAVEL	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry Dark Brown fine to medium SAND, some organics	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		Moist Dark Brown ORGANICS, some roots	3	12"	-
								3'6"				
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. 118
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt.		300#	BIT
Hammer Fall			

	Date	Time
START	7/8/94	a.m. p.m.
COMPLETE	7/8/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry Brown Gray SAND & medium to coarse Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry Gray medium to coarse GRAVEL, Cobbles	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		Dry Gray medium to coarse GRAVEL	3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	Moist Brown medium SAND & Silt, Organics	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 4'6"
Rock Coring

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO 119
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size · D		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/8/94	
COMPLETE	7/8/94	
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Dry Tan silty medium to coarse GRAVEL	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry Brown medium to coarse GRAVEL, little silt, organics	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		Moist Gray ORGANICS, Roots	3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	Moist Black ORGANICS, Peat	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. 120
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/9/94	a.m. p.m.
COMPLETE	7/9/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not	Taken		(3½")		Coarse GRAVEL, no sand	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry Brown medium to coarse GRAVEL, some sand	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		(No Recovery)	3	12"	0
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	Brown medium to coarse SAND, Gravel	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard
10-30	Med Dense	4-8	M/Stiff		

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. 121
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		S/S	
	Size I D		3½"-3"-2½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall			

	Date	Time
START	7/9/94	a.m. p.m.
COMPLETE	7/9/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	J. Sousa	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Gray coarse GRAVEL, some sand	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Cobbles (No Recovery)	2	12"	0
		2'6"-3'6"	D	"	"	"	(2½")		Brown coarse GRAVEL	3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	Dry, some sand, medium to coarse gravel	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 4'6"
Rock Coring ____
Samples 4

SOILS DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

SHEET ___ OF ___
DATE
HOLE NO 122
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/9/94	
COMPLETE	7/9/94	

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to coarse SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")			2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")	3'6"	Brown coarse GRAVEL, some sand	3	12"	-
									Bottom of Boring 3'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D - Dry C - Cored W - Washed
UP - Undisturbed Piston
TP - Test Pit A - Auger V - Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO 123
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ. NO
SAMPLES SENT TO Taken at Site | OUR JOB NO 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/9/94	a.m. p.m.
COMPLETE	7/9/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry Brown medium to coarse GRAVEL	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Cobbles (No Recovery)	2	12"	0
		2'6"-3'6"	D	"	"	"	(2½")		Dry Tan & Dark Brown medium to coarse SAND	3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")	4'6"	Dry Brown coarse SAND & Gravel	4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type: D Dry C Cored W Washed; UP Undisturbed Piston

Proportions Used: trace 0 to 10%; little 10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density: 0-10 Loose; 10-30 Med Dense

Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY: Earth Boring 4'6"; Rock Coring; Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. 124
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest. LOCATION Attleboro, Mass. / Bldg. #5
REPORT SENT TO above PROJ NO
SAMPLES SENT TO Taken at Site OUR JOB NO 95-41

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt.		300#	BIT
Hammer Fall			

	Date	Time
START		
COMPLETE		
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Gray medium to coarse SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Moist Brown silty medium SAND & Gravel	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")			3	12"	-
		3'6"-3'8"	D	"	"	"	(2½")		Cobbles	4	2"	-
								3'8"	Bottom of Boring 3'8" Refusal			

GROUND SURFACE TO ______ USED ______ CASING ______ THEN

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit ...

Proportions Used
trace 0 to 10%
little 10 to 20%

140lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 4-8 M/Stiff; 30 + Hard

SUMMARY
Earth Boring 3'8"
Rock Coring
Samples 4

SHEET 1 OF 1
DATE
HOLE NO. 125
LINE & STA.
OFFSET
SURF. ELEV.

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 95-41

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type		S/S	
	Size I.D.		3½"-3"-2½"	
At ____ after ____ Hours	Hammer Wt.		300#	BIT
	Hammer Fall			

	Date	Time
START	7/9/94	
COMPLETE	7/9/94	
TOTAL HRS.		
BORING FOREMAN	J. Sousa	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown coarse GRAVEL, Cobbles	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Moist Brown fine SAND, Silt, some organics	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")	3'6"	Moist Brown medium to coarse GRAVEL	3	12"	-
									Bottom of Boring 3'6" Refusal			

GROUND SURFACE TO ____ USED ____ CASING THEN ____

Sample Type: D = Dry C = Cored W = Washed; UP = Undisturbed Piston; TP = Test Pit ...
Proportions Used: trace 0 to 10%; little 10 to 20% ...
140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose; 10-30 Med Dense
Cohesive Consistency: 0-4 Soft; 30 + Hard; 4-8 M/Stiff

SUMMARY
Earth Boring 3'6"
Rock Coring
Samples 3

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. 126
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/9/94	am pm
COMPLETE	7/9/94	am pm

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Tan medium to coarse SAND	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Gray medium to coarse GRAVEL	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		COBBLES & Gravel	3	12"	-
		3'6"-3'9"	D	"	"	"	(2½")	3'9"	Cobbles (No Recovery)	-	3"	0
									Bottom of Boring 3'9" Refusal			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D = Dry C = Cored W = Washed
UP = Undisturbed Piston

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
30 + Hard

SUMMARY
Earth Boring 3'9"
Rock Coring
Samples 3

100 WATER STREET EAST PROVIDENCE, R. I.

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation Invest	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Bldg. #5	PROJ. NO	
SAMPLES SENT TO	Taken at Site	OUR JOB NO	95-41

DATE
HOLE NO. 127
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type		S/S	
At ___ after ___ Hours	Size I.D.		3½"-3"	
	Hammer Wt.		300#	BIT
	Hammer Fall			

	Date	Time
START	7/9/94	a.m. p.m.
COMPLETE	7/9/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	J. Sousa	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown coarse SAND	1	12"	-
		1'6"-2'2"	D	"	"	"	(3")		(No Recovery)	-	8"	0
								2'2"				
									Refusal at 2'2" with Spoon & Auger			

GROUND SURFACE TO ___ USED ___ CASING THEN ___

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'2"
Rock Coring
Samples 1

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE R I

SHEET 1 OF 1
DATE
HOLE NO 128
LINE & STA
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest.
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ NO
SAMPLES SENT TO Taken at Site
OUR JOB NO 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt.		300#	BIT
Hammer Fall			

	Date	Time
START	7/9/94	
COMPLETE	7/9/94	

TOTAL HRS.
BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium to coarse GRAVEL & Sand	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Brown medium to coarse SAND & Gravel	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		SAND & Cobbles	3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")	4'6"		4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard

SUMMARY
Earth Boring 4'6"
Rock Coring

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Boring Data - Low Level Radiation Investigation/Bldg. #5

Location: Attleboro, Mass. (Willard Street)

Our Job No: 95-41 **Your Project or Contract No.**

Date: July 12, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
	Boring Reports: 129 through 137.

SAMPLES:

Remarks: More reports to follow.

By: ______________________

L. L. MORRIS

cc:

OFFICIAL RECORD COPY ML 10

118945

100 WATER STREET EAST PROVIDENCE, R. I.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation Invest.
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Bldg. #5
PROJ NO:
SAMPLES SENT TO: Taken at Site
OUR JOB NO: 95-41

DATE:
HOLE NO: 129
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½" - 3" - 2½"	
Hammer Wt.		300#	BIT
Hammer Fall			

	Date	Time
START	7/10/94	a.m. p.m.
COMPLETE	7/10/94	a.m. p.m.
TOTAL HRS		

BORING FOREMAN: J. Sousa
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No.	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry, Brown medium to coarse GRAVEL, Cobbles, some sand	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")			2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")			3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")			4	12"	-
								4'6"	Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type: D=Dry C=Cored W=Washed; UP=Undisturbed Piston; TP=Test Pit A=Auger V=Vane Test

Proportions Used: trace 0 to 10%, little 10 to 20%, some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler
Cohesionless Density: 0-10 Loose, 10-30 Med. Dense
Cohesive Consistency: 0-4 Soft, 4-8 M/Stiff, 30+ Hard

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest | LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5 | PROJ NO
SAMPLES SENT TO Taken at Site | OUR JOB NO 95-41

DATE
HOLE NO 130
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At after Hours	Type		S/S	
	Size I.D.		3½"-3"-2½"	
At after Hours	Hammer Wt		300#	BIT
	Hammer Fall			

	Date	Time
START	7/10/94	
COMPLETE	7/10/94	
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry, Brown medium to coarse SAND & Gravel, Cobbles	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")			2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")			3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")			4	12"	-
								4'6"				
									Bottom of Boring 4'6"			

GROUND SURFACE TO USED CASING THEN

Sample Type
D Dry C Cored W Washed
UP Undisturbed Piston
TP Test Pit A Auger V Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. 131
LINE & STA.
OFFSET
SURF. ELEV.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation Invest.
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Bldg. #5
PROJ NO
SAMPLES SENT TO: Taken at Site
OUR JOB NO: 95-41

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I.D.		3½"-3"-2½"	
Hammer Wt.		300#	BIT
Hammer Fall			

	Date	Time
START	7/10/94	a.m. p.m.
COMPLETE	7/10/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN: J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	Sample No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry, Brown fine to medium SAND	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry, Brown medium to coarse SAND & Gravel	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")			3	12"	-
		3'6"-4'6"	D	"	"	"	(2½")	4'6"		4	12"	-
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density	
0-10	Loose
10-30	Med Dense

Cohesive Consistency		
0-4	Soft	30 + Hard
4-8	M/Stiff	

SUMMARY
Earth Boring 4'6"
Rock Coring
Samples 4

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. 132
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 95-41

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3½"-3"-2½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/10/94	a.m. p.m.
COMPLETE	7/10/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken			(3½")		Dry, Brown medium to coarse SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(3")		Dry, Gray medium to coarse SAND & Gravel	2	12"	-
		2'6"-3'6"	D	"	"	"	(2½")		(No Recovery)	3	12"	0
		3'6"-4'6"	D	"	"	"	(2½")		Gray medium to coarse SAND & Gravel	4	12"	-
								4'6"	Moist, Dark Brown ORGANICS			
									Bottom of Boring 4'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D-Dry C-Cored A-Washed
UP-Undisturbed Piston

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt x 30" fall on 2" O D Sampler
Cohesionless Density 0-10 Loose
Cohesive Consistency 0-4 Soft 30 + Hard

SUMMARY
Earth Boring 4'6"
Rock Coring

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation Invest
LOCATION Attleboro, Mass.
REPORT SENT TO above / Bldg. #5
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 95-41

DATE
HOLE NO 133
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type		S/S	
Size I D		3½"	
Hammer Wt		300#	BIT
Hammer Fall			

	Date	Time
START	7/10/94	
COMPLETE	7/10/94	
TOTAL HRS.		

BORING FOREMAN J. Sousa
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt - Gravel			
		6"-1'6"	D	Blows not Taken (3½")					Brown medium to coarse SAND & Gravel	1	12"	-
								1'6"				
									Bottom of Boring 1'6"			
									Stopped at 1'6" Poss. buried Utility			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D-Dry C-Cored W-Washed
UP-Undisturbed Piston
TP-Test Pit A-Auger V-Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 1'6"
Rock Coring
Samples 1

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments	ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation	LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation	PROJ. NO.
SAMPLES SENT TO: Taken at Site	OUR JOB NO. 94-312

SHEET ___ OF ___
DATE
HOLE NO. B-82
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ___ after ___ Hours	Type			
	Size I D		3½"-2½"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		
BORING FOREMAN	J. Souza	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Re
		0'-1'	D	Blows not Taken					4" Topsoil - Brown medium to coarse GRAVEL (Dry)	1	12"	1
		1'-2'	D	"	"	"		2'	Gray medium to coarse GRAVEL (Dry)	2	12"	8'
									Bottom of Boring 2'			

GROUND SURFACE TO ___ USED ___ "CASING. THEN ___

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY:
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2
		30-50 Dense	8-15 Stiff	

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET 1 OF 1
DATE
HOLE NO. B-83
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	

TOTAL HRS.
BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken					Brown medium to coarse GRAVEL (Dry)	1	12"	8"
		1'-2'	D	"	"	"		2'	(Moist)	2	12"	4"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ "CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston

Proportions Used
trace 0 to 10%
little 10 to 20%

140 lb Wt. x 30" fall on 2" O D Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY:
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-84
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS			CASING	SAMPLER	CORE BAR.
At	after	Hours			
		Type			
At	after	Size I D		3½"-2½"	
		Hammer Wt		300#	BIT
		Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	
TOTAL HRS.		
BORING FOREMAN	J. Souza	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken					Brown medium to coarse GRAVEL (Dry)	1	12"	8"
		1'-2'	D	"	"	"			(Moist)	2	12"	4"
								2'				
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ "CASING THEN

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

SHEET ___ OF ___
DATE
HOLE NO. B-85
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/24/94	
COMPLETE	5/24/94	

TOTAL HRS.
BORING FOREMAN J. Souza
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken (3½")					Brown medium to coarse GRAVEL (Dry)	1	12"	6'
		1'6"-2'6"	D	"	"	"	(2½")			2	12"	4'
								2'6"				
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______" CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler
Cohesionless Density
0-10 Loose
10-30 Med. Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ. NO.:
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-312

DATE:
HOLE NO.: B-86
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/25/94	a.m. p.m.
COMPLETE	5/25/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN: P. Vieira
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown Gray medium to fine SAND, Cobbles & Gravel	2	12"	4"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring ______
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

DATE
HOLE NO. B-87
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I.D.		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/25/94	a.m. p.m.
COMPLETE	5/25/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blo...	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown Gray medium SAND & Gravel	2	12"	1[illegible]
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-87

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-88
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ____ after ____ Hours	Type			
	Size I D		3½"-2½"	
At ____ after ____ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/25/94	a.m. p.m.
COMPLETE	5/25/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken			(3½")		Brown medium SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½'	2'6"	Gray medium SAND & Gravel, Cobbles	2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ________ USED ________ " CASING THEN ________

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

DATE
HOLE NO. B-89
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/25/94	a.m. p.m.
COMPLETE	5/25/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	-
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Gray Brown medium SAND & Gravel	2	12"	-
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO: Texas Instruments
ADDRESS: Attleboro, Mass.
PROJECT NAME: Low Level Radiation
LOCATION: Attleboro, Mass.
REPORT SENT TO: above / Investigation
PROJ. NO.:
SAMPLES SENT TO: Taken at Site
OUR JOB NO.: 94-312

DATE:
HOLE NO.: B-90
LINE & STA.:
OFFSET:
SURF. ELEV.:

GROUND WATER OBSERVATIONS	
At ____ after ____ Hours	
At ____ after ____ Hours	

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/25/94	a.m. p.m.
COMPLETE	5/25/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN: P. Vieira
INSPECTOR:
SOILS ENGR.:

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown Gray medium SAND & Gravel	2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ____ USED ____ " CASING THEN ____

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" O.D. Sampler		SUMMARY:
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples 2
		30-50 Dense	8-15 Stiff	

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments
ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation
LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation
PROJ. NO.	
SAMPLES SENT TO	Taken at Site
OUR JOB NO.	94-312
DATE	
HOLE NO.	B-91
LINE & STA.	
OFFSET	
SURF. ELEV.	

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	5/25/94	
COMPLETE	5/25/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken			(3½")		Brown TOPSOIL - Fill	1	12'	12'
		1'-2'	D	"	"	"	(2½")	2'	Brown medium SAND & Gravel	2	12'	12'
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	

SUMMARY:
Earth Boring 2'
Rock Coring ______
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET ___ OF ___
DATE ___
HOLE NO. B-92
LINE & STA. ___
OFFSET ___
SURF. ELEV. ___

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO ___
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ___ after ___ Hours	Type			
	Size I D		3½"-2½"	
At ___ after ___ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	5/25/94	a.m. p.m.
COMPLETE	5/25/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR ___
SOILS ENGR. ___

LOCATION OF BORING ___

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken			(3½")		Brown medium SAND & Gravel	1	12'	12"
		1'-2'	D	"	"	"	(2½")	2'		2	12'	12"
									Bottom of Boring 2'			

GROUND SURFACE TO ___ USED ___ "CASING THEN ___

Sample Type	Proportions Used	140lb Wt. x 30" fall on 2" O D Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring ___
TP: Test Pit A: Auger V: Vane Test	some 20 to 35%	10-30 Med Dense	4-8 M/Stiff	Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Additional Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312 **Your Project or Contract No.**

Date: June 3, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Elliot

Copies / or Sets	DESCRIPTION
3	Boring Reports: B-93 SS, B-94 SS, B-95 SS, B-96 SS, B-97 SS, B-98 SS, B-99, B-100, B-101 and B-102.

SAMPLES: Taken at Site.

Remarks: Complete to date.

By: ______________________

L. L. MORRIS

cc:

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-93 SS
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken			(3½")		Dark Brown medium SAND & Gravel	1	12"	10"
		1'-2'	D	"	"	"	(2½")			2	12'	8"
								2'				
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

DATE
HOLE NO. B-94 SS
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I.D.		3½"-2½"	
Hammer Wt.		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc.	SAMPLE No	Pen	Rec.
		0'-1'	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12'	12"
		1'-2'	D	"	"	"	(2½")	2'		2	12'	10"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-95 SS
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	
COMPLETE	6/2/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist.	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken			(3½")		Asphalt - Brown SAND & Gravel	1	12"	12
		1'-2'	D	"	"	"	(2½")	2'	Brown medium SAND & Gravel	2	12"	10
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
		30 +	Hard

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

DATE
HOLE NO. B-96 SS
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken			(3½")		Brown fine SAND & Gravel	1	12'	12"
		1'-2'	D	"	"	"	(2½")	2'		2	12'	10"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.

PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.

REPORT SENT TO above / Investigation | PROJ. NO.

SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-97 SS
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Mulch - Brown medium SAND & Gravel, Cobbles - Fill	1	12"	12"
		1'-2'	D	"	"	"	(2½")	2'		2	12"	4"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense
30-50 Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO 94-312

DATE
HOLE NO B-98 SS
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Mulch - Brown medium SAND	1	12'	12"
		1'-2'	D	"	"	"	(2½")	2'	Brown medium SAND	2	12'	8"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

DATE
HOLE NO. B-99
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I.D.		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec.
		0'-1'	D	Blows	not	Taken	(3½")		Yellow Brown medium SAND & Gravel	1	12'	12'
		1'-2'	D	"	"	"	(2½")	2'		2	12'	8"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY:
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.
100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation PROJ. NO.
SAMPLES SENT TO Taken at Site OUR JOB NO. 94-312

DATE
HOLE NO. B-100
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12
		1'-2'	D	"	"	"	(2½")	2'		2	12'	10
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
30 + Hard

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-101
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12'	12'
		1'-2'	D	"	"	"	(2½")	2'		2	12'	6'
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff
8-15 Stiff

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-102
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ. NO.
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/2/94	a.m. p.m.
COMPLETE	6/2/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12'	4"
		1'-2'	D	"	"	"	(2½")			2	12'	6"
								2'				
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston

Proportions Used	
trace	0 to 10%
little	10 to 20%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency			
0-10	Loose	0-4	Soft	30 +	Hard

SUMMARY
Earth Boring 2'
Rock Coring ______
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET, EAST PROVIDENCE, R.I. 02914
(401) 434-0750

Subject: Additional Boring Data - Low Level Radiation Investigation

Location: Attleboro, Mass. (Haggerty Drive)

Our Job No: 94-312 **Your Project or Contract No.**

Date: June 6, 1994 **Via:** fcm

To: Texas Instruments
34 Forest Street
Attleboro, Mass. 02703

Attention of: Mr. Michael Ellio

Copies / or Sets	DESCRIPTION
3	Boring Reports: B-103 through B-111.

SAMPLES: Taken at Site.

Remarks: Project complete to date.

By: ______________________________
L. L. MORRIS

cc:

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
PROJECT NAME Low Level Radiation
REPORT SENT TO above / Investigation
SAMPLES SENT TO Taken at Site

ADDRESS Attleboro, Mass.
LOCATION Attleboro, Mass.
PROJ NO
OUR JOB NO. 94-312

DATE
HOLE NO. B-103
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		140#	BIT
Hammer Fall		12"	

	Date	Time
START	6/4/94	a.m. p.m.
COMPLETE	6/4/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows not Taken			(3½")		Mulch - Brown medium to fine SAND	1	12"	8"
		1'-2'	D	"	"	"	(2½")		Brown medium SAND (Fill)	2	12"	6"
								2'				
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-104
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		140#	BIT
	Hammer Fall		12"	

	Date	Time
START	6/4/94	
COMPLETE	6/4/94	
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
		0'-1'	D	Blows	not	Taken	(3½")		Mulch - Brown medium SAND, trace gravel	1	12"	12
		1'-2'	D	"	"	"	(2½")	2'	Brown medium to fine SAND	2	12"	4"
									Bottom of Boring 2'			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type	Proportions Used		140 lb Wt. x 30" fall on 2" O D Sampler				SUMMARY	
D: Dry C: Cored W: Washed	trace	0 to 10%	Cohesionless Density		Cohesive Consistency		Earth Boring	2'
UP: Undisturbed Piston	little	10 to 20%	0-10	Loose	0-4	Soft 30 + Hard	Rock Coring	
TP: Test Pit A: Auger V: Vane Test	some	20 to 35%	10-30	Med Dense	4-8	M/Stiff	Samples	2
			30-50	Dense	8-15	Stiff	HOLE NO. B-104	

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

DATE
HOLE NO. B-105
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS

At ______ after ______ Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	6/4/94	
COMPLETE	6/4/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown fine to medium SAND & Gravel	1	12"	1[illegible]
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	1[illegible]
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-106
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments
ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation
LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation
PROJ. NO.
SAMPLES SENT TO Taken at Site
OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	6/4/94	a.m. p.m.
COMPLETE	6/4/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec.
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown fine to medium SAND & Gravel	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type	Proportions Used	140lb Wt. x 30" fall on 2" O D Sampler		SUMMARY
D: Dry C: Cored W: Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring 2'6"
UP: Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP: Test Pit A: Auger V: Vane Test		10-30 Med Dense	4-8 M/Stiff	Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET   EAST PROVIDENCE, R I

SHEET 1 OF 1
DATE
HOLE NO. B-107
LINE & STA.
OFFSET
SURF. ELEV.

TO Texas Instruments   ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation   LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation   PROJ NO.
SAMPLES SENT TO Taken at Site   OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS
At ______ after ______ Hours
At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	6/4/94	
COMPLETE	6/4/94	

TOTAL HRS.
BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	1[illegible]
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	1[illegible]
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
[illegible]

140 lb Wt. x 30" fall on 2" O D Sampler
Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

100 WATER STREET EAST PROVIDENCE, R I

TO	Texas Instruments	ADDRESS	Attleboro, Mass.
PROJECT NAME	Low Level Radiation	LOCATION	Attleboro, Mass.
REPORT SENT TO	above / Investigation	PROJ. NO.	
SAMPLES SENT TO	Taken at Site	OUR JOB NO.	94-312

DATE
HOLE NO. B-108
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS			CASING	SAMPLER	CORE BAR.
At ____ after ____ Hours		Type			
		Size I D		3½"-2½"	
At ____ after ____ Hours		Hammer Wt		300#	BIT
		Hammer Fall		12"	

	Date	Time
START	6/4/94	a.m. p.m.
COMPLETE	6/4/94	a.m. p.m.
TOTAL HRS.		
BORING FOREMAN	P. Vieira	
INSPECTOR		
SOILS ENGR.		

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	8"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ "CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO. B-108

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R I

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

SHEET ___ OF ___
DATE
HOLE NO. B-109
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	6/4/94	
COMPLETE	6/4/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not	Taken		(3½")		Brown medium SAND & Gravel	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	8"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ "CASING THEN

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt x 30" fall on 2" O D Sampler

Cohesionless Density
0-10 Loose
10-30 Med Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 2'6"
Rock Coring
Samples 2

GUILD DRILLING CO., INC.

100 WATER STREET EAST PROVIDENCE, R. I.

SHEET ____ OF ____
DATE ____
HOLE NO. B-110
LINE & STA. ____
OFFSET ____
SURF. ELEV. ____

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO. ____
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

GROUND WATER OBSERVATIONS

At ____ after ____ Hours

At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type			
Size I D		3½"-2½"	
Hammer Wt		300#	BIT
Hammer Fall		12"	

	Date	Time
START	6/4/94	a.m. p.m.
COMPLETE	6/4/94	a.m. p.m.
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR ____
SOILS ENGR. ____

LOCATION OF BORING ____

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Rec
								6"	Asphalt			
		6"-1'6"	D	Blows not Taken (3½")					Brown medium SAND & Gravel, Cobbles	1	12"	12"
		1'6"-2'6"	D	"	"	"	(2½")	2'6"		2	12"	10"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ____ USED ____ "CASING THEN ____

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%

140 lb Wt. x 30" fall on 2" O.D. Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense

Cohesive Consistency
0-4 Soft 30 + Hard
4-8 M/Stiff

SUMMARY
Earth Boring 2'6"
Rock Coring ____
Samples 2

100 WATER STREET EAST PROVIDENCE, R. I.

TO Texas Instruments | ADDRESS Attleboro, Mass.
PROJECT NAME Low Level Radiation | LOCATION Attleboro, Mass.
REPORT SENT TO above / Investigation | PROJ. NO.
SAMPLES SENT TO Taken at Site | OUR JOB NO. 94-312

DATE
HOLE NO. B-111
LINE & STA.
OFFSET
SURF. ELEV.

GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR
At ______ after ______ Hours	Type			
	Size I D		3½"-2½"	
At ______ after ______ Hours	Hammer Wt		300#	BIT
	Hammer Fall		12"	

	Date	Time
START	6/4/94	
COMPLETE	6/4/94	
TOTAL HRS.		

BORING FOREMAN P. Vieira
INSPECTOR
SOILS ENGR.

LOCATION OF BORING

DEPTH	Casing Blows per foot	Sample Depths From - To	Type of Sample	Blows per 6" on Sampler From To 0-6	6-12	12-18	Moisture Density or Consist	Strata Change Elev	SOIL IDENTIFICATION Remarks include color, gradation, Type of soil etc. Rock-color, type, condition, hardness, Drilling time, seams and etc	SAMPLE No	Pen	Re
								6"	Asphalt			
		6"-1'6"	D	Blows	not	Taken	(3½")		Brown medium SAND & Gravel, Cobbles	1	12"	12
		1'6"-2'6"	D	"	"	"	(2½")	2'6"	Brown medium SAND	2	12"	8"
									Bottom of Boring 2'6"			

GROUND SURFACE TO ______ USED ______ " CASING THEN ______

Sample Type
D: Dry C: Cored W: Washed
UP: Undisturbed Piston
TP: Test Pit A: Auger V: Vane Test
UT: Undisturbed Thinwall

Proportions Used	
trace	0 to 10%
little	10 to 20%
some	20 to 35%
and	35 to 50%

140 lb Wt. x 30" fall on 2" O D Sampler

Cohesionless Density		Cohesive Consistency		
0-10	Loose	0-4	Soft	30 + Hard
10-30	Med. Dense	4-8	M/Stiff	
30-50	Dense	8-15	Stiff	
50 +	Very Dense	15-30	V-Stiff	

SUMMARY:
Earth Boring 2'6"
Rock Coring
Samples 2

HOLE NO B-111