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ENVIRONMENTAL EVALUATION
NATIONAL WASTE TERMINAL STORAGE PROGRAM

"RESEARCH BOREHOLE DRILLING ACTIVITY FOR BOREHOLES
DH-18, DH-19, DC-12, DC-13, DC-14, DC-15, AND
DEEPENING OF EXISTING BOREHOLE DC-7."

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RHO-BWI-CD-42

ENVIRONMENTAL EVALUATION
NATIONAL WASTE TERMINAL STORAGE PROGRAM

RESEARCH BOREHOLE DRILLING ACTIVITY FOR BOREHOLES
DH-18, DH-19, DC-12, DC-13, DC-14, DC-15,
AND DEEPENING OF EXISTING BOREHOLE DC-7

Staff

Health, Safety and Environment

Basalt Waste Isolation Project
Rockwell Hanford Operations
Richland, Washington

September 1979

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INTRODUCTION

This report is an environmental evaluation of the impacts of proposed borehole drilling activities at the Hanford Site, northwest of Richland, Washington (Figure 1).

The proposed action is to drill six research boreholes ranging in depth from 137 to 1,372 meters (m) [250 to 4,500 $\pm$ feet (ft)]. In addition, an existing borehole (DC-7) will be extended from 1,249 to 1,524 m (4,099 to 5,000 $\pm$ ft).

The purpose of the U.S. Department of Energy's (DOE) borehole drilling activities is to collect data on in situ rock formations that are considered potentially suitable for nuclear waste repositories. The objective of the DOE program is to provide multiple underground terminal storage facilities to safely dispose of commercial radioactive waste required by 10 CFR 50 Appendix F, and defense-related waste that must be delivered to the repository for terminal storage. The technical program efforts necessary to identify and qualify specific underground waste facility sites in candidate rock formations include geologic and hydrologic studies (seismicity and tectonics, rock structure and stratigraphy, lithology, etc.) Borehole drilling is an integral part of the geological studies and is essential to a thorough understanding of potentially suitable geologic formations.

The purpose of the proposed drilling activities at Boreholes DH-18, DH-19, DC-12, DC-13, DC-14, DC-15, and DC-7 is to obtain data for evaluating Columbia River basalts that are being evaluated by the National Waste Terminal Storage (NWTS) Program to determine their suitability potential for nuclear waste repositories. The seven boreholes will be drilled to obtain subsurface geologic and hydrologic information.

Unavoidable impact to the environment is limited primarily to the clearing of land needed for access and drilling operations. Considerations exercised during site preparation, drilling, and subsequent site restoration will limit modification of the natural environment to the minimum required for accomplishment of test objectives.

At the completion of drilling and testing of the boreholes, each site will be restored as nearly as possible to its original condition. After

FIGURE 1. Basalt Waste Isolation Program Planned Boreholes.

restoration, no further disturbance to the site areas of either a temporary or permanent nature is foreseen.

The environmental impact on the sites selected for the proposed drilling is not expected to cause any significant change in the existing ecological, land use, social, or economic systems. The drilling of the boreholes will have minimal, if any, effect or impact on wildlife. Reasonable efforts will be implemented to ensure the protection and restoration of all of the affected environment.

NOISE

SOURCE TERM

Noise will be produced by heavy construction equipment and increased vehicle traffic during site and access construction and large diesel motors during drilling operations. Noise levels will not exceed the Environmental Protection Agency (EPA) criterion of 70 dB(A) at the nearest human habitation. Noise levels will be measured when drilling begins, to confirm that they are within EPA standards and mitigative measures, such as improved muffling systems for diesel engines, will be taken if necessary.

POTENTIAL FOR UNUSUAL EFFECTS ON WILDLIFE: CRITICAL HABITAT, ETC.

Noise and removal of vegetation will cause temporary displacement of wildlife, but little significant impact. No critical habitats have been designated on the Hanford Site.

POTENTIAL FOR IMPACTING HUMAN ENVIRONMENT: HOUSING, RECREATION

There are no private dwellings within the Hanford Site boundary. The estimated decibel level is well below the EPA criterion of 70 dB(A) at the site boundary.

CONCLUSION

The noise level at the nearest human habitation will be within EPA standards. Mitigation measures, as discussed above, will be undertaken if required.

ARCHAEOLOGY

IMPACT ON ARCHAEOLOGICAL, HISTORICAL, OR CULTURAL SITES

No sites will be impacted according to information presented in Reference 1, ERDA-1538.

CONCLUSION

No significant impact anticipated.

WATER SUPPLY

SOURCES OF WATER

Several water-bearing zones will be penetrated during boring operations; the unconfined aquifer water table elevation ranges from 112 to 123 m (370 to 405 ft) mean sea level, and the confined aquifer has several water-bearing zones within the interval being drilled.

IMPACT OF WATER REQUIREMENTS ON LOCAL USAGES

Water used for drilling fluids, fugitive dust suppression, and potable water will be transported to the site areas. Minute amounts of water will be removed from the boreholes during hydrologic testing operations.

IMPACT ON RUNOFF

The clearing of the sites and access roads will not result in increased surface water runoff.

The proposed sites are not located in a flood plain or wetland area.

IMPACT ON SURFACE WATER QUALITY

Casing will be cemented to the ground surface to eliminate any possibility of surface water contamination.

IMPACT OF FLOODS

The 100- and 500-year floods have been analyzed and it has been determined that no impacts will occur. Additionally, wetlands will not be impacted.

CONCLUSION

No significant impact on the quality or quantity of water will result from this activity.

LAND USE

CURRENT LAND USE

The proposed borehole sites are contained within the boundaries of the Hanford Site, a federally dedicated property for the national nuclear energy effort.

FARMLAND IMPACTED

No prime or unique farmland, as defined in U.S. Department of Agriculture (USDA) Regulation 101, part (b)4, will be impacted.

IMPACT ON "SPECIAL USE AREAS"

Drilling operations will have no significant impact on recreation or other activities within the Hanford Site.

REHABILITATION PLANS

Within 3 months after the completion of testing, each site will be returned to its original land contours and revegetated. The stock-piled topsoil scraped from the drill site will be used during the revegetation program.

PERMITS REQUIRED

An excavation (and/or drilling) permit as required by Rockwell Hanford Operations will be obtained prior to start of activity.

CONCLUSION

Unavoidable impacts are limited to clearing approximately 1 acre per borehole site in addition to that required for access roads. The proposed test sites are all located near existing paved or graveled roadways. Short access roads to the borehole sites will be constructed and graveled to limit dusting problems. These access roads will be approximately 5 m (15 ft) wide and will follow the existing contours of the land. Drilling operations will last an estimated 15 months and hydrological tests will be conducted during this period. No significant impact on land use is anticipated.

WASTE CONTROL

LIQUID WASTE CONTROL PROGRAM

Portable sanitary units will be used to accommodate the personnel at the sites. These wastes will be disposed of in an approved manner, offsite.

SOLID WASTE DISPOSAL PROGRAM

All solid waste will be collected in closed containers or deep pits and disposed of at a site approved by the state agency responsible for waste disposal operations.

SPILL CONTROL PROGRAM

A reserve pit for disposal of used drill bit cuttings and drilling fluids for each test site will constitute a short-term impact during drilling operations. The reserve pit will not be lined. Percolation and evaporation of the drilling fluids will not cause an adverse environmental impact. The reserve pit will be backfilled after drilling operations are completed. The drilling fluid will be a water, clay, and polymer mixture. The biodegradable polymer is added to increase the lubricity and viscosity of water used during drilling.

PERMITS REQUIRED

No waste control permits are required.

CONCLUSION

Disposal of liquid and solid waste in compliance with state and federal regulations will prevent adverse environmental effects.

ECOLOGY

TERRESTRIAL ECOLOGY: PROTECTED/THREATENED/ENDANGERED SPECIES

The Hanford Site is referred to as a shrub-steppe grassland. The vegetation mosaic consists of eight major kinds of shrub-steppe communities identified by the most conspicuous or abundant plant species. At lower elevations, such as those surrounding the proposed drilling sites, sagebrush, bitterbrush, rabbitbrush, balsam root, tumble mustard, and cheatgrass are the dominant plants.

The mule deer is the only big game mammal normally occurring at Hanford; the cottontail rabbit is the most abundant small game animal. Small mammals are the great basin pocket mouse and the black-tailed hare. The coyote is fairly common on the site, while the bobcat and

badger are present (but rarely seen). Chukar partridge, quail, and pheasant are the most conspicuous game birds. Raptorial birds use the site during nesting season. Other abundant birds are the western meadow-lark, the horned lark, raven, and magpie. Reptiles and amphibians are sparse and include the sideblotched lizard and gopher snake. Insect species are numerous, especially the mealybugs, grasshoppers, and darkling beetles. The site provides a habitat for several endangered or threatened raptorial birds including the prairie falcon and the bald eagle.

Considering the size of the Hanford Site, the biota will not be significantly affected by the drilling of Boreholes DH-18, DH-19, DC-12, DC-13, DC-14, DC-15, and the extension of Borehole DC-7. Additional information concerning Hanford geology, hydrology, and ecology may be obtained from ERDA-1538 (unclassified), U.S. Energy Research and Development Administration, "Final Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington," December 1975.

Disruption to terrestrial ecosystems will be minimal.

AQUATIC ECOLOGY

No aquatic habitats are located in the same drainage basin or within 500 m of the sites or access roads.

Disruption to aquatic ecosystems will be minimal.

CONCLUSION

Removal of vegetation will cause temporary displacement of some wildlife, but little significant impact.

Impact on aquatic systems will be negligible.

AIR QUALITY

The area is not classified as non-attainment for any specific pollutant.

Any fugitive dust emissions resulting from site preparation activity will be controlled with wet suppression or other environmentally acceptable techniques. As detailed in Appendix A, the borehole sites are comparatively small (4,407 m² or 1 acre), and fugitive dust is not expected to be significant. During drilling activities, control will be accomplished by a layer of gravel over the drilling site, augmented by other suppression methods as required.

PERMITS REQUIRED

None.

CONCLUSION

Drilling operations will not have a significant impact on air quality.

DRILLING IMPACTS

TESTING PLANS

Specific benefits anticipated from the subject boreholes will:

1. Furnish research information needed to determine the physical and chemical characteristics of the Columbia River Basalt Group;
2. Allow an improved definition of the stratigraphic framework of the Pasco Basin within the Columbia Plateau;
3. Provide samples of deep basalt formations for rock mechanics experiments; and,
4. Allow hydrologic testing of the aquifers associated with deep basalt flows. Details of the drilling and testing procedures are in Appendix A.

Drilling activities will last approximately 15 months.

POTENTIAL IMPACTS OF DRILLING

Several aquifers may be penetrated. To prevent hydraulic interconnection between these strata, the borehole will be case and grouted at the proper depths. The borehole is not likely to penetrate any strata bearing commercial quantities of fluid hydrocarbons. The borehole pipe will eventually be cut off at least 3 m (10 ft) below ground and the borehole will be plugged to total depth. An extensive research effort is currently underway to determine the optimum plug material.

CONCLUSION

The drilling operation and scientific investigations which will take place at the borehole should cause no detectable contamination of the subsurface environment and no long-term impacts on the surface environment.

AESTHETICS

AESTHETIC IMPACT

The drill rig and ancillary equipment will be minimally visible at some remote public access areas.

CONCLUSION

Drilling operations will have a minimal, short-term aesthetic impact.

REFERENCES

1. U.S. Energy Research and Development Administration, "Final Environmental Statement, Waste Management Operations, Hanford Reservation, Richland, Washington," Washington, D.C., December 1975, ERDA-1538.
2. Staff, Scientific Programs Section, "Environmental Assessment of Coring Well ARH-DC-2," Atlantic Richfield Hanford Company, Richland, Washington. July 1977.
3. Staff, Department of Waste Isolation, "Environmental Assessment of Drilling Well ARH-DC-3," Rockwell Hanford Operations, Richland, Washington. July 1977.
4. U.S. Department of Energy, "Environmental Assessment, National Waste Wells ARH-DC-4, -5, -6, -7, and -8, Hanford Reservation, Benton County, Washington," Washington, D.C., June 1978, DOE/EA-0048.

APPENDIX A

Each borehole site will occupy an area of approximately $4,407 \text{ m}^2$ (1 acre and the land surface will be scraped and leveled* to provide an area for storing materials necessary for the drilling operations. The top soil scraped from the drill site will be stockpiled and used to regrade the area after drilling activities are completed. After the site has been regraded, the area will be reseeded with natural grasses. The actual drilling sites within the borehole sites will be graveled to a sufficient depth to support the drilling rig and heavy service vehicles during drilling activities.

The proposed borehole drilling operations are similar to drilling operations for hydrocarbon and mineral exploration, and impacts are expected to be similar. These operations differ only in the end use of the geologic and hydrologic information.

The drilling and casing procedures for deepening existing Borehole DC-7 will be as follows (see Figure A-1):

1. Casing of 8.9 centimeters (cm) [3.5 inches (in)] outside diameter (OD) will be installed and temporarily packed off to the existing depth of 1.249 m (4,009 ft).
2. A 7.7-cm (3.032-in) hole will then be cored to $1,524 \pm \text{m}$ (5,000 $\pm$ ft) and the 8.9-cm (3.5-in) OD casing will be retrieved.

The drilling and casing procedures for Borehole DC-12 will be as follows (see Figure A-2):

1. A 31.1-cm (12.25-in) hole will be rotary drilled to $76.2 \pm \text{m}$ (250 $\pm$ ft) and 21.9-cm (8.625-in) OD casing will be set and cemented to the surface.
2. A 20.3-cm (8-in) hole will be rotary drilled to $381 \pm \text{m}$ (1,250 $\pm$ ft) and 14-cm (5.5-in) OD casing will be set and cemented to the surface.
3. Casing of 11.4 cm (4.5 in) OD will be temporarily installed to $381 \pm \text{m}$ (1,250 $\pm$ ft) and a 10-cm (3.937 in) hole will be core drilled to $610 \pm \text{m}$ (2,000 $\pm$ ft).

* Minor site preparation work will be required at Borehole DC-7.

FIGURE A-1. As Built With Proposed Deepening -- DC-7.

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FIGURE A-2. Proposed Completion -- DC-12.

4. Casing of 8.9 cm (3.5 in) will be set at $610 \pm m$ ($2,000 \pm ft$) and cemented to surface.
5. A 7.7-cm (3.032 in) core hole will be drilled to $1,372 \pm m$ ($4,500 \pm ft$).

The drilling and casing procedure for Borehole DC-13 will be as follows (see Figure A-3):

1. A 31.1-cm (12.25-in) hole will be rotary drilled to $183 \pm m$ ($600 \pm ft$) and 21.9-cm (8.625-in) casing will be set at $183 \pm m$ ($600 \pm ft$) and cemented to surface.
2. Casing of 11.4 cm (4.5 in) will be temporarily installed to $183 \pm m$ ($600 \pm ft$) and a 10-cm (3.937-in) hole will be cored to $457 \pm m$ ($1,500 \pm ft$) and the 11.4-cm (4.5-in) OD casing will be retrieved.
3. The hole will be reamed to 14.9 cm (5.875 in) and 11.4-cm (4.5-in) OD casing will be set at $457 \pm m$ ($1,500 \pm ft$) and cemented to surface.
4. A 10-cm (3.937-in) hole will be cored from $457 \pm m$ ($1,500 \pm ft$) to $762 \pm m$ ($2,500 \pm ft$).
5. Casing of 8.9 cm (3.5 in) OD will be set at $762 \pm m$ ($2,500 \pm ft$) and cemented to surface.

The drilling and casing procedures for Borehole DC-14 will be as follows (see Figure A-4):

1. A 25.4-cm (10-in) hole will be cable-tool drilled to $107 \pm m$ ($350 \pm ft$) and 21.9-cm (8.625-in) OD casing installed.
2. Casing of 11.4 cm (4.5 in) OD will be temporarily installed to $107 \pm m$ ($350 \pm ft$) and a 10-cm (3.937-in) hole will be core drilled to $335 \pm m$ ($1,000 \pm ft$) and the 11.4-cm (4.5-in) casing retrieved.
3. The hole will be reamed to 14.9 cm (5.875 in) and 11.4-cm (4.5-in) OD casing will be set at $335 \pm m$ ($1,100 \pm ft$) and cemented to surface.
4. A 10-cm (3.937-in) hole will be cored from $457 \pm m$ ($1,500 \pm ft$) to $762 \pm m$ ($2,500 \pm ft$).
5. Casing of 8.9 cm (3.5 in) OD will be set at $457 \pm m$ ($1,500 \pm ft$) and cemented to surface.

FIGURE A-3. Proposed Completion -- DC-13.

FIGURE A-4. Proposed Completion -- DC-14.

The drilling and casing procedures for Borehole DC-15 will be as follows (see Figure A-5):

1. A 25.4-cm (10-in) hole will be cable-tool drilled to $91 \pm \text{m}$ ($300 \pm \text{ft}$) and 21.9-cm (8.625-in) OD casing installed.
2. Casing of 11.4 cm (4.5 in) OD will be temporarily installed to $91 \pm \text{m}$ ($300 \pm \text{ft}$) and a 10-cm (3.937-in) hole will be cored to $457 \pm \text{m}$ ($1,500 \pm \text{ft}$).
3. The 11.4-cm (4.5-in) casing will be retrieved and the hole will be reamed to 14.9 cm (5.875 in) to a depth of $457 \pm \text{m}$ ($1,500 \pm \text{ft}$).
4. Casing of 11.4 cm (4.5 in) will be set at $457 \pm \text{m}$ ($1,500 \pm \text{ft}$) and cemented to surface.
5. A 10-cm (3.937-in) hole will be cored to from $457 \pm \text{m}$ ($1,500 \pm \text{ft}$) to $823 \pm \text{m}$ ($2,700 \pm \text{ft}$). Casing of 8.9 cm (3.5 in) OD will be set at $823 \pm \text{m}$ ($2,700 \pm \text{ft}$) and cemented to surface.
6. A 7.7-cm (3.032-in) hole will be cored to $1372 \pm \text{m}$ ($4,500 \pm \text{ft}$).

Boreholes DH-18 and DH-19 are shallow boreholes in near-surface sediments that will be drilled for subsurface paleomagnetic investigations. Borehole DH-18 will utilize a $46 \pm \text{m}$ ($150 \pm \text{ft}$) cable tool entrance hole followed by a $137 \pm \text{m}$ ($450 \pm \text{ft}$) core hole. Borehole DC-19 will consist of a $229 \pm \text{m}$ ($750 \pm \text{ft}$) core hole (no cable tool entrance hole necessary). These core samples can then be analyzed for their paleomagnetic characteristics to aid in the determination of the absolute age of the Ringold sediments.

The specifications noted above are subject to minor changes in the field as coring progresses if conditions different than those foreseen are encountered. In such a case, changes will be documented and made only on an as-needed basis within the scope of this drilling program.

Major elements of a drilling rig include a substructure (mounting platform), a derrick or mast, hoisting assembly, rotary table, and pump. Drilling is accomplished by rotating a bit which cuts or crushes (or a combination of both) the rock which it is contacting. The bit is connected to the surface by a drill stem, which is rotated by means of a kelly and rotary table. A bit-and-drill stem are moved in and out of the hole by the hoisting assembly, a large block-and-tackle, two or three

FIGURE A-5. Proposed Completion -- DC-15.

30-ft joints at a time. A circulating fluid (mud, water, or air) is pumped down the drill stem through the bit to cool the bit and bring the rock cuttings back to the surface through the drill stem-borehole annulus. Cuttings are removed from the fluid by shale shakers and gravity separation and are retained in the reserve pit.

Coring is a method of drilling which uses a rotating doughnut-shaped diamond bit to remove an intact portion of the geologic formation that the bit has penetrated. The core rig is truck mounted and hydrologically operated. No toxic or radioactive chemicals will be used in the drilling fluid or during the testing of the borehole. Following completion of the drilling, any remaining drilling debris and mud will be buried during restoration of the site.

The driller will be required to comply with all applicable federal and state regulations concerning the control and abatement of water pollution. The driller's activities will be performed in accordance with approved methods that will prevent entrance or accidental spillage of objectionable pollutants into streams, lakes, and underground water-bearing strata.

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