

**Long-Term Surveillance and Maintenance Program**

**Sampling and Analysis Plan for Radon and Direct Gamma  
Radiation at the Shiprock, NM Disposal Site**

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**Prepared for  
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## Attachments

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# 1.0 Introduction

This sampling and analysis plan (SAP) outlines the activities for conducting radon and direct gamma radiation monitoring at the Shiprock, New Mexico disposal cell. The purpose of conducting these monitoring activities is to ensure that the disposal cell cover (i.e., the radon barrier) is functioning as designed. The U.S. Department of Energy Grand Junction Office (DOE-GJO) is conducting these monitoring activities under the auspices of the Long Term Surveillance and Maintenance (LTSM) Program and DOE's commitment to the Navajo Nation (reference item #5 of the attachment to the letter dated May 13, 1999, from DOE-GJO to Ms. Madeline Roanhorse, Director Navajo UMTRA Program; see attachment A of this SAP).

The objectives of these monitoring activities are: (1) To measure radon concentrations and direct gamma exposure levels at various points along the disposal cell perimeter; (2) To measure radon concentrations and direct gamma exposure levels at select locations on the disposal cell cover; and (3) To establish background levels for both radon (i.e., radon-222) and direct gamma radiation for the Shiprock, New Mexico area. A comparison of site perimeter data to background data (i.e., ambient conditions) will enable project personnel to determine if the disposal cell cover (specifically, the radon barrier) is functioning as designed.

## 1.1 Location

The Shiprock disposal cell is located on the Navajo Indian reservation approximately 1 mile south of the unincorporated town of Shiprock, New Mexico, in San Juan County (Figure 1). The disposal cell is located on an elevated river terrace adjacent to the San Juan River, and occupies approximately 77 acres of the 105-acre site. The disposal cell is constructed in an asymmetrical pentagon with a maximum side length of 1,800 feet and a minimum side length of 800 feet.

The surrounding land is used for both residential (southwest and west of the disposal cell) and commercial/industrial purposes (the Navajo Engineering and Construction Authority [NECA] offices and equipment yard being located immediately north of the disposal cell, and gravel pit operations being located immediately south of the disposal cell). The east side of the disposal cell is bounded by the San Juan River. Agricultural lands are located beyond the San Juan River to the east.

## 1.2 Climate

The climate of the Shiprock area, and throughout northwestern New Mexico, is semiarid. Total annual precipitation is approximately 6 inches, and the annual average temperature is approximately 52 degrees Fahrenheit. The wettest months are July through October, when approximately half the annual precipitation falls; June is the driest month. Winters are relatively mild.

The wind at the Shiprock site blows most frequently from the southeast in summer and from the west in winter. On an annual basis, the most frequent wind direction is from the east-south-east.

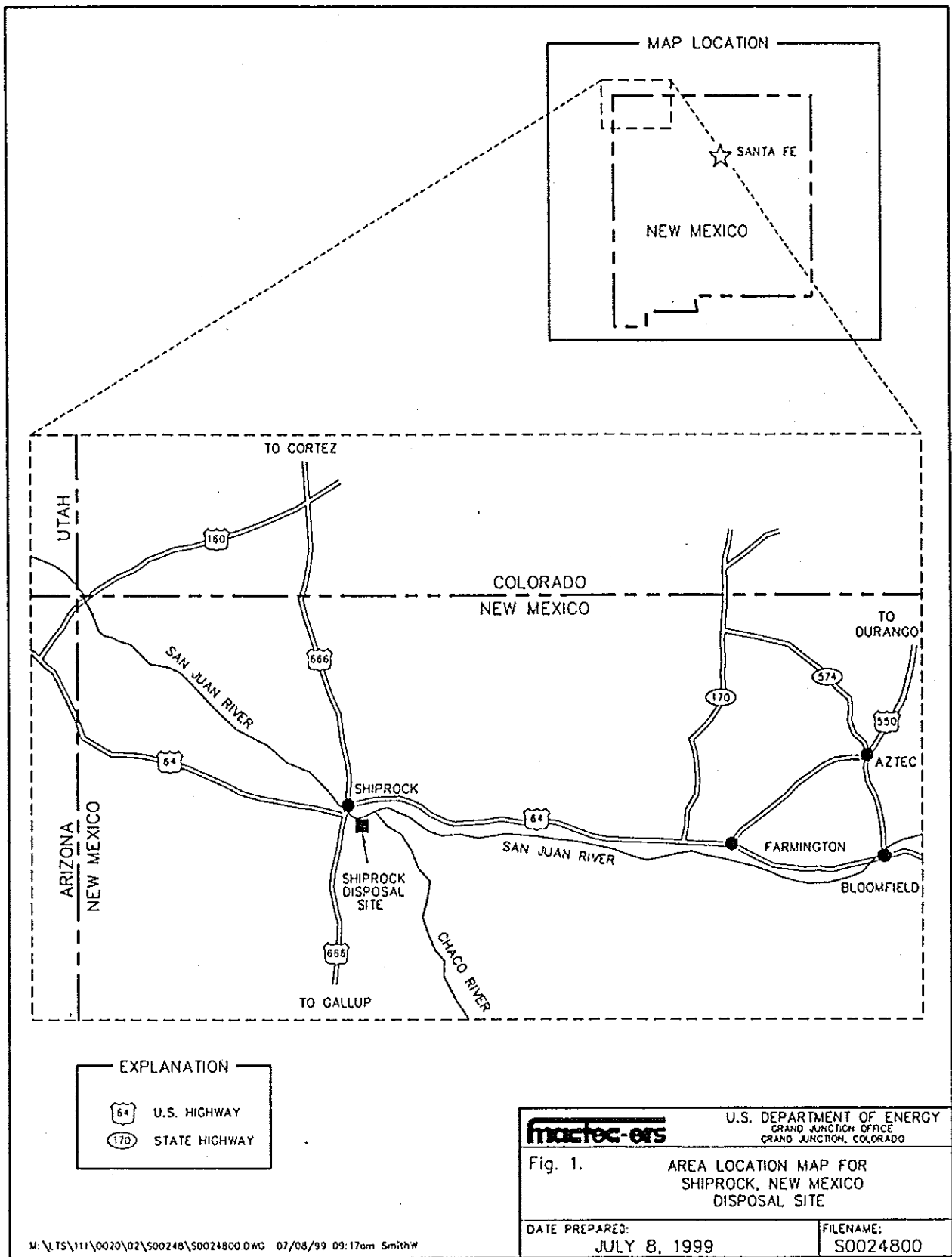


Figure 1. Area Location Map for Shiprock, New Mexico Disposal Site

Wind speed averages about 7.5 miles per hour (mph) annually. Spring is the windy season, when winds of 30 mph, gusting to 50 mph, can accompany frontal systems and thunderstorm activity. Winds exceeding 10 mph occur 27.3 percent of the time.

## 2.0 Objectives

The objectives of this SAP are to measure levels of radon and direct gamma radiation at the Shiprock disposal site perimeter; at strategic locations on top of the disposal cell itself; and at off-site background locations. Information gathered from this surveillance will be used to: (1) Compare radiation levels along the site perimeter to background/ambient conditions for the Shiprock area; (2) Determine if the cover is functioning as an effective radon barrier; and (3) Determine if standards for either radon or direct gamma exposures are exceeded at the site boundary.

## 2.1 Standards

The standards against which environmental monitoring data will be compared are listed below:

Analyte	Standard	Citation
Radon-222	Background + 0.5 pCi/L	40 CFR 192.02(b)(2)
Direct Gamma	Background + 100 mrem/yr <sup>a</sup>	DOE Order 5400.5 <sup>b</sup>

<sup>a</sup> Gamma radiation measurements are included along with radiation measurements associated with radon in the calculation of total offsite dose to the public to determine compliance with the DOE standard of 100 milli rem per year (mrem/yr) above background.

<sup>b</sup> "DOE Order 5400.5 "Radiation Protection of the Public and the Environment," (U.S. Department of Energy, January 7, 1993, Washington, D.C.).

## 3.0 Strategy

Meteorological data collected at the Shiprock site (DOE, 1984) indicate two prevailing wind directions—one from the southeast in summer and the other from the west in winter. However, as noted above, on an annual basis, the most frequent wind direction is from the east-south-east. Therefore, the primary point of anticipated exposure would be in the downwind direction of west-north-west. A total of ten monitoring locations (SHP-1 through SHP-10) will be established along the perimeter of the disposal cell. Of these ten locations, six (SHP-4 through SHP-9) will be placed along the perimeter fences north and west (i.e., downwind of the prevailing wind direction) of the disposal site (Figure 2). Upwind perimeter monitoring locations include SHP-1 and SHP-2 (placed along the south and east fence lines), and SHP-10 (placed on

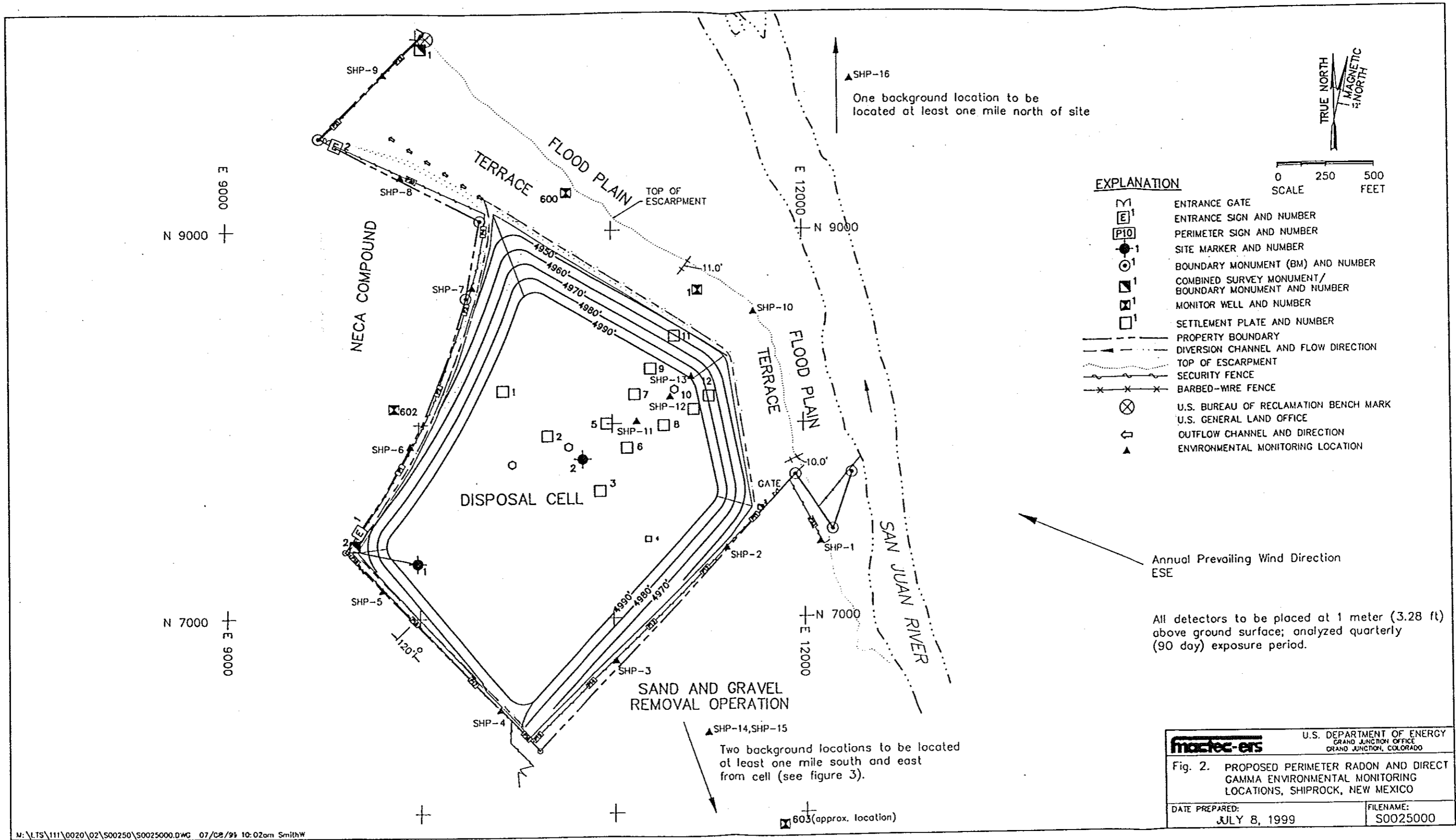


Figure 2. Proposed Perimeter Radon and Direct Gamma Environmental Monitoring Locations, Shiprock, New Mexico

the edge of the river terrace east of the disposal cell). Three additional monitoring locations (SHP-11 through SHP-13) will be placed on top of the disposal cell cover near settlement plates nos. 6, 8, and 12. Three background monitoring stations also will be established at locations at least one mile away from the disposal cell (Figure 3). Background monitoring stations SHP-14 and SHP-15 will be located south and east of the disposal cell (upwind) and SHP-16 will be located northwest (downwind) of the cell.

As shown in Figures 2 and 3, the monitoring stations will be located in a ring around the site. This strategy will allow for quantification of actual public exposure. The background sampling locations will be established in locations that have similar physiographic characteristics (e.g., elevation, land use, geology, vegetation cover, and precipitation potential) to that of the disposal cell. All background monitoring stations will be located at a sufficient distance from the disposal cell such that, in the event that a shift of the wind direction should occur and the background stations are downwind of the disposal cell, any potential contaminants transported from the disposal cell are diluted by natural dispersion and diffusion forces prior to reaching the background sites.

## **4.0 Field Sampling Procedures**

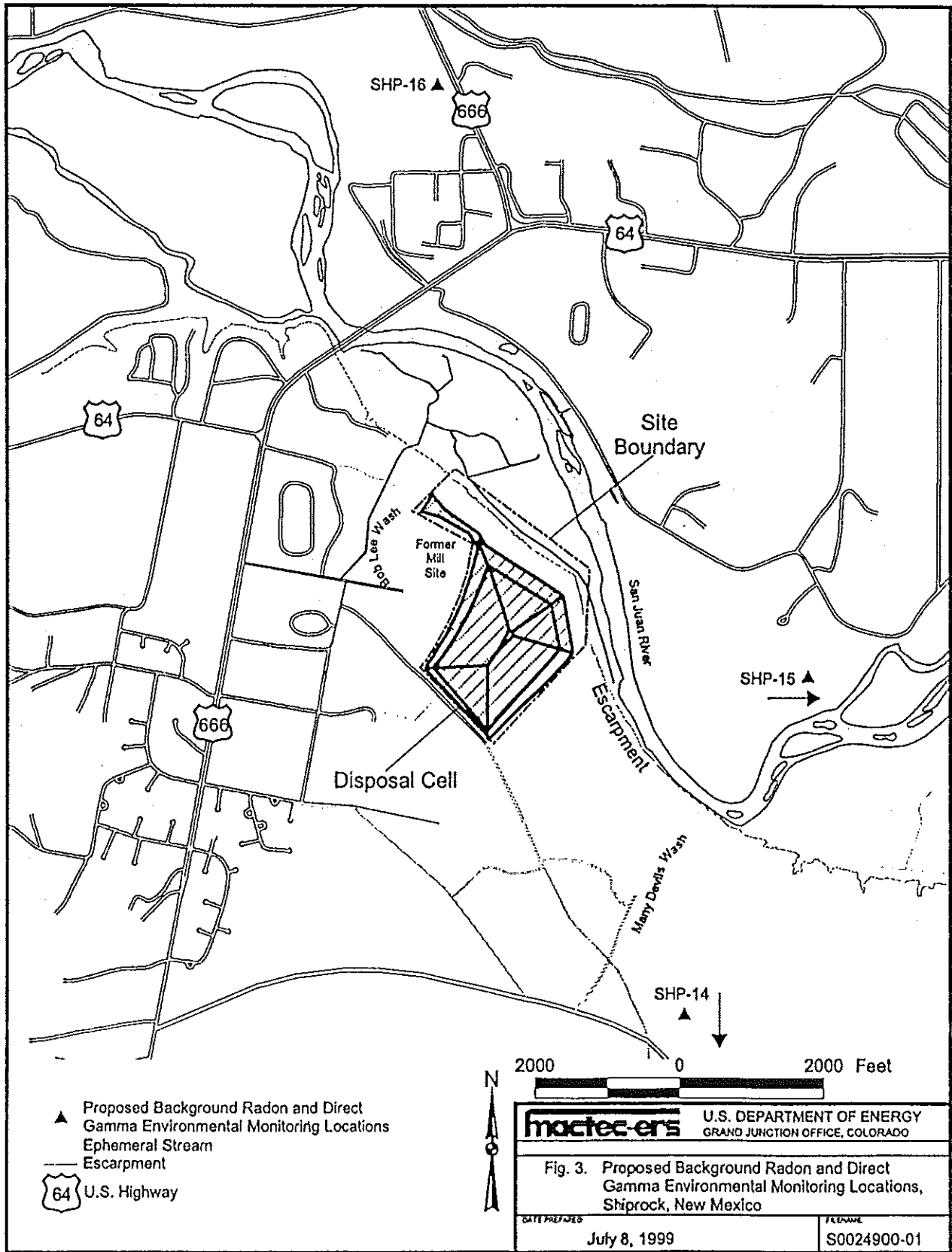
### **4.1 Radon and Direct Gamma Radiation**

Radon will be measured by using a single Landauer Radtrack alpha-sensitive detector (i.e., radon cup) that is placed into a protective polyvinyl chloride (PVC) housing. The housing is attached either to a fence line or to a metal t-post at approximately 1 meter (3.28 feet) above the ground surface. The radon cups will not be exposed in duplicate.

Direct gamma radiation will be measured with Teledyne Brown Environmental (TBE) calcium sulfate dysprosium ( $\text{CaSO}_4:\text{Dy}$ ) thermoluminescent detectors (TLDs) placed approximately 1 meter (3.28 feet) above the ground surface. All TLDs will be co-located with the radon cups and will be attached to either a fence line or affixed to a metal t-post by using wire. TLDs will not be exposed in duplicate.

LTSM personnel, in cooperation with the Navajo Nation Abandoned Mine Lands (AML) Office, will establish monitoring locations and perform quarterly change out activities. LTSM personnel will be responsible for returning exposed radon cups and TLDs to their respective laboratories for analysis, and ordering replacement radon cups and TLDs. The DOE GJO will request assistance from the AML Office in establishing off-site background monitoring locations as well as participating in the sampling activities.

Radon and direct gamma radiation surveillance at the Shiprock disposal site will be conducted for a 1-year time period. Radon cups and TLDs will be removed quarterly (every 90 days) and returned to their respective laboratories for analysis.



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Figure 3. Proposed Background radon and Direct Gamma Environmental Monitoring Locations, Shiprock, New Mexico



## 4.2 Sample Identification and Handling Procedures

Radon cups are identified by a pre-assigned, unique number printed on the detector (assigned by the manufacturer). All radon monitoring activities will comply with procedure GS-13(T), "Standard Test Method for Exterior Radon Measurements Using Alpha-Track Monitors," of the *Environmental Procedures Catalog* (DOE, 1999).

TLDs will be identified as SHP-1 through SHP-16. It is standard practice for the manufacturer to send an "in transit" TLD as a quality assurance control to ensure that the TLDs were not exposed at some point during shipment either to or from the laboratory.

Approximately every 90 days, sampling personnel shall remove exposed radon cups and TLDs from each surveillance station, replacing them with unexposed ones. After removing the exposed radon cup from its protective housing, an adhesive metal foil will be immediately placed over the open portion of the radon cup to prevent any further exposure. There is no special shielding requirement for TLDs.

Sampling personnel are responsible for maintaining a sample log documenting specific information relevant to the monitoring activities (e.g., detector number, location of placement, dates of placement/retrieval, duration of exposure, and specific comments). After all exposed radon cups and TLDs have been collected, sampling personnel will be responsible for ensuring that the monitors are express-mailed to their respective laboratories within 2 days of collection.

## 4.3 Analytical Procedures

Exposed radon cups will be analyzed by Landauer, Inc., according to an internal procedure, and in accordance with the *Quality Assurance Manual for Radon Monitoring, Revision Number 8* (Landauer, Inc. 1994). Exposed TLDs will be analyzed by Teledyne Isotopes according to *Preparation and Read-Out of Teledyne Isotopes TLD Card, TIML-TLD-01, Revision 6* (Teledyne Isotopes, 1995). The respective laboratories are responsible for providing analytical results to sampling personnel within 3 weeks upon completion of analysis. The analytical reporting limits and methods of analysis are summarized below:

Analyte	Reporting Limit <sup>a</sup>	Analytical Method
Radon Cups	0.07 pCi/L	Tech/Ops Landauer Inc., 1994
Direct Gamma Radiation	1 mrem	Teledyne Isotopes, 1990

<sup>a</sup> Analytical reporting limits are values slightly above instrument detection limits and are used to negate the variability of instrument detection limits.

## 5.0 Data Review and Reporting

At the conclusion of the one-year project, DOE GJO will submit a report to the Navajo Nation AML Office. The report will summarize the data and compare the results with applicable standards. Data will be tabulated on a quarterly basis to compare seasonal fluctuations at the site with background locations.

## 6.0 References

U.S. Department of Energy, 1994. *Environmental Assessment of Remedial Action at the Shiprock Uranium Mill Tailings Site, Shiprock, New Mexico*, Volumes I and II, U.S. Department of Energy, UMTRA Project Office, Albuquerque, New Mexico.

\_\_\_\_\_, 1999. *Environmental Procedures Catalog*, GJO Manual 6, continuously updated. Prepared by MACTEC-ERS for the U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado.

\_\_\_\_\_, 1993. DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, Washington, DC.

40 CFR 192. U.S. Environmental Protection Agency, "Uranium Mill Tailings Radiation Control Act," *U.S. Code of Federal Regulations*.

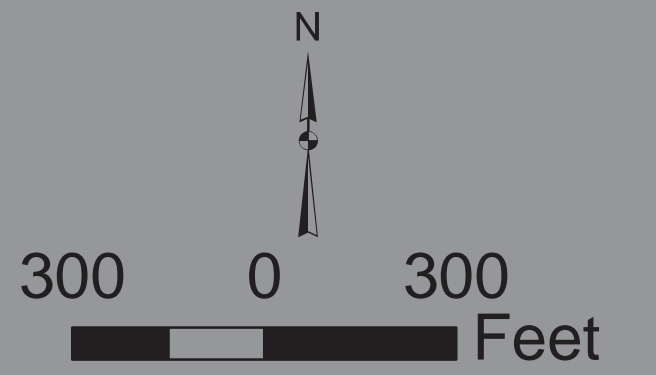
Landauer, Inc., 1994. *Quality Assurance Manual for Radon Monitoring, Revision Number 8*; Glenwood, Illinois.

Teledyne Isotopes, 1995. *Preparation and Read-Out of Teledyne Isotopes TLD Card, TIML-TLD-01, Revision 6*, Northbrook, Illinois.

**Attachment A. DOE Letter to Madeline Roanhorse,  
Director, Navajo UMTRA Program, Dated May 13, 1999**



02+00 ★	Air Relief Valve	0425 ○	Seep Location	—	Fence	—	River	—	Contour (10 foot)
21+50 ■	Drain Line	1071 ●	Extraction Well	—	Gate	—	Stream	—	Contour (2 Foot)
17+00 ▲	Valve Box	—	Concrete	—	Road	—	Pipe, Utility or Tank	—	ES #1
		—	Culvert	—	Ditch	—	Electrical Service Location		



<b>U.S. DEPARTMENT OF ENERGY</b> GRAND JUNCTION, COLORADO	Work Performed by <b>S.M. Stoller Corporation</b> Under DOE Contract No. DE-AC01-07LM00060
<b>Plate 1: Shiprock, New Mexico          UMTRA Project Site          Ground Water Remediation System</b>	
DATE PREPARED: June 13, 2003	FILENAME: U0180800-01