UMTRA-DOE/AL

WM-72

United States Department of Energy

Comparative Analysis of Disposal Site Alternatives Report for the UMTRA Project Spook Site, Converse County, Wyoming

PRELIMINARY

March, 1987

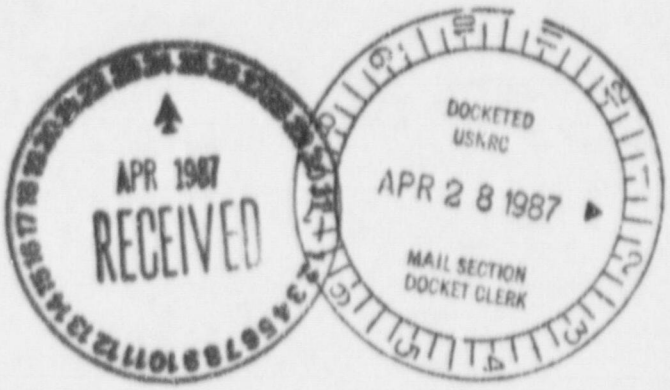
Uranium Mill Tailings Remedial Action Project UMTRAP

w/ltr 4/24/87
87-565

WM-72

Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

APR 24 1987



Malcolm Knapp
Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Springs, Maryland 20910

Dear Mr. Knapp:

Enclosed are six copies of the Preliminary Final Comparative Analysis of Disposal Site Alternatives Report (CADSAR) for Spook, Wyoming. Also enclosed for informational purpose are six copies of the review comments and responses to the Spook Draft CADSAR.

A public meeting will be scheduled to inform the community of the actions which have taken place, and of the plans for proceeding with the NEPA process upon receipt of your comments and/or concurrence on the Preliminary Final CADSAR, which is requested by May 25, 1987.

Sincerely,

James R. Anderson, Project Manager
Uranium Mill Tailings Project Office

2 Enclosures (12)

cc w/enclosure:
Dale Smith, NRC (4)

OFFICIAL DOCKET COPY

87-565

WM-72

Comments From

Nuclear Regulatory Commission

Draft CADSAR - Issued October, 1986
Nuclear Regulatory Commission Comments - November 26, 1986
U.S. Department of Energy Responses - March 6, 1987

87-565

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page General

Ground-water Issues

1. Although the draft CADSAR is designed to aid interested parties in addressing potential concerns, this document provides no ground-water information, thereby precluding any specific, technically based comment on ground-water issues with respect to the proposed options for the Spook tailings. The final CADSAR on Spook alternatives should include results from monitor well installation and preliminary monitoring, such as: a discussion on the thickness and extent of permeable aquifer materials, preliminary indications on the extent of ground-water contamination, flow directions, potential for recharge of the open-pit mine, and incorporation of these factors into a preliminary assessment on water resource impacts and potential ground-water contamination resulting from the disposal options.

SECTION 2

Response: Page General By: EBanks/TAC , Date: 01/22/87

At the time of preparation of the draft CADSAR very little ground-water information was known. Since issuance of the dCADSAR, ten monitor wells have been installed and a minor amount of preliminary water quality and water level data has been evaluated. The final CADSAR will include this updated knowledge, as well as a discussion of any appropriate well installation observations.

Plans for Implementation:

The final CADSAR will include appropriate evaluations and observations made since issuance of the draft CADSAR.

SECTION 3

Confirmation of Implementation:
Checked by: , Date: _____
Approved by: , Date: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page General

Ground-water Issues

If the SIP option is chosen as the preferred alternative, several ground-water concerns will arise relating to potential interaction of water with the tailings material. Briefly, NRC staff will review the disposal design with several key questions in mind:

1a. What is the potential for water to percolate through the backfill material and collect in the bottom of the pit (bathtubbing)?

SECTION 2

Response: Page General By: JDupuy/TAC , Date: 01/22/87

Samples of the material found at the bottom of the pit will be collected as part of the planned geotechnical sampling program. Hydraulic conductivity values will be calculated from these samples to determine the potential for a "bathtub" effect to occur in the Spook pit.

Plans for Implementation:

A field testing program will be implemented and the available results will be incorporated into the dEA and dRAP.

SECTION 3

Confirmation of Implementation:
Checked by: _____, Date: _____
Approved by: _____, Date: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page General

Ground-water Issues

If the SIP option is chosen as the preferred alternative, several ground-water concerns will arise relating to potential interaction of water with the tailings material. Briefly, NRC staff will review the disposal design with several key questions in mind:

1b. What is the likelihood that the water table will rise above the pit floor?

SECTION 2

Response: Page General By: JDupuy/TAC , Date: 01/22/87

The likelihood of this occurrence will be evaluated by the periodic monitoring of water levels within the monitor wells installed by DOE in December 1986. This water level monitoring will continue through the spring and summer of 1987 when recharge to the aquifer should be greatest and the subsequent rise in the water level should be at a maximum.

Plans for Implementation:

A field program will be implemented and the available results will be incorporated into the dEA and dRAP.

SECTION 3

Confirmation of Implementation:
Checked by: _____, Date: _____
Approved by: _____ _____, Date: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page General

Ground-water Issues

If the SIP option is chosen as the preferred alternative, several ground-water concerns will arise relating to potential interaction of water with the tailings material. Briefly, NRC staff will review the disposal design with several key questions in mind:

1c. If the State of Wyoming delays remedial action as part of the AML program, the open-pit may act as a collector for surface water runoff. What effects will this have on ground-water contamination?

SECTION 2

Response: Page General By: JDupuy/TAC , Date: 01/22/87

It is not presently known if milling-related contamination exists in the ground water in the area of the Spook pit; this cannot be determined until the results of the first ground-water sampling of the DOE-installed wells are completed. Thus, the effects of any delays by the State of Wyoming on the ground-water contamination are unknown.

Plans for Implementation:

A field program of water sampling is underway and the available results will be incorporated into the dEA and dRAP.

SECTION 3

Confirmation of implementation:
Checked by: _____, Date: _____
Approved by: _____, Date: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
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Comment: Page General

Ground-water Issues

If the SIP option is chosen as the preferred alternative, several ground-water concerns will arise relating to potential interaction of water with the tailings material. Briefly, NRC staff will review the disposal design with several key questions in mind:

1d. If water collects on the pit floor, will it contact waste material? What measures will be taken to preclude this contact?

SECTION 2

Response: Page General By: DTr itt/TAC , Date: 01/22/87

As will be discussed in the final CADSAR, the tailings will be stabilized near the center of the pit. The east and west ends of the pit are lower than the center, and thus will collect any surface water in the pit. The AML work should provide for backfilling the pit such that any ponded surface water does not contact the tailings.

Plans for Implementation:

The plans for implementation are discussed in the response and will be incorporated into the final CADSAR.

SECTION 3

Confirmation of Implementation:
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Approved by: _____, Date: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
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Comment: Page General

Surface Water and Erosion Issues

2. Additional information is needed on analysis of drainage basins, their past geomorphic history, and the identification of potential geomorphic history, and the identification of potential geomorphic hazards such as channel incision, widening, and headcutting.

Review of FBDU reports indicates that some diversion of surface water may be required for either option. A discussion should be provided regarding the proposed methods for diverting surface runoff away from the tailings, and any potential problems associated with these diversions. If diversions are not provided, discussions should be included to indicate how the design will prevent erosion. If SIP is chosen, the surface of the backfill must rise at least as high as the natural grade and be properly contoured to provide positive drainage to natural surface drainage basins near the site. Remedial action should include designs to prevent concentration of erosion runoff as well as ponding of surface waters above the buried tailings embankment.

If SOS is chosen, additional field characterization should include selection and testing of locally available rock to estimate its durability and potential need for oversizing if rock quality is poor.

No topographic maps were provided in the draft CADSAR. A detailed topographic map of the site needs to be prepared before NRC can reach conclusions regarding surface drainage.

SECTION 2

Response: Page General By: DTruitt/TAC, Date: 01/22/87

Diversion of surface water will not be required for the SIP option. The pit will be backfilled to natural grade with stockpiled overburden material as part of the AML Program. Natural drainage patterns will be restored and the placement of tailings in the pit will be such that stream erosion cannot impact the tilings within the 1,000-year design life of the remedial action. Any ponding of surface water due to surface runoff will be separated laterally and isolated from the portion of the pit containing the tailings. A copy of the USGS topography map showing final drainage paths and a plan view of the location of the tailings material within the pit will be included in the final CADSAR.

Plans for Implementation:

Discussed in the response.

SECTION 3

Confirmation of Implementation: _____, Date: _____
Checked by: _____, Date: _____
Approved by: _____

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
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Commentor: NRC

Comment: Page General

NRC Certification

3. If the SIP option is chosen, NRC will not concur in site certification until the State has completed reclamation of the Spook Mine. If the State's Abandoned Mine Lands Program is delayed, the tailings may become subject to erosion and dispersal due to a lack of rock protection. Therefore, the NRC would recommend that placement of overburden fill should begin soon after placement of the tailings and radon barrier, or additional discussion should be provided to explain why the pit design will not require rock protection.

If the SOS option is chosen, NRC may not be able to concur in site certification until the State completes reclamation. This is due to potential instability of the pile when located next to a large open pit. Also of concern will be the effects of gullies eroding headward toward the pile caused by erosion of the steep pit slopes.

SECTION 2

Response: Page General By: EBanks/TAC , Date: 01/22/87

Comment acknowledged. It is the DOE's intention that placement of the overburden fill will begin soon after placement of the tailings is complete, thereby precluding the need for rock protection.

Plans for Implementation:

The final CADSAR will incorporate the concerns raised in the comment.

SECTION 3

Confirmation of Implementation:
Checked by: , Date:
Approved by: , Date:

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page General - SOW, Section 5.0, Exhibit A

Although the draft CADSAR provides no ground-water information, there appears to be some knowledge available, since well locations and an apparent flow direction were included in the SOW. With specific reference to the proposed well locations in the SOW, NRC staff are concerned that the area northwest of the tailings pile will not be adequately monitored since well construction is not planned in that area. Although the SOW includes a figure illustrating the reported ground-water flow direction as NE, no evidence has been provided that demonstrates its accuracy. Thus, a significant portion of the proposed disposal area may go unmonitored. To alleviate potential conflicts on ground-water characterization in the future, DOE should include available ground-water information in the final CADSAR demonstrating that the wells were defensibly located during characterization. Also, the SOW does not indicate in which stratigraphic interval the wells will be completed. NRC staff recognizes that these depths cannot realistically be predicted, but if accurate monitoring is to be achieved, the TR/FTR should have some knowledge of the hydrogeology prior to deciding where the wells should be completed. This hydrologic information should be presented in the final CADSAR, or referenced accordingly.

SECTION 2

Response: Page General-SOW By: JDupuy/TAC , Date: 01/22/87

Comment acknowledged. The questions incorporated in this comment will be addressed in the final CADSAR.

Plans for Implementation:

The concerns raised in the comment will be addressed in the final CADSAR.

SECTION 3

Confirmation of Implementation: , Date:
Checked by: , Date:
Approved by:

UMTRA DOCUMENT REVIEW FORM

SECTION 1

Site: Spook , Date: 11/26/86
Document: Draft CADSAR
Commentor: NRC

Comment: Page General - SOW, Section 3.5, Attachment 1

The SOW indicates that drilling equipment will be cleaned with steam prior to entering the site, then cleaned again prior to leaving. Thus, steam cleaning will be performed only once during drilling operations (unless hydrocarbons are encountered). Although the equipment will be rinsed off with potable water between each drill hole, it may be prudent to include in the SOW, a statement indicating that additional cleaning may be required if significant contamination sources, other than hydrocarbon, are encountered. This will give the TR/FTR legal latitude when considering additional cleaning of equipment.

The TAC should consider using chlorinated water in the drilling fluid. Research has shown that chlorinated water used in drilling fluids and a follow-up treatment after casing emplacement were useful in preventing bacterial growth known to cause well encrustation and subsequent failure. This procedure may increase the effective life of the well characterization and remedial action activities.

SECTION 2

Response: Page General-SOW By: JDupuy/TAC , Date: 01/22/87

Comment acknowledged.

Plans for Implementation:

Future SOW's will consider the comment/suggestion.

SECTION 3

Confirmation of Implementation:
Checked by: _____, Date: _____
Approved by: _____, Date: _____

COMPARATIVE ANALYSIS OF DISPOSAL SITE ALTERNATIVES REPORT FOR THE UMTRA PROJECT SPOOK SITE CONVERSE COUNTY, WYOMING

March, 1987

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1.0 INTRODUCTION

In November, 1978, Congress enacted Public Law 95-604, the "Uranium Mill Tailings Radiation Control Act of 1978." The Act authorized the Department of Energy (DOE) to enter into cooperative agreements with the affected states and Indian tribes to establish remedial action programs at inactive uranium mill tailings sites. The Act stipulates that the DOE will meet the applicable radiation standards promulgated by the Environmental Protection Agency (EPA). A discussion of these standards is presented in Appendix A. It further states that the Nuclear Regulatory Commission (NRC) is to concur in all major decisions and to license the surveillance and maintenance of final disposal sites. The DOE is to pay 90 percent of the remedial action costs, with the affected states paying the remaining 10 percent of the costs. For those sites on Indian tribal lands, 100 percent of the remedial action costs will be borne by the Federal Government.

Twenty-four sites including the Spook site in Converse County, Wyoming, have been designated as eligible for remedial action. A cooperative agreement establishing guidelines, responsibilities, and conditions for remedial actions at the Spook site was signed by Wyoming representatives and the DOE, concurred in by the NRC, and became effective on December 23, 1983.

The remedial actions for the Spook site will be managed by the DOE through the Uranium Mill Tailings Remedial Action (UMTRA) Project Office, Albuquerque, New Mexico, in consultation with the State of Wyoming and with concurrence by the NRC and the State of Wyoming in major decisions.

The purpose of the Comparative Analysis of Disposal Site Alternatives Report (CADSAR) is to provide a mechanism by which the DOE and the State of Wyoming can formally agree on a preferred remedial action alternative. The State of Wyoming and Nuclear Regulatory Commission are consulted during the key steps as data are collected and evaluated. The CADSAR is prepared in a draft and final version followed by the draft Environmental Assessment (EA) and draft Remedial Action Plan (RAP). Final concurrence on the remedial action is ultimately obtained through the final RAP.

The scope of this report, the final CADSAR, includes the following main items:

- A summary evaluation of characterization data collected.
- A brief description of the conceptual design for each option.
- An updated revision of the resolution of significant issues.
- A revised cost estimate for each option.
- A technical evaluation of the remedial action alternatives for compliance with the EPA standards.
- A brief evaluation of key environmental concerns for each option.

- o A discussion of additional data and/or evaluation needs for site characterization and engineering design.

- o A recommendation for the preferred remedial action option.

The final CADSAR will be jointly reviewed by the cooperating agencies and a formal review meeting will be held, as appropriate. The purpose of this review is to reach agreement with the State of Wyoming on the preferred alternative remedial action and with NRC that the preferred alternative will meet the EPA standards described in Appendix A.

Following resolution of comments, the DOE and the State of Wyoming will agree upon the preferred alternative to be evaluated in the environmental assessment. The final CADSAR will then be issued and a public meeting may be held to inform the affected communities of the actions which have taken place, and of the proposed remedial action to be addressed in the environmental assessment.

2.0 ALTERNATE SITE SELECTION

The National Environmental Policy Act (NEPA) established guidelines for the preparation of Environmental Assessments (EA). One requirement is that the documents compare alternatives. In the case of the Uranium Mill Tailings Remedial Action (UMTRA) Project, the no action alternative is compared with the stabilization of the tailings in place and the relocation of the tailings to another site. The U.S. Department of Energy (DOE) contracted with Ford, Bacon, and Davis, Utah, Inc. (FBDU) in the late 1970s to prepare an early site assessment of each of the 24 UMTRA Project sites. One of FBDU's tasks was to identify alternate disposal sites for cost comparisons. In some cases, FBDU selected specific sites and in others they developed cost estimates for tailings relocation to an unspecified site within two or three specific radii.

The Technical Assistance Contractor (TAC) and the DOE reviewed FBDU work and other reports and data relative to the Spook site and determined that an additional alternate site selection process for a remote site was not necessary for the Spook tailings because both the existing site and a contiguous open pit uranium mine are technically suitable tailings disposal sites.

A portion of the tailings are already in the pit and the remainder of the tailings are adjacent to the Spook pit. Stabilization in place (SIP) would provide below-grade stabilization with all of the tailings buried within the Spook pit. Stabilization on site (SOS) would be above-grade in an area adjacent to the Spook pit (see Section 4.0). The no-action alternative would leave unstabilized tailings both within and adjacent to the Spook pit.

3.0 CHARACTERIZATION OF SITES

3.1 SITE DESCRIPTION AND HISTORY

The Spook mill site and tailings pile are in Converse County, approximately 48 miles northeast of Casper, Wyoming, approximately 31 miles northeast of Glenrock, Wyoming, and approximately 36 miles northwest of Douglas, Wyoming (Figure 3.1). The site is among rolling hills at an elevation of about 5100 feet above sea level in the drainage basin of the Cheyenne River. Vegetation is sagebrush and native grasses, with cottonwood trees along the creek bottoms.

The Spook pit is immediately west and north of the tailings pile (Figure 3.2). The site encompasses about five acres, including the former mill area, some concrete leach bins and foundations, a depleted acid disposal pond, and the tailings (Figures 3.3 and 3.4). Both the SIP and SOS areas are within the Spook site boundary. A portion of the tailings are adjacent to the large open pit from which the ore was mined. The remainder of the tailings have been dumped over the edge and are inside this pit. The tailings have not been stabilized, and exhibit signs of both sheet and gully erosion.

The remnants of three mine tunnels extend back from the pit walls. The longest of these tunnels is 200 feet and is partially caved in.

The Wyoming Mining and Milling Company operated on the Spook site. The site is owned by Richard T. Hornbuckle, Pearl R. Hornbuckle, Kirkwood T. Hornbuckle, and Brent B. Hornbuckle. Western Nuclear, Inc., a subsidiary of Phelps Dodge Corporation, is presently the operational controller for the property. Sequoyah Fuels, a subsidiary of Kerr-McGee, controls the mineral rights along the eastern boundary of the site.

The upgrader became operational in 1962 and ran until June, 1965. Ore from the adjacent open-pit mine averaged 0.12 percent U_3O_8 and about 187,000 tons were processed. Most of the ore was acid-leached and the uranium slurry was trucked 165 miles to the Western Nuclear Mill at Jeffrey City, Wyoming, for further processing. Some of the ore was shipped directly to the mill at Jeffrey City.

3.2 GEOLOGIC, SEISMIC, AND GEOMORPHIC

The open pit exposes flat lying, Eocene age Wasatch Formation bedrock which extends for hundreds of feet below land surface (Fox, 1974). This formation consists of medium- to coarse-grained buff, arkosic sandstone with grayish blue claystone and siltstone, and light gray to black carbonaceous shale (DeBruin, 1985). Thin coal seams commonly occur within the claystone and shale units. The Wasatch Formation sandstones and shales are overlain on hilltops by a shallow cover of weathered bedrock of the same lithologies. The natural drainages contain Quaternary soil deposits as channel filling with depths of up to 25 feet below present land surfaces.

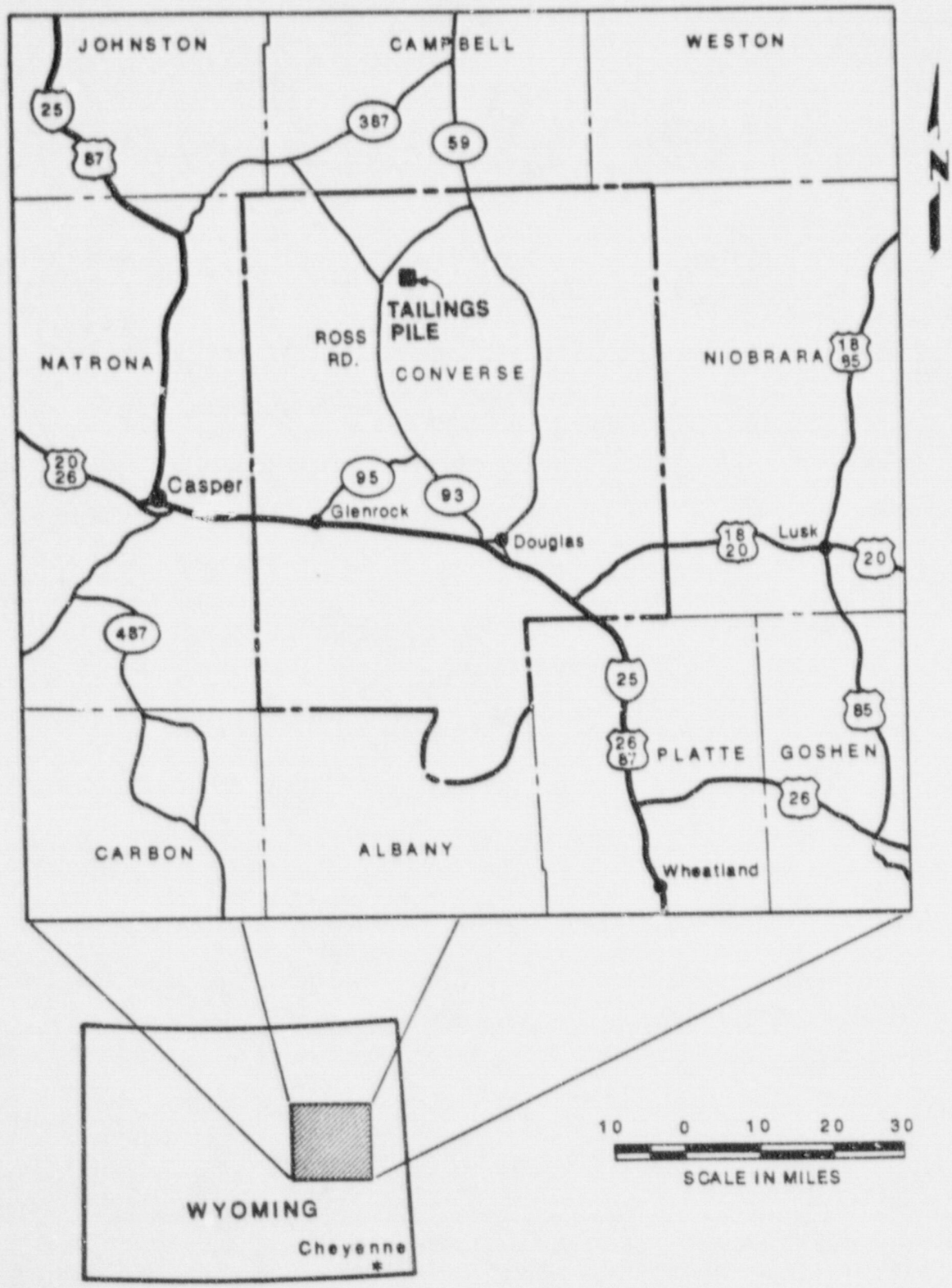


FIGURE 3.1
SPOOK SITE
CONVERSE COUNTY, WYOMING

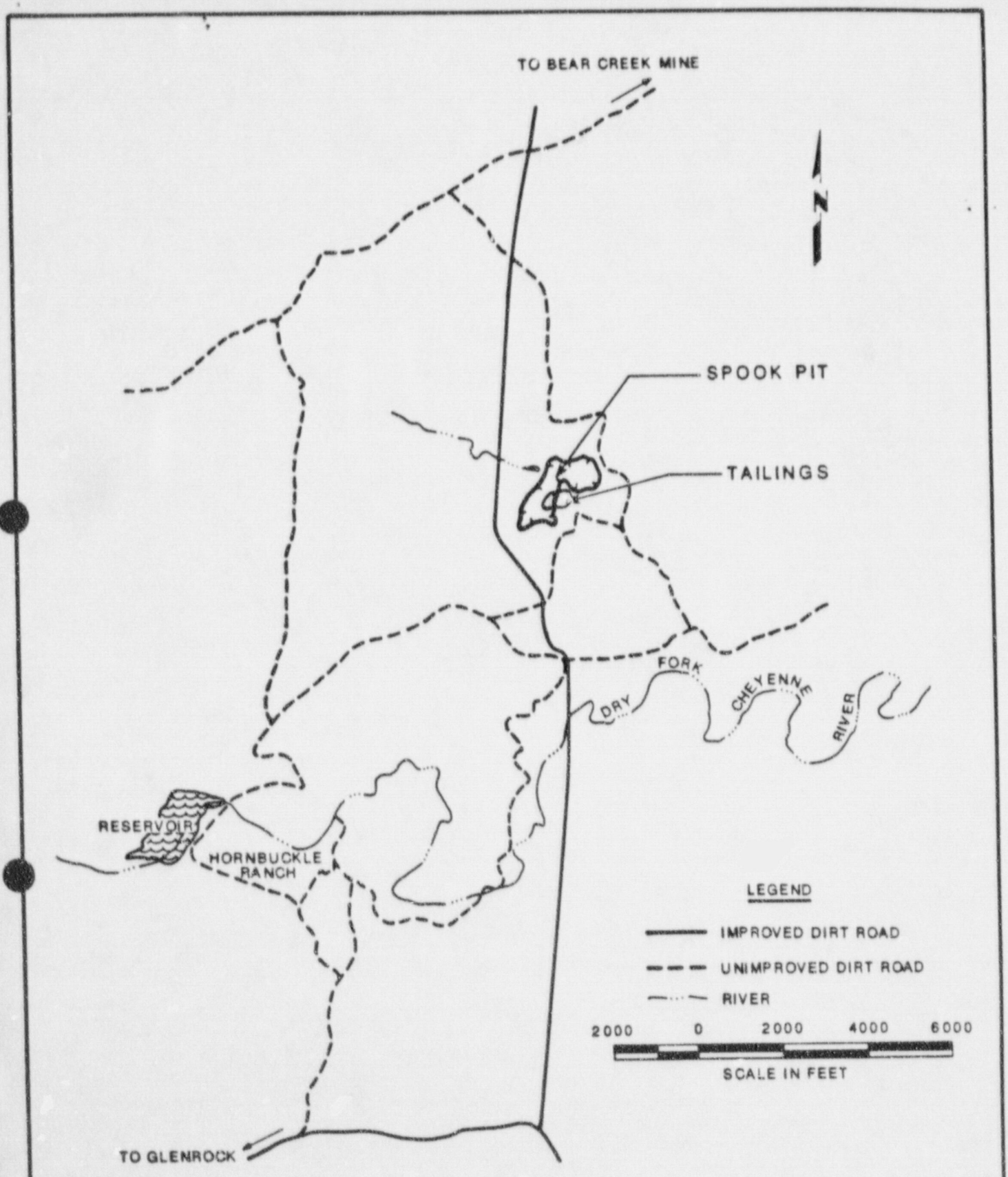


FIGURE 3.2
SITE MAP
SPOOK, WYOMING

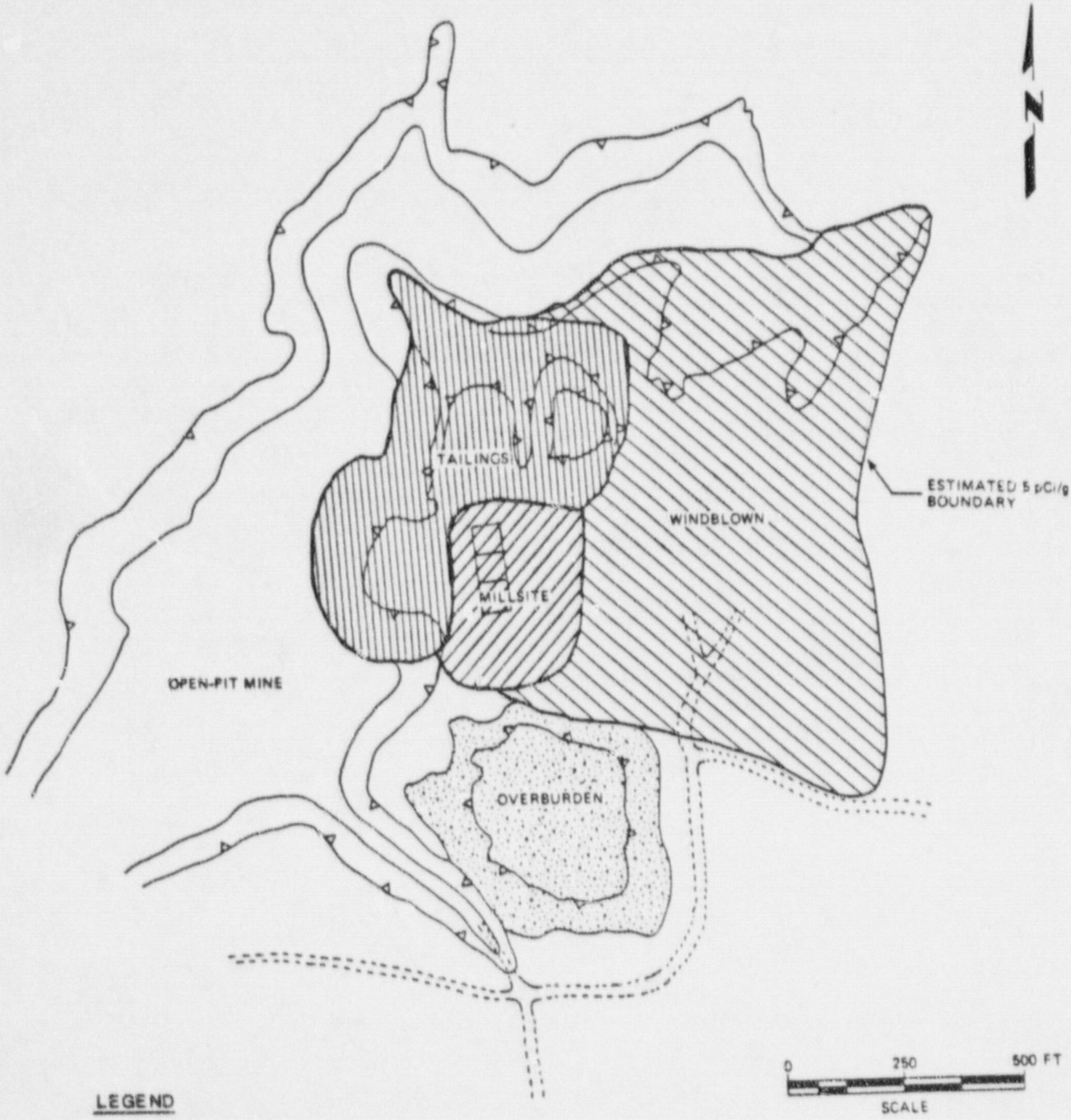


FIGURE 3.3
BOUNDARIES OF CONTAMINATION
SPOOK SITE
CONVERSE COUNTY, WYOMING

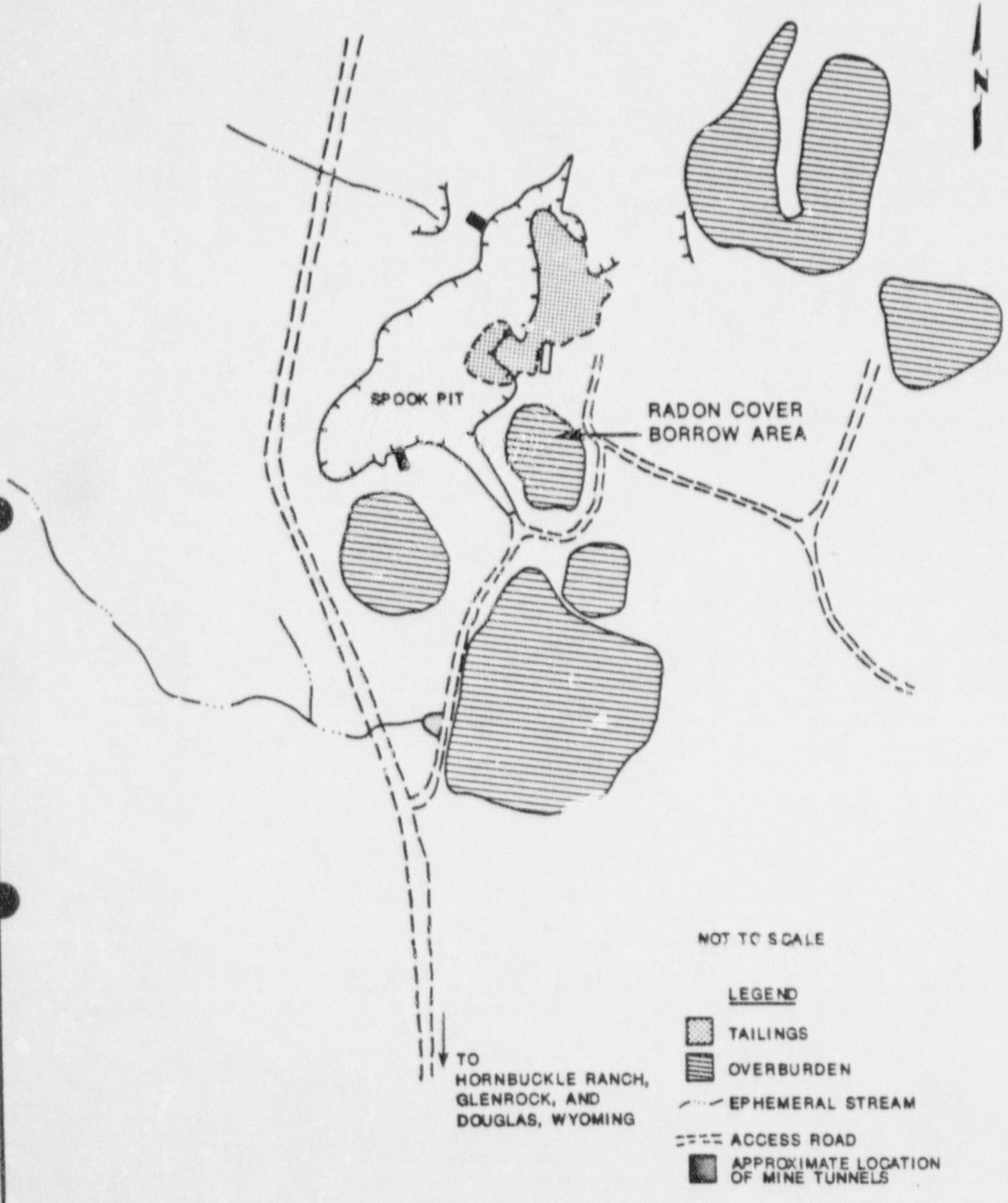


FIGURE 3.4
PROPOSED RADON COVER BORROW AREA
SPOOK SITE
CONVERSE COUNTY, WYOMING

Underlying the Wasatch Formation are up to 2000 feet of Paleocene age strata of the Lebo Member of the Fort Union Formation. This consists of fine- to coarse-grained, drab to gray sandstone, interbedded with drab siltstone, claystone, shale, and thin coal beds. The formations dip very gently to the north at less than one degree. A simplified stratigraphic column of the site area is shown in Figure 3.5.

Geologic hazards

No known active faults occur within the site area. The closest suspected active fault with surficial expression occurs 64 miles to the southeast in Niobrara County (Case, 1986a). No known liquefaction-prone, natural deposits are known to exist in the site area (Case, 1986b). Mined-out areas occur near the tailings site, but none of these are known to have subsided (Case, 1986c). There are no areas of landslides or windblown sand deposits within 5 miles of the site (Case and Boyd, 1984a).

Seismic hazards

Several seismic events with Modified Mercalli Intensities III to VII have occurred within a 40-mile radius of the site (Case and Boyd, 1984b). Preliminary maps of horizontal bedrock acceleration as a percentage of gravity (Algermissen et al., 1982) for 10-, 50-, and 250-year periods suggest that future events would produce values of 0.04g, 0.04g, and 0.09g, respectively, for the site area (Case, 1986d). These values have a 90 percent probability of not being exceeded. Provided that ground rupture does not occur immediately below the pit, a below grade stabilized pile (SIP option, see Section 4.1) would not be adversely affected by future events.

Geomorphic conditions

Geomorphic processes operating at the Spook site include fluvial erosion and deposition and minor eolian deposition. Weathering of sandstone and shale outcrops on bedrock hills adjacent to the tailings site is also occurring. Future changes in fluvial conditions in the Dry Fork of the Cheyenne River south of the site are not anticipated to impact the site area.

The most important geomorphic process of concern to the stabilized tailings pile is from fluvial erosion in ephemeral stream channels adjacent to the open pit. Two existing ephemeral stream channels currently are ponded against berms and the overflow is diverted around the north end of the pit. The north end of the pit is excavated into the former stream channel. On-going geomorphic evaluations will assess any impacts these streams may have on the stabilized tailings area.

Three mine tunnels extend from the pit wall at the northwest and southwest areas of the pit (Figure 3.4). The chimneying effects of a

SYSTEM	FORMATION	THICKNESS	CHARACTER	POSITION OF THE TAILINGS
TERTIARY	WASATCH FORMATION	0-1500 FT	SHALES, SANDSTONES, AND CONGLOMERATES; FORMS VALLEYS SLOPES, AND ROLLING HILLS; SANDSTONES YIELD WATER	← SPOOK SITE
	FORT UNION FORMATION	1500-3200 FT	SHALES, SANDSTONES, OCCASIONAL COAL BEDS; FORMS ROLLING HILLS, VALLEYS AND SLOPES; SANDSTONES YIELD WATER	
CRETACEOUS	LANCE FORMATION	1000-2900 FT	SHALES WITH SOME SANDSTONE UNITS AND OCCASIONAL COAL BEDS; FORMS VALLEYS AND SLOPES; AQUICLUDE	
	FOX HILLS SANDSTONE	125-300 FT	SANDSTONES; FORM BENCHES; AQUIFER	
	LEWIS SHALE FORMATION	1150 FT	DARK GRAY MARINE SHALE; FORMS VALLEYS AND SLOPES; AQUICLUDE	
	MESAVERDE FORMATION	500 FT	BUFF SANDSTONES WITH INTERBEDDED SHALES; FORMS BENCHES, RIDGES, AND CLIFFS; AQUIFER	
OLDER SEDIMENTARY ROCKS				

REF: FROM FBDU, 1981.

FIGURE 3.5
SIMPLIFIED STRATIGRAPHIC COLUMN
SPOOK SITE
CONVERSE COUNTY, WYOMING

collapse of these tunnels may extend to the surface, potentially disrupting and concentrating flow. The volume of these tunnels, two of which may connect, may exceed 1000 cubic yards. The filling of these tunnels during reclamation of the pit may prevent the surface expression of a possible collapse.

The proposed reclamation program for the Spook site by the State of Wyoming will backfill the pit such that the natural contours at the site will be restored (see Section 4.1). The reclaimed pit area would allow surface runoff to drain away from the stabilized tailings site area.

3.3 GEOTECHNICAL

Field observations and existing borehole data (MSRD, 1981) suggest that the methods employed by the Spook milling operation have virtually eliminated any fine-grained zones in the tailings pile. The material appears to be a silty, fine- to coarse-grained sand, angular to subangular in shape, and purplish-brown in color. Sand tailings such as these typically have high permeability, high strength, and low to moderate compressibility. Bowles (1982) and Vick (1983) note that the friction angle for such a sand may vary from 30 to 37 degrees. The steep angle of repose observed along the edge of the pit suggests a value near 37 degrees. The material is expected to exhibit very low cohesion and remain in a fully drained condition.

Previous borings (MSRD, 1981) and visual observation indicate the depth of the tailings ranges from five to 15 feet, except where the tailings have been pushed over the edge of the pit. Additional geotechnical data collection is discussed in Secton 8.0, Recommendations.

3.4 RADIOLOGICAL

The contaminated materials include: (1) tailings; (2) soils in the mill yard; (3) concrete leach bins and foundations; (4) windblown tailings adjacent to the designated site; (5) soils at the depleted acid disposal pond; and (6) possibly contaminated ground water.

The initial radiological characterization of the site was performed by DOE contractors (FBDU, 1981). The approximate boundaries of the contaminated area are shown in Figure 3.3, and the estimated quantities are summarized in Table 3.1.

3.5 GROUND-WATER HYDROLOGY

Hydrogeological data for the Spook vicinity have been reported by previous investigators (Fox, 1974; FBDU, 1981; and GECR, 1983). During November, 1985, the DOE conducted a preliminary assessment of groundwater quality in the area by analyzing ground-water samples withdrawn from several existing wells. Based upon reviews of these investigations,

Table 3.1 Spook contaminated quantities

	Volume (cy)
Tailings[a]	145,800
Contaminated soil under tailings and in mill yard[b]	32,300
Windblown contamination[c]	8,900
Total	187,000

[a]Based on 187,000 tons at 95 pounds per cubic foot.
[b]Based on four foot average contamination depth over five acres.
[c]Based upon 0.5-foot average thickness over 11 acres.

In December, 1986, the DOE installed 10 monitor wells near the Spook tailings site. The locations of the existing wells and the 10 DOE-installed monitor wells are shown on Figure 3.6.

Hydrostratigraphy

Based on data from the previous investigations and the DOE drilling program, ground water occurs within the Wasatch Formation in the area of the Spook tailings site. Ground water was encountered in each of the 10 boreholes at depths between 63 feet and 176 feet below land surface, depending upon surface topography.

Underlying the Wasatch Formation are the deposits of the Fort Union Formation. Ground water in the lower part of the Wasatch Formation and in the underlying Fort Union Formation, is reported to be of variable quality (Fox, 1974; FBDU, 1981).

Ground-water flow

Previously published reports document the regional ground-water flow direction within the Wasatch Formation in the vicinity of the Spook site as generally northeastward (Fox, 1974; FBDU, 1981). Based upon this information, the DOE installed the 10 monitor wells in the presumed upgradient and downgradient directions of the regional flow. This was done in order to establish background water quality and to intercept any potential milling-related contamination.

A preliminary ground-water flow map was developed based upon the surveyed locations, surface elevations, and the depth to water measured within the completed and developed monitor wells (Figure 3.7). The preliminary ground-water flow map illustrates variable flow directions near the existing Spook tailings site. It is likely that this variable ground-water flow is due to local recharge at the existing pit which disrupts the regional ground-water flow pattern.

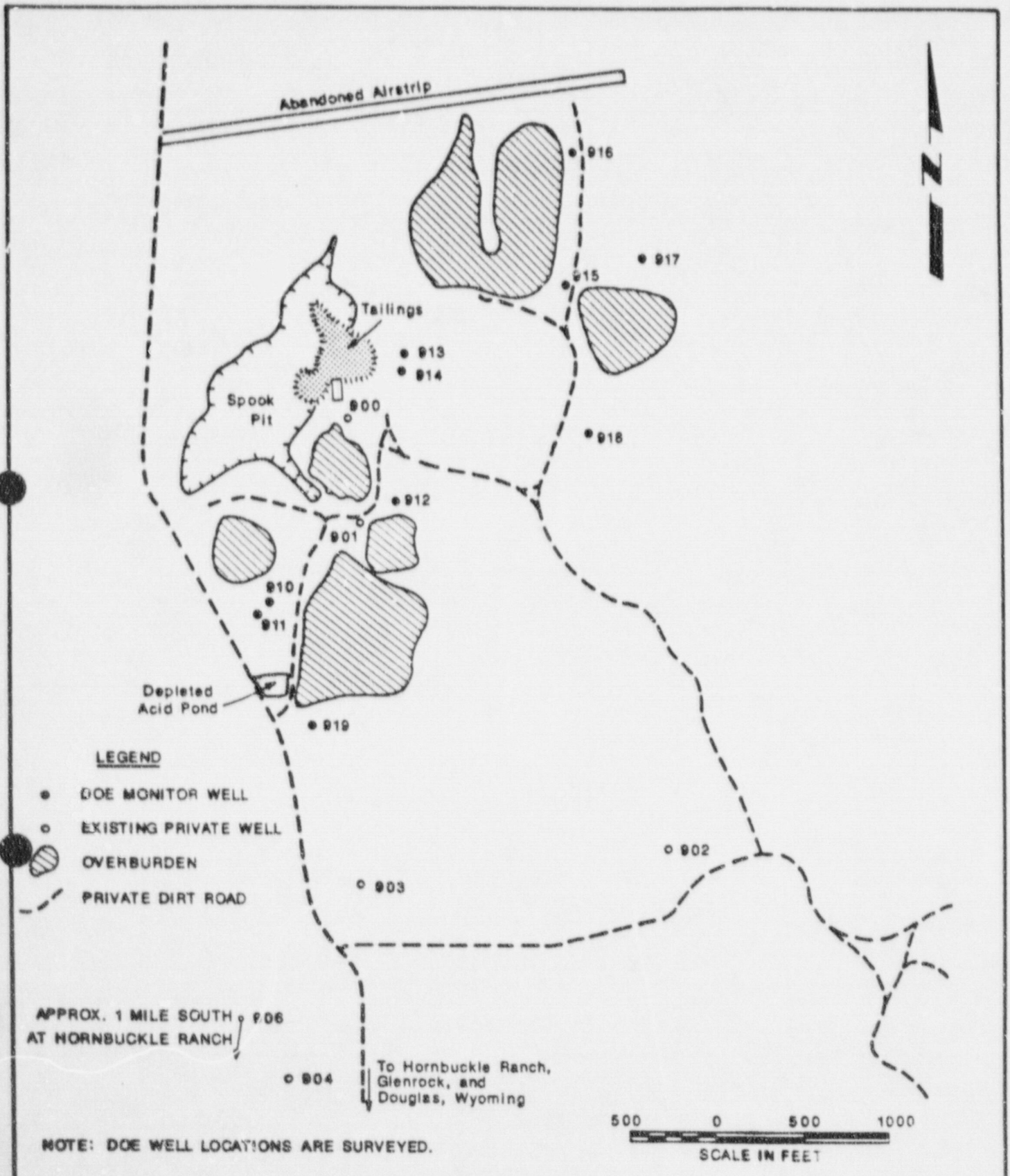
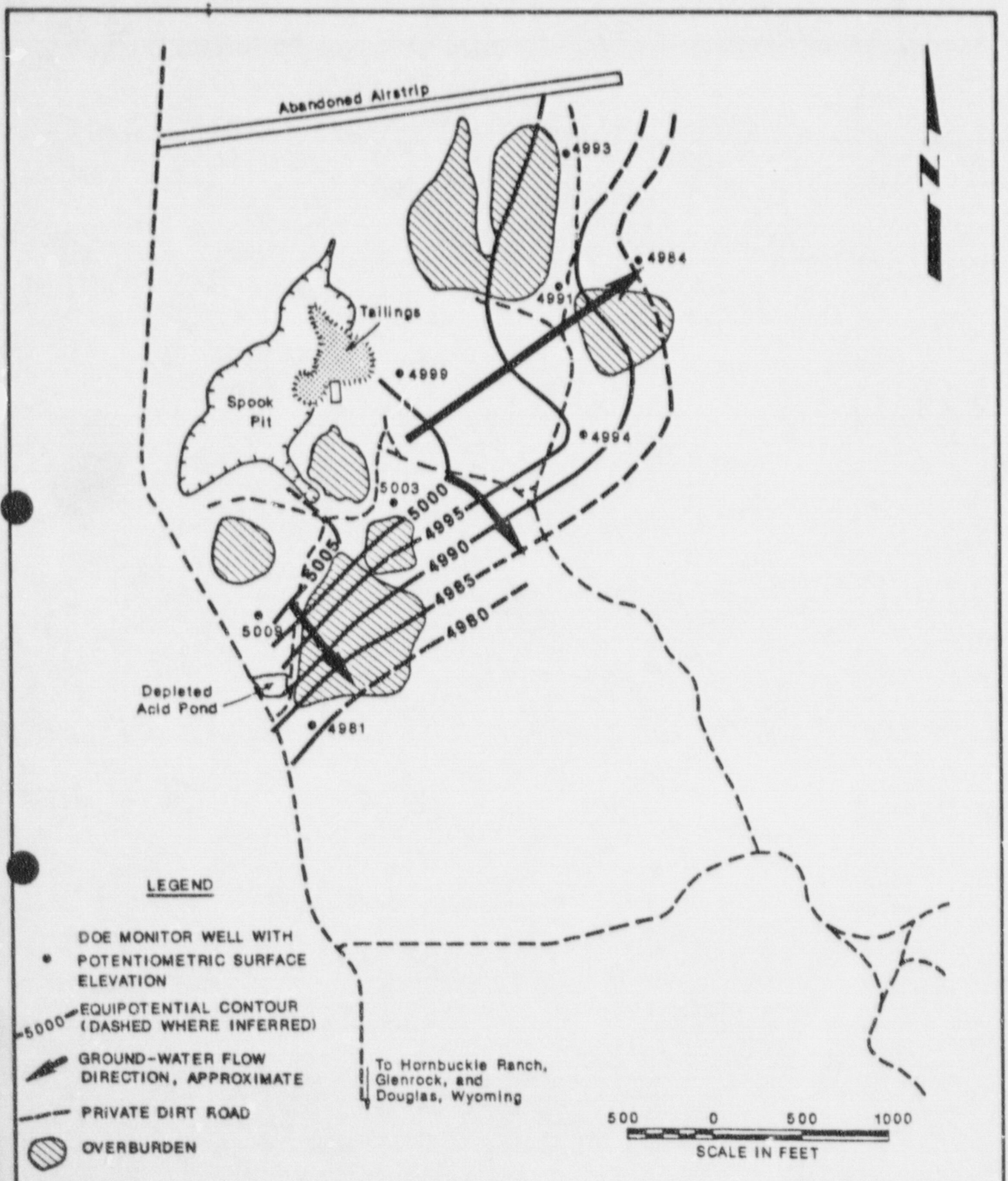


FIGURE 3.6
MONITOR WELLS AND GROUND-WATER SAMPLING LOCATIONS
SPOOK, WYOMING



NOTE: DOE WELL LOCATIONS ARE SURVEYED.

FIGURE 3.7
GROUND-WATER FLOW MAP
SPOOK, WYOMING

Ground-water quality

A preliminary summary of ground-water quality in the Spook vicinity is presented in Table 3.2. The background values are the average of analyses from existing wells numbered 902, 903, 904, and 906. The Hornbuckle tap water is supplied by well number 906. The on-site wells are numbered 900 and 901. In most cases the well completion data (i.e., total depth and screened intervals) for these six existing wells are incomplete or missing. Thus, the identification of the hydrogeologic interval from which the samples were withdrawn is tentative, and the characterization of background ground-water quality must be taken as a first approximation.

The EPA and Wyoming Primary Drinking Water Standard for radium-226 is exceeded as a result of the highly mineralized nature of the area. The fact that the Wyoming Primary (EPA Secondary) Drinking Water Standards for iron and manganese are exceeded by samples from the on-site wells is not significant because such standards primarily measure aesthetic qualities, rather than health effects. The water withdrawn by the well at the Hornbuckle ranch house shows no exceedances of either EPA or Wyoming Drinking Water Standards (Table 3.2).

3.6 BORROW MATERIALS

A recent test pit program was completed at the Spook site to investigate sources of radon cover material. The results of this program will be presented in the Remedial Action Plan (RAP). The results of an earlier site assessment visit to locate probable sources of borrow material are summarized below.

Radon cover material

The mining operation at the Spook pit resulted in the accumulation of large volumes of overburden material in several piles nearby. A pile south of the tailings pile has been identified as a potential source of material for use in constructing a radon cover (Figure 3.4) for the SOS option (Section 4.2).

Erosion protection material

No rock borrow sources have been identified. The rock available near the Spook site is mostly poor- to moderately-cemented coarse sandstone, which is not durable enough for use in erosion protection. Mine operators nearby have indicated that hauls of 35 to 65 miles are necessary to obtain durable rock for erosion protection.

Table 3.2 Preliminary summary of Spook site ground-water quality

Constituent[a]	Background	Hornbuckle tap	On-site wells
Ammonia	0.2	0.2	0.4
Arsenic	<0.01	<0.01	<0.01
Barium	0.2	0.1	0.1
Boron	0.3	0.3	0.3
Cadmium	<0.001	<0.001	<0.001
Chloride	4	3	5
Chromium	0.01	0.02	0.02
Copper	0.04	0.02	0.02
Fluoride	1.0	0.4	0.5
Iron	0.1	<0.03	0.31[c]
Lead	<0.01	<0.01	<0.01
Manganese	0.03	0.03	0.06[c]
Mercury	<0.0002	<0.0002	<0.0002
Nitrate	<1	<1	1
pH	7.89	7.66	7.32
Selenium	<0.005	<0.005	<0.005
Silver	<0.01	<0.01	<0.01
Sulfate	70	148	208
Total dissolved solids	329	372	484
Uranium	<0.0003	<0.0003	0.0151
Zinc	0.04	0.009	0.02
Radium-226	11.2 ± 0.8[b]	0.3 ± 0.2	0.7 ± 0.3

[a]All constituents expressed in milligrams per liter (mg/l), except pH (Standard Units, S.U.) and radium-226 (picocuries per liter, pCi/l).
[b]Exceeds EPA Primary Drinking Water Standard.
[c]Exceeds EPA Secondary Drinking Water Standard.

4.0 SITE CONCEPTUAL DESIGN

The designs of possible disposal options presented in this section are conceptual only, and may be revised after site characterization is completed. Design details such as pile volume and cover thickness are based upon available data and experience from remedial action plans prepared for other UMTRA Project sites. The requirements for stabilizing uranium mill tailings, as adopted by the DOE Technical Assistance Contractor (TAC), are described in the Project Technical Approach Document (DOE, 1986).

4.1 STABILIZATION IN PLACE (SIP)

Stabilization of the tailings in place, herein defined as the consolidation of all on-site contamination into the Spook pit, is a viable option. The final stabilized pile would cover about four acres inside the pit with an average depth of about 35 feet. (Figure 4.1).

A barrier of compacted, low-permeability soil (site overburden material) would be placed over the entire pile to inhibit infiltration of water into and through the contaminated materials. The upper surface of the barrier would be crowned to encourage runoff of water and reduce infiltration into the tailings. The upper portion of the barrier may also include a coarse-grained, high-permeability layer to provide a preferential runoff path for water. The thickness and design of the barrier would be determined during the design phase.

This stabilization option presumes that, following construction of the pile, the state of Wyoming will proceed with reclamation of the Spook pit under the State Abandoned Mine Lands (AML) Program. The restoration would involve placing and compacting stockpiled overburden material in the pit, bringing the surface of the backfill up to the original and surrounding ground surface. The backfill would be up to 50 feet thick, and would serve as a radon barrier for the tailings as well as eliminate the need for erosion protection rock.

The stabilized tailings pile would be constructed in the southwest portion of the Spook site (Figure 4.1). The nearest stream, approximately 400 feet north of the pile area (Figure 4.2), is ephemeral and flows eastward. Stream erosion, gully migration, and surface ponding associated with the ephemeral stream are not expected to threaten the integrity of the pile.

Leaching of contaminants from the stabilized pile should be minimized prior to, during, and after completion of the AML work. The proposed location for the tailings is between two existing low points in the pit (Figure 4.1). Any water collecting in the pit would pond at these points, away from the pile. During AML construction, ponded surface water would be kept away from the tailings by placing backfill materials on the tailings and maintaining the slope of the pit floor away from the tailings area.

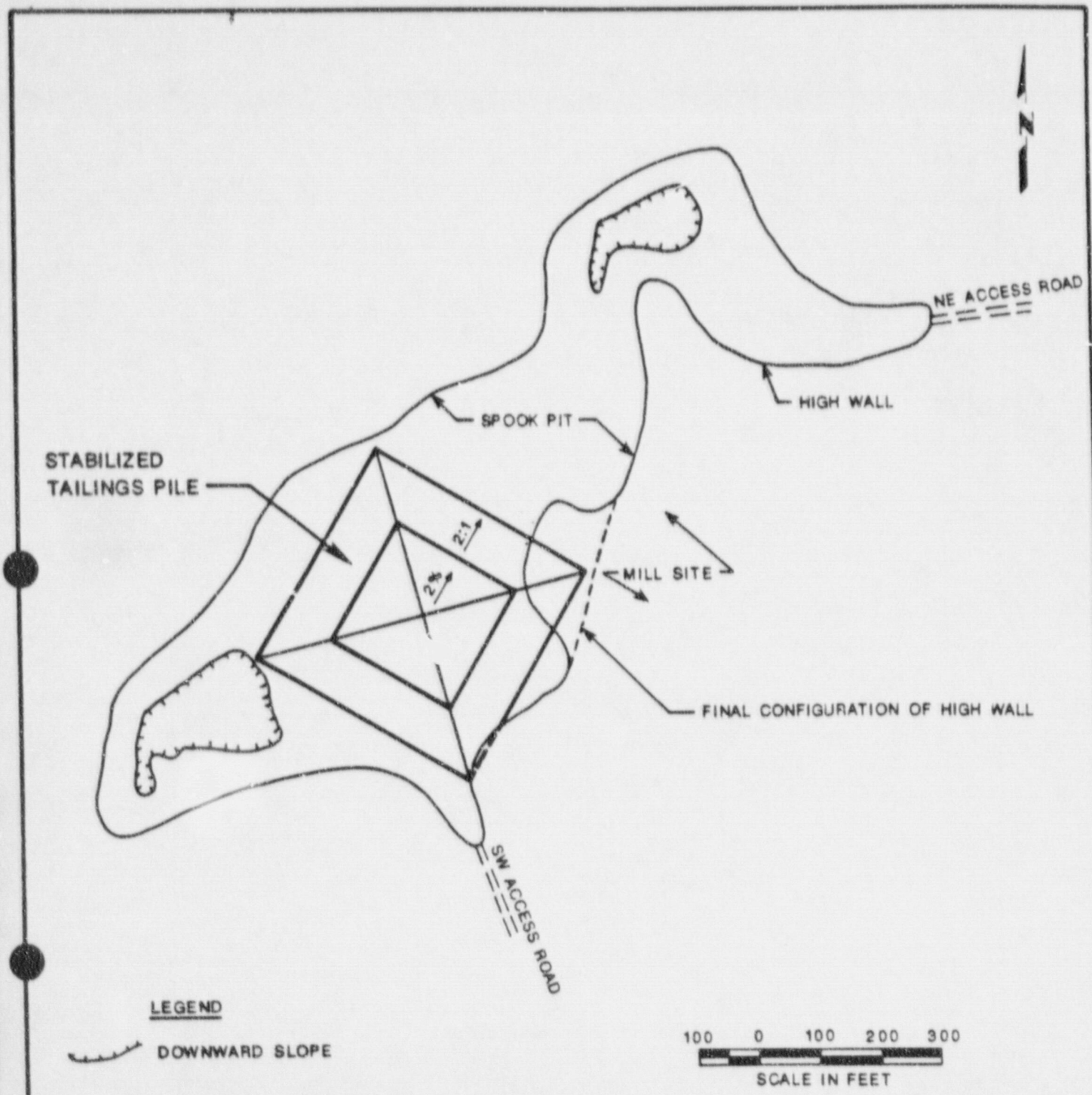
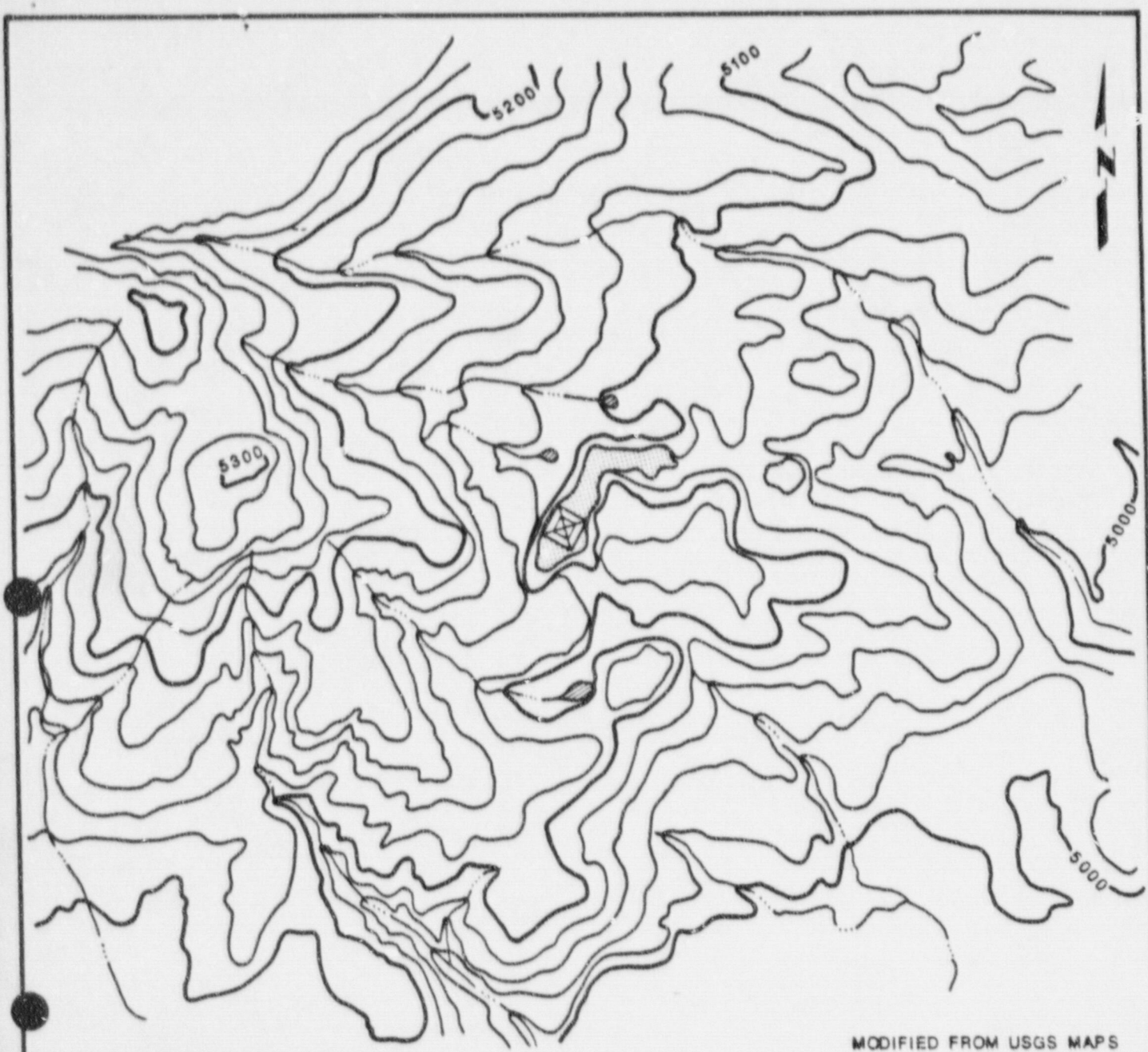


FIGURE 4.1
STABILIZATION IN PLACE
SPOOK SITE
CONVERSE COUNTY, WYOMING



MODIFIED FROM USGS MAPS

NOTE: CONTOURS AT 20' INTERVALS

LEGEND

- EPHEMERAL STREAM
- POND
- SPOOK PIT
- STABILIZED TAILINGS

1000 0 1000 2000

SCALE IN FEET

FIGURE 4.2
SURFACE TOPOGRAPHY AND DRAINAGE
SPOOK SITE
CONVERSE COUNTY, WYOMING

The former mill yard and the windblown areas will be graded and left for revegetation by the AML Program.

4.2 STABILIZATION ON SITE (SOS)

Stabilization of the tailings on the site, adjacent to the Spook pit, is also a viable option. Under this option, the tailings inside the pit would be excavated and consolidated with the tailings adjacent to the pit. The windblown and mill yard contaminated materials would also be consolidated into the pile adjacent to the pit.

A radon barrier of compacted, low-permeability soil would be placed over the entire pile to inhibit both the infiltration of water and the emanation of radon gas. The thickness of the barrier would be determined during the design phase. Based upon previous experience at other UMTRA Project sites, a three-foot barrier is used for preliminary calculations of the volume of material needed.

A rock erosion-protection layer, including an intermediate filter layer if needed, would be placed over the radon cover. The rock would be sized during the design phase to resist erosion resulting from the runoff (on the pile and on the upstream watershed) during the Probable Maximum Precipitation (PMP) event. Based upon previous experience at other UMTRA Project sites, the thickness of the rock layer would be about one foot on the top and two feet on the sideslopes of the pile.

The windblown area would be graded and revegetated with native plants. The Spook pit would not be revegetated by the DOE remedial action, because backfilling of the pit with overburden under the AML Program reclamation is anticipated shortly after stabilization of the tailings.

5.0 SIGNIFICANT ISSUES

5.1 WYOMING ABANDONED MINE LANDS (AML) PROGRAM

Coordination efforts have been initiated between the State of Wyoming and the DOE regarding the need to meet the objectives of both the Wyoming AML Program and the UMTRA Project at the Spook site. The two agencies have agreed to a cooperative effort with regard to the specific issues discussed in the following sections.

5.1.1 Technical/design

The State of Wyoming and the DOE have agreed to coordinate the remedial action design details, as well as the remaining characterization efforts, to prevent the costly duplication of work. These efforts will ensure that all applicable standards (for both the AML Program and UMTRA Project) are achieved. If the tailings are stabilized in the pit, subsequent backfilling with stockpiled overburden is expected to satisfy the radon cover requirements for the pile. Therefore, the State of Wyoming and the DOE must formally agree on a backfill design, i.e., compaction requirements, selective placement of overburden materials, final grade configuration, and the reclamation of the three adjoining mine tunnels. These design details will influence such issues as infiltration, differential settlement, final levels of allowable surface contamination, and the optimization of the surface-water drainage pattern to minimize erosion potential.

5.1.2 Coordination of work

The original DOE schedule for remedial action at Spook assumed construction would occur in 1991. The State of Wyoming indicated that it planned reclamation of the Spook pit as early as the spring of 1988. The State's reclamation of the pit cannot be completed before the tailings pile and other contaminated materials are stabilized, or otherwise removed from the pit. The DOE has accelerated the site schedule so that construction will be completed in the spring of 1989. This is one year later than the state had originally requested. The state has tentatively agreed to a 1989 UMTRA Project construction schedule, pending the opportunity for the AML construction to be completed the same year. Any impacts to the AML program as a result of delay should be monitored by the DOE. Close communication must be maintained with the AML program representatives to ensure adherence to both the joint schedule and program responsibilities.

A final decision on the preferred remedial action and a resolution of the issues discussed in Section 5.1 should be agreed upon immediately. This will ensure that work under the AML Program and the UMTRA Project is coordinated efficiently and without delays to the construction schedule.

5.1.3 Joint AML/UMTRA Project Environmental Assessment

Personnel from the state AML Program have raised the possibility of combining the Environmental Report (ER) which is required for the AML Program, with the UMTRA Project Environmental Assessment (EA) document. The legal and institutional feasibility of this proposal is being investigated by the DOE. The DOE and the state are discussing schedule differences and working toward a division of task responsibility in an effort to successfully satisfy both environmental document requirements.

5.2 GROUND-WATER CONDITIONS

A number of significant issues have evolved from the limited characterization and analyses completed to date. First, high ground-water levels may flood the pit floor and the stabilized tailings pile. Additional data are required to determine both the range of water level fluctuation and the resultant elevation of the water level under the pit area. Second, the hydraulic characteristics of the materials comprising both the overburden backfill and the pit floor must be determined to assess the potential impact of infiltration through the stabilized tailings and into the ground water. Third, the background water quality must be determined to assess the milling operation impacts on the Wasatch Formation aquifer. Since the region is known to be highly mineralized, it may be difficult to identify the source of constituents which exceed EPA Primary Drinking Water Standards. Additional data will be required to determine ground-water flow directions and aquifer properties. This may require a second-phase hydrologic drilling program. The need for this additional drilling will be determined after the initial chemical analyses are complete in May of 1987. If a second drilling program is initiated in late spring or summer, 1987, the complete results would not be available for the draft EA and RAP, currently scheduled for issue the end of July, 1987.

5.3 EXISTING SURFACE CONTAMINATION

Surface contamination samples have been collected and are being analyzed to determine background contamination levels and the areal extent of the windblown tailings materials. Initial assessments of the site indicate that the contamination levels of the windblown tailings may be indistinguishable from those of the overburden and/or the natural surface materials. Thus, excavation and stabilization of the windblown tailings may be of questionable benefit.

5.4 DURABLE ROCK BORROW SOURCES

Initial site assessment included conversations with local mine operators. They indicated that the nearest sources of durable erosion protection rock may be as far as 35 to 65 miles from the Spook site. The cost of obtaining rock from such distances will be a major factor in choosing a remedial action alternative.

6.0 COST ESTIMATES

Tables 6.1 and 6.2 identify the estimated costs associated with SIP and SOS, respectively. These costs differ from those presented in the draft CADSAR. The costs in the draft CADSAR are direct costs, while the costs presented here are loaded. These costs include only the items to be shared with the State of Wyoming. Additional cost items, not shared with the state, include:

- o Planning and design development.
- o Environmental, health, and safety support.
- o Technology development.
- o Surveillance and maintenance.
- o Technical and management support.

Table 6.1 SIP cost estimate summary[a] (1987 - $000)

Item		Cost
SITE ACQUISITION		74
Remedial action		
Site preparation and mobilization	279	
Tailings pile placement	272	
Cover construction	56	
Decontamination	37	
Site restoration	17	
Erosion protection	0	
Fence	0	
TOTAL REMEDIAL ACTION		661
25 PERCENT CONSTRUCTION CONTINGENCY		165
Engineering/construction management		
Engineering	469	
Construction management	195	
Field supervision	345	
TOTAL ENGINEERING/CONSTRUCTION MANAGEMENT		1,009
TOTAL SITE COST ESTIMATE[a]		1,909

[a]Summary indicates shared costs only.

Table 6.2 SOS cost estimate summary[a] (1987 - $000)

Item		Cost
SITE ACQUISITION		74
Remedial Action		
Site preparation and mobilization	263	
Tailings pile placement	218	
Cover construction	55	
Decontamination	33	
Site restoration	15	
Erosion protection (35-mile haul)	274	
Fence	27	
TOTAL REMEDIAL ACTION		885
25 PERCENT CONSTRUCTION CONTINGENCY		221
Engineering/construction management		
Engineering	469	
Construction management	195	
Field supervision	345	
TOTAL ENGINEERING/CONSTRUCTION MANAGEMENT		1,009
TOTAL SITE COST ESTIMATE[a]		2,189

[a]Summary indicates shared costs only.

7.0 EVALUATION AND COMPARISON OF ALTERNATIVES

7.1 DESCRIPTION OF KEY FACTORS

The alternatives for remedial action of the Spook site are evaluated on technical, environmental, and cost bases in this document. This evaluation is the basis for a summary comparison of the alternatives and is presented in Table 7.1.

7.2 RISKS

The risks associated with each alternative are presented in Table 7.2. Probabilities, but no costs, were developed for these items.

Table 7.1 Comparison of the disposal alternatives

Stabilization in place (SIP)	
Technical concerns	
(+) SIP followed by AML reclamation eliminates the need for erosion protection materials.	(-) It is necessary to reconcile any conflicts in technical design and/or cleanup standards between the AML Program and the UMTRA Project.
(+) Below grade disposal is probably the more hydrologically and geomorphically stable option.	(-) The remedial action schedule must be coordinated soon to minimize interference between the AML Program and UMTRA Project plans.
(+) The overburden may satisfy the requirement for a radon/infiltration barrier if the State of Wyoming backfills the pit.	(-) Background radioactivity levels are variable due to mineralization in the area; therefore, excavation control may be complicated. Also windblown contaminated materials may not be easily differentiated from natural materials and overburden materials.
	(-) Tailings stabilized in the pit may be close to the ground-water table.
Administrative concerns	
	(-) Title to and maintenance responsibility for the affected lands above the stabilized pile must be agreed upon before this remedial action is begun.
Cost comparison	
(+) Least costly action alternative.	
Environmental/social	
(+) Less potential impact on the surrounding environment and is preferred by the local public.	(-) Private land acquisition involving multiple owners (surface and mining claims) required.
(+) Threatened or endangered species unlikely.	(-) Site near mule deer and white-tailed deer wintering areas (Christiansen, 1986).

Table 7.1 Comparison of the disposal alternatives (Continued)

(+) Cultural resources probably not present.	
(+) Site is remote.	
Stabilization on site (SOS)	
Technical concerns	
(+) The tailings in the pit can be removed and stockpiled for later stabilization, allowing reclamation of the pit by the AML Program to proceed earlier.	(-) A source for durable erosion protection rock must be identified. Long haul distances are likely.
(+) Overburden may serve as radon barrier material.	(-) The stabilized pile may need to be set back a significant distance from the Spook pit to accommodate AML Program work.
	(-) The pile may be less stable during seismic activity.
	(-) Background radioactivity levels are variable due to uranium mineralization in the area; therefore, excavation control may be complicated. Also windblown contaminated materials may not be easily differentiated from natural materials and overburden materials.
Administrative concerns	
	(-) The state and then DOE must acquire title to the land and mining claims occupied by the pile, which is currently privately owned.
Cost comparison	
	(-) More costly than the SIP alternative.

Table 7.1 Comparison of the disposal alternatives (Concluded)

Environmental/social	
(+) Threatened or endangered species unlikely.	(-) Private land acquisition involving multiple owners required.
(+) Cultural and historic resources are not present.	(-) Site near mule deer and white-tailed deer wintering areas.
(+) Site is remote.	

Table 7.2 Risks associated with each alternative

Risk item	SIP (percent)	SOS (percent)
Fault present.	N/A[a]	15
Larger volume of contaminated material is identified.	20	20
Schedule coordination between the UMTRA and AML Projects may not occur which may necessitate placement of erosion protection for SIP in lieu of overburden backfill.	25	N/A[b]
Design modifications may be necessary if the seasonal ground-water level fluctuations flood the pit floor area and the stabilized tailings pile.	50	N/A

[a]Seismic activity would not affect the stabilized tailings in a below-grade design because there would be no possibility of slope failure.
[b]Erosion protection is assumed to be required.

N/A - not applicable

8.0 RECOMMENDATIONS

8.1 WYOMING ABANDONED MINE LANDS (AML) PROGRAM

Scheduling and design coordination between the AML Program and the UMTRA Project (described in Section 5.0) should be pursued in order to complete timely remedial action and reclamation at the Spook site.

8.2 SUMMARY OF DATA AND ANALYSIS NEEDS

Geological requirements

Stabilization in place will require identification of potential on-site faulting and an understanding of the geomorphic and geologic processes which may affect the remedial action design. Since stabilization is below grade, seismicity is not important, unless the possibility of site fault rupture exists.

Since no source of durable rock exists near the site, geomorphic processes of potential mass wasting, gully encroachment, and head cutting will be assessed and their impacts incorporated into the design.

Stabilization on site above the pit will require a full geologic, geomorphic, and seismic investigation as outlined in the DOE Technical Approach Document (DOE, 1986).

Geotechnical requirements

Scopes of work for the geotechnical evaluation of the Spook site will be transmitted to the NRC, RAC, and the State of Wyoming in the early spring of 1987.

Stabilization in the pit will require determination of the stratigraphy underlying the pile area and a minimal characterization of the tailings. Since a portion of the tailings already in the pit may remain in place, tests will be performed to determine in-place density. Samples will be obtained and tested for gradation and relative density or relative compaction. Consolidation tests will be performed (on samples remolded to the in-situ density) in order to determine the potential for settlement of the tailings due to saturation and/or loading. Other associated tests on remolded samples of the overburden and foundation material will also be performed in order to quantify settlement potential, permeability, and density. Should unusual or unanticipated conditions be encountered in this program, or should this design be significantly altered, further geotechnical work may be conducted.

Stabilization on site above the pit will require a detailed soils investigation including borings, test pits, and a full range of geotechnical testing. A borrow source for radon cover material will require detailed investigations. A durable rock borrow source would need identification and testing.

Radiological requirements

Additional radiological characterization of the Spook site was started in November, 1986, and has not yet been completed. This characterization consists of soil sampling of surface and test pit locations for levels of contamination and radon diffusion coefficients. In addition to the analyses of these samples, UNC Technical Services currently is analyzing soil samples previously collected by Mountain States Research and Development. Two major goals of this characterization program are to: (1) further characterize the extent of contamination both in the immediate area around the mill yard and the extent of windblown contamination; and (2) obtain a technical basis for differentiating between tailings materials and overburden or low grade ore materials. This differentiation will be especially important for areas of windblown contamination, where a combination of tailings and ore materials may be present. All data and completed analyses will be included in the RAP.

Hydrological requirements

Additional water level elevations and ground-water quality data should be collected for a minimum of two quarterly periods to determine seasonal variations in these parameters. Water level elevation data must be collected to determine water table fluctuations, and the subsequent potential for flooding the stabilized pile in the pit. These elevation data should also verify the preliminary ground-water flow directions presented in Figure 3.4. Water quality samples will be collected from the 10 DOE-installed monitor wells and chemically analyzed to determine background water quality and the potential presence of milling-related contamination. Slug tests will be performed in the 10 DOE-installed monitor wells and the resulting data analyzed to determine aquifer properties in the vicinity of the Spook tailings site.

Based upon the results of these analyses, it may be necessary to proceed with a second-phase drilling program.

Environmental requirements

The DOE is required to perform a Class III archaeological survey and various wildlife surveys for inclusion in the Environmental Assessment (EA). These surveys will be performed in the spring of 1987. The DOE and the State of Wyoming have agreed to share the responsibility for these obligations. The state has agreed to complete the raptor, prairie dog, and threatened and endangered species surveys in the spring of 1987, and the DOE will be responsible for the Class III archaeological survey.

8.3 PREFERRED ALTERNATIVE

Based on the available information, the DOE proposes SIP as the preferred remedial action at the Spook site. Although EPA standards can

be met with either alternative, the SIP cost is less than SOS, the SIP option is the more technically stable option, and SIP is preferred by the local landowners. The Environmental Assessment will, therefore, examine SIP as the preferred alternative for the remedial action at the Spook Site. A Remedial Action Plan will also be developed to accomplish the preferred alternative.

8.4 SCHEDULE OF FUTURE ACTIVITIES

A schedule of the key activities for the Spook project is presented in Table 8.1.

Table 8.1 Schedule of key activities for Spook

Item	Proposed schedule	
	Start	Finish
Radiological analysis of data	01/87	04/87
Preliminary geotechnical investigation (test pitting)	02/87	04/87
Borrow site investigation[a]	04/87	05/87
Phase II ground-water investigation[b]	03/87	06/87
Final geotechnical investigation (drilling)[c]	04/87	06/87
Low-Sun-angle photography[a]	05/87	06/87
Wildlife and cultural surveys	04/87	06/87
Issue final CADSAR to public		06/87
Issue draft EA and RAP to agencies		08/87
Finding of No Significant Impact (FONSI)		03/88
Issue final RAP to public		07/88
Perform remedial action	04/89	09/89

[a]Required only if SOS near the pit is preferred or if the AML Program is cancelled.
[b]May not be required.
[c]Required only for SOS near the pit if soil depth is greater than backhoe capability.

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APPENDIX A

EPA STANDARDS

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LIST OF TABLES

A.1 EPA STANDARDS

The requirements and considerations for long-term isolation and stabilization of tailings, radon control, cleanup of land and buildings, and protection of water quality have been discussed and published in the Plan for Implementing EPA Standards for UMTRA Sites (UMTRA-DOE, 1984b). That document was used as a guide in the development of the Remedial Action Plan. This EPA Standards appendix has been extracted from the above-referenced publication.

A.1.1 GENERAL

Pursuant to the requirements of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), EPA has promulgated health and environmental standards to govern cleanup, stabilization, and control of residual radiological materials at inactive uranium mill tailings sites. The promulgated standards establish requirements for long-term stability and radiation protection and provide procedures for ensuring the protection of ground-water quality.

In developing the standards, EPA determined "that the primary objective for control of tailings should be isolation and stabilization to prevent their misuse by man and dispersal by natural forces such as wind, rain, and flood waters" and that "a secondary objective should be to reduce radon emissions from tailings piles." A third objective should be "the elimination of significant exposure to gamma radiation from tailings piles." (Ref. preamble to Standards for Remedial Actions at Inactive Uranium Processing Sites, 40 CFR Part 192.) These conclusions were based on a determination that the most significant public health risks associated with inactive tailings were posed by exposure to people living and working in structures contaminated by relocated tailings. EPA further concluded that the potential for contamination of ground water and surface water should be evaluated on a site-specific basis.

The EPA standards are discussed in the following paragraphs and are summarized in Table A.1.1.

A.1.2 LONG-TERM STABILITY

Isolation and stabilization of tailings in order to prevent misuse by man and dispersal by natural forces is the primary objective of the EPA standards. Accordingly, long-term stability was emphasized in the development and promulgation of the standards. This is consistent with the guidance provided by the legislative history of the UMTRCA which stresses the importance of avoiding remedial actions which would be effective only for a short period of time and which would require future Congressional consideration.

The EPA standard-setting process distinguished "passive controls" such as thick earthen covers, below-ground disposal, rock covers, and massive earth and rock dikes, from "active controls" such as semi-permanent covers, fences, warning signs, and restrictions on land use.

PART 192 - HEALTH AND ENVIRONMENTAL PROTECTION STANDARDS FOR URANIUM MILL TAILINGS

SUBPART A - Standards for the Control of Residual Radioactive Materials from Inactive Processing Sites

192.02 Standards

Control shall be designed to:

(a) Be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,

(b) Provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not:

(1) Exceed an average release rate of 20 picocuries per square meter per second, or
(2) Increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter.

SUBPART B - Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites

192.12 Standards

Remedial actions shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site:

(a) The concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than -

(1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and
(2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.

(b) In any occupied or habitable building -

(1) The objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL, and
(2) The level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour.

SUBPART C - Implementation (condensed)

192.20 Guidance for Implementation

Remedial action will be performed with the "concurrence of the Nuclear Regulatory Commission and the full participation of any state that pays part of the cost" and in consultation as appropriate with other government agencies.

192.21 Criteria for Applying Supplemental Standards

The implementing agencies may apply standards in lieu of the standards of Subparts A or B if certain circumstances exist, as defined in 192.21.

192.22 Supplemental Standards

"Federal agencies implementing Subparts A and B may in lieu thereof proceed pursuant to this section with respect to generic or individual situations meeting the eligibility requirements of 192.21."

(a) ". . .the implementing agencies shall select and perform remedial actions that come as close to meeting the otherwise applicable standards as is reasonable under the circumstances."

(b) ". . .remedial actions shall, in addition to satisfying the standards of Subparts A and B, reduce other residual radioactivity to levels that are as low as is reasonably achievable."

(c) "The implementing agencies may make general determinations concerning remedial actions under this Section that will apply to all locations with specified characteristics, or they may make a determination for a specific location. When remedial actions are proposed under this Section for a specific location, the Department of Energy shall inform any private owners and occupants of the affected location and solicit their comments. The Department of Energy shall provide any such comments to the other implementing agencies [and] shall also periodically inform the Environmental Protection Agency of both general and individual determinations under the provisions of this section."

Ref: Federal Register, Volume 48, No. 3, January 5, 1983, 40 CFR Part 192.

TABLE A.1.1 EPA STANDARDS

Active control covers could be expected to need frequent replacement or other major repairs requiring the appropriation and expenditure of public funds. In setting the standards, EPA called for designs which rely primarily on passive controls.

The standard is framed as a longevity requirement which recognizes the difficulty in predicting very long-term performance with a very high degree of confidence. In establishing the longevity requirement, EPA concluded that existing knowledge permits the design of control systems that have a good expectation of lasting at least 1000 years. Therefore, a design objective of 1000 years was established to be satisfied whenever reasonably achievable, but in any case, with a minimum performance period of 200 years.

The standard recognizes the need for institutional controls such as custodial maintenance, monitoring, and contingency response measures. In its preamble to the standards, EPA calls for such controls to be provided as an essential backup to the primary passive controls.

A.1.3 RADON EMISSIONS CONTROL

EPA identified a reduction of radon emission from tailings piles as the second objective in its standards for the control of tailings. In developing the standards, EPA considered several alternative approaches and selected an emission limitation as the primary form of the standard. In addition, a concentration limit was established by EPA as an alternative form of the standards for use in cases where the DOE determined that the alternative was appropriate.

In establishing the emission limitation for tailings piles, EPA sought to reduce both the maximum risk to individuals living very near to the sites and the risk to the population as a whole. With regard to individuals very near to disposal sites, EPA estimates that exposure to radon emissions will be reduced by more than 96 percent. The radon standard will limit the increase in radon concentration attributable to a pile to a small increase above the background radon level near the disposal site. Both radon standards are design standards with compliance to be determined on the basis of predicted rather than measured emission rates and concentrations. EPA states that "post-remediation monitoring will not be required to show compliance, but may serve a useful role in determining whether the anticipated performance of the control system is achieved."

In establishing the radon standard, EPA determined that the emission limitation could be achieved by well-designed thick earthen covers and that such control techniques would be compatible with the requirements of the EPA longevity standard.

A.1.4 WATER-QUALITY PROTECTION

EPA reviewed available water-quality data at inactive tailings sites and determined that there was little evidence of recent movement

of contaminants into ground water. They also determined that any degradation of ground-water quality should be evaluated in the context of potential beneficial uses of the ground water as determined by background water quality and the available quantity of ground water.

Rather than establish specific numerical limitations for contaminant discharges or ground-water quality, EPA determined that the most appropriate course of action would be to require site-specific analyses of potential future contaminant discharge and a case-by-case evaluation of the significance of such a discharge. The implementation guidelines for the EPA standards call for adequate hydrological and geochemical surveys at each site as a basis for determining whether specific water-protection measures should be applied. On September 3, 1985, the United States Circuit Court of Appeals set aside EPA's water protection standards, 40 CFR Part 192.20(a)(2)-(3), and EPA has not yet reissued these standards. The site-specific environmental document identifies how DOE will approach this issue until water protection standards are reissued.

Specific site assessment must include monitoring programs sufficient to establish background ground-water quality through one or more upgradient wells, and to identify the present movement and extent of contaminant plumes associated with the tailings piles. The site assessments further call for judgements of the need for restoration or prevention, or both, to be guided by EPA's hazardous waste management system and relevant state and Federal water-quality criteria. Decisions on specific actions to protect or restore water quality are to be guided by such factors as the technical feasibility of improving the aquifer, the cost of applicable restorative or protective programs, the present and future value of the aquifer as a water source, the availability of alternate water supplies, and the degree to which human exposure is likely to occur.

The UMTRCA requires that the standards promulgated by EPA ". . . to the maximum extent practicable, be consistent with the requirements of the Solid Waste Disposal Act, as amended." In setting the standards, EPA determined that the statutory requirement for NRC to concur with the selection and performance of remedial actions and to issue licenses encompassing "monitoring, maintenance, or emergency measures necessary to protect public health and safety" was consistent with the EPA regulations implementing the Solid Waste Disposal Act (47 FR 32274, July 26, 1982). Accordingly, EPA established the implementation procedures requiring case-by-case evaluations of potential contamination at sites. Decisions regarding monitoring or remedial actions will be guided by relevant considerations in the hazardous waste management systems.

A.1.5 CLEANUP OF LANDS AND BUILDINGS

The EPA evaluated the risk associated with the dispersal of tailings off the site and concluded that the principal risk to man was the exposure to radon daughter products inside buildings. EPA therefore

stated that the objective of the cleanup of tailings from around existing structures was to achieve an indoor radon daughter concentration (RDC) of less than 0.02 WL (working level). For open lands, the purpose of removing the contamination is to remove the potential for excessive indoor radon daughter concentrations that might arise from new construction on contaminated land. The 5 pCi/g and 15 pCi/g Ra-226 concentration limits for 15-cm surface and subsurface layers were considered adequate to limit indoor RDCs to below 0.02 WL. A secondary concern was to limit exposure to people from gamma radiation.

The standard requires that residual radioactive materials be removed from buildings exceeding 0.02 WL. In cases where levels are between 0.02 and 0.03 WL after cleanup, the Federal Government will have the flexibility to use measures such as sealants, filtration devices, or ventilation devices to reduce concentrations to below 0.02 WL. If the working levels are still greater than 0.02 WL but less than 0.03 WL, no additional remedial action will be performed.