DOE-LM/GJ705–2004

# Office of Legacy Management

# Long-Term Surveillance Plan

# for the

# Gas Hills North (UMTRCA Title II) Disposal Site
# Fremont County, Wyoming

April 2005

DRAFT FINAL

Work Performed by S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado

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# 1.0 Introduction

## 1.1 Purpose

This Long-Term Surveillance Plan (LTSP) explains how the U.S. Department of Energy (DOE) Office of Legacy Management (LM) will fulfill general license requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28) as the long-term custodian of the Gas Hills North site (formerly known as the Pathfinder Mines Corporation (PMC) Lucky Mc uranium mill tailings disposal site) in Fremont County, Wyoming. The LM Program at the DOE-LM office in Grand Junction, Colorado, is responsible for the preparation, revision, and implementation of this LTSP, which specifies procedures for inspecting the site, monitoring, maintenance, annual and other reporting requirements, and maintaining records pertaining to the site.

## 1.2 Legal and Regulatory Requirements

The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 (42 USC §7901) as amended, provides for the remediation (or reclamation) and regulation of uranium mill tailings at two categories of mill tailings sites: Title I and Title II. Title I includes former uranium mill sites that were unlicensed as of January 1, 1978, and essentially abandoned. Title II includes uranium-milling sites under specific license as of January 1, 1978. In both cases, the licensing agency is the U.S. Nuclear Regulatory Commission (NRC), or in the case of certain Title II disposal sites, an Agreement State. The Gas Hills North site is a Title II site under UMTRCA. The State of Wyoming is not an Agreement State.

Federal regulations at 10 CFR 40.28 provide for the licensing, custody, and long-term care of uranium and thorium mill tailings sites closed (reclaimed) under Title II of UMTRCA.

A general license is issued by the NRC for the custody and long-term care, including monitoring, maintenance, and emergency measures necessary to ensure that uranium and thorium mill tailings disposal sites will be cared for in such a manner as to protect the public health, safety, and the environment after closure (completion of reclamation activities).

The general (long-term custody) license becomes effective when the current specific license is terminated by the NRC or the Agreement State, and when a site-specific LTSP (this document) is accepted by the NRC.

Requirements of the LTSP and general requirements for the long-term custody of the Gas Hills North site are addressed in various sections of the LTSP (Table 1–1).

The plans, procedures, and specifications in this LTSP are based on the guidance document, *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2001). Rationale and procedures in the guidance document are considered part of this LTSP.

*Table 1–1. Requirements of the LTSP and for the Long-Term Custodian of the Gas Hills North Site*

| Requirements of LTSP | | |
|---|---|---|
| | *Requirement* | *Location* |
| 1. | Description of final site conditions | Section 2.0 |
| 2. | Legal description of site | Appendix A |
| 3. | Description of the long-term surveillance program | Section 3.0 |
| 4. | Criteria for follow-up inspections | Section 3.5.1 |
| 5. | Criteria for maintenance and emergency measures | Section 3.6.3 |
| **Requirements for the Long-Term Custodian (DOE)** | | |
| | *Requirement* | *Location* |
| 1. | Notification to NRC of changes to the LTSP | Section 3.1 |
| 2. | NRC permanent right-of-entry | Section 3.1 |
| 3. | Notification to NRC of significant construction, actions or repairs at the site. | Section 3.5 and 3.6 |

## 1.3 Role of the U.S. Department of Energy

In December 2003, DOE formally established the DOE-LM office. The LM mission includes "...implementing long-term surveillance and maintenance projects at sites transferred to LM to ensure sustainable protection of human health and the environment."

Previously in 1988, DOE had designated the Grand Junction facility as the program office for managing long-term surveillance and maintenance of DOE disposal sites that contain regulated low-level radioactive materials and portions of sites that do not have a DOE mission after cleanup, as well as other sites (including Title II sites) as assigned, and to establish a common office for the security, surveillance, monitoring, and maintenance of those sites.

# 2.0 Final Site Conditions

Decommissioning of the Gas Hills North mill facility in Fremont County, Wyoming, occurred from 1993 to 1994 in accordance with the U.S. Nuclear Regulatory Commission (NRC) approved decommissioning plan. In 1996 to 1997, windblown-contaminated soils were cleaned up according to the NRC-approved reclamation plan. A final verification report documenting the cleanup was published by ERG (1999). This section summarizes the site milling history and the final cleanup.

## 2.1 Site History

Uranium milling at the Gas Hills North site was conducted from 1958 through 1988. The ore for the mill came from open pit mines in the immediate vicinity of the mill. A total of 12 million tons of ore were processed at this site. Milling at the site was accomplished using a sulfuric acid leaching process, counter current decantation, ion exchange, solvent extraction, precipitation, and yellowcake drying and packaging (NRC 1993).

During the milling period, depleted tailings were slurried into a series of tailings impoundments, or ponds, which were constructed along a natural draw north-northwest of the original millsite. Ponds 1, 2, and 2A are located immediately north of the mill and contain all of the solid tailings generated at the site. Ponds 3, 3A, and 4 are located further north and were used only to contain tailings solution (NRC 1993).

The uranium–mill facilities were decommissioned in 1993–1994 according to the Decommissioning Plan, as approved by the NRC as License Condition No.29. Some of the contaminated soils from Ponds 3, 3A, and 4 were removed and placed in ponds 1, 2, and 2A according to the *Revised Solution Pond Area Reclamation Design* (Hydro-Engineering 2002a). The balance of the contaminated soils in Ponds 3, 3A, and 4 were stabilized in place. Soils contaminated by windblown tailings also were placed in these ponds and reclaimed in place. The uranium mill facilities were razed and the mill debris were placed in the tailings ponds along with process residues.

Ground water corrective action at the site began in 1980 when pumping was begun from a series of collection wells. In 1989, the ground water corrective action was enhanced with a freshwater injection system that was placed in operation to form a hydraulic barrier, reverse the local ground-water gradient, and to more effectively collect the contaminated ground water. The ground water restoration program also included a tailings-dewatering component that was brought on stream in 1989 and was later expanded (Hydro-Engineering 2002b). The ground water corrective action produced 187 million gallons from the aquifer system and 199 million gallons from the tailings-dewatering program. In addition, approximately 172 million gallons of freshwater was injected into the aquifer system as part of the ground water corrective action (Hydro-Engineering 2002b).

## 2.2 General Description of the Disposal Site Vicinity

The Gas Hills North disposal site is located in the Gas Hills region of Fremont County, Wyoming, approximately 45 miles east of Riverton, Wyoming (Figures 2–1 and 2–2). The site elevation ranges from about 6,200 to 6,400 feet. The topography in the immediate vicinity of the site is characterized by gently rolling hills.

The climate of the Gas Hills North area is semi-arid, with annual precipitation of approximately 9 inches. More than half of the annual precipitation occurs during the spring months in the form of wet snow and rain (NRC 1993). The prevailing wind direction is from the south-southwest, and the mean annual wind speed is 12.8 miles per hour (mph) (http://www.crh.noaa.gov/riw/clm/lcdcpr.htm).

The primary land uses in the immediate surrounding vicinity include cattle grazing during the warmer months of the year, minerals extraction, wildlife habitat, and hunting.

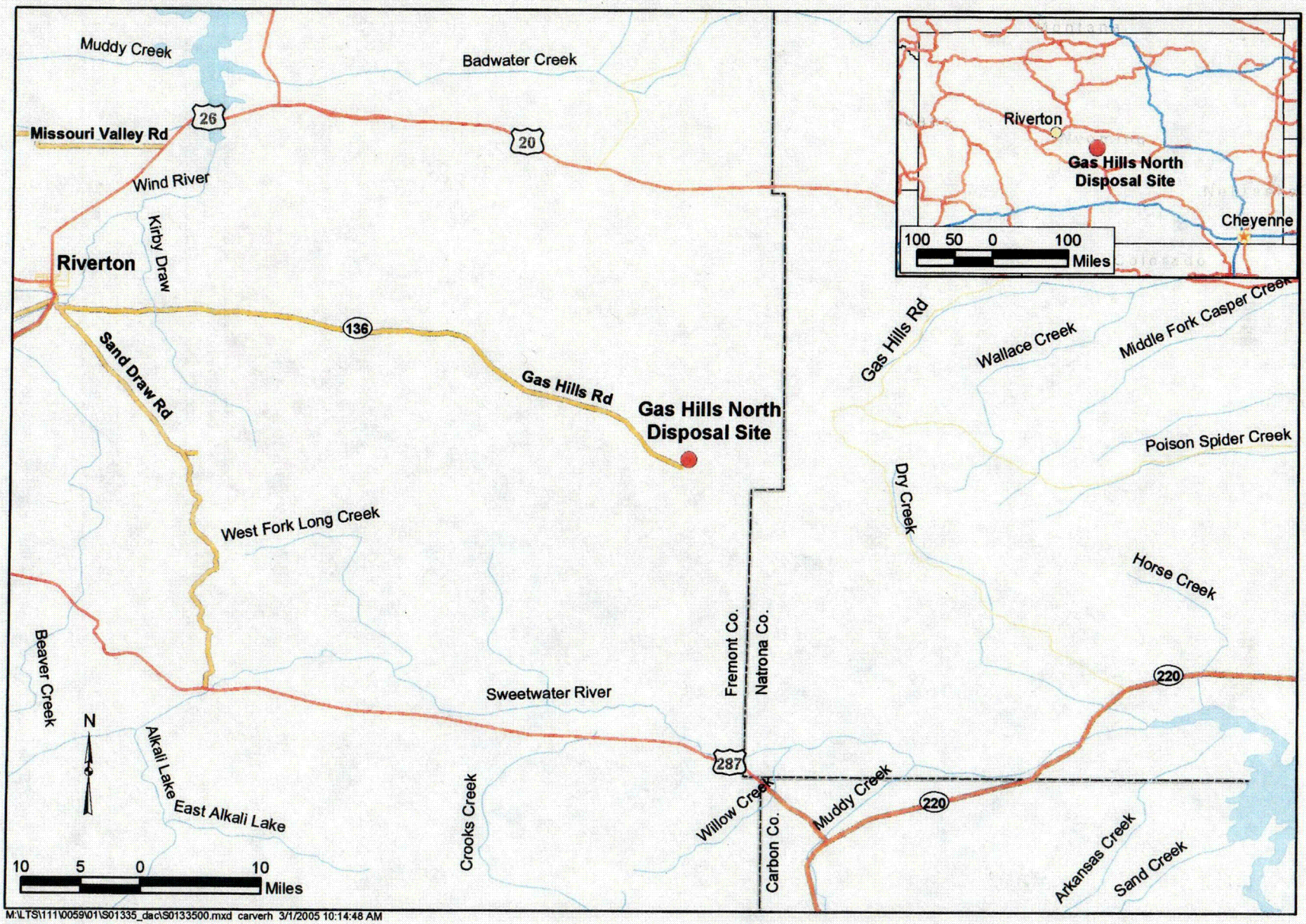


*Figure 2-1. General Location Map of the Gas Hills North, Wyoming, Disposal Site*



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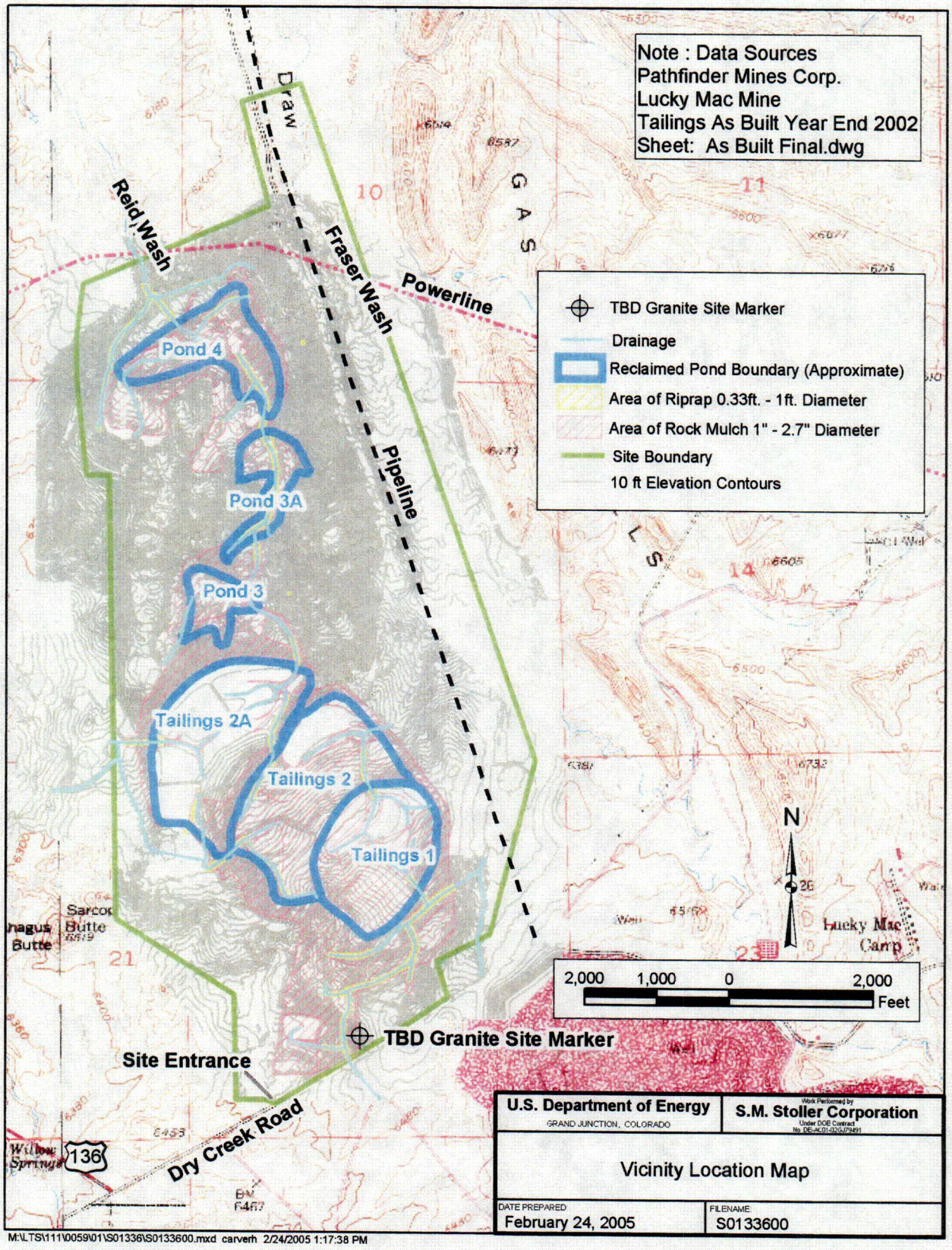


*Figure 2-2. Vicinity Location Map Gas Hills North, Wyoming, Disposal Site*



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## 2.3 Disposal Site Description

### 2.3.1 Site Ownership

The United States Government will soon own the 1094-acre Gas Hills North disposal site property. Supporting real estate information is presented in Appendix A. The former mill area encompasses approximately 56 acres; the post-reclamation tailings ponds 1, 2, and 2A encompass approximately 59, 82, and 100 acres, respectively, and are illustrated on Plate 1.

### 2.3.2 Directions to the Disposal Site

From Riverton, Wyoming, travel east on State Highway 136 approximately 45 miles to the terminus of State Highway 136, which is also the junction with Dry Creek Road. Turn left on Dry Creek Road and proceed approximately 0.8 mile east to the site entrance, which is located on the north side of Dry Creek Road (Figures 2–1 and 2–2).

### 2.3.3 Description of Surface Conditions

The land surface at the Gas Hills North site was reclaimed to achieve gentle topography and a drainage pattern that distributes storm water away from the site. Tailings ponds 1, 2, and 2A were graded to achieve gentle top slopes and a 5H:1V slope for the dam-outslope area for tailings pond 2A (Hydro-Engineering 1999). Rock mulches were used on the top and side slopes of the tailings and on the outslope area of tailings pond 2A to provide long-term erosion protection to the reclaimed land surface. The reclaimed surface of the solution ponds 3, 3A, and 4 is an extension of the cover over the tailings ponds, also protected by riprap and rock mulch.

In accordance with the Soil Cleanup and Verification Plan (ERG 1999), surface soils having radium–226 concentrations exceeding the 5 pCi/g above background standard, were removed and placed in the tailings impoundments. Subsurface soils (below 15 cm) with radium–226 concentrations exceeding the 15 pCi/g above background standard, also were removed and placed in the tailings impoundments.

Drainage at the site was designed to decrease the peak runoff during storm events. To achieve this objective, the tailings disposal and solution pond areas were graded into 35 subbasins. In addition, channel-control structures were used at the outlets to the subbasins to further decrease peak discharges (Hydro-Engineering 1999). Various gradations of riprap were used in the drainages to protect against erosion.

The final surface at the Gas Hills North site combines grading and rock armoring to achieve the necessary surface water run-on and run-off control and erosion protection to satisfy the longevity design requirements.

All areas that were disturbed during construction, including cut and fill areas, were planted according to the specified seed mixture and covered with a dry mulch (Hydro-Engineering 1999).

The millsite combined with the stabilized tailings piles occupies 297 acres of the 1094-acre disposal site property. There are a total of 5 monitor wells at the Gas Hills North site. The entire site property is fenced with a barbed wire stock fence.

### 2.3.4 Permanent Site Surveillance Features

Boundary monuments, a site marker, and a posted warning sign are permanent surveillance features at the Gas Hills North disposal site. These features will be inspected and maintained as necessary as part of the passive controls for the site.

TBD# survey monuments mark the final site boundary. These monuments are a combination of the standard UMTRCA disposal site aluminum-cap monuments placed by the surveyor on behalf of Pathfinder Mines Corporation, brass-cap monuments placed by the U.S. General Land Office, the Bureau of Land Management (BLM), previous property boundary surveys, and TBD# witness corners.

One unpolished granite marker with an incised message identifying the site of the Gas Hills North disposal area is placed on site property just inside the main entrance gate adjacent to the county road. The message on the granite site marker is shown on Figure 2–3.

A warning sign displaying the DOE 24-hour telephone number (Figure 2–4) was placed near the entrance to the site.

The positions of the permanent site surveillance features are shown on Plate 1.

### 2.3.5 Site Geology

The Gas Hills North disposal area is located in the southeastern portion of the Wind River Basin along the western flank of the Dutton Basin Anticline, a northwest-plunging anticline exposing rocks of Precambrian through Tertiary ages. Northeast of the millsite are the Gas Hills, a series of hogbacks of steeply dipping shale and sandstone located along the north and west flanks of the anticline (NRC 1993).

Major bedrock units in the vicinity of the mill are the Wind River Formation (Eocene) and Cody Shale (Upper Cretaceous). Figure 2–5 is a partial stratigraphic column showing the geologic units in the area of the Gas Hills North site. Near the site, the Wind River Formation consists of a lower member composed of fine-grained siltstones and mudstones with a maximum thickness of 130 feet (40 meters), and an upper member composed of coarser grained sandstones and conglomerates with a maximum thickness of over 600 feet (180 meters). The lower, fine-grained member is the geologic unit that underlies portions of the site. The Cody Shale is a massively thick formation of shale with some sandstone layers. The Cody Shale forms bedrock for most of the tailings retention system (NRC 1993).

All of the economically important uranium deposits in the area occur in the Wind River Formation. The ore was produced from open pit mining operations in the immediate vicinity of the site (Hydro-Engineering 2002b).

# GAS HILLS NORTH, WYOMING

| | |
|---|---|
| DATE OF CLOSURE: | TBD |
| TONS OF TAILINGS: | TBD |
| RADIOACTIVITY: | TBD |

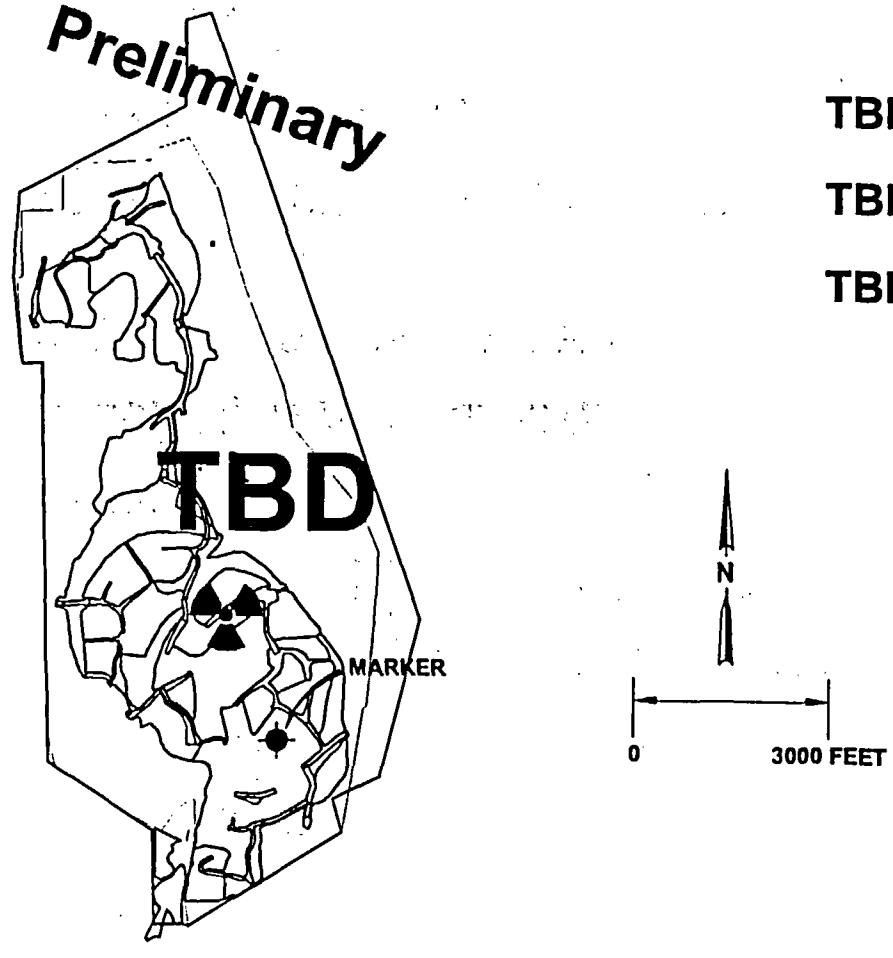


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*Figure 2-3. Site Marker at the Gas Hills North, Wyoming, Disposal Site*

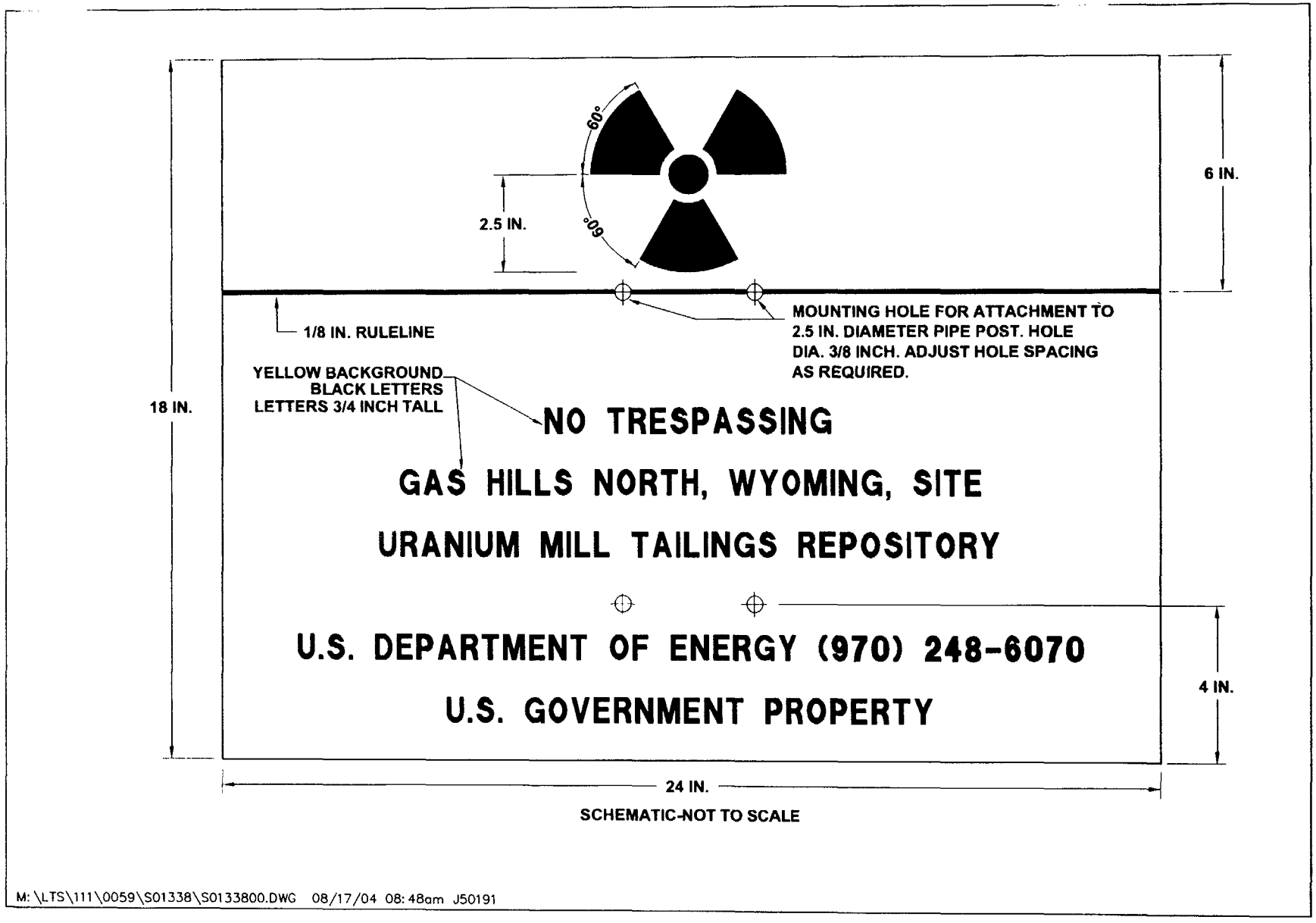


*Figure 2-4. Warning Sign at Gas Hills North, Wyoming, Disposal Site*

| Generalized Section Of The Geologic Formations | | | | | |
|---|---|---|---|---|---|
| ERA | SYSTEM | SERIES | Formation (Thickness In Feet) | Lithology | Occurrence Of Ground Water |
| CENOZOIC | QUATERNARY | Pleistocene | Fraser Draw Alluvial Deposits (0-65) | Fine to coarse sand intermixed with silt and clay | Yields enough water for stock and domestic supplies; yields may vary depending on seasonal recharge. The quality of the water ranges from suitable for domestic supplies to unsuitable for stock. |
| | TERTIARY | Eocene | Wind River Formation (0-8,000) | Interbedded siltstone, sandstone, and conglomerate containing some carbonaceous shale and thin coal seams | Large supplies have been developed in the Riverton and Gas Hills areas and could be developed elsewhere, especially along the margin of the basin. Yields small supplies to many widely distributed stock and domestic wells. The quality of water ranges from good for domestic uses to unfit for stock. |
| MESOZOIC | CRETACEOUS | Upper Cretaceous | Cody Shale (3,000-5,000) | Shale containing some sandstone beds in upper half | Yields only meager supplies of poor quality water |

Modified after Whitcomb and Lowry (1968)

*Figure 2-5. Partial Stratigraphic Column of the Gas Hills North, Wyoming, Disposal Site*

## 2.4 Tailings Impoundments Design

There are six tailings impoundments at the Gas Hills North site. Three of the impoundments, tailings ponds 1, 2, and 2A, were used to contain all the solid tailings generated at the site. Tailings were deposited hydraulically to these ponds. The finer grained materials were typically carried to the pool area in the center of the ponds where they were deposited as slimes. The transition from coarse to fine grained materials is gradual. The three remaining impoundments, Ponds 3, 3A, and 4, were used to contain tailings solutions only. All of the ponds were constructed as embankments across Reid Draw.

The tailings ponds 1, 2, and 2A were reclaimed in place; the ponds encompass approximately 59, 82, and 100 acres, respectively. A radon barrier, which was derived from Cody Shale and/or Lower Wind River claystone, was placed on tailings ponds 1, 2, and a portion of 2A. An engineered drainage channel system was designed and constructed to protect the stabilized tailings ponds from surface water run-off and run-on during catastrophic precipitation events (Hydro-Engineering 2002a).

### 2.4.1 Encapsulation Design

The objective of the tailings impoundment cover is to isolate the uranium mill tailings from the surrounding environment. This is accomplished by reducing radon gas emission rates to below regulatory standards of 20 pCi/m$^2$-s, minimizing infiltration of precipitation that could potentially leach contaminants into the subsurface, and physically containing the contaminated materials to prevent dispersion.

The RAECOM model (Rogers et al 1984) was used to design the thickness of the radon-barrier cover required to protect human health and the environment. Based on these results, a 3-foot thick cover consisting of compacted Cody Shale and Lower Wind River claystone was placed on Tailings Ponds 1 and 2. A 2-foot thick cover was placed on Tailings Pond 2A. In addition, a 1-foot thick cover was placed in the ore stockpile area, and a 2-foot thick cover was placed on the mill area (Hydro-Engineering 1999). Rock mulch is used as erosion protection on the covered surfaces.

The radon barrier for the solution ponds 3, 3A, and 4 varies from 13 inches on top to 26 inches on the Pond 3 outslope. The solution ponds are also covered with rock mulch for erosion protection and riprap in the flow channels.

### 2.4.2 Storm Water Drainage System

The storm water drainage for the site was designed to reduce the surface area of tributary drainage basins in order to lower the potential of erosion by surface runoff. Major drainage areas were divided into smaller basins and the discharge was routed off the tailings in several directions. Riprap armor was placed on the steeper slopes and at flow-concentration points where design-flow velocities would have the potential to erode the tailings-encapsulation surfaces.

The design basis for the storm-water drainage system was the probable maximum flood (PMF). The 1-hour, 1-square mile storm, having a precipitation of 9.70 inches was selected as the design-storm event (Hydro-Engineering 1999). Flow velocities and channel inundation profiles from this event were used as the basis for riprap armoring of the drainage channels. Overland flow paths associated with this storm event were used to design the rock mulch (Hydro-Engineering 1999).

## 2.5 Ground Water Conditions

The uppermost ground water at the Gas Hills North site is an unconfined, interconnected flow system composed of both the Wind River aquifer and the Fraser Draw alluvial aquifer. The Wind River Formation consists mainly of sand- and clay-lens sequences. A lower member of the Wind River Formation, composed mainly of clay, exists in the tailings area and its upper surface is considered the base of the Wind River aquifer (Hydro-Engineering 2002b).

Laterally, the Wind River aquifer and the Fraser Draw alluvium are bounded by bedrock highs composed of Cody Shale. Channels eroded through the buried highs permit ground water to flow laterally from the main aquifer into adjacent, relatively isolated, ground water reservoirs. One such reservoir, which is composed of Wind River Formation, underlies Tailings Ponds 1, 2, and 2A. Seepage from these tailings ponds, which was more voluminous during milling, contains

elevated concentrations of process-related chemicals, including uranium, selenium, nickel, combined radium–226 and radium–228, arsenic, beryllium, cadmium, chromium, thorium–230, chloride, sulfate, nitrate, and total dissolved solids (TDS). Seepage from these ponds is the source of mill-related ground-water contamination in the area.

Corrective actions at the site had two objectives: (1) chemical-mass removal in the Wind River and Fraser Draw aquifer system, and (2) dewatering of the tailings responsible for the seepage of process-related chemicals. The ground water corrective action was effective in removing a substantial portion of the drainable water from the tailings, and at reducing the mass flux of contaminants into the alluvial aquifer. However, after considerable pumping the operator concluded that further significant reductions in the concentrations of uranium, selenium, nickel, combined radium–226 and radium–228, beryllium, and cadmium were not readily achievable with continued pumping. On December 21, 2000, the operator submitted an Alternate Concentration Limit (ACL) application to the NRC for these constituents because their concentrations were deemed to be as low as reasonably achievable, considering practicable corrective actions.

The NRC approved the ACL application on December 20, 2002 (NRC 2002).

End of current text

# 3.0 Long-Term Surveillance Program

## 3.1 General License for Long-Term Custody

States have right of first refusal for long-term custody of Title II disposal sites (UMTRCA, Section 202 [a]). On July 15, 1994, the State of Wyoming exercised its right of first refusal and declined the long-term custody of the Gas Hills North site (State of Wyoming 1994). Because the State declined this right, the site was transferred to the DOE for long-term custody.

When the NRC accepts this LTSP and terminates Pathfinder Mines Corporation's license, SUA–672, the site will be included under the NRC's general license for long-term custody (10 CFR 40.28 [b]). Concurrent with this action, a deed and title to the site are transferred from Pathfinder Mines Corporation to DOE.

Although sites are designed to last "for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years [10 CFR 40, Appendix A, Criterion 6]," there is no termination of the general license for the DOE's long-term custody of the site (10 CFR 40.28 [b]).

Should changes to this LTSP become necessary, the NRC must be notified of the changes, and the changes may not conflict with the requirements of the general license. Additionally, representatives of the NRC must be guaranteed permanent right-of-entry for the purpose of periodic site inspections.

## 3.2 Requirements of the General License

To meet the requirements of the NRC's license at 10 CFR 40, Section 28, and Appendix A Criterion 12, the long-term custodian must, at a minimum, fulfill the following requirements. The section in the LTSP in which each requirement is addressed is given in parentheses.

1. Annual site inspection. (Section 3.3)
2. Annual inspection report. (Section 3.4)
3. Follow-up inspections and inspection reports, as necessary. (Section 3.5)
4. Site maintenance, as necessary. (Section 3.6)
5. Emergency measures in the event of catastrophe. (Section 3.6)
6. Environmental monitoring. (Section 3.7)

## 3.3 Annual Site Inspections

### 3.3.1 Frequency of Inspections

At a minimum, sites must be inspected annually to confirm the integrity of visible features at the site and to determine the need, if any, for maintenance, additional inspections, or monitoring (10 CFR 40, Appendix A, Criterion 12).

To meet this requirement, DOE will inspect the Gas Hills North disposal site once each calendar year. The date of the inspection may vary from year to year, but DOE will endeavor to inspect the site approximately once every 12 months unless circumstances warrant variance. Any variance to this inspection frequency will be explained in the inspection report. The DOE will notify the NRC and the State of Wyoming of the inspection at least 30 days in advance of the scheduled inspection date. The points of contact are listed in Appendix C.

### 3.3.2 Inspection Procedure

For the purpose of inspection, the Gas Hills North disposal site will be divided into sections called *transects*. Each transect will be inspected individually. Proposed transects for the first inspection of the Gas Hills North site are listed in Table 3–1 and shown on Figure 3–1.

*Table 3–1. Transects Used During First Inspection of the Gas Hills North Site*

| Transect | Description |
|---|---|
| Cover of Stabilized Tailings Ponds | Cover and rock-mulch integrity. |
| Drainage Channels | Riprap placement and integrity. |
| Site Perimeter and Balance of Site | Site perimeter including 0.25 mile beyond site boundary, area between tailings impoundment and site boundary, site entrance, boundary monuments, entrance sign, and site marker. |

The annual inspection will be a visual walk-through. The primary purpose of the inspection will be to look for evidence of cover cracking, wind or water erosion, structural discontinuity of the containment dams, condition of vegetation, and animal or human intrusions that could result in adverse impacts. Disposal site and disposal cell inspection techniques are described in detail in Attachment 4 of the guidance document (DOE 2001).

In addition to inspection of the site itself, inspectors will note changes and developments in the area surrounding the site, especially changes within the surrounding watershed basin. Significant changes within this area could include development or expansion of human habitation, erosion, road building, or other change in land use. Changes in land use in the area immediately surrounding the site have the potential to effect overland water flow characteristics and general site management considerations, and therefore should be noted.

It may be necessary to document certain observations with photographs. Observations warranting photographs include evidence of vandalism or a slow modifying process, such as rill erosion, that should be monitored more closely during general site inspections. Photographs are documented on the Field Photograph Log.

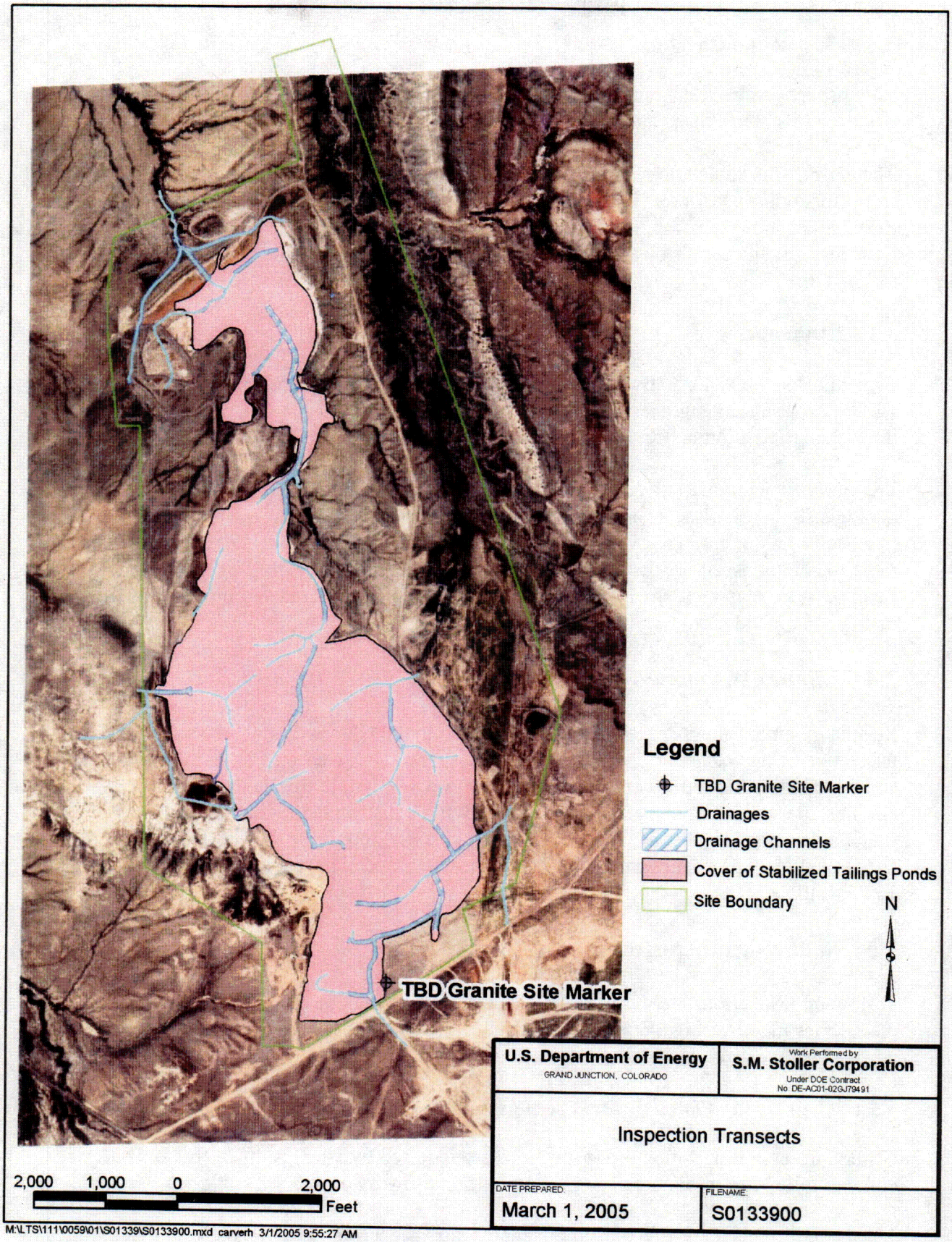


*Figure 3-1. Inspection Transects for the Gas Hills North, Wyoming, Disposal Site*



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### 3.3.3 Inspection Checklist

The inspection checklist guides the inspection. The initial site-specific inspection checklist for the Gas Hills North disposal site is presented in Appendix B.

The checklist is subject to revision as necessary. At the conclusion of an annual site inspection, inspectors will make notes regarding revisions to the checklist, if necessary, in anticipation of the next annual site inspection. Revisions to the checklist will include such items as new discoveries or changes in site conditions that must be inspected and evaluated during the next annual inspection.

### 3.3.4 Personnel

Annual inspections normally will be performed by a minimum of two inspectors. Inspectors will be experienced engineers and scientists who have been specifically trained for the purpose through participation in previous site inspections.

Engineers typically will be civil, geotechnical, or geological engineers. Scientists will include geologists, hydrologists, biologists, and environmental scientists representing various fields (e.g., ecology, soils, range management). If serious or unique problems develop at the site, more than two inspectors may be assigned to the inspection. Inspectors specialized in specific fields may be assigned to the inspection to evaluate serious or unusual problems and make recommendations.

## 3.4 Annual Inspection Reports

Results of annual site inspections will be reported to the NRC within 90 days of the last site inspection of that calendar year (10 CFR 40, Appendix A, Criterion 12). In the event that the annual report cannot be submitted within 90 days, DOE will notify the NRC of the circumstances. Annual inspection reports also will be distributed to the State and any other stakeholders who request a copy. The annual inspection report for the Gas Hills North disposal site is included in a document containing the annual inspection reports for all sites licensed under 10 CFR 40.28.

## 3.5 Follow-up Inspections

Follow-up inspections are unscheduled inspections that may be required (1) as a result of discoveries made during a previous annual site inspection, or (2) as a result of changed site conditions reported by a citizen or outside agency.

### 3.5.1 Criteria for Follow-up Inspections

Criteria necessitating follow-up inspections are required by 10 CFR 40.28 (b)(4). DOE will conduct follow-up inspections should any of the following occur:

1. A condition is identified during the annual site inspection, or other site visit that requires personnel, perhaps personnel with specific expertise, to return to the site to evaluate the condition.

2. DOE is notified by a citizen or outside agency that conditions at the site are substantially changed.

With respect to citizens and outside agencies, DOE will establish and maintain lines of communications with local law enforcement and emergency response agencies to facilitate notification in the event of significant trespass, vandalism, or natural disaster. Due to the remote location of the Gas Hills North site, DOE recognizes that local agencies may not necessarily be aware of current conditions at the site. However, these agencies will be requested to notify DOE or provide information should they become aware of a significant event that might affect the security or integrity of the site.

DOE may request the assistance of local agencies to confirm the seriousness of a condition before conducting a follow-up inspection or emergency response.

The public may use the 24-hour DOE telephone number posted prominently on the entrance sign to request information or to report a problem at the site.

Once a condition or concern is identified at the site, DOE will evaluate the information and determine whether a follow-up inspection is warranted. Conditions that may require a routine follow-up inspection include changes in vegetation, erosion, storm damage, low-impact human intrusion, minor vandalism, or the need to evaluate, define, or perform maintenance tasks.

Conditions that threaten the safety or the integrity of the disposal site may require a more immediate (non-routine) follow-up inspection. Slope failure, disastrous storm, major seismic event, and deliberate human intrusion are among these conditions.

DOE will use a graded approach with respect to follow-up inspections. Urgency of the follow-up inspection will be in proportion to the seriousness of the condition. Timing of the inspection may be governed by seasonal considerations. For example, a follow-up inspection to investigate a vegetation problem may be scheduled for a particular time of year when growing conditions are optimum. A routine follow-up inspection to perform maintenance or to evaluate an erosion problem might be scheduled to avoid snow cover or frozen ground.

In the event of "unusual damage or disruption" (10 CFR 40, Appendix A, Criterion 12) that threatens or compromises site safety, security, or integrity, DOE will

- Notify NRC pursuant to 10 CFR 40, Appendix A, Criterion 12, or 10 CFR 40.60, whichever is determined to apply;
- Begin the DOE Environment, Safety, and Health Reporting process (DOE Order 231.1A);
- Respond with an immediate follow-up inspection or emergency response team;
- Implement measures as necessary to contain or prevent dispersion of radioactive materials (Section 3.6).

### 3.5.2 Personnel

Inspectors assigned to follow-up inspections will be selected on the same basis as for the annual site inspection (see Section 3.3.4).

### 3.5.3 Reports of Follow-up Inspections

Results of follow-up inspections will be included in the next annual inspection report (Section 3.4). Separate reports will not be prepared unless DOE determines that it is advisable to notify the NRC or other outside agency of a problem at the site.

If follow-up inspections are required for more serious or emergency reasons, DOE will submit to the NRC a preliminary report of the follow-up inspection within the required 60 days (10 CFR 40, Appendix A, Criterion 12).

## 3.6 Routine Site Maintenance and Emergency Measures

### 3.6.1 Routine Site Maintenance

UMTRCA disposal sites are designed and constructed so that "ongoing active maintenance is not necessary to preserve isolation" of radioactive material (10 CFR 40, Appendix A, Criterion 12). The tailings impoundment has been designed and constructed to minimize the need for routine maintenance.

The surface of the tailings impoundment was constructed with minimal slope to promote positive drainage while minimizing runoff water velocities. The surface was covered with rock mulch that is expected to endure for the long-term. Because of the rock mulch and mild slopes, adverse wind or water erosion impacts that would require maintenance are not anticipated. The tailings impoundment area is fenced to prevent damage from livestock grazing in the vicinity. Areas where runoff water could achieve erosional velocities have been armored with riprap.

However, if an inspection of the disposal site cell does reveal failure, or degradation of an as-built feature, repairs will be conducted to re-establish the as-built condition. DOE will perform routine site maintenance, where and when needed based on best management practices. Results of routine site maintenance will be summarized in the annual site inspection report.

### 3.6.2 Emergency Measures

Emergency measures are the actions that DOE will take in response to "unusual damage or disruption" that threaten or compromise site safety, security, or integrity. The DOE will contain or prevent dispersal of radioactive materials in the unlikely event of a breach in cover materials.

### 3.6.3 Criteria for Routine Site Maintenance and Emergency Measures

Conceptually, there is a continuum in the progression from minor routine maintenance to large-scale reconstruction of the tailings impoundment following a potential disaster. Criteria, although required by 10 CFR 40.28 (b)(5), for triggering particular DOE responses for each progressively more serious level of intervention, are not easily defined because the nature and scale of all

potential problems cannot be foreseen. The information in Table 3–2 will, however, serve as a guide for appropriate DOE responses. The table shows that the difference between routine maintenance and emergency response is primarily one of urgency and degree of threat or risk. The DOE's priority (urgency) in column 1 of Table 3–2 bears an inverse relationship with DOE's estimate of probability. The highest priority response is also believed to be the least likely to occur.

*Table 3–2. DOE Criteria for Maintenance and Emergency Measures*

| Priority | Description[a] | Example | Response |
|---|---|---|---|
| 1 | Breach of disposal cell with dispersal of radioactive material. | Seismic event that exceeds design basis and causes massive discontinuity in cover. | Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to prevent further dispersal, recover radioactive materials, and repair breach. |
| 2 | Breach without dispersal of radioactive material. | Partial or threatened exposure of radioactive materials. | Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to repair the breach. |
| 3 | Breach of site security. | Human intrusion, vandalism. | Restore security; urgency based on assessment of risk. |
| 4 | Maintenance of specific site surveillance features. | Deterioration of signs, markers. | Repair at first opportunity. |
| 5 | Minor erosion or undesirable changes in vegetation. | Erosion not immediately affecting disposal cell, invasion of undesirable plant species. | Evaluate, assess impact, respond as appropriate to address problem. |

[a]Other changes or conditions will be evaluated and treated similarly on the basis of risk.

### 3.6.4 Reporting Maintenance and Emergency Measures

Routine maintenance completed during the previous 12 months will be summarized in the annual inspection report.

In accordance with 10 CFR 40.60, within 4 hours of discovery of any Priority 1 or 2 event listed in Table 3–2, DOE will notify:

Fuel Cycle Facilities Branch
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission

The phone number for the required 4-hour contact to the NRC Operations Center is (301) 816-5100.

## 3.7 Environmental Monitoring

### Ground Water Monitoring

As discussed in Section 2.5, the NRC has granted alternate concentration limits (ACL) for uranium, selenium, nickel, combined radium–226 and radium–228, beryllium, and cadmium (NRC 2002). DOE also will analyze ground water samples for arsenic, chromium, thorium–230, TDS, sulfate, chloride, and nitrate plus nitrite, as these parameters are useful indicators of contaminant migration. The established ACL values and pertinent ground water protection standards are shown in Table 3–3.

*Table 3–3. Analytes, Alternate Concentration Limits, and Ground Water Protection Standards for the Gas Hills North, Wyoming, Disposal Site*

| Analyte | ACL | Ground Water Protection Standard | Comments |
|---|---|---|---|
| Arsenic | NA | 0.05 mg/L | Standard applicable at POC well |
| Chromium | NA | 0.05 mg/L | Standard applicable at POC well |
| Uranium | 1.70 mg/L | NA | Standard applicable at POC well |
| Selenium | 1.10 mg/L | NA | Standard applicable at POC well |
| Nickel | 0.85 mg/L | NA | Standard applicable at POC well |
| Ra–226 + Ra–228 | 7.50 pCi/L | NA | Standard applicable at POC well |
| Th–230 | NA | 13.2 pCi/L | Standard applicable at POC well |
| Beryllium | 0.07 mg/L | NA | Standard applicable at POC well |
| Cadmium | 0.02 mg/L | NA | Standard applicable at POC well |
| TDS | NA | 5,000 mg/L* | Standard applicable at POE well |
| Sulfate | NA | 3,000 mg/L* | Standard applicable at POE well |
| Chloride | NA | 2,000 mg/L* | Standard applicable at POE well |
| Nitrate plus nitrite | NA | 100 mg/L* | Standard applicable at POE well |

*Wyoming Class III Ground Water Protection Standards for Livestock use are applicable to this site.

Table 3–4 summarizes the ground water monitoring plan. The locations of the monitor wells in the ground water monitoring network are shown on Figure 3–2. The intent of the annual sampling is to verify that the ACLs are not exceeded at the point-of-compliance (POC) wells, and to verify continued compliance with the applicable ground water protection standards at the site boundary.

If an ACL is exceeded at a POC well, or trends indicate that a ground water protection standard may be exceeded at the site boundary, DOE will inform NRC and the Wyoming Department of Environmental Quality of the results and conduct confirmatory sampling. If the confirmatory sampling verifies the exceedance or threat of exceedance, DOE will develop an evaluative monitoring work plan and submit that plan to the NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used in consultation with the NRC to determine if corrective action is necessary.

Results of the ground water monitoring program will be included in the annual inspection report (Section 3.4). Ground water monitoring results will include a ground water contour map; iso-concentration maps for selenium, uranium, combined radium–226 and –228, sulfate, chloride, and TDS; time versus concentration graphs for selenium, uranium, combined radium–226 and –228, sulfate, chloride, and TDS.

Once every 10 years, beginning in 2010, DOE will check the records at the Wyoming State Engineer's Office to determine if there have been significant changes in water demands in the vicinity of the site.

*Table 3–4. Ground Water Monitoring Plan for the Gas Hills North, Wyoming, Disposal Site*

| Well Designation | Monitoring Frequency | Analytes | Comments |
|---|---|---|---|
| T1–12 | Annually | Arsenic, Chromium, Uranium, Selenium, Nickel, Ra–226 + Ra–228, Th–230, Beryllium, Cadmium, TDS, Sulfate, Chloride, Nitrate plus Nitrite, pH, electrical conductivity, water level | POC well, Wind River Aquifer |
| AL–1 | Annually | Arsenic, Chromium, Uranium, Selenium, Nickel, Ra–226 + Ra–228, Th–230, Beryllium, Cadmium, TDS, Sulfate, Chloride, Nitrate plus Nitrite, pH, electrical conductivity, water level | Fraser Draw Alluvial Aquifer between POC and point of exposure (POE) wells |
| AL–6 | Annually | Arsenic, Chromium, Uranium, Selenium, Nickel, Ra–226 + Ra–228, Th–230, Beryllium, Cadmium, TDS, Sulfate, Chloride, Nitrate plus Nitrite, pH, electrical conductivity, water level | POE well, Fraser Draw Alluvial Aquifer |
| AL–7 | Annually | Arsenic, Chromium, Uranium, Selenium, Nickel, Ra–226 + Ra–228, Th–230, Beryllium, Cadmium, TDS, Sulfate, Chloride, Nitrate plus Nitrite, pH, electrical conductivity, water level | Fraser Draw Alluvial Aquifer between POC and POE wells |
| T1–6 | Annually | Arsenic, Chromium, Uranium, Selenium, Nickel, Ra–226 + Ra–228, Th–230, Beryllium, Cadmium, TDS, Sulfate, Chloride, Nitrate plus Nitrite, pH, electrical conductivity, water level | Background Well, Wind River Aquifer |

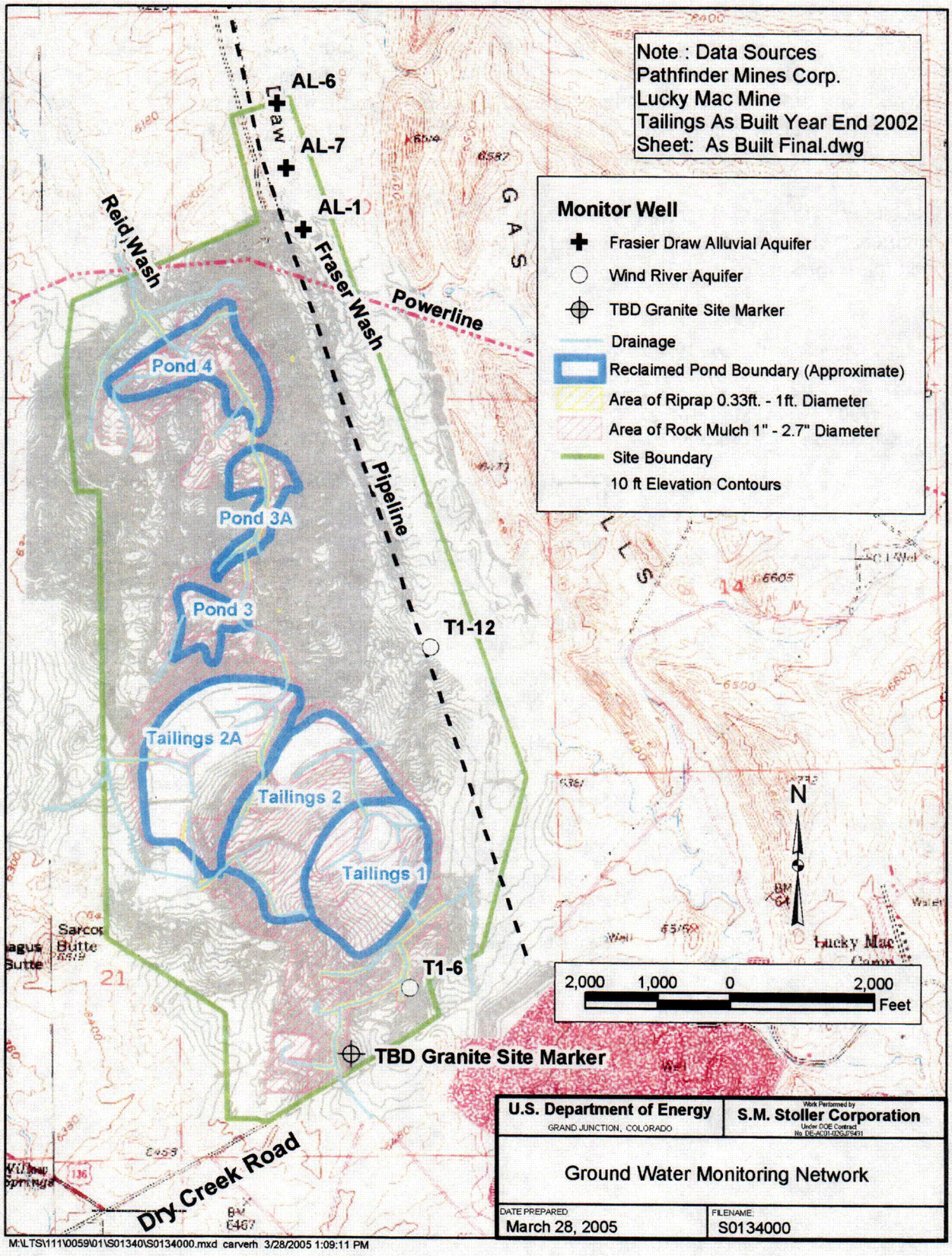


*Figure 3-2. Location of Monitor Wells in the Ground Water Monitoring Network*

C04

## 3.8 Records

The DOE-LM Office receives and maintains select records at their office in Grand Junction, Colorado, to support post-closure site maintenance. These records are being maintained by LM because they contain critical information required to protect human health and the environment, manage land and assets, protect legal interests of the Department and the public, and mitigate community impacts resulting from the cleanup of legacy waste. The records are managed in accordance with the following requirements:

- Title 44, United States Code (USC), Chapter 29, Records Management by the Archivist of the United States and by the Administrator of General Services, Chapter 31, "Records Management by Federal Agencies", and Chapter 33, "Disposal of Records";
- Title 36, *Code of Federal Regulations* Chapter 12, Subchapter B, "Records Management";
- DOE G 1324.5B, *Implementation Guide*;
- *LM Information and Records Management Transition Guidance.*

## 3.9 Quality Assurance

All activities related to the surveillance and maintenance of the Gas Hills North site will comply with DOE Order 414.1A, Quality Assurance (QA) and ANSI/ASQC E4–1994, *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (American Society for Quality Control 1994).

QA requirements will be transmitted through procurement documents to subcontractors if and when appropriate.

## 3.10 Health and Safety

Health and safety requirements and procedures for DOE-LM activities are consistent with DOE Orders, Federal regulations, and applicable codes and standards. The DOE Integrated Safety Management process serves as the basis for the Contractor's Health and Safety Program.

Specific guidance is contained in the *Office of Land and Site Management Project Safety Plan* (DOE 2004). This Project Safety Plan identifies specific hazards associated with the anticipated scope of work and provides direction for the control of these hazards. During the pre-inspection briefing, personnel are required to review the plan to ensure that they have an understanding of the potential hazards and the health and safety requirements associated with the work to be performed.

End of current text

# 4.0 References

American Society for Quality Control (ASQC), 1994. *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs,* ANSI/ASQC E4–1994, Energy and Environmental Quality Division, Environmental Issues Group.

ERG (Environmental Restoration Group, Inc.), 1999. Lucky Mc Mill Site Completion Report. Prepared for Pathfinder Mines Corporation, Mills, Wyoming, February.

Hydro-Engineering, LLC, 1999. Lucky Mc Mine Tailings Reclamation Plan Source Material License No SUA–672, 2 Volumes, Prepared for Pathfinder Mines Corporation Lucky Mc Mine, Gas Hills, Wyoming, July.

_____, 2002a. Lucky Mc Mine Tailings Reclamation Plan Source Material License No SUA–672, Addendum 1, Revision No. 4, Revised Solution Pond Area Reclamation Design. Prepared for Pathfinder Mines Corporation Lucky Mc Mine, Gas Hills, Wyoming, August.

_____, 2002b. Application for Alternate Concentration Limits Pathfinder Mines Corporation, Lucky Mc Tailings. Prepared for Pathfinder Mines Corporation Lucky Mc Mine License No. SUA–672, Docket No. 40–2259, January.

Rogers, V.C., K.K. Nielson, and D.R. Kalkwarf, 1984. *Radon Attenuation Handbook for Uranium Mill Tailings Cover Design.* NUREG/CR–3533; PNL–4878; RAE–18–5.

State of Wyoming, 1994. Letter to Joseph E. Virgona, Project Manager, U.S. Department of Energy, from Dennis Hemmer, Director of the Wyoming Department of Environmental Quality, declining custody of all UMTRCA Title II sites within the State of Wyoming, July 15.

U. S. Department of Energy, 2001. *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites*, prepared by the U.S. Department of Energy, Grand Junction Office, Grand Junction, Colorado, GJO–2001–215–TAR, April 2001.

_____, 2004. *Office of Land and Site Management Project Safety Plan*, prepared for the U.S. Department of Energy, Office of Legacy Management, Grand Junction, Colorado.

U.S. Nuclear Regulatory Commission (NRC), 2002. Letter to Mr. T.W. Hardgrove, Pathfinder Mines Corporation, from Daniel M. Gillen, Chief, Fuel Cycle Facilities Branch, U.S. Nuclear Regulatory Commission, approving the proposed use of alternate concentration limits for gorund water at Pathfinder Mines Corporation's Lucky MC Site, December 20.

_____, 1993. Environmental Assessment for the proposed decommissioning and reclamation of the Pathfinder Lucky Mc Mill and Tailings Ponds, Docket Number 40–2259, July.

Whitcomb, Harold A., and Marlin E. Lowry, 1968. Ground-Water Resources and Geology of the Wind River Basin Area, Central Wyoming. United States Geological Survey Hydrologic Investigations Atlas HA–270.

End of current text

# Appendix A

# Real Estate Information

## Legal Description of Site Boundary

The legal description of the 1094-acre Gas Hills North Disposal site follows:

Beginning approximately one foot south of the southernmost point of the NRC restricted area fence: 804839, 783809;

Thence northeasterly running one foot south of the restricted area fenceline, 2790.0 feet to a point one foot SE of the SE fence corner: 807205, 785286;

Thence NNW 523.5 feet to a point about 27 feet NW of Water Well #8 wellhouse, 807056, 785788;

Thence northeasterly 823.8 feet to the NE corner of patented Millsite No. 50 out of Mineral Survey No. 649: 807790, 786161;

Thence NNE 2495.1 feet to a point on the north line of Section 22, T28N, R78W, 400 feet west of the NE corner of Section 22, 808406, 788581;

Thence NNW 9894.1 feet to a point, 805316, 797332;

Thence westerly 405.1 feet to the NW corner of the SWNW of Section 10, T28N, R78W: 805137, 797923 (per AllTopo);

Thence South 1329.0 feet to SW corner of SWNW of Section 10, 804750, 796481 (per AllTopo);

Thence SW 2928.6 feet to the NW corner of the SWSE of Section 9, 802148, 795137 (per AllTopo);

Thence southerly 1322.9 feet to a point on the north line of Section 16, T28N, R78W, one foot west of the restricted fenceline: 802061, 793817;

Thence southerly running one foot west of the fenceline, 1324.9 feet to a point about one foot SW of a fence corner: 802200, 792499;

Thence easterly running one foot south of the fenceline, 314.5 feet to a point about one foot SW of a fence corner: 802514, 792503;

Thence southerly running one foot west of the fenceline, 6170.8 feet to a point: 802629, 786334;

Thence southeasterly generally along the fenceline 1634.8 feet to a point on the west line of patented Millsite No.177 out of Mineral Survey No 649, 192 feet south of its NW corner: 804263, 785296;

Thence South along the west side of patented Millsite No. 190 out of M.S. 649 1453.4 feet to a point on the its west line 153 feet north of its SW corner: 804296, 783842;

Thence East 438.1 feet to a point, the NE corner of a tract to be conveyed to RT Communications: 804734, 783842;

Thence southeasterly 109.6 feet to the point of beginning.

All coordinates are based on Pathfinder's coordinate grid, which is approximately 4.4 feet South and 1.5 feet East from the State Plane Coordinate System 1927, West Central Wyoming.

The real estate correspondence and instruments are maintained and filed by the U. S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

(This legal description is approximate. The remainder of the real estate information will be included when available.)

# Appendix B

# Initial Site Inspection Checklist

# Inspection Checklist: Gas Hills North

Date of This Revision: _____
Last Annual Inspection: _____
Inspectors: _____ and _____

Next Annual Inspection (Planned): _____

| No. | Item | Issue | Action |
|---|---|---|---|
| 1 | Access | Access is from a county road. | None. |
| 2 | Specific site surveillance features | See attached list. | Inspect.<br><br>Identify maintenance requirements. |
| 3 | Rock Mulch | The surface of the tailings impoundment has been covered with rock mulch to control wind and water erosion. | Inspect impoundment cover and note condition of rock mulch and evidence of displacement. |
| 4 | Riprap | Certain areas have been armored with riprap for erosion protection. | Inspect riprap, note evidence of rock displacement, rock degradation, hydraulic scour or bank cutting. |

# Checklist of Site Specific Surveillance Features: Gas Hills North

| Feature | Comment |
|---|---|
| Access Road | |
| Entrance Gate | |
| Entrance and Perimeter Signs | Total: TBD |
| Perimeter Fence | Barbed-wire stock fence |
| Boundary Monuments | Total: TBD |
| Site Marker | |
| Monitor Wells | Total: 7<br>Background Well: T1–6 (Wind River Aquifer)<br>POC well: T1–12 (Wind River Aquifer)<br>POE well: AL–6 (Fraser Draw Alluvial Aquifer)<br>Alluvial wells between POC and POE: AL–1, AL–7<br>Alluvial wells north of site boundary: AL–8, AL–9 |

# Appendix C

# Points of Contact

**Points of Contact**

U.S. Department of Energy
Attn: Tom Pauling
2597 B 3/4 Road
Grand Junction, CO 81503
(970) 248-6048
tom.pauling@gjo.doe.gov

U.S. Nuclear Regulatory Commission
Attn: John Lusher
Fuel Cycle Facilities Branch
Mail Stop T8–A33
Washington, DC 20555
(301) 415-7694
jhl@nrc.gov

Wyoming Department of Environmental Quality
Attn: Mark Thiesse
250 Lincoln Street
Lander, WY 82520
(307) 332-3144
mthies@state.wy.us

# THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

## THAT CAN BE VIEWED AT THE RECORD TITLED:

## PLATE 1: Provisional Map Showing Areas of Riprap, Rock Mulch, and Drainages.

## WITHIN THIS PACKAGE... OR BY SEARCHING USING THE DOCUMENT/REPORT NO.

D-01X