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Revision No. 4

Health Physics Monitoring Plan

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MORRISON-KNUDSEN COMPANY, INC.

PROJECT PROCEDURES MANUAL

UMTRA Project

Prime Contract No. DE-AC04-83AL18796

Rev. No.

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Date

April 12, 1985

Designated Contact

Dawn Skinner

UNITED STATES
DEPARTMENT OF ENERGY
ALBUQUERQUE OPERATIONS OFFICE

APPENDIX D
OF THE
HEALTH PHYSICS MONITORING PLAN
UMTRA PROJECT

SHIPROCK, NEW MEXICO
SITE SPECIFIC HEALTH PHYSICS MONITORING PLAN

April 12, 1985

Prepared by:

Chem-Nuclear Systems, Inc.

For

Morrison-Knudsen Company, Inc.

Remedial Action Contractor



Remedial Action Contractor - Health Physics Monitoring Plan

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SHIPROCK HEALTH PHYSICS PLAN
Appendix D to the Health Physics Monitoring Plan



UMTRA
RAC

Chem-Nuclear Systems, Inc.

1.0 INTRODUCTION

This Appendix D to the UMTRA Remedial Action Contractor (RAC) Health Physics Monitoring Plan comprises the Shiprock, New Mexico site specific Health Physics Plan. Specific implementing methods and procedures are found in the RAC Procedures manual.

The implementing procedures will be maintained by the Site Health Physics Manager or his designee, and will be available at the Shiprock field office.

2.0 TRAINING

2.1 Radiation Worker

All individuals who regularly enter a controlled area to perform work will receive radiation worker training as described in the RAC Health Physics Monitoring Plan. This training will be given on site by the Health Physics Manager or his designee. The Health Physics Manager will maintain the specific training procedure as delineated in the RAC Training Manual as well as individual training records. These records will be available at the Shiprock field office.

2.2 Industrial Safety

All individuals working on the Shiprock UMTRA Project shall periodically attend industrial safety indoctrination sessions. This training will be presented by the RAC Construction Safety and Health Manager or his designee. The RAC Site Manager will maintain documentation of these training sessions.

2.3 Health Physics Staff

The Health Physics Staff will meet the standards of the RAC Health and Safety Personnel Training Program. If not previously qualified, individuals will be trained and qualified by the site Health Physics Manager. The site Health Physics Manager will maintain training procedures and documentation regarding site Health Physics Staff. These records will be available for audit.

The anticipated organizational chart for Shiprock is included in Figure 1.0.

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Approved by:

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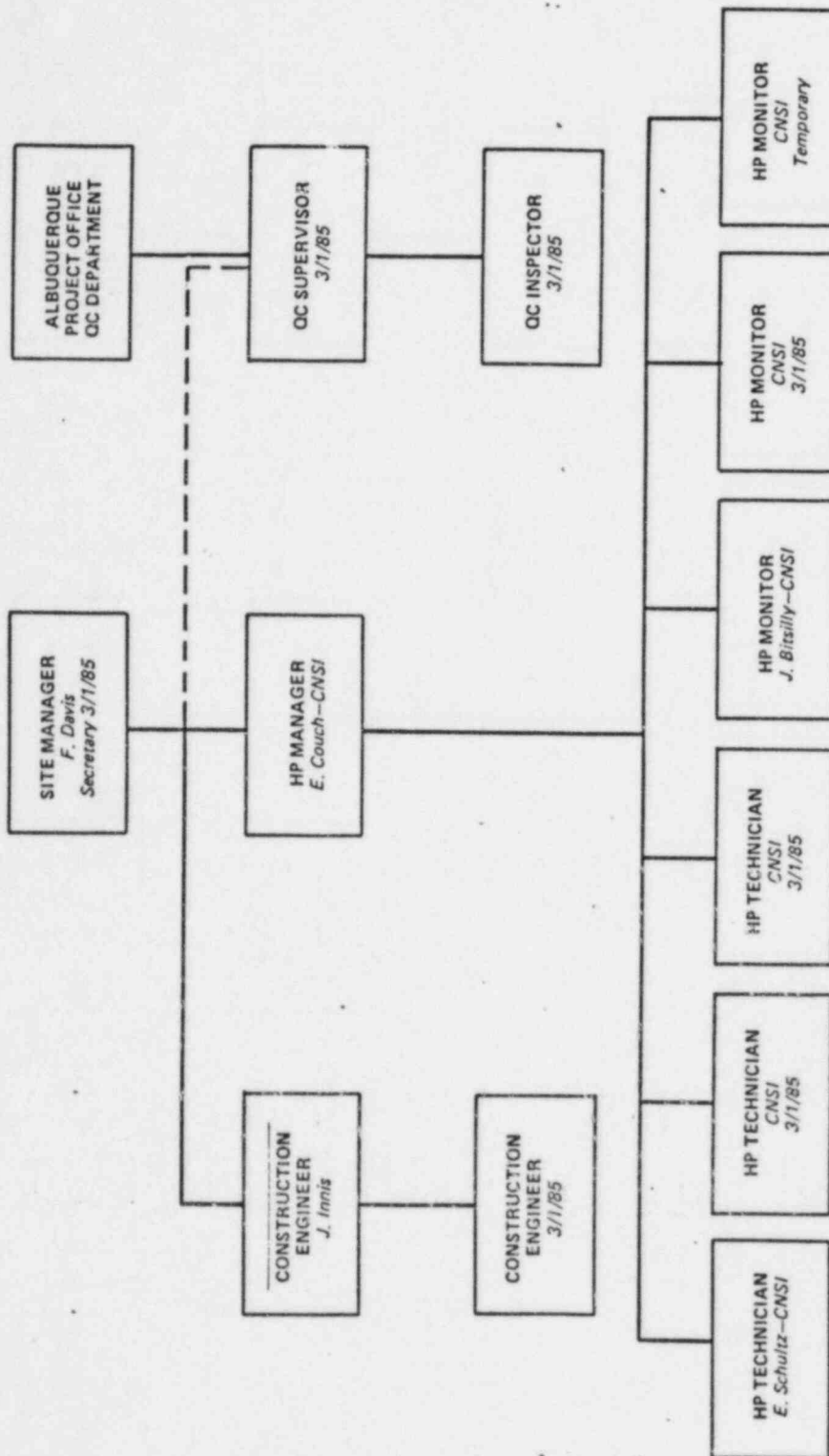
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FIGURE 1.0 SHIPROCK ORGANIZATION



SHIPROCK SITE OFFICE
SHIPROCK, NEW MEXICO
CONTRACT 3050
10-11-84

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3.0 ACCESS CONTROL

3.1 Boundary Establishment and Posting

Controlled areas shall be established for the mill site and for certain vicinity properties to protect the workers and the general public from unnecessary radiation exposure, and to prevent the spread of radioactive contamination. Controlled areas include, but are not limited to, any work areas which meet the following conditions:

- o. Significant portions of potentially exposed surface contamination exceed 200 pCi/g of Ra-226.
- o. The estimated external gamma dose to any individual in that work area may exceed 500 millirem/year (240 micro R/hr, 40 hours per week).
- o. Airborne concentrations of radionuclides may approach quantities provided in DOE Order 5480.1A, Attachment II.
- o. Transferable surface contamination is likely to exceed 200 dpm cm² alpha, or 1000 dpm/100 cm² beta-gamma.

Initially, Figures 1.1 and 2.0 may be utilized by the site Health Physics Manager to establish access control areas as defined above. Periodic area exposure rate surveys are required to verify the information on exposure rates.

Access to these areas shall be controlled for people, vehicles, and equipment by fencing the area or using other methods to prevent inadvertent exposure to contaminated material.

Smoking, drinking, and eating are prohibited in controlled areas.

Controlled areas defined as above must be conspicuously marked at points of potential access with a sign or signs bearing the radiation caution symbol and the words:

CAUTION
RADIOACTIVE MATERIAL

All other applicable posting and labeling requirements set forth in 10 CFR 20 must be followed.

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N

SHIPROCK N.M.

FAIRGROUNDS

PONDS

TAILINGS PILES

HOUSING AREA

SAN JUAN RIVER

504

666

550

17

2.9

3.5

8

C

2.6

8.3

24

13

5.2

40

3.3

25

6.9

46

3.0

2.5

2.0

A

2.4

2.1

5.4

8.3

1.3

17

18.0

475

8.3

6.1

3.0

2.5

1.0

2.1

3.0

2.1

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2.1

LEGEND



SEDIMENT SAMPLES MEASURED IN pCi/g



WATER SAMPLES MEASURED IN pCi/l



SURFACE SAMPLE MEASURED IN pCi/g
SAMPLES TAKEN SIX INCHES DEEP pCi/g



SURFACE SAMPLE MEASURED IN pCi/g
DATA FROM REFERENCE 1



STATE HIGHWAY



U.S. HIGHWAY

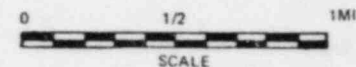
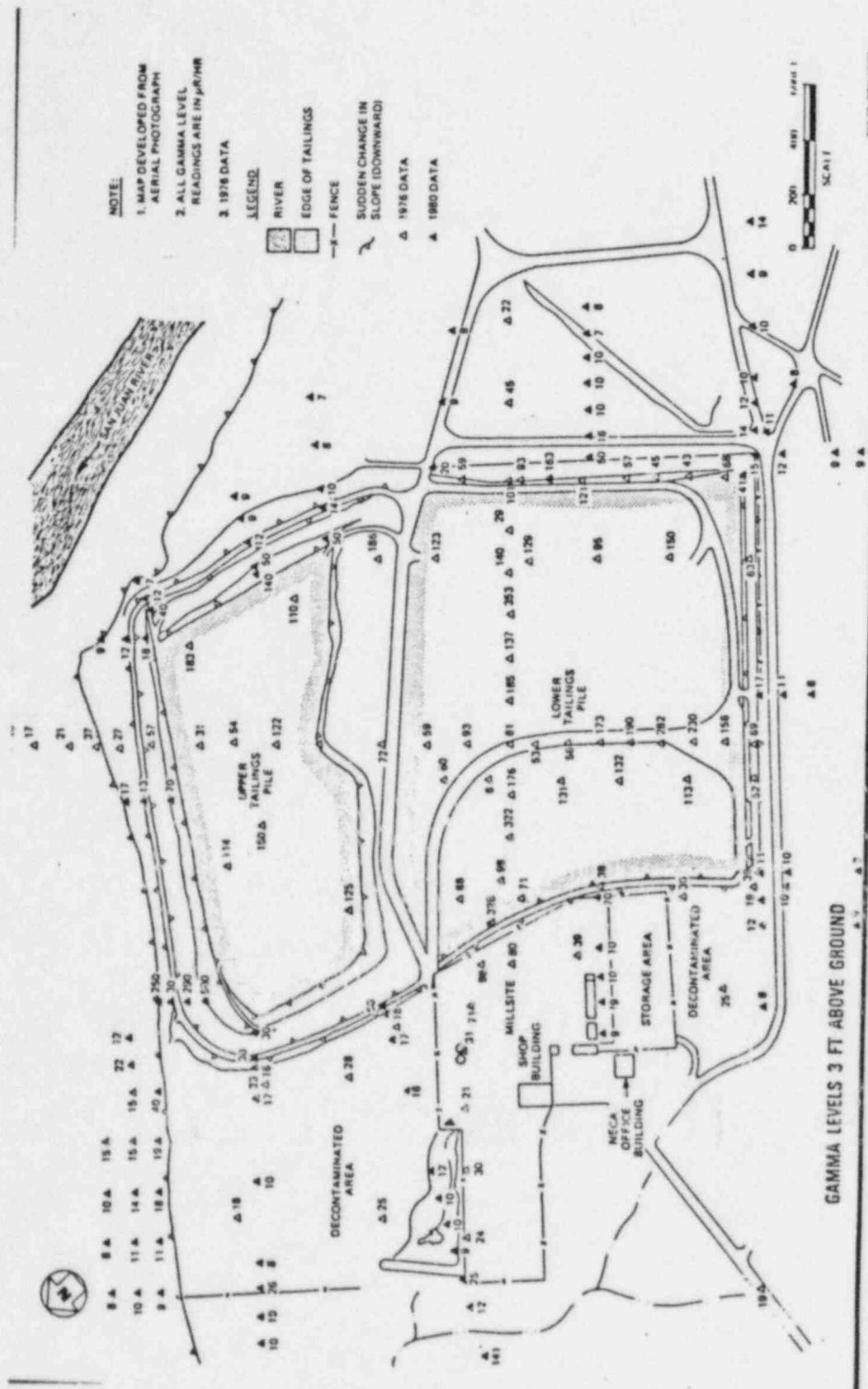


FIGURE 1.1 SURFACE AND SUBSURFACE RADIUM CONCENTRATIONS

FIGURE 2.0 EXPOSURE RATE DATA AS REPORTED IN THE RAP, ($\mu\text{r/hr}$)

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3.2 Protective Clothing

Protective clothing requirements will be established by the site HP Manager on a case by case basis, with requirements posted at controlled area access points.

3.3 Respiratory Protection

Respiratory protection shall be required when airborne contamination projected exposure in an area may exceed 40 MPC hours per week or 160 MPC hours per month. Training, and a determination of physical ability to wear a respirator is required, as defined in Procedure RAC-006. The site HP Manager shall make every effort to reduce personnel exposures to airborne radionuclides to levels as low as are reasonably achievable.

3.4 Personnel Monitoring

All personnel shall thoroughly frisk for alpha contamination at the end of each shift, and each time they exit a controlled area. An alarming alpha rate meter shall be utilized. Personnel shall be trained in self-monitoring by site HP staff during initial Health Physics training.

3.5 Equipment Surveys

All Equipment taken into a controlled area will be surveyed for contamination prior to release from the area. Any equipment having fixed or loose contamination levels exceeding free release limits as stated in Procedure RAC-004 will be held for decontamination and resurvey.

3.6 Decontamination

Skin contamination will be removed by washing with luke warm water and mild soap. Contaminated equipment will be decontaminated by scraping, wire brushing, washing, etc. See Procedure RAC-008 for specific procedures.



4.0 DOSIMETRY AND BIOASSAY PROGRAMS

4.1 Thermoluminescent Dosimetry

Personnel requiring access to controlled areas for more than 40 hours in any three consecutive months shall be issued uniquely numbered thermoluminescent dosimeter badges (TLD's). Such personnel shall receive health physics indoctrination training as described in the RAC Health Physics Monitoring Plan. Note: The Health Physics Manager may waive health physics indoctrination training for personnel with health physics backgrounds. Appropriate records as per Procedure RAC-002 shall be maintained by the Health Physics Manager. TLD's shall be issued daily and collected by Health Physics at the end of each day. Appropriate control TLD's are required to determine contribution of background to accumulated dose.

TLD's will be exchanged and read quarterly by a properly qualified vendor.

4.2 Self Reading Dosimeters (SRD's)

Visitors shall be issued SRD's prior to entry into radiologically controlled areas. A visitor log shall be maintained stating date, visitors name, social security number, time into controlled area, time out of controlled area, SRD reading in, SRD reading out, and total exposure received.

4.3 Bioassay Requirements

Prior to commencement of work in controlled areas, radiation workers will be required to furnish specimens for urinalysis. Each specimen should be 2 liters, consisting of total voiding over at least 24 hours. Samples will be analyzed by a vendor for Ra-226, Th-230, and U-nat concentrations. Additional urinalyses will be required for potentially exposed radiation workers if weekly average radionuclide air concentrations exceed any radionuclide MPC_a. In addition, a determined effort will be made to acquire urinalysis data upon worker termination. The need for additional bioassay will be determined by the Shiprock Health Physics Manager upon consultation with the RAC HS&E Manager. In general, additional urinalysis will be required as per the following guideline:

- o Th-230:
 - resample - 0.05 pCi/l
 - investigate work conditions - 0.1 pCi/l
 - prohibit employee from working in restricted areas - 0.2 pCi/l

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- o Ra-226
 - resample - 0.5 pCi/l
 - investigate work conditions - 0.7 pCi/l
 - prohibit employee from working in restricted areas - 1.0 pCi/l

The site HP manager is responsible for review and action regarding urinalysis data, upon receipt. The ALB HS&E manager and Environmental Assessment manager should be informed via a brief memo whenever such action is taken.

A permanent record of bioassay results shall be maintained. Samples and records shall be marked with unique identifications as per the RAC Systematic Sample Numbering memo (Skinner to Purvis, 4/10/84, HS-014-04-84 Ref. 6). Copies of all Shiprock staff and subcontractor quarterly urinalysis records shall be forwarded to the CNSI/ALB EAV Manager each quarter. As work progresses at the site, a continuous set of negative urinalysis readings may be interpreted as indicating reduced need for urinalysis, with approval of the RAC HS&E Manager and the US DOE.

4.4 Radon Monitoring

Where the potential exists for exposure of workers to significant concentrations of Rn-222, provision shall be made to monitor such exposure. Depending on the anticipated exposure, one of the following monitoring procedures may be employed at the discretion of the site HP Manager: 1) Routine grab sampling for radon in close proximity to exposed workers; 2) Continuous monitoring with an Eberline RGM-2 or equivalent located in the immediate vicinity of exposed workers; 3) Use of Track Etch R radon dosimeters, routinely worn by workers with maximum potential for radon exposure, and read on a monthly basis. Based on initial experience at the Canonsburg UMTRA site, it is not anticipated that worker annual average exposures approaching the limit of 30 pCi/l will be encountered at Shiprock, except in rare cases involving enclosed structures containing high radium concentrations. In such cases, monitoring for radon daughter exposures is also required.

5.0 INITIAL SURVEYS

5.1 Gamma Radiation Surveys (Surface)

Prior to excavation of the mill site or included Vicinity Properties, a survey will be conducted with a gamma detection instrument to locate limits of contamination, and to identify potential health physics problems. VP survey measurements will be performed as per Procedure RAC-013. Correlation to exposure rate is required to determine potential worker exposures. Health Physics procedures shall be utilized to generate and routinely check this correlation.

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Portable instruments used for this purpose must be routinely calibrated against a Pressurized Ion Chamber over the gamma exposure rate range of interest. A probe/ratemeter pair thus calibrated shall always be used as a pair for purposes of gamma exposure rate measurements. Separate calibration curves shall be maintained for millsite vs. Vicinity Property use. All such field calibration data shall be maintained both by the Site HP Manager, and via copies sent to the RAC Radiological Programs Manager in ALB.

5.2 Gamma Radiation Surveys (Borehole)

In addition to area surveys, areas with elevated gamma readings will be augered and boreholes will be logged using a gamma detection instrument coupled to a portable rate meter. Gamma measurements will be taken at 15 cm increments to estimate the contamination depth. All measurements will be recorded and borehole locations tied to the established grid system as per RAC HP procedure 009 and 013.

5.3 Gamma Radiation Surveys (Haul Roads)

Routes used for hauling excavated material from vicinity properties to the Uranium Mill Tailings Site will be gamma surveyed initially, and then routinely during transfer of material.

6.0 SURVEILLANCE AND RESPONSE

6.1 Exposure Rates

Portable gamma detection instruments will be used to routinely measure area radiation exposure rates. Initial readings will be taken in the on-site areas occupied by workers to characterize the gamma radiation field to which they are exposed. These readings will be recorded and submitted to the site Health Physics Manager. During excavation, area gamma radiation exposure rate surveys will be conducted on a routine basis specified by the Health Physics Manager. See Section 5.1 for correlation requirements for portable gamma exposure rate instruments.

6.2 Air Samples

Portable high-volume air samples will be taken with calibrated hi-volume air samplers at least twice per shift during excavation of large volumes of contaminated material as prescribed by the Health Physics Manager. Air samples will be counted with an Alpha detection system capable of detecting gross Alpha at 25% MPCa for Th-230. Samples with 24-hour-decayed gross alpha activity in excess of the Th-230 MPCa will be sent to an offsite laboratory specified by the RAC Albuquerque office for analysis for Th-230 and Ra-226.

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Initially, worker protection against radioactive dusts shall be based on the one-day decayed gross alpha result, assuming 100% of the count to be due to Th-230. After 10 or more hi-vol air samples have been analyzed by EDA laboratory, the Th-230/gross-alpha ratio established by these results may be used to control worker exposure to radioactive particulates. Records of the data and calculations used to establish this ratio shall be maintained by the site HP Manager. Samples shall be uniquely marked as per the RAC system. The ALB Radiological Programs Manager shall be immediately notified when 24 hour decayed air samples determined to be in excess of MPCa (by onsite gross alpha) are found.

Whenever dust is generated within a controlled area, or whenever significant concentrations of airborne particulate or gaseous radionuclides are measured at the mill site or vicinity property, measures must be implemented to reduce such concentrations. RAC Procedure 010 defines such procedures for radon control. For control of particulates, water sprays should routinely be applied to all areas potentially releasing radioactive dusts. In severe cases, including windstorms, advance planning to control release of radioactive dusts must be performed by the Site Manager. Measures such as covering of recently exposed, highly contaminated areas may be necessary to reduce the potential for radioactive dust release.

6.3 Contamination Surveys

Surveys for loose contamination will be made by taking smears from floor areas, desk tops, etc., on a routine basis established by the Health Physics Manager. Loose alpha contamination exceeding 200 dpm/100 cm² will require decontamination of the area. Smears of loose contamination will be counted with alpha, and/or beta-gamma detection systems capable of detecting gross alpha and beta-gamma below levels for unrestricted release. Routine smears will be taken daily in eating areas and lab areas, weekly in access control and office areas, and monthly on permanent support equipment.

6.4 Working Level Surveys

Working level measurements will be required when significant worker exposure is possible, in the judgment of the HP Manager.

Working levels will be measured by taking air samples and analyzing for radon daughters using a modified Kusnetz method, or by using Eberline WLM-1's or equivalent. Working level measurements will also be taken prior to remedial action in any poorly ventilated building, and, for EPA verification purposes, in all inhabited structures when remedial action is completed in or near those structures (i.e., fill around foundations, utility lines, etc).

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7.0 EXCAVATION CONTROL

7.1 Gamma Radiation Scans

During excavation at Shiprock, New Mexico, health physics personnel will employ portable detectors to locate residual tailings material by gamma-ray emissions. Where gamma radiation levels due to interfering tailings material are excessive shielded detectors or other methods, such as OCS soil sampling, shall be employed to guide excavation.

7.2 Soil Sampling

Where analysis of the Ra-226 concentration of soil samples is required to demonstrate compliance with USEPA, USDOE or USNRC standards, either the Opposed Crystal System (OCS) gamma spectrometer (RAC procedure 015A) or independent analysis by an approved vendor, is acceptable.

Soil sampling procedure for both vicinity property and mill site verification shall be as per RAC procedure 015 and 016 based on the "Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings Site at Shiprock, New Mexico," June 1984, pages C6 and C7.

7.3 Post Excavation Gamma Radiation Scans

Hauling routes, entry paths, and access points will be routinely spot-surveyed with a gamma detector to ensure that removal and transfer of contaminated material is being done in a controlled manner. This data will be compared to initial survey readings, at the completion of decontamination.

8.0 ENVIRONMENTAL MONITORING

8.1 Airborne Particulate Monitoring

Continuous air particulate sampling is required at points around the site boundary during periods of major activity. This requirement applies only to piles being stabilized in place, piles being excavated for relocation, disposal sites, and those vicinity property sites where large volumes of contaminated soils averaging 200 pCi/g of Ra-226 or more are present and the potential exists for measurable increases in airborne radioactivity. Gross activity measurements shall be compared to the DOE Order 5480.1A, Attachment 11, limit for Th-230, (8×10^{-14} microCi/ml above background). Continuous air

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particulate sampling may be performed under other conditions, such as that specified in air quality permits issued by the respective tribe or state. Nine Shiprock site particulate sample locations are required; three in the downwind direction, one at the site upwind boundary, one at Shiprock High School, one at the old mill classroom building and one at a background location. Locations as identified on Figures 3.1 shall be utilized as closely as practical. The site HP Manager in conjunction with the M-K Site Manager will make arrangements with local residents and officials to locate the offsite monitors.

Sampling will commence at least 1 month prior to major onsite remedial action construction activities, continue through major remedial action and may be discontinued after winter shut down or completion of remedial action. Prior to any shut down, provision must be made to minimize windblown radioactive dust release.

An onsite meteorology station will be located near the counting trailer.

For large vicinity property sites, initial site boundary "grab" air sampling performed during the first exposure to large quantities of material contaminated to 200 pCi/g or greater, to determine whether environmental releases in excess of MPC's are likely, may be performed at the discretion of the site HP Manager. The HP Manager shall consider such factors as anticipated quantities of material to be removed, proximity of neighboring populations, etc, in making this decision. Depending upon the outcome of such sampling, additional short-term air sampling at the vicinity property may be performed, at a frequency determined by the HP Manager. Samples and records shall be marked with unique identification as per the RAC Systematic Sample Numbering memo (Skinner to Purvis, Ref. 6). One-day decay prior to counting shall be employed to exclude radon daughters when gross alpha analysis is performed. Samples exceeding applicable gross alpha activity after decay shall be sent to an offsite vendor for Th-230, Ra-226 isotopic analysis.

The RAC EAV Manager or his designee shall be immediately notified when offsite or site boundary gross alpha analyses exceed applicable MPC a 10CFR20 Table I column II values. Air sampling and counting equipment shall be operated at an MDA (minimum detectable activity) averaging no higher than 25% of the most restrictive MPCa (Th-230), unless specific approval to operate temporarily at a higher MDA is received from the RAC Radiological Programs Manager.

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SHIPROCK

ENVIRONMENTAL MONITORING

(LOCATIONS APPROXIMATE)

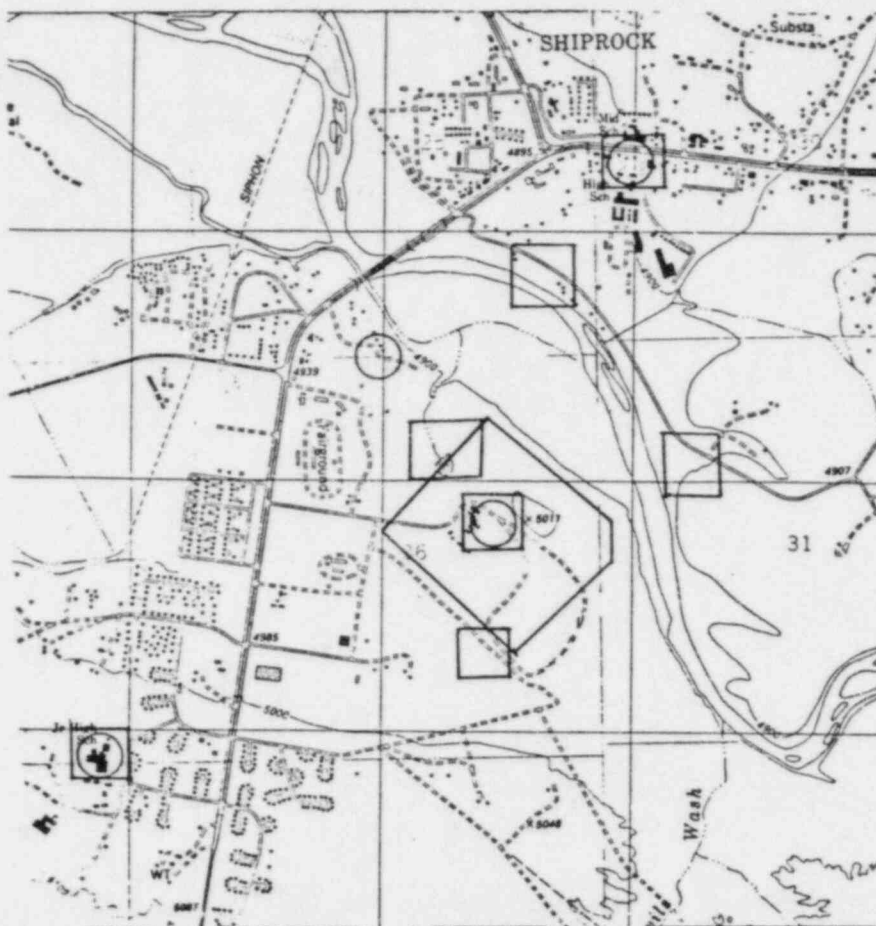


FIGURE 3.2

LEGEND



PARTICULATE MONITOR



RADON MONITOR

RQM

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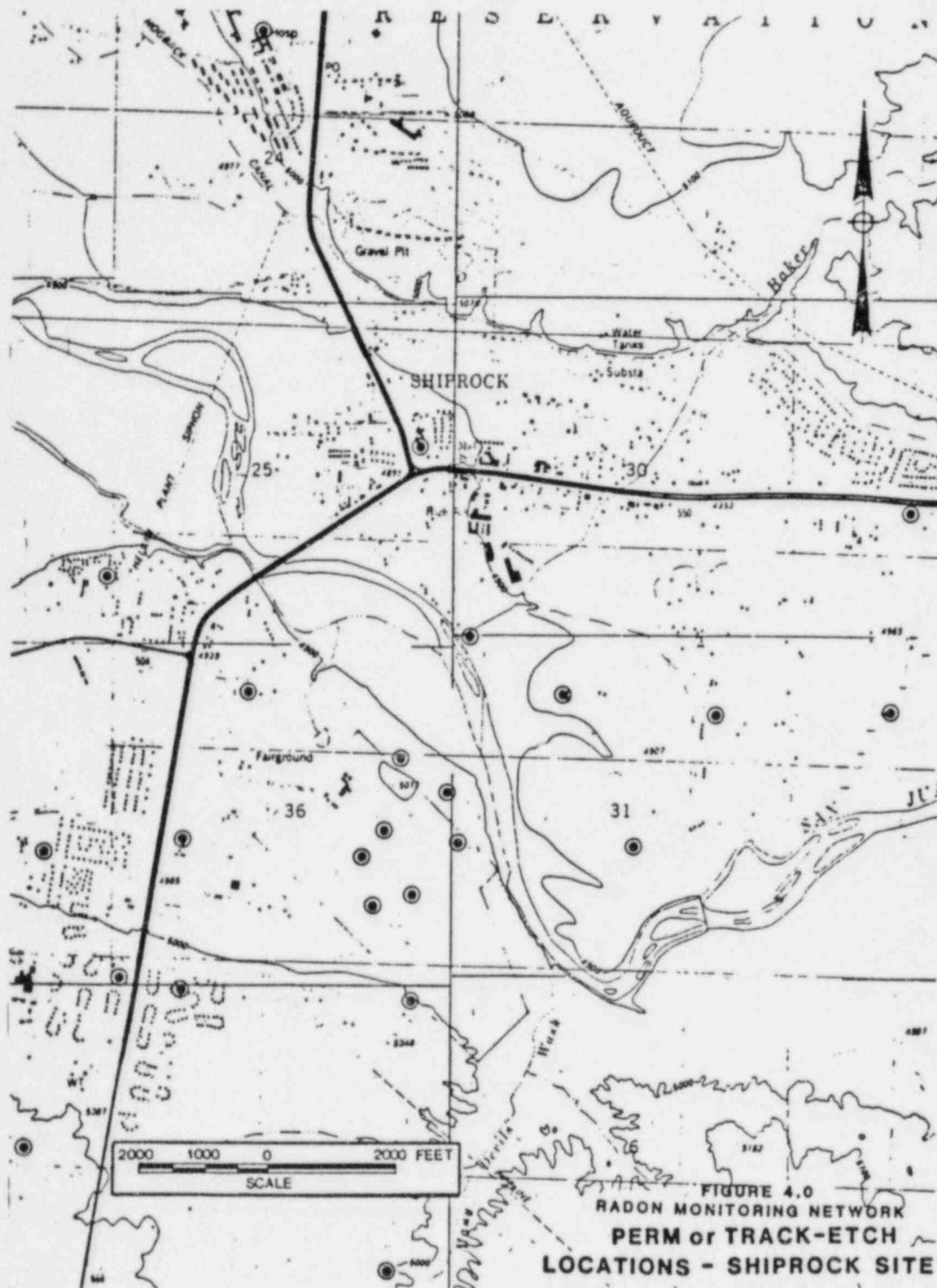
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On a monthly basis, the set of air filters from each continuous monitor location shall be sent to an offsite vendor, for compositing and analysis for Th-230 and Ra-226 monthly average air concentrations for each sampler location.

8.2 Radon Monitoring

Mill site boundary radon monitoring is required. Real time (RGM or equivalent type) radon monitors will be placed as specified on Figure 3.1. Monitoring shall be continuous, with measurements integrated over one week periods. Modification of remedial activities shall be required if boundary results exceed average projections of 3 pCi/l, annual average above background radon concentrations. Locations shall be chosen to coincide with designated Radon RGM locations as indicated on Figure 3.1. The locations of the PERM's or Track etch cups maintained by Mound Laboratory are also indicated on Figure 4.0. These data will also provide radon concentration data (with a longer turn around time) in addition to the RGM realtime monitors.

Monitoring for radon shall be performed at the boundary of large vicinity property sites where the potential exists for significant offsite increases in radon air concentrations. Modification of remedial activities to reduce Rn levels is indicated if results near the boundary exceed an average of 3 pCi/l weekly. For properties meeting or exceeding the above criteria, an initial, downwind grab sample for radon should be taken following initial exposure of large quantities of contaminated material. If no significant Rn activity above background is found, radon concentrations downwind should be routinely measured by grab sampling. If significant Rn activity is determined to exist as a result of remedial action, more frequent monitoring will be necessary, at a frequency to be determined by the Shiprock HP Manager in consultation with the ALB Radiological Programs Manager.

8.3 Water Monitoring

If significant dewatering is required at the site or at a large vicinity property, potentially contaminated water produced as a result of remedial activities will be analyzed for Th-230 and Ra-226 as necessary, prior to release off-site. On a quarterly basis during operations, gross alpha, Ra-226, Th-230, and U-nat analyses shall be required on any natural drainages associated with the mill site.

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Ground water: where wells exist upgradient and downgradient from the mill site, water samples will be collected according to RAC procedures, and analyzed by an approved vendor for U-238, Th-230, Ra-226, and gross alpha. Preoperational samples are to be taken from wells 1, 1H, 4H, 5, 7, 8GT, 11, 6GT, 9GT, and 3A as indicated in Figure 5.0. Additional sampling will be done on a quarterly basis and at the completion of remedial action on permanent wells numbered 1, 4H, 5, 7, 6GT and 9GT. An additional well designated MW-1 north east of the pile will be constructed and sampled quarterly.

Surface water: two upstream and two downstream surface water samples will be collected from the San Juan River in the approximate locations indicated on Figure 6.0. Preoperational samples will be collected and analyzed for Ra-226, Th-230, U-nat and gross alpha. Quarterly, samples will be analyzed for Ra-226 and Th-230.

Other parameters (not specified herein) may be added if agreed to by the US DOE and the appropriate Tribal Officials.

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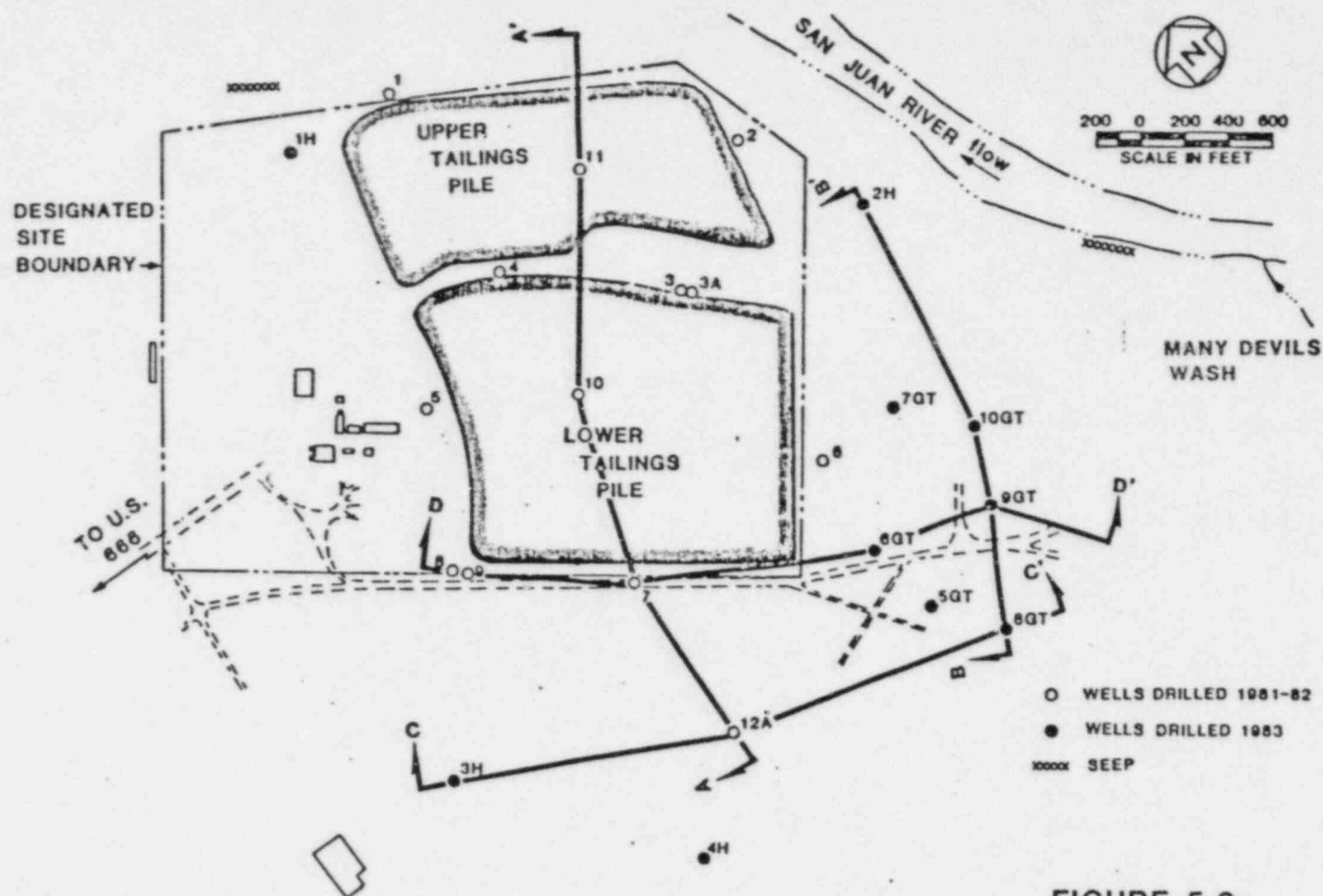


FIGURE 5.0
WELL LOCATIONS
SHIPROCK SITE

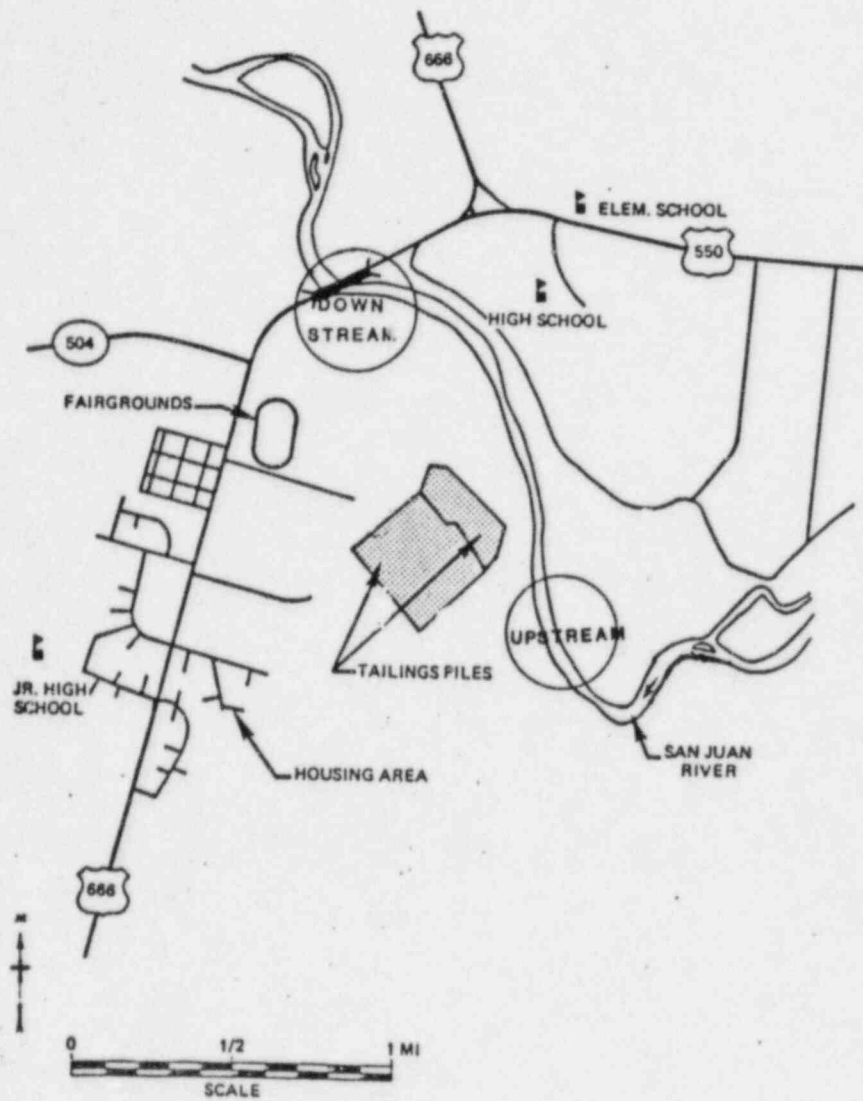


Figure 6.0 Surface Water Sample Locations



REFERENCES

1. Letter from Masud Uz Saman, Director Department Water Management, Navajo Nation to Russ Hopkins, February 85.
2. "UMTRA Project Environmental Health and Safety Plan," June 1984, UMTRA-DOE/AL-150224.006 US DOE.
3. 10 CFR 20 (Code of Federal Regulations).
4. Remedial Action Plan and Site Conceptual Design for Stabilization of the Inactive Uranium Mill Tailings site at Shiprock, New Mexico, June 1984
5. RAC Health Physics Monitoring Plan, M-K/UMTRA-3, December 2, 1983.
6. Memo, Dawn Skinner to Jim Purvis, "Systematic Sample Numbering at Shiprock/April 10, 1984; HS-019-04-84.
7. "Vicinity Properties Management and Implementation Manual, "June 1984, UMTRA-DOE/AL-050601, US DOE.
8. 40 CFR 192 (Code of Federal Regulations).

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REV. 4 - Table of Contents REV. 4 - Approval Sheet REV. 0 - Appendix D Shiprock

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