DRAFT REPORT

CONFIRMATORY SURVEY OF McGEAN-ROHCO BUILDING 3A, 4, 9, 10C, 10D, 10E, 18 AND RELATED EQUIPMENT CHEMETRON CORPORATION CUYAHOGA HEIGHTS, OHIO

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Prepared for the
U.S. Nuclear Regulatory Commission
Division of Waste Management and Region III Office

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION
Environmental Survey and Site Assessment Program
Environmental and Health Sciences Division

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ABBREVIATIONS AND ACRONYMS

µR/h	microroentgens per hour
µrem/h	microrem per hour
AEC	Atomic Energy Commission
ASME	American Society of Mechanical Engineers
ATC	antimony trichloride
BKG	background
cm	centimeter
cm^2	square centimeter
CMC	Chemetron Corporation
cpm	counts per minute
DOE	U.S. Department of Energy
dpm/100 cm^2	disintegration per minute per 100 square centimeters
DU	depleted uranium
EML	Environmental Measurements Laboratory
EPA	Environmental Protection Agency
ESSAP	Environmental Survey and Site Assessment Program
GM	Geiger-Mueller
ha	hectare
kg	kilogram
km	kilometer
m	meter
m^2	square meter
MCR	McGean-Rohco Incorporated
MDC	minimum detectable concentration
MeV	million electron volts
mm	millimeter
NaI	sodium iodide
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
pCi/L	picocuries per liter

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INTRODUCTION

In 1965, the Atomic Energy Commission (AEC), a predecessor of the U.S. Nuclear Regulatory Commission (NRC) issued to Chemetron Corporation (CMC) Source Material License No. SUB-852, which authorized Chemetron's possession and use of depleted UF_6 for conversion to U_3O_8 at the Harvard Avenue facility. The facility was used to produce a chemical catalyst utilizing primarily the south end of Building 21 at the Harvard Avenue site from 1965 to 1972. By February 1972, the manufacture of the catalyst had been terminated, and in December 1973, the license was amended to authorize storage only for the remaining depleted uranium (DU). No activities involving source material, other than decontamination, have been conducted at the site since the termination of the catalyst production. In 1974, the catalyst production equipment housed in the south end of Building 21 was dismantled and shipped to a CMC subsidiary in Louisville, Kentucky.

In 1975, the McGean Chemical Company, Inc., the predecessor to McGean-Rohco Incorporated (MCR), purchased the Harvard Avenue site. Chemetron, however, retained the license and responsibility for the depleted uranium at the facility. In 1979, a revised license (License Number SUB-1357) was issued to CMC by the NRC which allowed CMC to possess DU in the form of contaminants at the Harvard Avenue site.

Chemetron performed characterization surveys and then remediated any residual contamination. After removing the residual contamination, Chemetron performed final status surveys that included surface scans of the building and equipment surfaces, direct measurements and sampling to determine total and removable contamination, and exposure rate measurements. Chemetron's final release survey results indicated that the buildings and equipment met the NRC requirements for release for unrestricted use.

At the request of the U.S. Nuclear Regulatory Commission's Division of Waste Management and Region III Office, the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) performed an independent radiological survey of several of the McGean-Rohco Inc. buildings, a railroad spur, and a 100 square meter (m^2) outdoor area adjacent to Building 1.

SITE DESCRIPTION

The property required to be remediated by Chemetron Corporation is owned by McGean-Rohco, Inc., and is located at 2910 Harvard Avenue in the suburb of Cuyahoga Heights, Ohio (Figure 1). The facility is located in a mixed industrial and residential area approximately six kilometers (km [4 miles]) south of downtown Cleveland. The portion of the McGean-Rohco, Inc., facility on which licensed activities were performed is known as the Harvard Avenue site. The Harvard Avenue site is located on the west side of the property and borders the Aluminum Company of America property. This portion of the property consists of approximately 1.2 hectares (ha [3 acres]) and has been cleared of buildings and debris as part of previous decontamination and remediation activities (RMC 1985). Currently, McGean-Rohco, Inc. operates a chemical manufacturing facility which is located to the east of the Harvard Avenue site and consists of thirteen main buildings and several auxiliary buildings—this portion of the site is referred to as the McGean-Rohco Complex. The McGean-Rohco Complex site boundaries are Harvard Avenue to the north, the Harvard Avenue site to the west, the Newburgh and South Shore Railroad to the south, and the Ohio Crankshaft Company to the east (Figure 2).

The buildings surveyed were 3A, 4, 9, 10C, 10D, 10E, 18, including equipment associated with processes in those buildings. The buildings and their past and current use are identified as follows:

- Building 3A: The building was originally used as a foundry and later converted for processing antimony trichloride (ATC). Current usage is for storage of products produced by McGean-Rohco, Inc., that are to be shipped out to customers at a later date. No processing currently takes place in any section of the building.

- Building 4: This building was previously used as the tin oxide mill processing building. Currently, the building is mainly used for storing products and materials.

- Building 9: This building has been and is currently a foundry for nickel plating and brass balls. The building also houses the plant's laundry room, a shower room, and an office.

- Building 10C: This building has been and is currently used for chrome plate processing.

- Building 10D: This building was previously used for processing miscellaneous salts and plating materials. Currently, the building is being used for processing miscellaneous salts.

- Building 10E: This building was previously used for cyanide production and is currently being used for processing nickel hydrate.

- Building 18: There was no information regarding the history of this building in the data packages.

- A 100 m^2 area immediately adjacent to Building 1.

- An area immediately outside of the south perimeter fence to include a 10-meter wide strip of the entire Newburgh and South Shore Railroad bed.

OBJECTIVES

The objectives of the confirmatory survey are to provide independent document reviews and radiological data for use by the NRC in evaluating the adequacy and accuracy of the licensee's procedures and final status survey results.

DOCUMENT REVIEW

ESSAP has reviewed the licensee's radiological survey data. Procedures and methods used by the licensee were reviewed for adequacy and appropriateness (CMC 1993 and 1995). The data were reviewed for accuracy, completeness, and compliance with guidelines (CMC 1996a and b).

PROCEDURES

During the period of June 17 through 20, 1996, ESSAP performed a confirmatory survey of McGean-Rohco Buildings 3A, 4, 9, 10C, 10D, 10E, 18, and related equipment associated with processes in those buildings. At the request of NRC, Building 4 was included in the confirmatory survey after ESSAP had arrived on-site. The survey was in accordance with a plan dated June 13, 1996 (ORISE 1996a) submitted to and approved by the NRC's Division of Waste Management. Survey procedures were performed in accordance with the ORISE/ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 1995a and b). This report summarizes the procedures and results of the survey.

INTERIOR SURVEY PROCEDURES

The following surveyed areas were designated as affected areas: Building 3A, first floor; Building 4, first floor; Building 9, first floor and mezzanine; Buildings 10C and 10E, first floor and mezzanine; and Building 10D, first floor and mezzanines. The remaining areas were designated as unaffected areas.

Reference System

ESSAP referenced measurement and sampling data to both the licensee's grid system and to prominent building features, and recorded the survey information on appropriate field drawings. Measurement and sampling locations on equipment and components were identified on figures prepared by ESSAP.

Surface Scans

Surface scans for beta and gamma activity were performed over a minimum of 10% of floor, lower wall (up to 2 meters), and equipment surfaces, and a minimum of 5% of upper surfaces (above 2 meters and including mezzanines) in the affected areas. ESSAP randomly selected 25% of the unaffected survey units and performed beta and gamma surface scans over a minimum of 10% of floor, lower wall, and equipment surfaces in these areas. Scans were performed using gas proportional, GM, and/or NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation identified by surface scans were marked for further investigation.

Surface Activity Measurements

Initially, construction material specific backgrounds—for brick, concrete, metal, painted brick, and wood—were determined in areas of similar construction but without a history of radioactive material use.

A total of 236 direct measurements for total beta surface activity levels were performed on building and equipment surfaces. In addition, one five-point measurement was performed to determine the 1 m^2 grid block average beta surface activity. Direct measurements were performed using gas proportional or GM detectors coupled to ratemeter-scalers. A smear sample for determining removable gross alpha and gross beta activity was collected at each direct measurement location where residual total contamination was determined to be greater than 1000 dpm/100 cm^2. Measurement and sampling locations are shown in Figures 3 through 31.

Exposure Rate Measurements

Background exposure rate measurements were performed at five locations of similar construction, but without a history of radioactive material use. Site exposure rates were measured at one to ten locations within each building surveyed. Exposure rates were measured at 1 meter above the surface using a microrem meter and are shown in Figures 3 through 6, 19, 27, and 31.

Miscellaneous Sampling

One water sample was collected from the pit at the base of the AJAX Turntable in Building 9 (Figure 6).

EXTERIOR SURVEY PROCEDURES

A 100 m^2 area adjacent to Building 1 and the area immediately outside of the south perimeter fence, including the 10-meter wide strip of the entire Newburgh and South Shore Railroad bed, was designated as affected (Figures 32 and 33). The remaining exterior areas were designated as unaffected.

Reference System

ESSAP used the survey grid established by the licensee to reference confirmatory survey measurements and sampling locations.

Surface Scans

Exterior soil surfaces were scanned for gamma radiation over 100% of the 100 m^2 area adjacent to Building 1 and over a minimum of 50% of the railroad spur area using NaI scintillation detectors coupled to ratemeters with audible indicators. Locations of elevated direct radiation identified by surface scans were marked for further investigation.

Exposure Rate Measurements

Area background exposure rate measurements were performed during a previous survey in the vicinity of the site [Figure 34 (ORISE 1992)]. Exposure rates were measured at five locations in the area adjacent to Building 1 and at 22 locations within the railroad spur area (Figures 32 and 33). Exposure rates were measured at 1 meter above the surface using a microrem meter.

Soil Sampling

Background soil samples were collected during a previous radiological survey in the vicinity of the site [Figure 34 (ORISE 1992)].

Three of the 10 m x 10 m grid blocks (D2, G1, and J2) were randomly selected from the 25 grid blocks along the railroad spur. Soil samples were collected at the center and four points equidistant from the center and grid block corners. Five soil samples similarly spaced were collected from the 10 m x 10 m area adjacent to Building 1. Seven additional soil samples were collected from within four railroad spur grids by ESSAP and McGean-Rohco personnel for confirmatory analysis after additional remedial activities. Since portions of grid blocks C2 and C3 were contaminated, ESSAP collected the split samples in a manner to obtain a 100 m^2 average for the southern portion of grid block C2 and the northern portion of grid block C3. Sample locations are shown in Figures 32 and 33.

Confirmatory Analyses

The licensee provided ESSAP with 12 soil samples for analysis, along with the results of their uranium analyses for data comparison. Analytical results for each of these samples were compared to those reported by the licensee.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and survey data were returned to ORISE's ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Sample analyses were performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 1995c). Soil and miscellaneous samples were analyzed by solid state gamma spectrometry. The radionuclide of concern is U-238; however, spectra were reviewed for other identifiable photopeaks. Soil and miscellaneous sample results were reported in units of picocuries per gram (pCi/g). Smears were analyzed for gross alpha and gross beta activity using a low-background gas proportional counter. Smear data and direct measurement data were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Exposure

rates were reported in microroentgens per hour (μR/h). Additional information regarding major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B. The data generated were compared with the licensee's documentation and NRC guidelines established for release for unrestricted use (Appendix C).

FINDINGS AND RESULTS

DOCUMENT REVIEW

ESSAP reviewed the licensee's final survey plan and report, including the final status survey data and comment letters documenting these reviews, were submitted to the NRC (ORISE 1995d, e, f, and 1996b). On May 28, 1996, a telephone conference call was held between CMC, NRC, and ORISE to discuss ORISE concerns regarding the final survey data for the McGean-Rohco Buildings. The results of which were addressed in an NRC letter dated May 31, 1996 (NRC 1996). The licensee's documentation provides an adequate description of the radiological status of the surveyed areas.

INTERIOR

Surface Scans

Surface scans identified several locations of elevated beta activity on the floor and lower walls of Buildings 3A and 9; on the floors of Buildings 4 and 10D; and on equipment surfaces in Buildings 3A, 10D, and 10E. Each of these areas were marked for further investigation.

Surface Activity Levels

Interior total beta surface activity levels and removable alpha and beta activity levels are summarized in Table 1. Initially, total beta activity in all affected and unaffected areas ranged from less than 150 to 11,000 dpm/100 cm^2. Grid block H4 on the floor of the south half of Building 3A exceeded the average guideline. McGean-Rohco personnel were informed of the elevated area. They subsequently remediated the one square meter area and performed additional survey activites. ESSAP then resurveyed the area.

Final total beta activity ranged from less than 150 to 8,200 dpm/100 cm^2, with the 1 m^2 average of 2,700 dpm/100 cm^2. Removable activity was less than 9 dpm/100 cm^2 for gross alpha and ranged from less than 15 to 62 dpm/100 cm^2 for gross beta.

Exposure Rates

Exposure rates are provided in Table 2. Background exposure rates ranged from 6 to 12 µR/h, with an average of 9 µR/h. Exposure rates in the surveyed buildings ranged from 7 to 13 µR/h.

Radionuclide Concentration in Miscellaneous Sample

The total uranium concentration in the water sample, collected from the pit at the base of the AJAX Turntable in Building 9, was 16.5 pCi/L.

EXTERIOR

Surface Scans

Gamma surface scans of exterior areas identified a small area of elevated direct gamma radiation approximately 1 m^2 in area in grid F1 of the railroad spur. McGean-Rohco personnel were informed of the elevated area and removed additional soil. ESSAP resurveyed the area and determined that gamma activity was comparable to background levels. No elevated direct gamma radiation was detected in any of the other remaining soil areas.

Exposure Rates

Background exposure rate measurements ranged from 6 to 11 µR/h, with an average of 9 µR/h (Table 3). Exposure rates were measured at each soil sampling location and ranged from 7 to 12 µR/h. Exposure rates are presented in Table 4.

Radionuclide Concentrations in Soil Samples

Total uranium concentrations in background samples ranged from 1.4 to 6.0 pCi/g and averaged 3.9 pCi/g. Results are summarized in Table 3.

Total depleted uranium in site soil samples was determined by multiplying the measured U-238 concentration, based on Th-234, by 1.5 to account for the U-234 and U-235 concentrations. Total uranium concentrations ranged from 2.0 to 41.4 pCi/g and are shown in Table 4.

Confirmatory Analyses

The licensee's results for U-238 analyses on the twelve soil samples are provided in Table 5. ESSAP's analytical results are consistent with the licensee's analytical results for U-238, with the exception of sample M1-NC-1302.

COMPARISON OF RESULTS WITH GUIDELINES

The primary contaminant at this site is depleted uranium, which emits both alpha and beta radiation in an approximate 1:1.6 ratio. Therefore, either alpha or beta activity may be measured for determining the residual activity of the uranium contaminant. However, the uranium surface activity guidelines specify alpha activity. Because rough or dirty surfaces may selectively attenuate alpha radiation, beta measurements were performed. Based on this, the tabulated beta activity comparison guideline could be increased by a factor of 1.6 to obtain an estimate of the residual alpha activity. Because Chemetron has elected to use the uranium guidelines for both alpha and beta contamination, the use of the alpha activity guideline for residual beta activity is more conservative. Therefore, ESSAP used Chemetron's approach for confirmatory measurements.

The applicable depleted uranium surface activity guidelines are as follows (NRC 1987):

Total Activity

5,000 α dpm/100 cm^2, averaged over a 1 m^2 area

15,000 α dpm/100 cm^2, maximum in a 100 cm^2 area

Removable Activity

1,000 α dpm/100 cm^2

Surface scans for beta activity identified several locations of elevated direct radiation, within interior affected areas, on equipment surfaces, and on exterior areas. Direct measurements were performed at each of these locations, which resulted in two of the locations exceeding the average guideline of 5,000 dpm/100 cm^2. The 1 m^2 average activity level satisfied the average guideline criteria for grid H4 on the floor of Building 3A. The remaining elevated location was taken on the large dryer in Building 10E. A total of four measurements were performed on the dryer. Total beta activity was slightly below the average guideline value at each measurement location, with the exception of one location on the concrete base, which had activity of 5,600 dpm/100 cm^2.

Soil concentrations for residual uranium wastes in soil are presented in the NRC's Branch Technical Position on "Disposal or Onsite Storage of Thorium and Uranium Wastes from Past Operations (NRC 1981)." The following soil guideline was used for comparison with results:

Depleted Uranium (U-238 + U-235 + U-234): 35 pCi/g

Surface scans for gamma activity identified one location of elevated surface activity in the railroad spur area. Concentrations of total uranium ranged from 2.0 to 41.4 pCi/g, with one sample exceeding the uranium guideline value, after subtraction of background. This sample was one of five taken within a 100 m^2 area including Grids C2 and C3. The average soil concentration for the 100 m^2 area was 18.6 pCi/g. All remaining soil samples met the established guideline value.

Confirmatory analysis of the 12 soil samples provided by the licensee showed an overall consistency between ESSAP's and the licensee's analytical results.

The NRC guideline for exposure rates at 1 m above the surface is 10 μR/h above background (NRC 1991). All interior and exterior exposure rates were within the guideline limits.

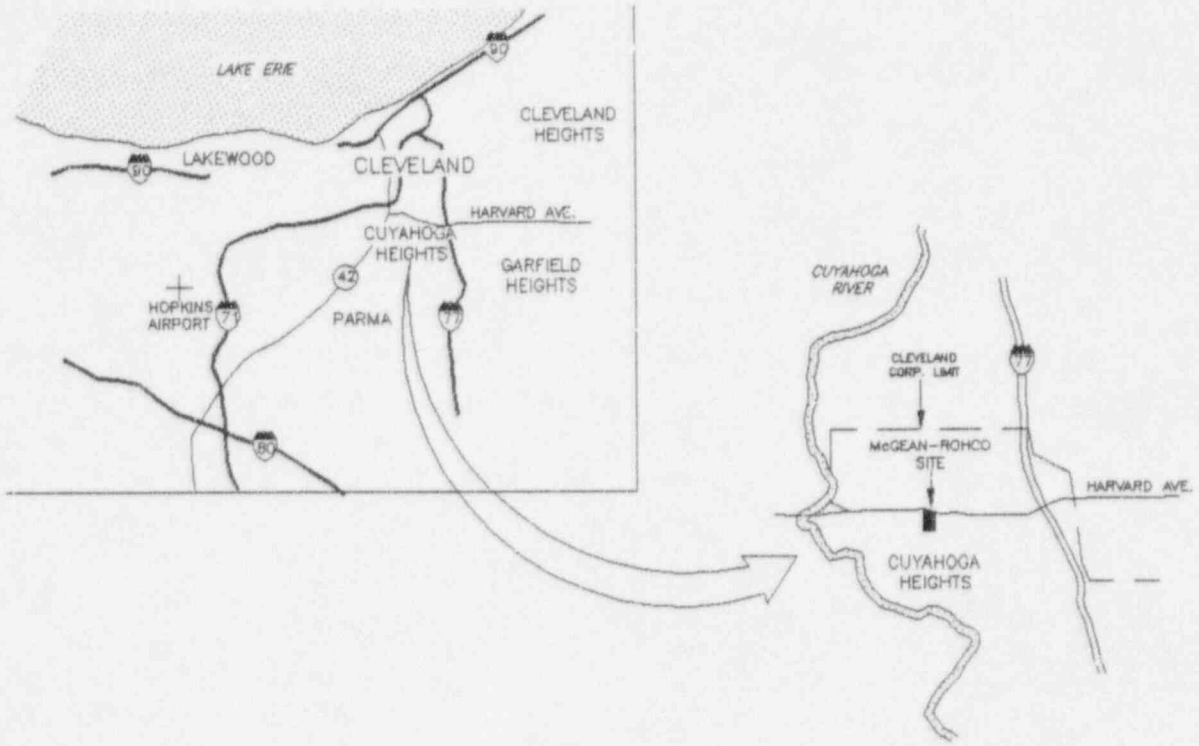
SUMMARY

During the period of June 17 through 20, 1996, at the request of the NRC's Division of Waste Management, the Environmental Survey and Site Assessment Program of ORISE performed a confirmatory survey of several of the McGean-Rohco Inc. buildings, a railroad spur, and a 100 m^2 area adjacent to Building 1 in support of the Chemetron Corporation's remediation activities in Cuyahoga Heights, Ohio. Survey activities included document reviews, surface scans, direct measurements, smear sampling, soil and miscellaneous material sampling, and exposure rate measurements.

The confirmatory survey identified elevated direct beta activity on the floor of Building 3A. Surface activity at each of these locations was isolated and when averaged with additional measurements over a 1 m^2 area met the NRC average surface activity guideline. Also, residual activity near the average guideline was present throughout the large dryer in Building 10E.

Gamma surface scans of soil areas along the railroad tracks identified one location of elevated activity—determined by surface scans to be confined to an area of 1 m^2 or less—which was remediated. Analytical results of final soil samples were all within acceptable guideline limits.

The confirmatory survey results for the surveyed areas are consistent with those of the licensee and support the conclusion that residual surface activity levels and radionuclide concentrations in soil satisfy the guidelines for release for unrestricted use.



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NOT TO SCALE

FIGURE 1: McGean-Rohco Site, Cuyahoga Heights, Ohio

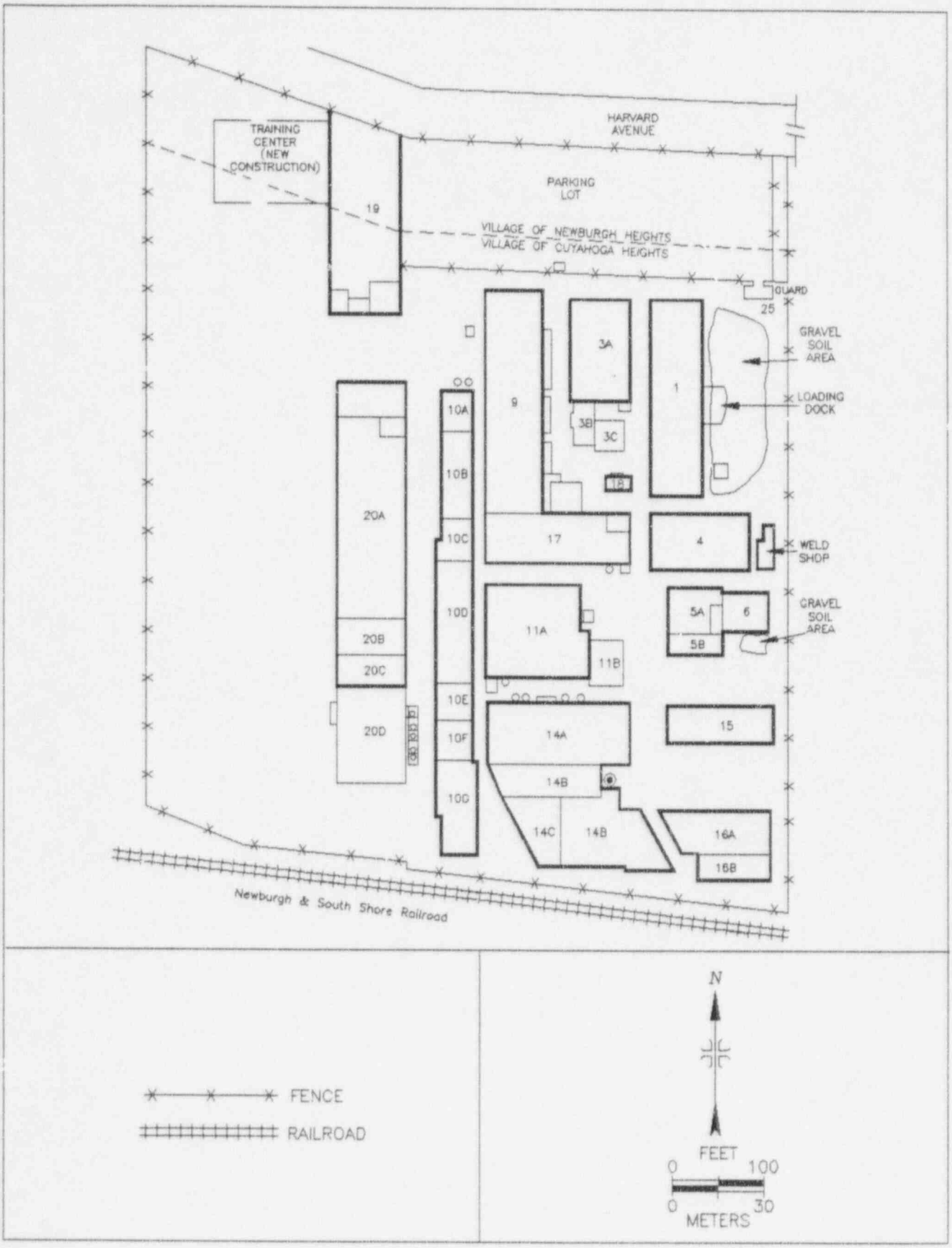


FIGURE 2: Plot Plan of McGean-Rohco, Inc.

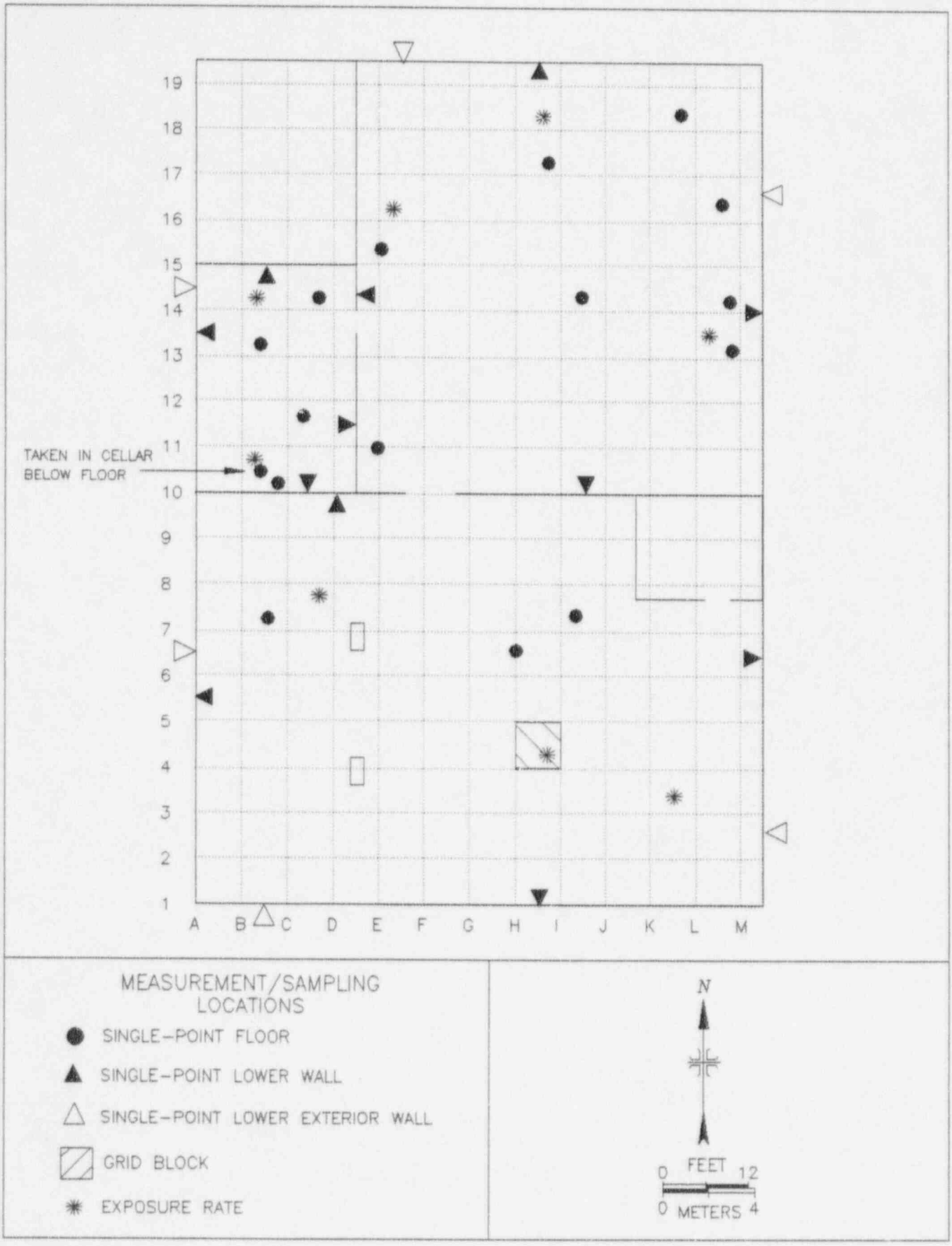


FIGURE 3: Building 3A – Measurement and Sampling Locations

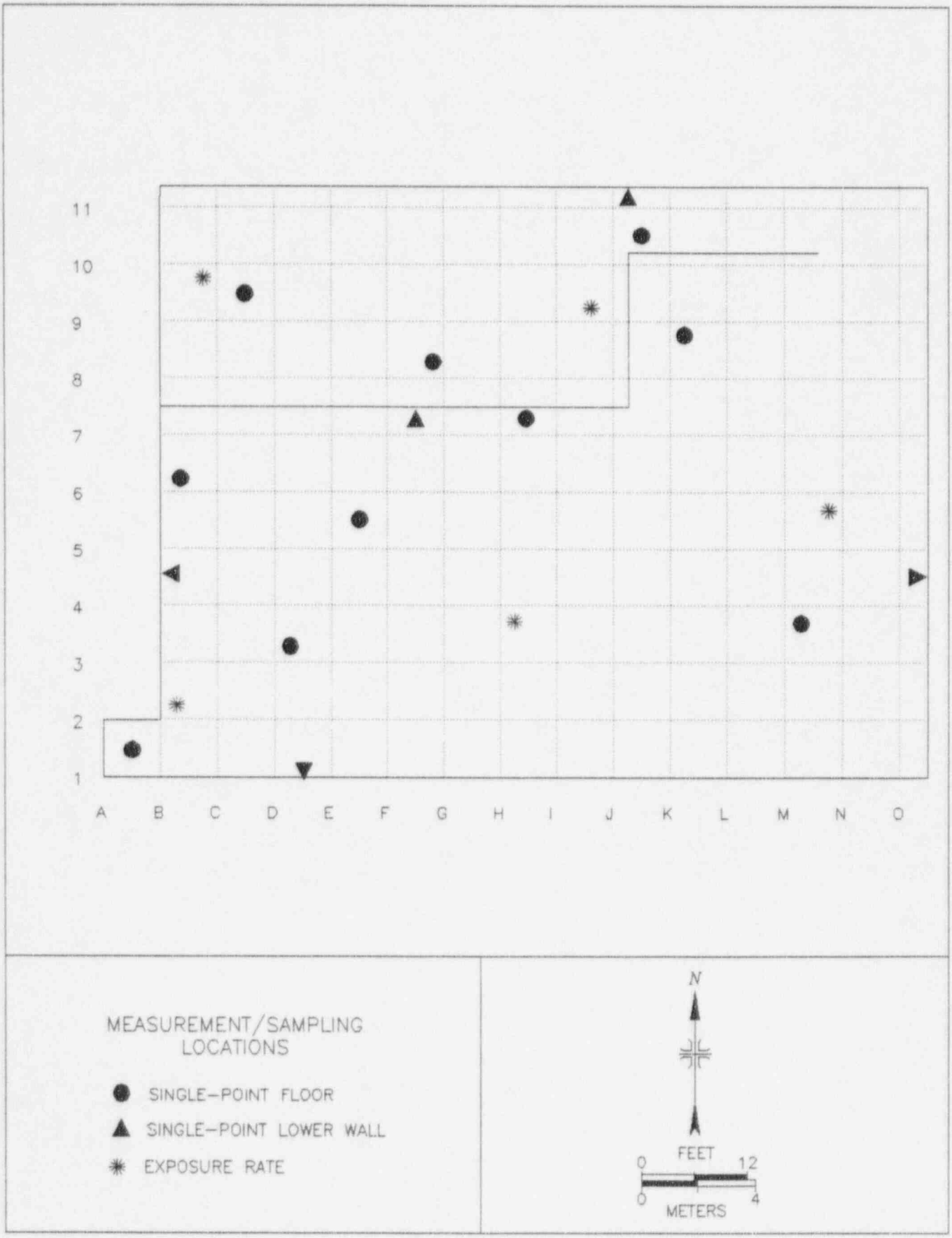
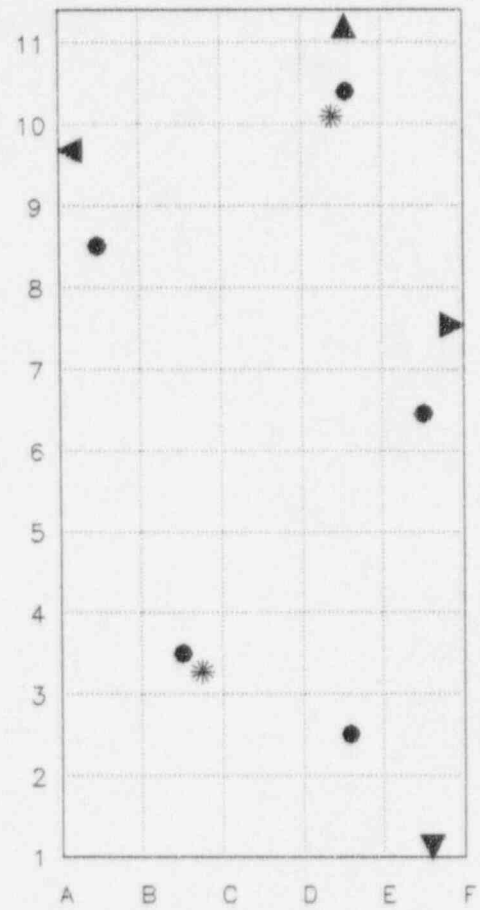


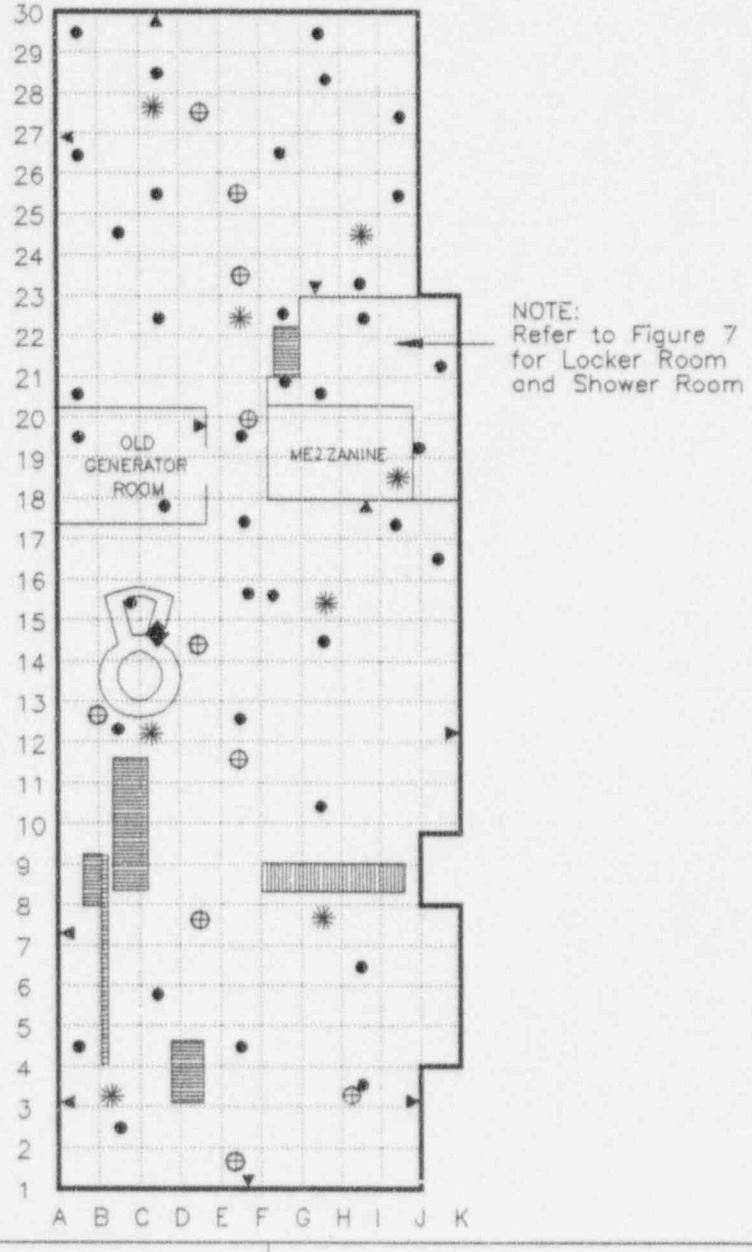
FIGURE 4: Building 4, East Room – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

- SINGLE-POINT FLOOR
- SINGLE-POINT LOWER WALL
- EXPOSURE RATE

FIGURE 5: Building 4, West Room – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

- SINGLE-POINT FLOOR
- SINGLE-POINT LOWER WALL
- SINGLE-POINT UPPER SURFACE
- EXPOSURE RATE
- WATER SAMPLE

FIGURE 6: Building 9 – Measurement and Sampling Locations

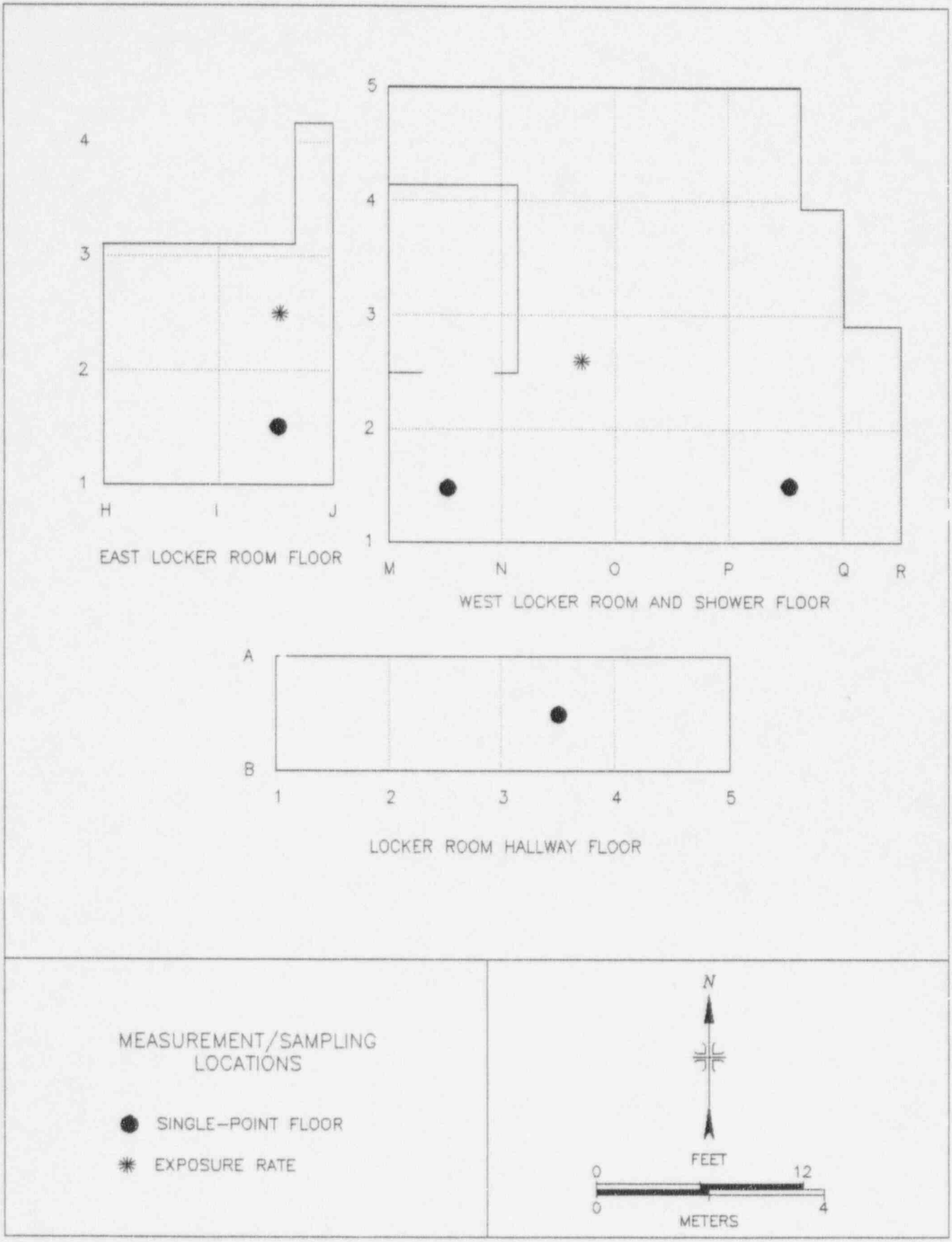
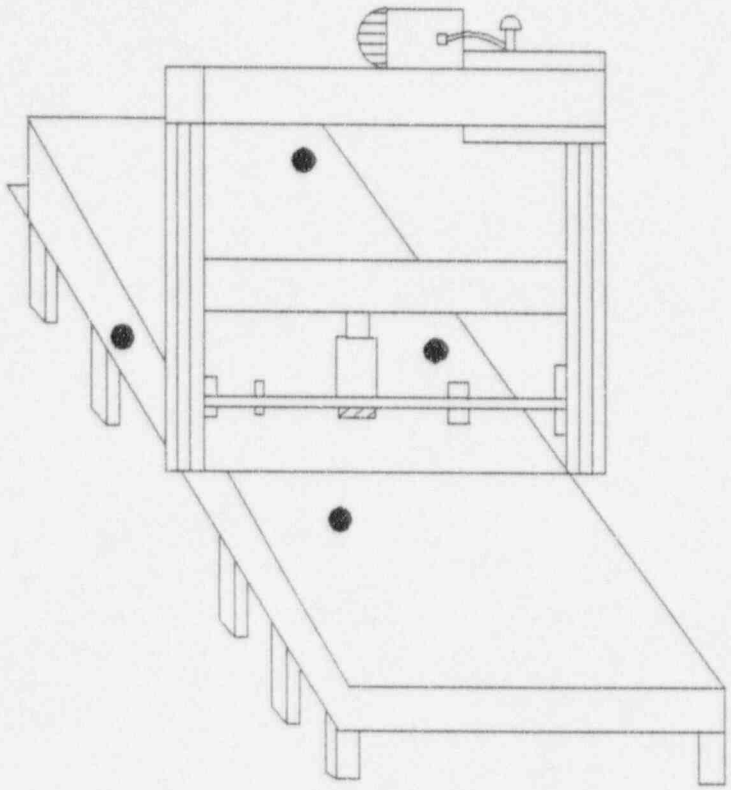


FIGURE 7: Building 9, East and West Locker Rooms, Shower, and Hallway – Measurement and Sampling Locations

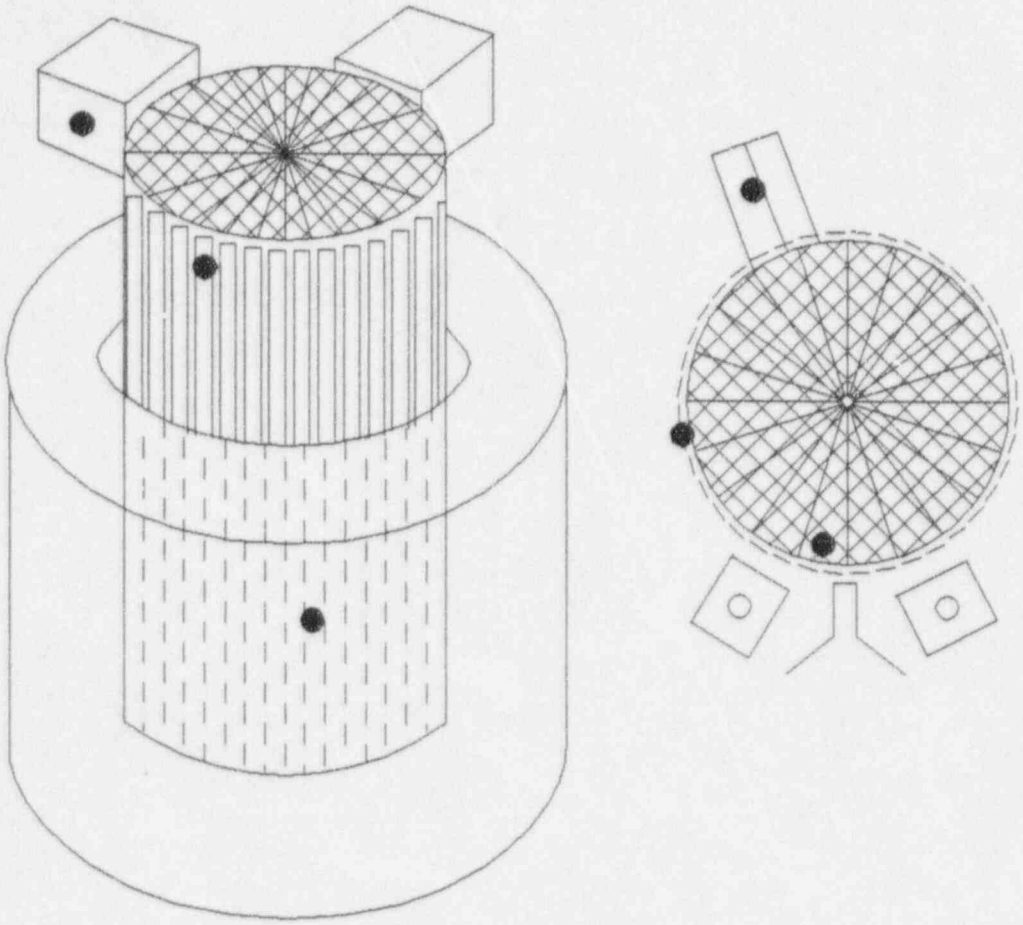


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 8: Building 9, Milling Machine – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

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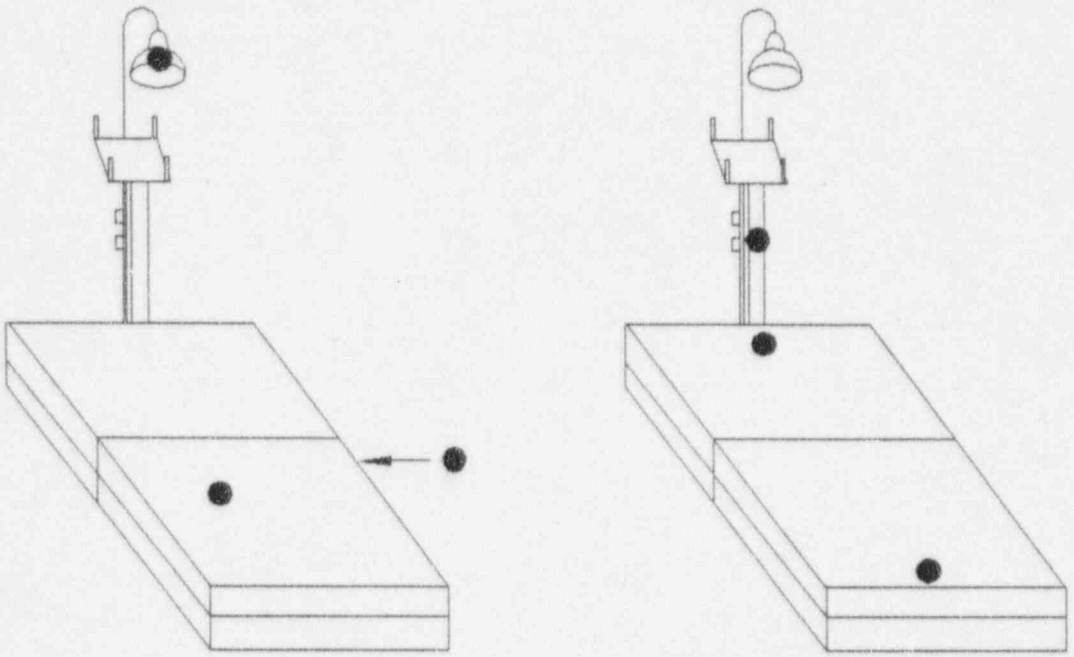
FIGURE 9: Building 9, AJAX Turntable – Measurement and Sampling Locations

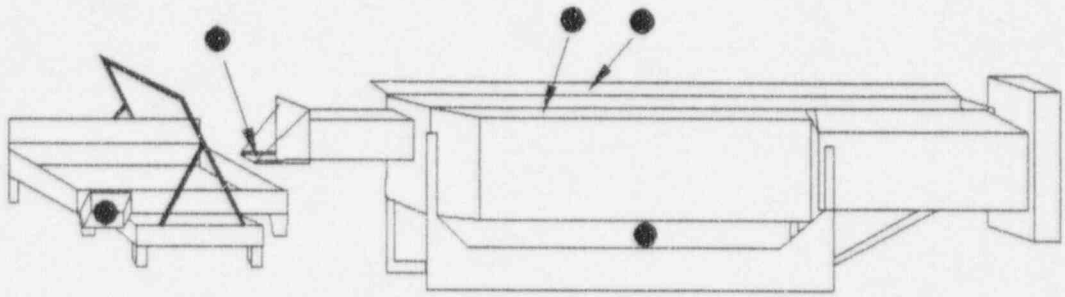


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 10: Building 9, Scales – Measurement and Sampling Locations

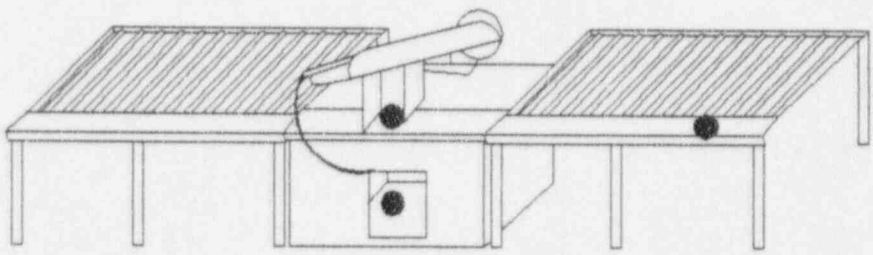


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 11: Building 9, Tumbler – Measurement and Sampling Locations

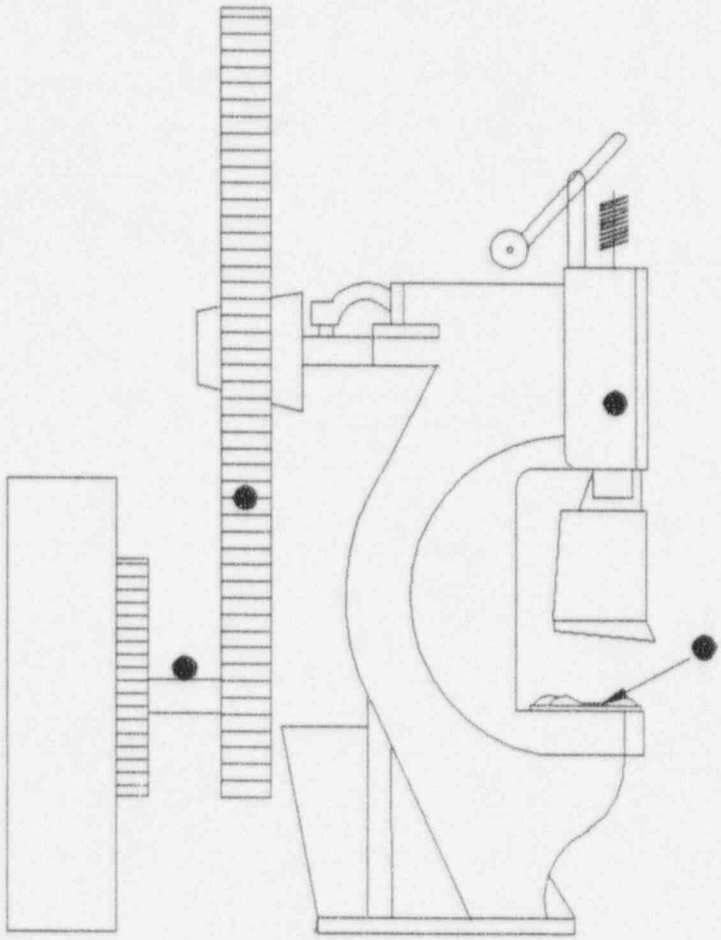


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 12: Building 9, Saw #1 – Measurement and Sampling Locations

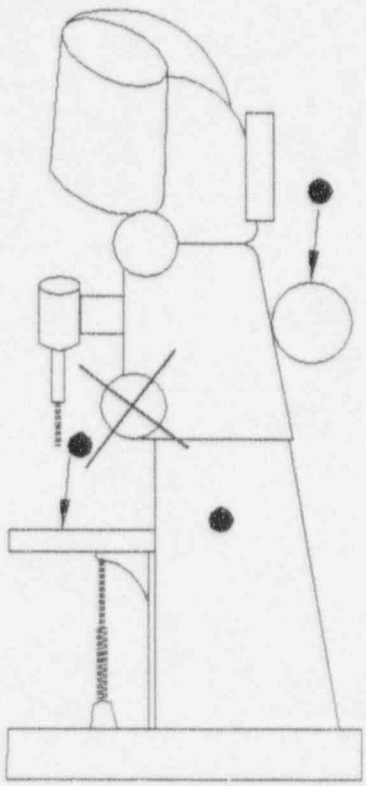


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 13: Building 9, Press #1 – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 14: Building 9, Drill Press #4 – Measurement and Sampling Locations

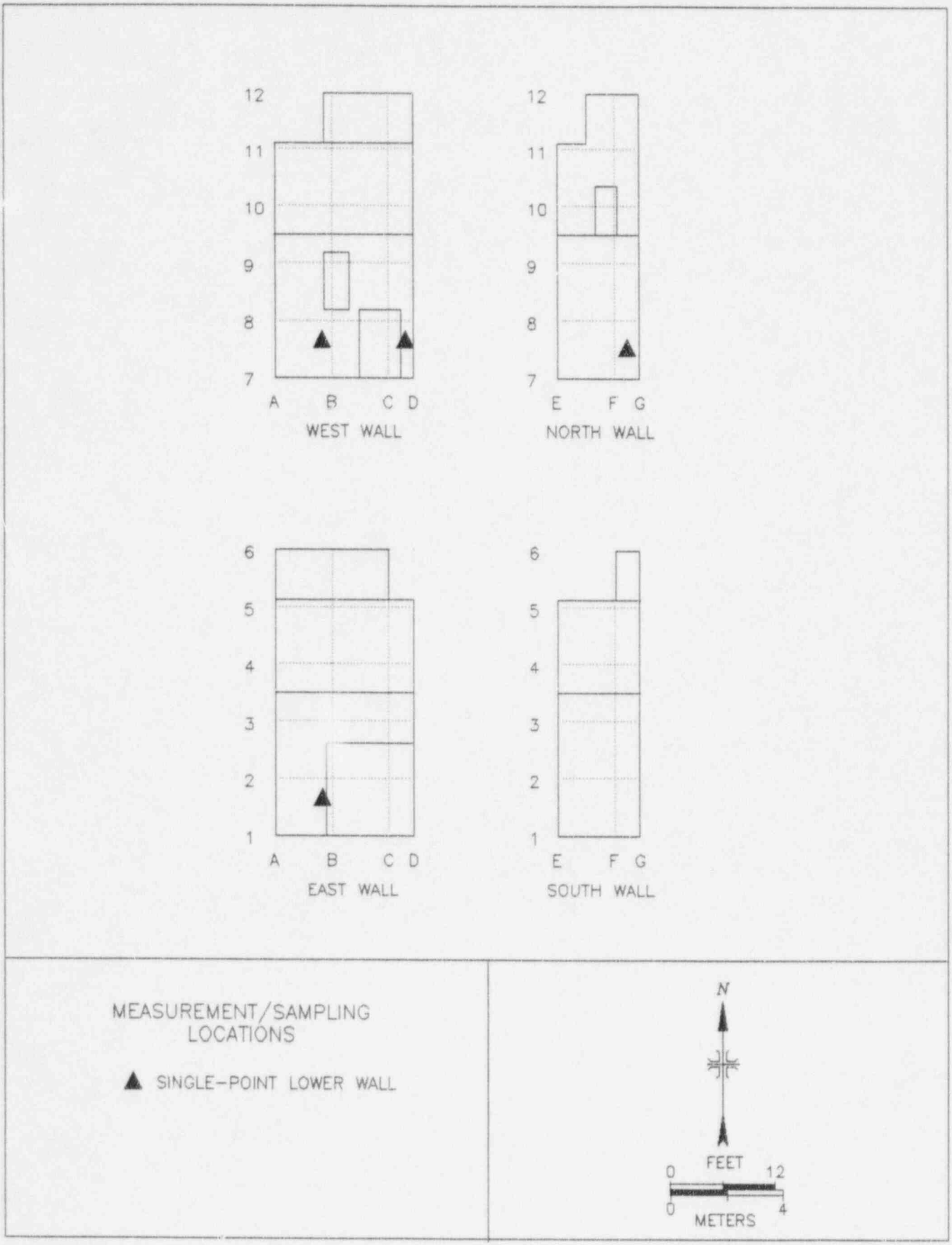


FIGURE 15: Building 10C, Reactor Room Walls – Measurement and Sampling Locations

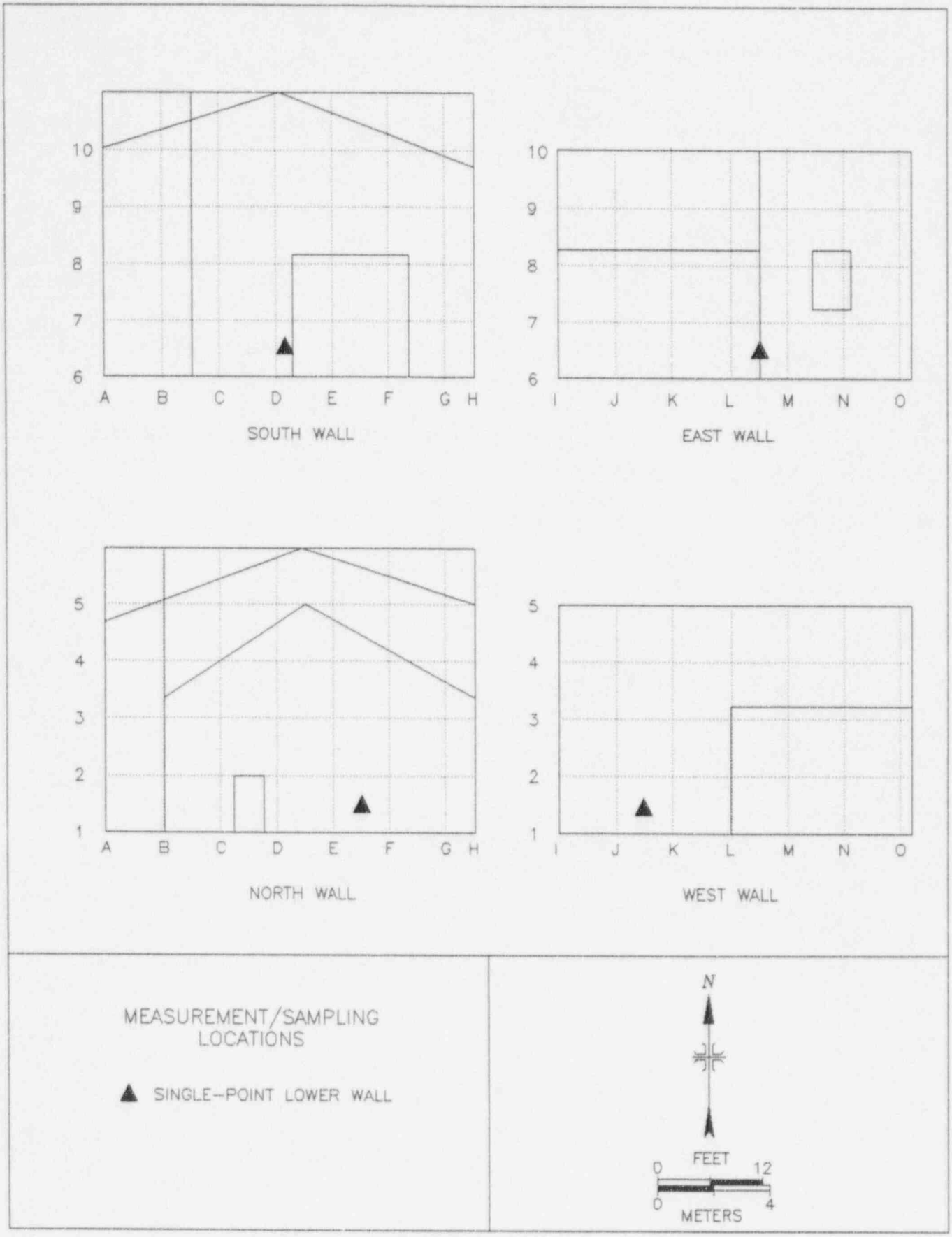
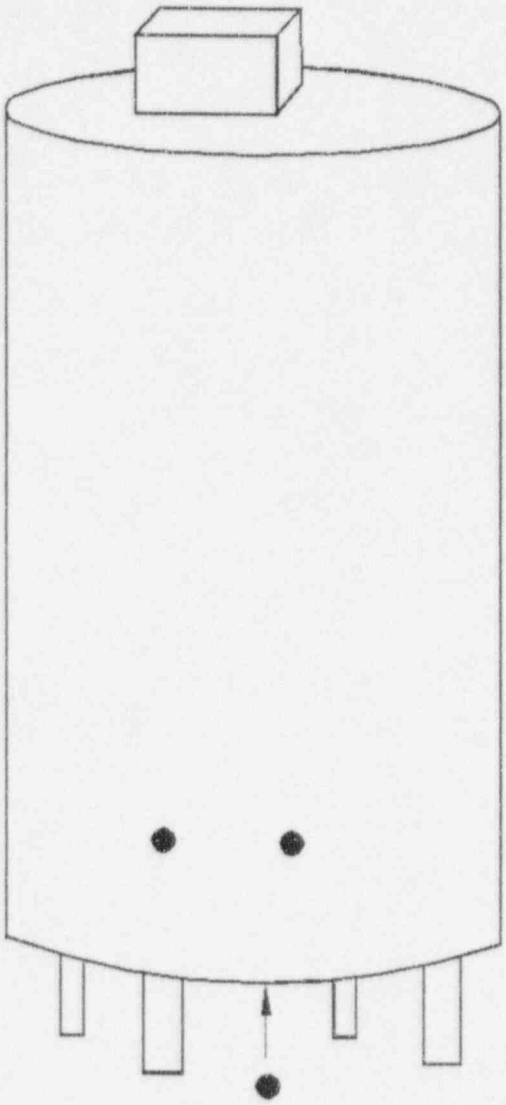


FIGURE 16: Building 10C, Walls – Measurement and Sampling Locations

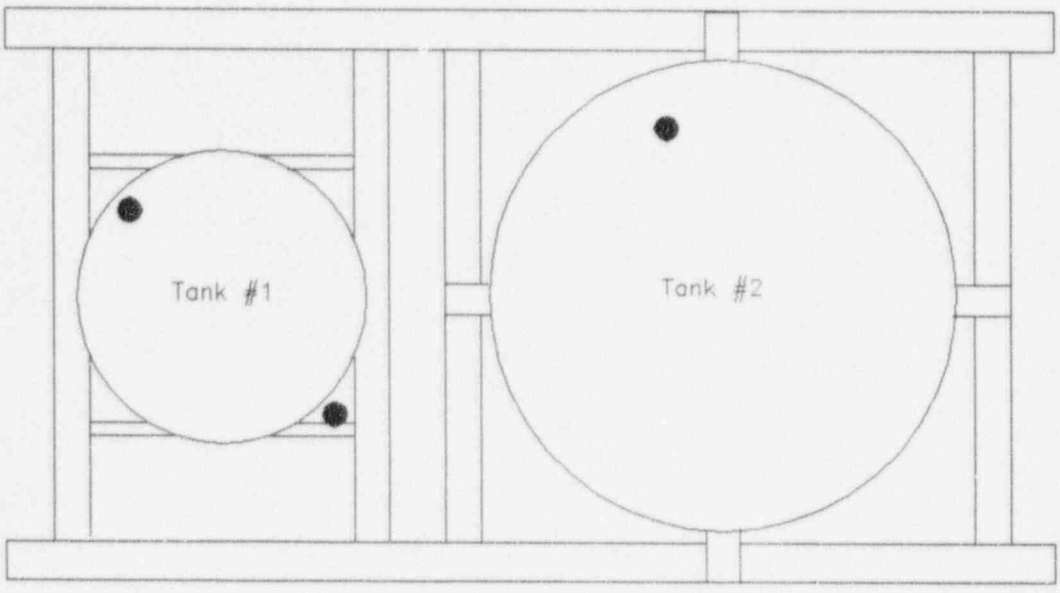


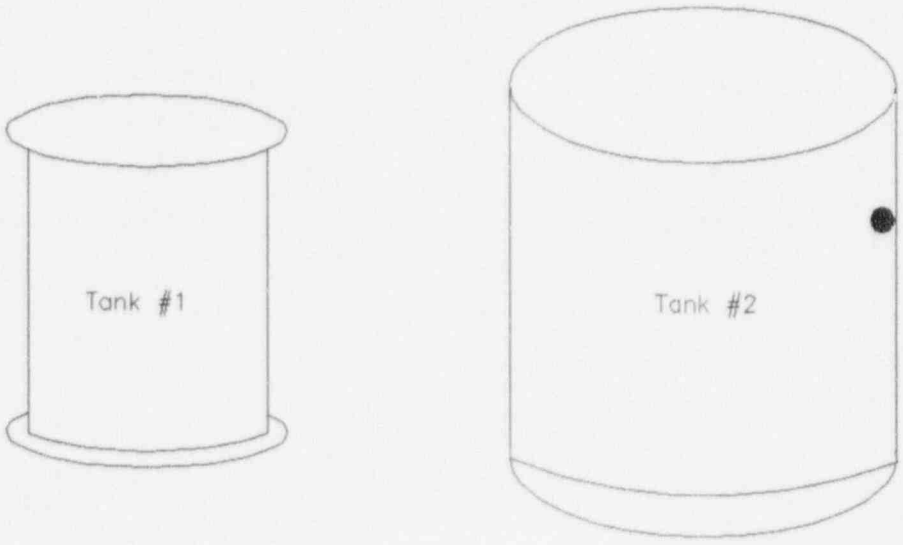
MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 17: Building 10C, Holding Tank #281 – Measurement and Sampling Locations



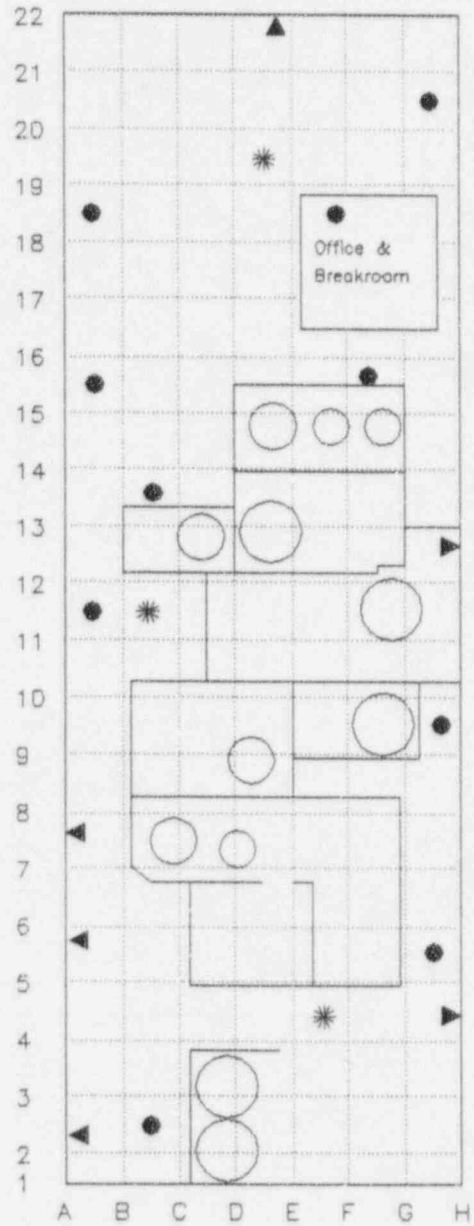


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

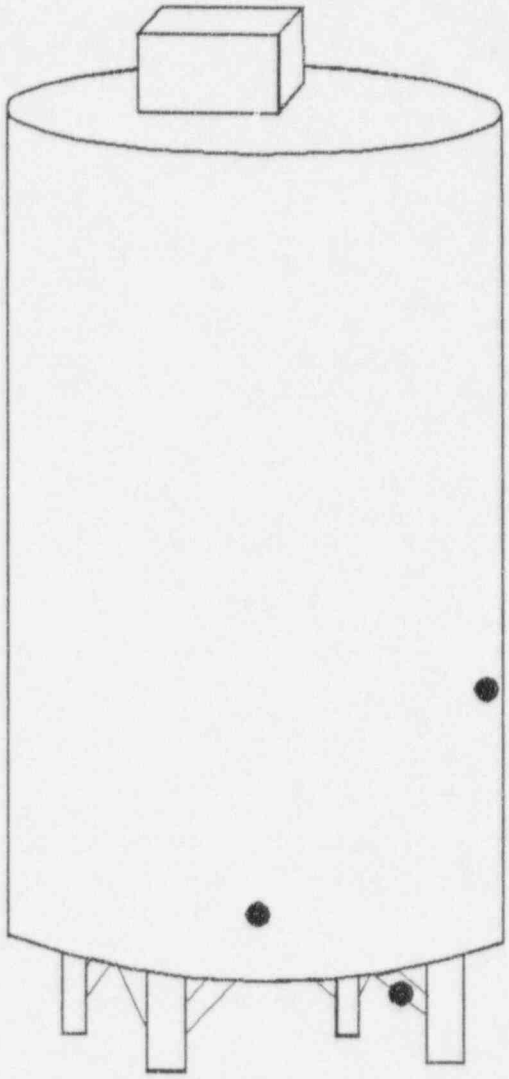
FIGURE 18: Building 10C, Reactor Room Tank Assembly (2nd Mezzanine) – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

- ● SINGLE-POINT FLOOR
- ▲ SINGLE-POINT LOWER WALL
- ✳ EXPOSURE RATE

FIGURE 19: Building 10D, East Side of First Floor – Measurement and Sampling Locations

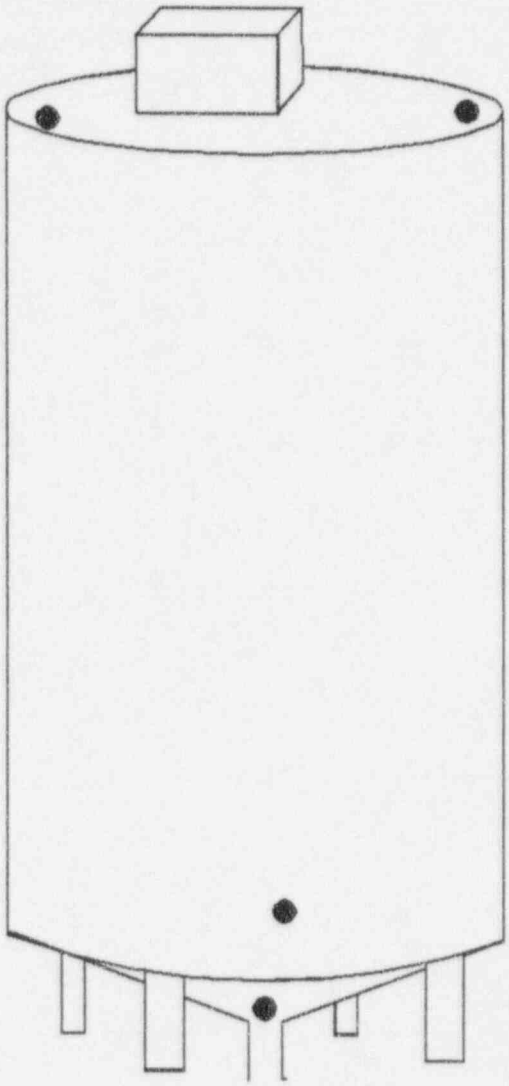


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 20: Building 10D, Holding Tank A – Measurement and Sampling Locations

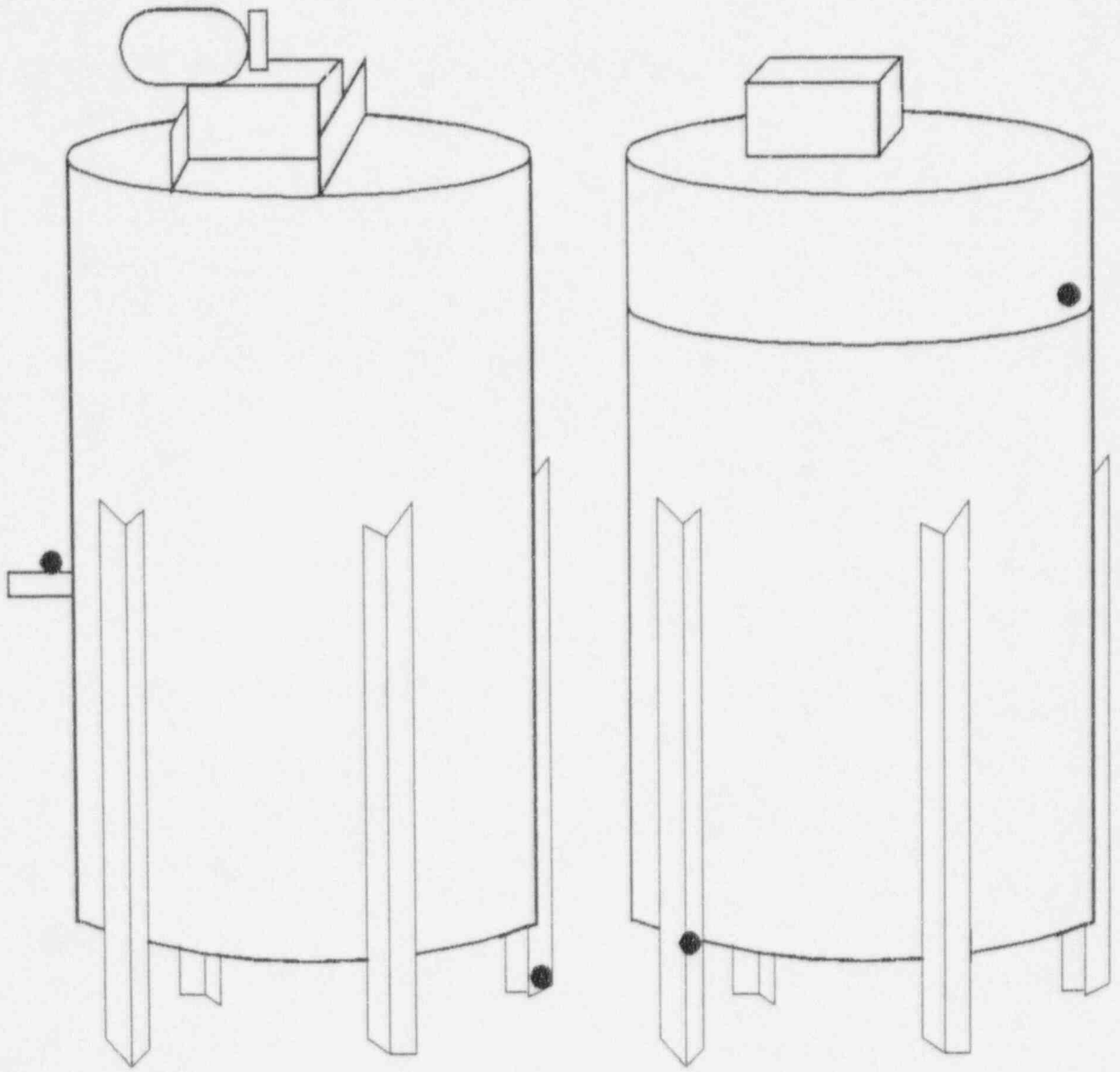


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 21: Building 10D, Holding Tank G – Measurement and Sampling Locations

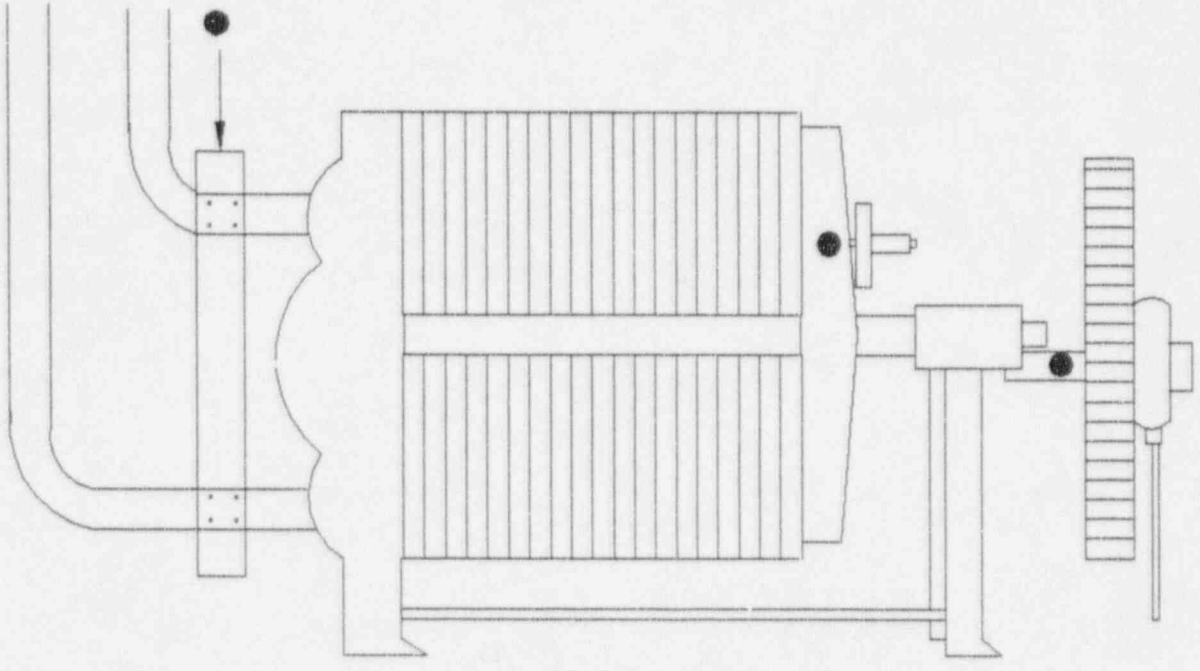


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 22: Building 10D, Holding Tanks T-12 & T-14 – Measurement and Sampling Locations

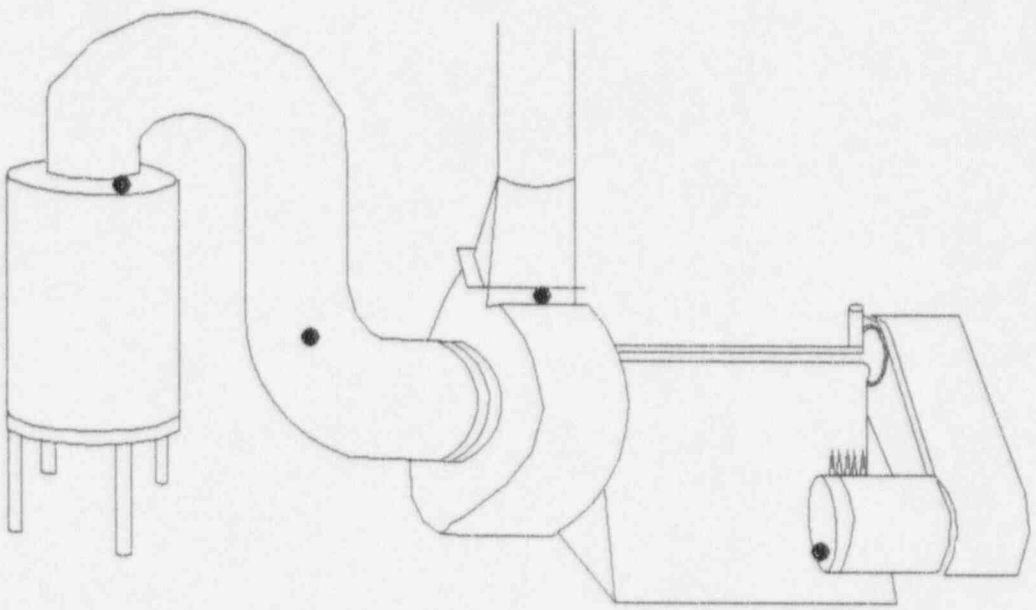


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 23: Building 10D, Filter Press #1 – Measurement and Sampling Locations

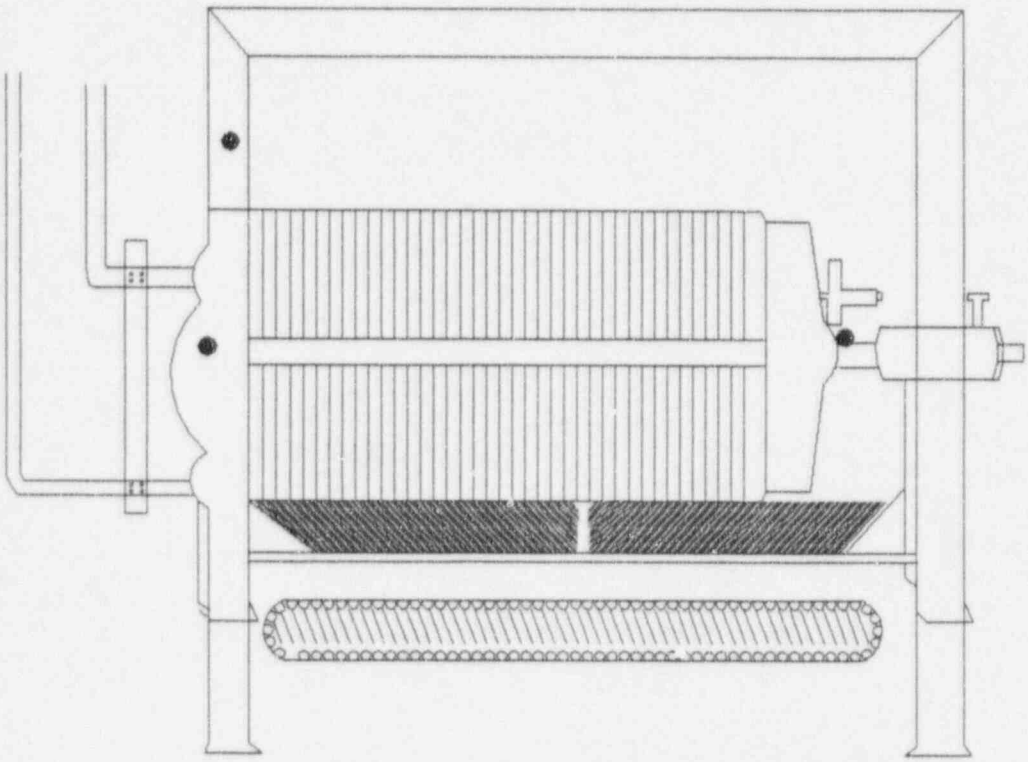


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE–POINT EQUIPMENT

NOT TO SCALE

FIGURE 24: Building 10D, Section D, 2nd Mezzanine Motor – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT EQUIPMENT

NOT TO SCALE

FIGURE 25: Building 10D, Section D, Press #4 – Measurement and Sampling Locations

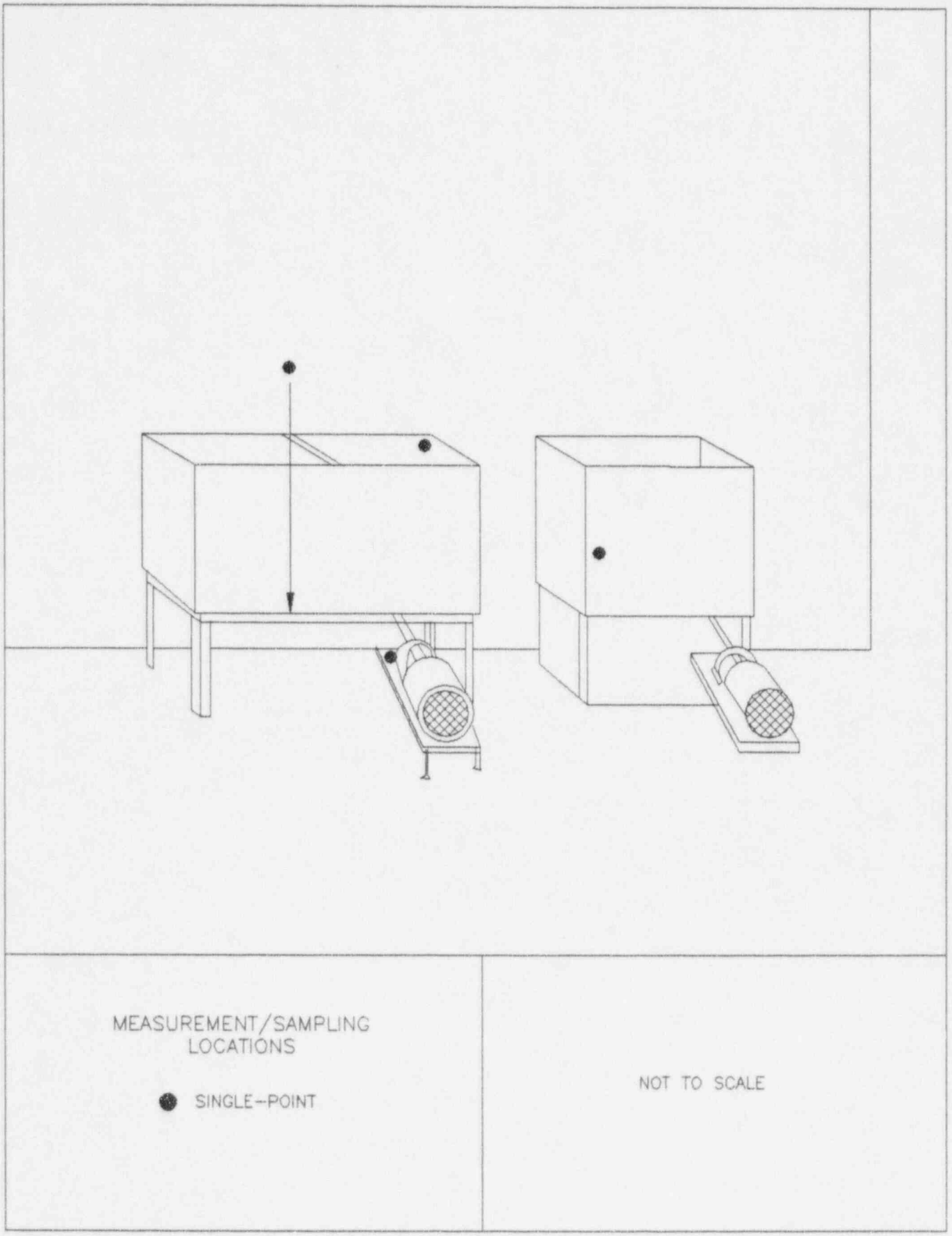
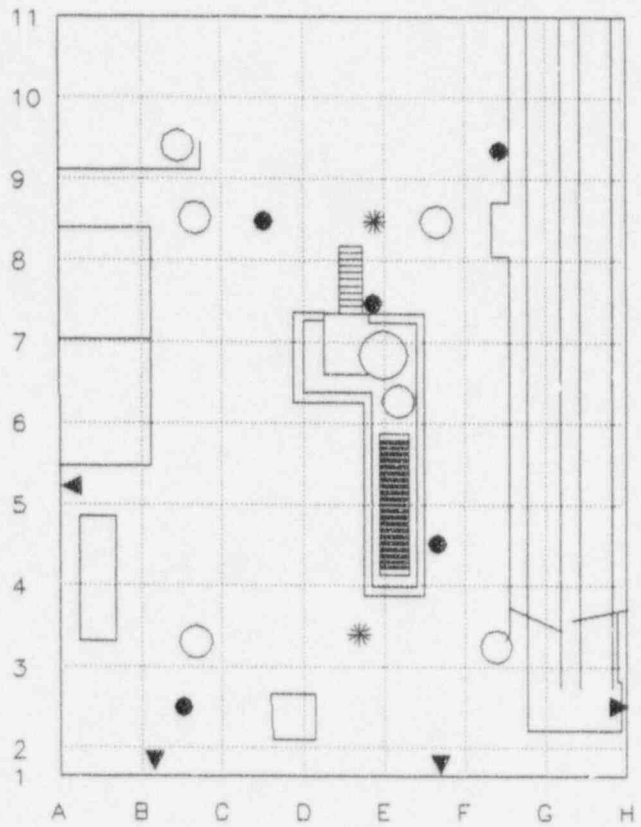


FIGURE 26: Building 10D, Section D, Large and Small Vats – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

- ● SINGLE-POINT FLOOR
- ▲ SINGLE-POINT LOWER WALL
- ✳ EXPOSURE RATE

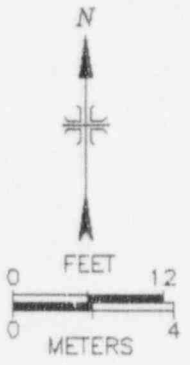
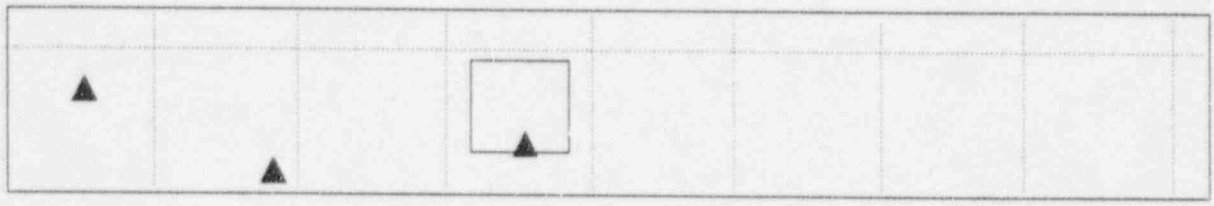
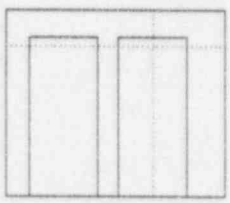


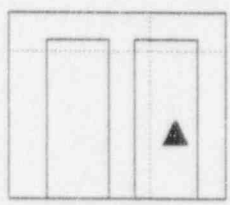
FIGURE 27: Building 10E – Measurement and Sampling Locations



WEST WALL



NORTH WALL

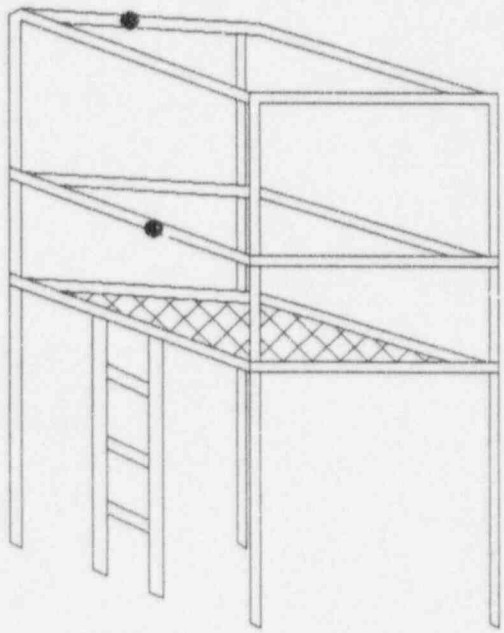


SOUTH WALL

MEASUREMENT/SAMPLING LOCATIONS

▲ SINGLE-POINT LOWER WALL

FIGURE 28: Building 10E, Large Dryer (Exterior) – Measurement and Sampling Locations

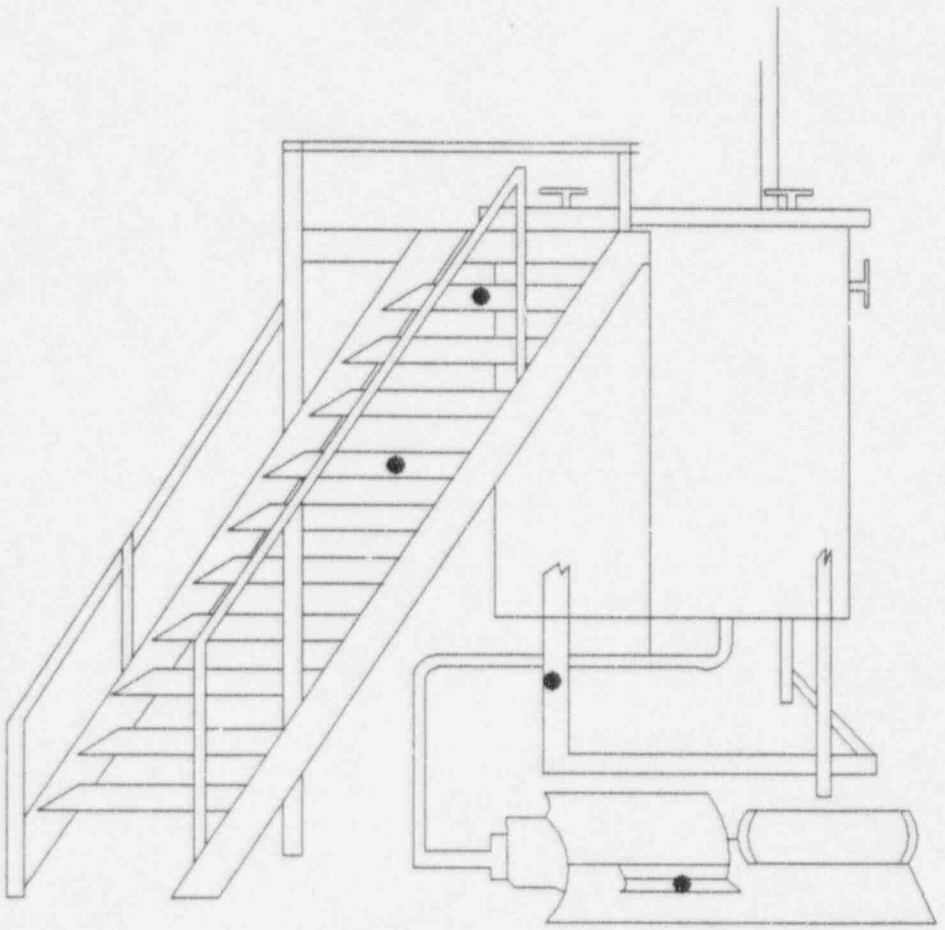


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT

NOT TO SCALE

FIGURE 29: Building 10E, Section E, South Platform – Measurement and Sampling Locations

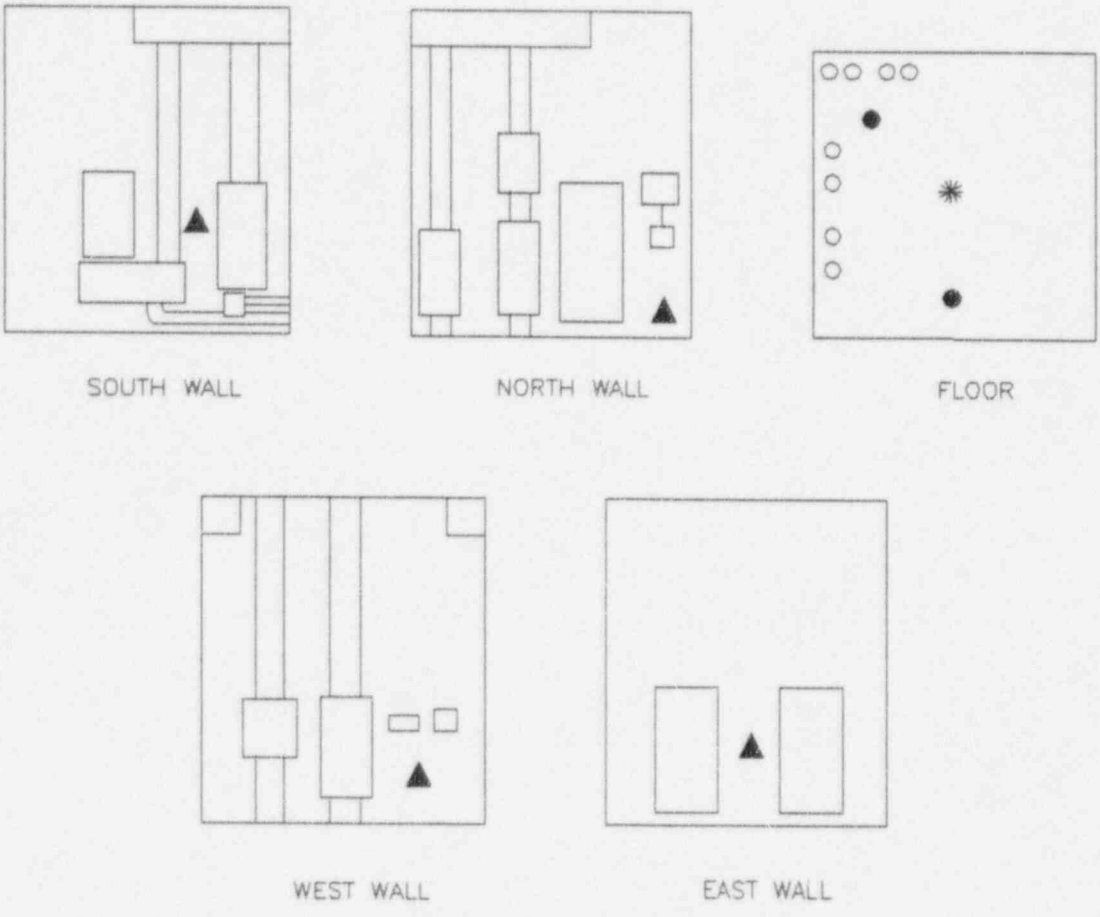


MEASUREMENT/SAMPLING LOCATIONS

● SINGLE-POINT EQUIPMENT

NOT TO SCALE

FIGURE 30: Building 10E, STK-Holding Tank, South Platform - Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

- ● SINGLE-POINT FLOOR
- ▲ SINGLE-POINT LOWER WALL
- ✳ EXPOSURE RATE

FIGURE 31: Building 18, West Room, 2nd Floor – Measurement and Sampling Locations

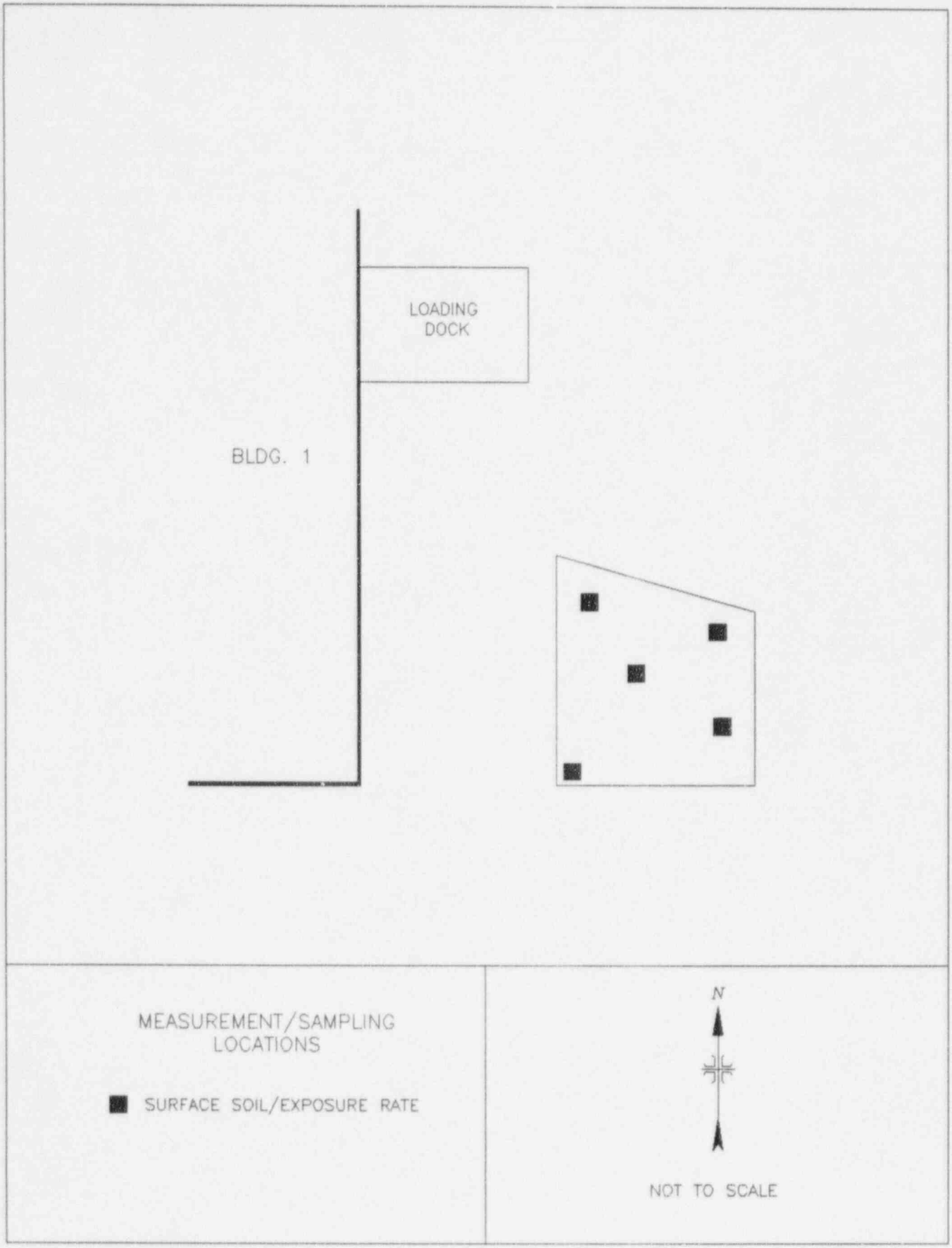


FIGURE 32: Exterior Area Adjacent to Building 1 – Measurement and Sampling Locations

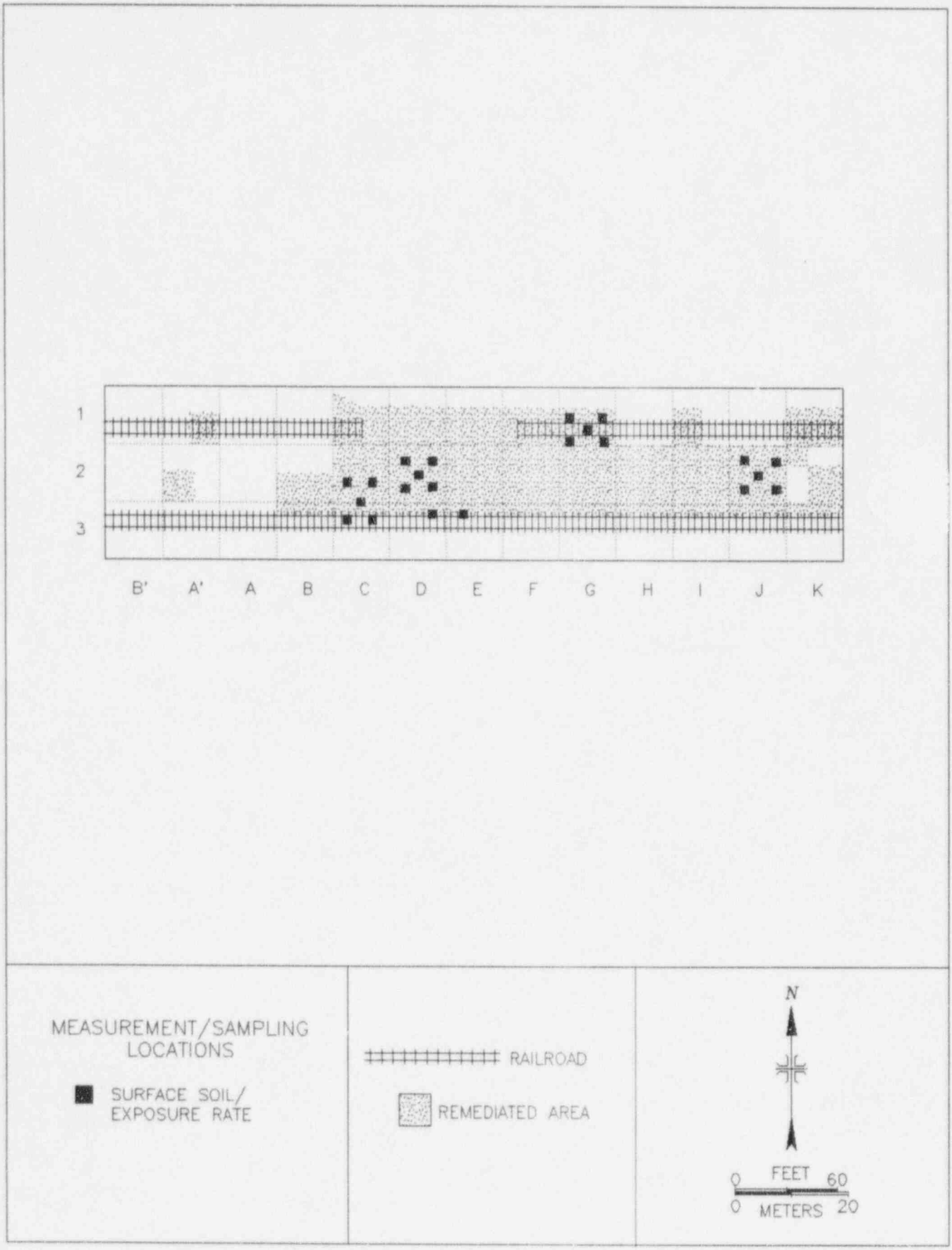
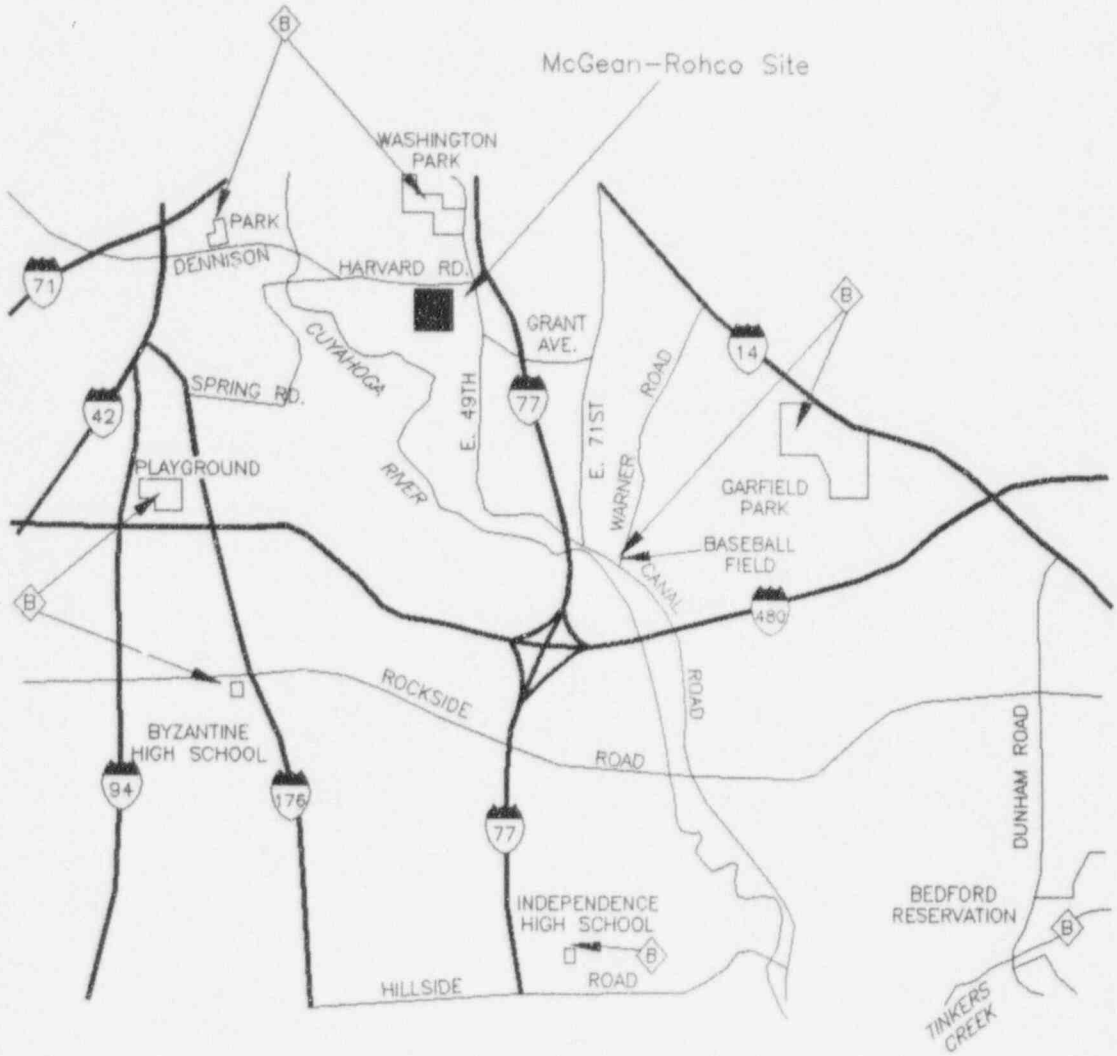


FIGURE 33: Newburgh South Shore Railroad -- Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

(B) BACKGROUND EXPOSURE RATE AND SOIL SAMPLE

FIGURE 34: McGean-Rohco Site, Cuyahoga Heights, Ohio - Background Exposure Rate and Soil Sampling Locations

TABLE 1

SUMMARY OF SURFACE ACTIVITY LEVELS
McGEAN-ROHCO
CHEMETRON CORPORATION
CUYAHOGA HEIGHTS, OHIO

Location[a]	Number of Beta Measurement Locations	Total Activity Range (dpm/100 cm^2)	Removable Activity Range (dpm/100 cm^2)	
			Alpha	Beta
Building 3A				
Floor	21[b]	<710 to 8,200	<9	<15
Lower Walls	12	<910 to 2,800	<9	<15
Exterior Walls	6	<260 to 670	NA[c]	NA
Building 4				
Floor	15	<200 to 2,000	<9	<15
Lower Walls	9	<250	NA	NA
Building 9				
Floor	41	<200 to 1,300	<9	<15
Lower Walls	10	<200 to 2,800	NA	NA
Upper Surfaces	10	<150	NA	NA
Equipment	31	<580 to 1,800	<9	62
Building 10C				
Lower Walls	8	<270	NA	NA
Equipment	7	<660 to 670	NA	NA
Building 10D				
Floor	10	<210 to 3,800	<9	<15
Lower Walls	6	<270	<9	<15
Equipment	25	<680 to 4,900	<9	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY LEVELS
McGEAN-ROHCO
CHEMETRON CORPORATION
CUYAHOGA HEIGHTS, OHIO

Location[a]	Number of Beta Measurement Locations	Total Activity Range (dpm/100 cm^2)	Removable Activity Range (dpm/100 cm^2)	
			Alpha	Beta
Building 10E				
Floor	5	<210	NA	NA
Lower Walls	4	<270	NA	NA
Equipment	10	<660 to 5,600	NA	NA
Building 18				
Floor	2	200 to 260	NA	NA
Wall	4	510 to 700	NA	NA

[a]Refer to Figures 3 through 31.
[b]Includes 5 measurements for grid block averaging (grid block average was 2,700 dpm/100 cm^2).
[c]NA=not applicable

TABLE 2

EXPOSURE RATES
McGEAN-ROHCO
CHEMETRON CORPORATION
CUYAHOGA HEIGHTS, OHIO

Location[a]	Number of Exposure Rate Measurements	Exposure Rate Range at 1 m (μR/h)
Building 3A	8	8 to 13
Building 4	7	7 to 11
Building 9	10	8 to 13
Building 10C[b]	2	8 to 9
Building 10D	3	8 to 9
Building 10E	2	7 to 9
Building 18	1	11
Background		
Interior[b]	5	6 to 12

[a]Refer to Figures 3 through 6, 19, 27, and 31.
[b]No figure provided.

TABLE 3

BACKGROUND EXPOSURE RATES AND URANIUM CONCENTRATIONS IN SOIL SAMPLES McGEAN-ROHCO CHEMETRON CORPORATION CUYAHOGA HEIGHTS, OHIO

Measurement Location[a]	Exposure Rate at 1 m (μR/h)	Radionuclide Concentration (pCi/g)	
		U-238	Total[b] Uranium
Baseball Field	6	0.7 ± 0.4[c]	1.4
Washington Park	9	1.4 ± 0.9	2.8
Garfield Park	11	1.4 ± 0.6	2.8
Bedsford Reservation	9	1.2 ± 1.2	2.4
Independence High School	11	2.3 ± 1.1	4.6
Byzantine High School	8	2.4 ± 1.2	4.8
Playground	9	<3.0	<6.0
Dinnison Park	9	3.0 ± 0.7	6.0

[a]See Figure 34. Samples collected during previous site survey adjacent to McGean-Rohco Site (ORISE 1992).

[b]A ratio of 2:1 total uranium to U-238 was used to determine total (natural) uranium concentrations, assuming natural isotopic abundances, in the background soil samples.

[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 4

URANIUM CONCENTRATIONS IN SOIL SAMPLES
McGEAN-ROHCO
CHEMETRON CORPORATION
CUYAHOGA HEIGHTS, OHIO

Location[a]	Exposure Rate at 1 m (μR/h)	Uranium Concentration (pCi/g)	
		U-238	Total Uranium[b]
Building 1 Excavation			
a	7	1.6 ± 0.6[c]	2.4
b	9	1.3 ± 0.5	2.0
c	10	1.5 ± 0.6	2.3
d	11	6.5 ± 0.7	9.8
e	11	2.5 ± 0.6	3.8
Railroad, Grid D-2			
a	8	15.2 ± 1.2	22.8
b	8	2.1 ± 0.5	3.2
c	10	7.3 ± 0.8	10.1
d	10	6.9 ± 0.9	10.4
e	9	7.0 ± 0.8	10.5
Railroad, Grid J2			
a	9	4.6 ± 0.9	6.9
b	10	3.0 ± 0.5	4.5
c	11	5.5 ± 0.9	8.3
d	12	10.7 ± 0.9	16.1
e	9	5.5 ± 0.8	8.3

TABLE 4 (Continued)

URANIUM CONCENTRATIONS IN SOIL SAMPLES
McGEAN-ROHCO
CHEMETRON CORPORATION
CUYAHOGA HEIGHTS, OHIO

Location[a]	Exposure Rate at 1 m	Uranium Concentration (pCi/g)	
		U-238	Total Uranium[b]
Railroad, Grid G1			
a	8	10.0 ± 1.0	15.0
b	8	13.3 ± 1.1	20.0
c	9	2.6 ± 0.7	3.9
d	9	2.2 ± 0.6	3.3
e	7	23.7 ± 1.1	35.6
Railroad, Grid C2/C3			
a	12	8.0 ± 1.0	12.0
b	11	27.6 ± 1.6	41.4
c	10	7.9 ± 0.9	11.9
d	9	11.9 ± 1.0	17.9
e	10	6.4 ± 0.8	9.6
Railroad, Grid D3	11	5.3 ± 0.7	8.0
Railroad, Grid E3	10	18.7 ± 1.3	28.1

[a]Refer to Figures 32 and 33.
[b]Total uranium activity determined by multiplying U-238 concentration by 1.5, includes background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.
[d]To obtain an average 100 m^2 area the southern portion of grid block C2 and the northern portion of grid block C3 were combined to cover a 100 m^2 area and a 5 point grid block sampling pattern was utilized. The average total uranium concentration for the C2/C3 grid block was 18.6 pCi/g.

TABLE 5

COMPARISON OF URANIUM CONCENTRATIONS
LICENSEE SOIL SAMPLES
McGEAN-ROHCO
CHEMETRON CORPORATION
CUYAHOGA HEIGHTS, OHIO

Location	U-238 (pCi/g)		Total Uranium[a] (pCi/g)	
	Chemetron	ESSAP	Chemetron	ESSAP
K1-1-1295	28.4 ± 3.5	27.7 ± 1.8[b]	42.6	41.2
K-1-NW-1296	11.5 ± 1.5	9.8 ± 1.3	17.3	14.7
K1-NC-1297	10.7 ± 1.5	9.7 ± 1.5	16.1	14.6
K1-1-1298	8.5 ± 2.0	7.7 ± 1.4	12.8	11.6
K1-CW-1299	18.0 ± 2.3	14.1 ± 1.1	27.0	21.2
K1-C-1300	15.5 ± 2.0	12.9 ± 1.3	23.3	19.4
N1-NW-1301	54.0 ± 6.8	51.8 ± 1.9	81.0	77.7
M1-NC-1302	8.5 ± 2.5	1.5 ± 0.9	12.8	2.3
M1-C-1303	4.7 ± 1.4	4.0 ± 0.9	7.1	6.0
N1-NW-1304	1.2 ± 1.0	2.8 ± 1.0	BDL[c]	4.2
N1-NC-1305	9.5 ± 2.1	8.4 ± 1.2	14.3	12.6
N1-C-1306	27.5 ± 3.4	26.5 ± 1.9	41.3	39.8

[a]Total uranium activity determined by multiplying U-238 concentration by 1.5.
[b]Uncertainties represent the 95% confidence level, based only on counting statistics.
[c]Below detection limits.

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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 Floor Monitor
Model 239-1
(Ludlum Measurements, Inc., Sweetwater, TX)

Ludlum Ratemeter-Scaler
Model 2221
(Ludlum Measurements, Inc., Sweetwater, TX)

Detectors

Eberline GM Detector
Model HP-260
Effective Area, 20 cm^2
(Eberline, Santa Fe, NM)

Ludlum Gas Proportional Detector
Model 43-37
Effective Area, 550 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

Ludlum Gas Proportional Detector
Model 43-68
Effective Area, 126 cm^2
(Ludlum Measurements, Inc., Sweetwater, TX)

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: ERVDS 30-25195
(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)

Low Background Gas Proportional Counter
Model LB-5100-W
(Oxford, Oak Ridge, TN)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the detectors slowly over the surface; the distance between the detector and the surface was maintained at a minimum - nominally about 1 cm. A large surface area, gas proportional floor monitor was used to scan the floors of the surveyed areas. Other surfaces were scanned using small area (20 cm^2 or 126 cm^2) hand-held detectors. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument. Combinations of detectors and instruments used for the scans were:

Beta - gas proportional detector with ratemeter-scaler

\- GM detector with ratemeter-scaler

Gamma - NaI scintillation detector with ratemeter

Surface Activity Measurements

Measurements of total beta activity levels were primarily performed using gas proportional and GM detectors with portable ratemeter-scalers.

Count rates (cpm), which were integrated over 1 minute in a static position, were converted to activity levels (dpm/100 cm^2) by dividing the net rate by the 4 π efficiency and correcting for the active area of the detector. Because different building materials (poured concrete, concrete block, metal, wood, etc.) can have very different background levels, average background counts were determined for each material encountered in the surveyed area at a location of similar construction and having no known radiological history. The beta activity background count rates for the

proportional detectors averaged 458 cpm for painted brick, 644 cpm for brick, 376 cpm for concrete floor, 220 cpm for wood, and 218 cpm on metal. The GM detector beta activity background averaged 93 cpm for brick, 54 cpm for concrete floor, 38 cpm for wood, and 35 cpm on metal. Net count rates were determined by subtracting the appropriate material background from the gross count rate for each measurement location. Beta efficiency factors ranged from 0.35 to 0.38 for the gas proportional detectors and from 0.23 to 0.27 for the GM detectors calibrated to T1-204. The beta minimum detectable concentrations (MDC) for the gas proportional detectors varied by material and ranged from 150 dpm/100 cm^2 to 270 dpm/100 cm^2. The MDCs for the GM detectors ranged from 660 dpm/100 cm^2 to 1,000 dpm/100 cm^2. The effective window areas for the gas proportional and the GM detectors were 126 cm^2 and 20 cm^2, respectively.

Removable Activity Measurements

Removable activity levels were determined using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear and approximately 100 cm^2 of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded.

Exposure Rate Measurements

Measurements of dose equivalent rate (µrem/h) were performed at 1 m above the surface using a Bicron microrem meter. Although the instrument displays data in µrem/h, the µrem/h to µR/h conversion is essentially unity.

Soil Sampling

Approximately 1 kg of soil was collected at each sample location. Collected samples were placed in a plastic bag, sealed, and labeled in accordance with ESSAP survey procedures.

ANALYTICAL PROCEDURES

Gross Alpha/Beta

Smears were counted on a low-background gas proportional system for gross alpha, and gross beta activity.

Gamma Spectrometry

Samples of solid materials (soil, residues) 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.

All photopeaks associated with the radionuclides of concern were reviewed for consistency of activity. The energy peak used for determining the activity of uranium was:

U-238 0.063 MeV or 0.093 MeV from Th-234*

*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. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels. 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 concentration (MDC), were based on 2.71 plus 4.65 times the standard deviation of the background count [$2.71 + 4.65\sqrt{BKG}$]. When the activity was determined to be less than the MDC of the measurement procedure, the result was reported as less than MDC. 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 standard/sources were available. In cases where they were not available, standards of an industry recognized organization were used.

Analytical and field survey activities were conducted in accordance with procedures from the following documents of the Environmental Survey and Site Assessment Program:

- Survey Procedures Manual, Revision 9 (April 1995)
- Laboratory Procedures Manual, Revision 9 (January 1995)
- Quality Assurance Manual, Revision 7 (January 1995)

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 DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE OR SPECIAL NUCLEAR MATERIAL

AND

GUIDELINES FOR RESIDUAL CONCENTRATIONS OF THORIUM AND URANIUM WASTES IN SOIL

APPENDIX C

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE OR SPECIAL NUCLEAR MATERIAL

U. S. Nuclear Regulatory Commission
Division of Fuel Cycle & Material Safety
Washington, D.C. 20555

August 1987

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces or premises, equipment, or scrap which are likely to be contaminated, but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to special circumstances such as razing of buildings, transfer from premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

    a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

    b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle, Medical, Academic, and Commercial Use Safety, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1
ACCEPTABLE SURFACE CONTAMINATION LEVELS

Nuclides[a]	Average[b,c,f]	Maximum[b,d,f]	Removable[b,e,f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1,000 dpm $\beta\gamma$/100 cm^2

[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 instrumentation.

[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 absorbent 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 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/h at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

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 establishes 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.