CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM

Management and Operating Contractor

Contract #: DE-AC01-91-RW00134
LV.PA.JEH.3/93-020

WASTE ISOLATION EVALUATION DRILLING OF UE-25 NRG#2A

by

James E. Houseworth

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This waste isolation impact evaluation was prepared in accordance with M&O QAP-3-5. Drillhole UE-25 NRG#2A and associated components have not been assigned a QA classification.

WASTE ISOLATION EVALUATION
DRILLING OF UE-25 NRG#2A

1. INTRODUCTION

1.1 Purpose of Evaluation

This evaluation was performed in response to a request from the Yucca Mountain Site Characterization Project Office (YMPO) to assess the potential waste isolation impacts of drilling UE-25 NRG#2A (Ref. 1).

1.2 Planned Activities

The planned drillhole UE-25 NRG#2A is located on the west side of Exile Hill outside the conceptual perimeter drift boundary, about 55 m (180 ft) southwest of UE-25 NRG#2 (see Figure 1) (Ref. 2; personal communication, W. A. Girdley, YMP, 3/16/93). A 0.15 m (0.5 ft) diameter vertical drillhole (personal communication, W. A. Girdley, YMP, 3/16/93) will be drilled dry using air with a gas-phase tracer as the drilling fluid. NRG#2A is planned as an exploratory drillhole, primarily to provide input data for design of the ESF north ramp (Ref. 1). The drillhole depth will be 61 ± 6 m (200 ± 20 ft) and is planned to penetrate the Tiva Canyon Member of the Paintbrush Formation (personal communication, R. P. Nance, SAIC, 3/16/93). Continuous sampling of earth materials will begin at a depth of 24 m (80 ft) and will continue to the final depth (Ref. 1). Access to the drill site will be via an existing road (personal communication, W. A. Girdley, YMP, 3/16/93). The hole will be drilled with minimal disturbance to the surrounding surface and will not require the construction of a drill pad (personal communication, W. A. Girdley, YMP, 3/16/93).

1.3 Quality Assurance

The planned activities will affect natural barriers at the UE-25 NRG#2A drill site, which lies within the controlled area. Accordingly, this report was prepared as a quality-affecting activity according to CRWMS M&O Quality Administrative Procedure QAP-3-5 "Development of Technical Documents." No calculations were involved in this evaluation. Some of the referenced data may not have been approved for quality-affecting activities, and the referenced analyses may not have been performed as quality-affecting activities or under software QA requirements. The extent and possible effects of non-qualified data and analyses on the evaluations, conclusions, and recommendations of this report were not determined, but are not expected to be significant.

2. EVALUATION

2.1 Evaluation Approach

This is a qualitative evaluation of the potential influence of the planned activity on waste isolation. A checklist (see last page) was used as guidance to ensure no activities were overlooked. General guidance for the format and content of waste isolation evaluations was provided by Younker (Ref. 3) so that all waste isolation impacts would be considered. Many of the concerns and recommendations given for the waste isolation evaluation for UE-25 NRG#2 (Ref. 4) will be discussed here due to the proximity of these sites.

2.2 Relative Locations and Elevations

The planned location for UE-25 NRG#2A is approximately 1.2 km (0.75 mi) to the east of and outside the conceptual perimeter drift boundary on the western side of Exile Hill, as shown in Figure 1 (Ref. 1, personal communication, W. A. Girdley, YMP, 3/16/93). The planned drill site also lies approximately on the boundary of the potential repository expansion area 6 (Ref. 5). The approximate map coordinates for the planned drill site are N765700 ft, E569000 ft (Ref. 1). The planned drill site lies about 30 m (100 ft) southwest of the proposed ESF north ramp alignment and about 55 m (180 ft) southwest of UE-25 NRG #2 (personal communication, W. A. Girdley, YMP, 3/16/93). UE-25 NRG#2 was drilled about 66 m (215 ft) at an angle of 30 degrees from the vertical in an approximately easterly direction, leaving the bottom of the hole at a depth of 57 m (186 ft) and 33 m (107 ft) east of the drillhole entrance (Ref. 1).

The planned drillhole lies approximately 3 m (10 ft) east of the Trench 14A spoil pile (personal communication, W. A. Girdley, YMP, 3/16/93). Trench 14A lies about 30 m (100 ft) from the planned drill site (Ref. 1).

The following table gives elevations relevant to the UE-25 NRG#2A drillhole.

Location	Approx. Elevation	Source
Drillhole UE-25 NRG#2A, surface	1154 m (3785 ft)	(*)
Estimated bottom of UE-25 NRG#2A	1093 ± 6 m (3585 ± 20 ft)	(*)
Drillhole UE-25 NRG#2, surface	1160 m (3805 ft)	(Ref. 1)
Drillhole UE-25 NRG#2, bottom	1103 m (3620 ft)	(Ref. 1)
ESF north ramp at surface	1124 m (3687 ft)	(Ref. 6)
ESF north ramp nearest UE-25 NRG#2A	1103 m (3635 ft)	(Ref. 1)
ESF north ramp at Topopah Spring level	988 m (3240 ft)	(Ref. 6)

* personal communication, W. A. Girdley, YMP, 3/16/93

2.3 Relevant Hydrogeology

The major expected lithologic units at UE-25 NRG#2A from the surface to the north ramp elevation are alluvium/colluvium and the Rainier Mesa and Tiva Canyon Members of the Paintbrush Formation. In the vicinity of NRG#2A, the geologic formations dip downward in an easterly direction, away from the potential repository (Ref. 1).

The planned drillhole will be about 60 - 90 m (200 - 300 ft) west of the Bow Ridge Fault Zone (Ref. 1).

The average elevation of the ground-water table at drillholes UE-25 WT#4, UE-25b#1, UE-25 WT#15 and UE-25 WT#14, which lie in the vicinity of UE-25 NRG#2A, is about 729 to 731 m (2392 to 2400 ft) (Refs. 7 and 8). The saturated ground-water flow direction is difficult to estimate at this location due to low ground-water table gradients.

The drill site lies outside the maximum probable flood zone (Ref. 9).

2.4 Specific Evaluations and Conclusions

2.4.1 Water Flowing to Potential Repository/Expansion Areas. The drillhole will be drilled dry, and there are no other plans to introduce water into the drillhole (personal communication, W. A. Girdley, YMP, 3/16/93). The water table is estimated to be more than 360 m (1180 ft) below the estimated final depth of the drillhole (see Sections 2.2 and 2.3). Therefore, the drillhole is not expected to produce water. Standard precautions to prevent runoff from entering the drillhole should be sufficient, because the drill site is not within a flood prone area (Ref. 9). These precautions include placement of a grout-sealed surface casing that extends above the ground surface and shielding the drillhole with a cap to prevent entry of precipitation or runoff into the drillhole. Other possible sources of water to enter the drillhole are water used for fishing operations, natural perched water, and accidental spills (Ref. 4). Any water loss into the drillhole should be reported (Ref. 10).

The proximity of the planned drillhole to the ESF north ramp requires that any standing water introduced to the drillhole from the surface be removed as quickly as possible to prevent water migration into the north ramp alignment (Refs. 4 and 11). Drilling should be stopped if standing water is found in the drillhole. If water encountered in the drillhole is believed to be perched water, contact the site characterization project office regarding required analyses prior to removal of the water (Ref. 12). The quantity of water and the drillhole depth should be recorded upon removal, and the water disposed of at an approved location. Similarly, if cuttings from the drilling operation are found to be wet, they should be taken to an approved disposal point, such as the cuttings piles near the North Portal (Ref. 4).

Water use for dust control around the drillhole and access road should not exceed 2 gals/yd^2/day on average over any six month period (Refs. 4 and 13). Any accidental spillage or water used for equipment washdown should be recorded and counted towards the allowable limit for dust-control water.

Prior to abandonment, the drillhole shall be sealed so that the drillhole will not be a preferential pathway for water flow to the potential repository or repository expansion areas (Ref. 13).

2.4.2 Saturated Zone Ground-Water Travel Time. The water table is estimated to be over 360 m (1180 ft) below the estimated final depth of the drillhole (see Sections 2.2 and 2.3). Therefore, the drillhole is not anticipated to affect the saturated zone ground-water travel time, provided that the precautions discussed in Section 2.4.1 are taken to prevent excess infiltration down the drillhole, and the drillhole is effectively sealed for the post-closure period.

2.4.3 Aqueous Radionuclide Transport. The lowest point of the drillhole will lie 105 m (344 ft) above the point where the ESF north ramp enters the potential repository horizon. In addition, the drillhole is about 1.2 km (0.75 mi) east of the potential repository. Consequently, the drillhole is not expected to be a pathway for aqueous radionuclide transport which, in the unsaturated zone, is presumed to be the region between the potential repository horizon and the water table (Ref. 14).

2.4.4 Gaseous Radionuclide Transport. The drillhole could possibly provide a pathway for gaseous radionuclide transport, which is expected to move both laterally and up from the potential repository. This is more likely if the ESF north ramp also acts as a pathway for gaseous radionuclide transport, or if repository expansion areas result in waste emplacement closer to the drillhole. However, the drillhole will be sealed before any radioactive waste is placed in the potential repository (Ref. 13). Therefore, drilling UE-25 NRG#2A is not expected to affect gaseous radionuclide transport.

2.4.5 Thermo-Mechanical Effects. Blasting will not be used for this drillhole, and drilling is expected to have only short-range effects. Therefore, no thermo-mechanical effects are expected on the conceptual repository or repository expansion areas.

2.4.6 Fluids, Tracers and Materials (other than water). This evaluation does not address methods of drillhole sealing. However, it is important to note any precautions considered necessary for drilling, casing, and operation of the drillhole so that NRG#2A may be effectively sealed in the future (Ref. 4). Compressor operations for dry drilling may introduce lubricating oil into the drillhole. Precautions should be taken to minimize any oil from entering the drillhole. If measurable amounts of oil do enter the drillhole, the amount of oil and the drillhole depth should be recorded and reported in accordance with the Tracers, Fluids, and Materials Management Plan (Ref. 10).

Leachates may drain off the Trench 14A spoil pile, which is adjacent to the drill site. However, precautions to prevent runoff from entering the drillhole (see Section 2.4.1) should also prevent leachates from entering NRG#2A.

Potential spills of engine fuels, hydraulic fluids, and lubricants will not affect waste isolation if normal precautions are taken to prevent spills and, if any spills occur, to clean up promptly.

3. RECOMMENDATIONS

The drilling activities described here are not expected to affect waste isolation for the conceptual repository or repository expansion areas, provided existing controls (Refs. 10, 13, 15) are used, with particular attention to the following items:

1. Use a grout-sealed surface casing with cap that extends above the ground surface.

2. Remove any standing water found in the drillhole that was introduced from the surface.

3. If perched water is encountered, contact the site characterization project office prior to removal of the water.

4. Dispose of any water or wet cuttings removed from the drillhole at approved locations.

5. Minimize the introduction of oil to the drillhole through compressor operations.

Prior to permanent sealing, evaluations should be performed to determine the effectiveness of seals with respect to potential effects on ground-water flow and on radionuclide transport through the drillhole.

4. REFERENCES

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3) Younker, J. L., "Waste Isolation Evaluations of Surface and Underground Design, Construction, Testing, and Related Activities," LV.SY.JLY.12/92-064, CRWMS M&O interoffice correspondence, December 11, 1992.

4) Blejwas, T. E., "Performance Assessment Evaluation of Impacts of Proposed Exploratory Drillholes UE25-NRG-2, 3, 4, & 5 (Test Planning Package 92-01, Revision 1) on Waste Isolation," letter to J. R. Dyer, September 30, 1992.

5) "YMP Potentially Usable Areas with Topsoil and Rock Storage Areas," EG&G Map YMP-92-258.0, December 1992.

6) "Title I Design Summary Report for the Exploratory Studies Facility," YMP/CC-0019, Rev. 1, p. 0-8, October 16, 1991.

7) Robinson, J. H., D. M. Stephens, R. R. Luckey, D. A. Baldwin, "Water Levels in Periodically Measured Wells in the Yucca Mountain Area, Nevada, 1981-87," USGS OFR-88-468, 1988.

8) "Yucca Mountain Site Characterization Project: Existing Drillholes," EG&G Map YMP-92-093.1, May 1992.

9) "Existing and Proposed Boreholes within 2 km of UZ-16," EG&G Map YMP-93-021.1, January 1993.

10) "YMP Tracers, Fluids, and Materials Management Plan." YMP 91-23, Rev. 1, November 2, 1992.

11) "Identification, Monitoring, and Sampling of Perched or Ground Water Encountered While Drilling Surface-Based Boreholes," USGS Hydrologic Procedure NWM-USGS-HP-231T, R0, January 8, 1992.

12) "Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Study Facility," Study Plan Number 8.3.1.2.2.4, Revision 1. Section 3.7, "Perched Water Test," January 15, 1993.

13) "Technical Requirements for the Yucca Mountain Site Characterization Project Surface-Based Testing," YMP/CM-0007, Rev. 9, November 6, 1992.

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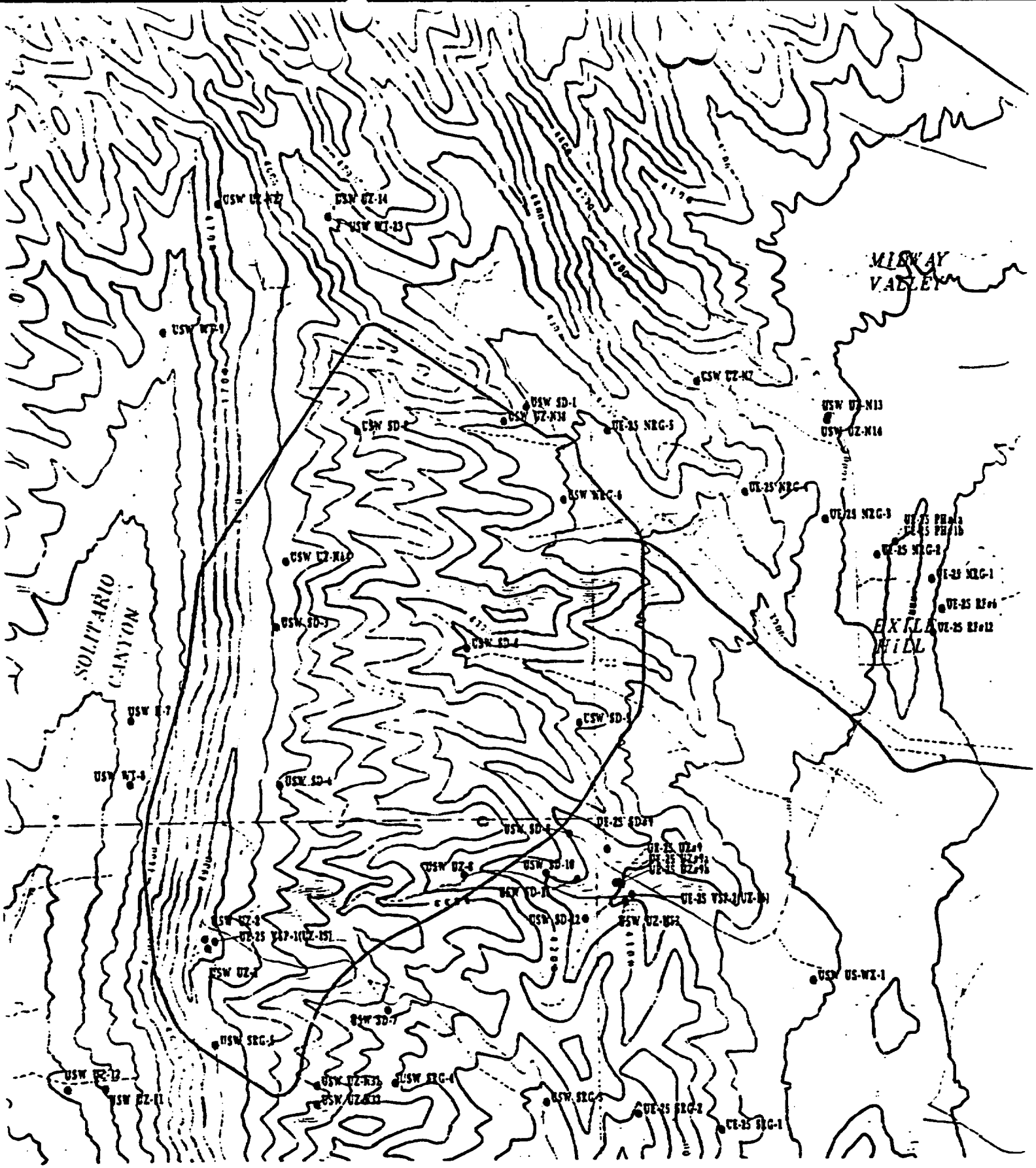
15) "Reclamation Implementation Plan for the Yucca Mountain Site Characterization Project," YMP/91-14, 1991.



Conceptual Perimeter Drift Boundary and Proposed Drillholes (Ref. 2)

Figure 1

CHECKLIST OF GENERAL CONCERNS REGARDING IMPACTS ON WASTE ISOLATION	
CONCERNS	**COMMENTS**
I. Water	
A. Surface Sources	
1. Road watering for dust control	See Section 2.4.1
2. Drill pad dust control	See Section 2.4.1
3. Equipment washdown	See Section 2.4.1
4. Natural surface runoff	See Section 2.4.1
5. Accidental water spillage	See Section 2.4.1
6. Used in testing	NA
B. Underground	
1. Water loss during drilling	
a) Normal	NA
b) Fishing	See Section 2.4.1
c) Unexpected	NA
2. Recovered or produced during drilling	
a) Perched water	See Section 2.4.1
b) Water table	NA
3. Used in testing	NA
II. Materials (other than water)	
A. Used in surface construction	
1. Building materials	NA
2. Leachates from rock & muck piles	See Section 2.4.6
B. Used in borehole construction and/or sealing	
1. Grout for surface casings	See Section 2.4.6
2. Drilling fluids	See Section 1.2
3. Other materials left in boreholes	See Section 2.4.6
C. Used in testing	NA
III. Other considerations	
A. Physical and chemical characteristics of seals	NA
B. Seals may not achieve design objectives	NA
C. Cut-and-fill for roads, pads, trenches & pits	NA
D. Blasting	See Section 2.4.5