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UMTRA PROJECT WATER SAMPLING AND ANALYSIS PLAN

SPOOK, WYOMING

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Prepared for
U.S. Department of Energy
UMTRA Project Office
Albuquerque, New Mexico

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EXECUTIVE SUMMARY

Surface remedial action is complete at the Spook Uranium Mill Tailings Remedial Action Project site in Wyoming. Based on an evaluation of site characterization data, the U.S. Nuclear Regulatory Commission, U.S. Department of Energy, and state of Wyoming have concurred in the determination that a program to monitor ground water is not required because ground water in the uppermost aquifer is Class III (limited use) (40 CFR 192.21(g)(1993)).

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LIST OF ACRONYMS

Acronym	Definition
cm/s	centimeters per second
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
km	kilometer
m	meter
MCL	maximum concentration limits
mg/L	milligrams per liter
mi	mile
RAP	remedial action plan
RRM	residual radioactive materials
UMTRA	Uranium Mill Tailings Remedial Action Project

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

The Uranium Mill Tailings Remedial Action (UMTRA) Project Spook site is in Converse County, Wyoming, approximately 48 miles (mi) (77 kilometers [km]) northeast of Casper, Wyoming. Remedial action consisted of stabilizing the residual radioactive materials (RRM) in the bottom of the adjacent Spook open-pit mine and covering this disposal cell with approximately 35 feet (ft) (10.7 meters [m]) of mine overburden material.

1.2 GROUND WATER MONITORING

The need for ground water monitoring at the Spook disposal site was evaluated in accordance with the guidelines established by the U.S. Department of Energy (DOE) in the *Guidance for Implementing the UMTRA Project Long-term Surveillance Program* (DOE, 1992). Based on an evaluation of site characterization data, it was determined that a program to monitor ground water was not required because ground water in the uppermost aquifer is Class III (limited use). A narrative supplemental standard was applied to the site, and it did not include numerical concentration limits or a point of compliance (40 CFR §192.21(g)(1993)).

The Class III designation is based on the fact that ground water in the uppermost aquifer is not currently or potentially a source of drinking water in the area because it contains widespread ambient uranium and selenium contamination resulting from naturally occurring conditions (natural uranium mineralization associated with an alteration front) and from the effects of broad-scale human activity not related to uranium milling operations (uranium exploration and mining activities) such that it cannot be effectively cleaned up for drinking or other beneficial purposes using treatment methods reasonably employed in public water supply systems (40 CFR 192.11(e)(1993)).

2.0 SPOOK PROCESSING/DISPOSAL SITE (SPK-01)

2.1 SITE CONCEPTUAL MODEL

To comply with the proposed U.S. Environmental Protection Agency (EPA) ground water protection standards for remedial action at inactive uranium mill tailings sites ((40 CFR Part 192)(1993)), the DOE has characterized the hydrogeology, ground water quality, and water resources at the Spook site. A detailed discussion of site characterization is available in Appendix D of the Spook remedial action plan (RAP) (DOE, 1990).

Ground water occurs beneath the Spook site in two sandstone units within the Tertiary Wasatch Formation. The upper sandstone unit averages 110 ft (34 m) in thickness, and is considered the uppermost aquifer beneath the site. Ground water is unconfined in the upper sandstone unit and confined in the lower sandstone unit. The depth to ground water in the upper sandstone unit is approximately 90 ft (27m). The upper and lower sandstone units are separated by an aquitard consisting of a laterally extensive, silty shale unit more than 40 ft (12 m) thick). There is no observed hydraulic interconnection between the upper and lower sandstone units in the vicinity of the Spook site.

In the upper sandstone unit, ground water flows predominantly northeast, under an average hydraulic gradient of 0.005. The average hydraulic conductivity in the upper sandstone unit is 15 ft/day (5.3×10^{-3} centimeters per second [cm/s]) and the average linear ground water velocity is 0.38 ft/day (1.34×10^{-4} cm/s). In the lower sandstone unit, ground water flows predominantly southeast, under an average hydraulic gradient of 0.01. The average hydraulic conductivity in the lower sandstone unit is 0.07 ft/day (2.47×10^{-4} cm/s). Recharge and discharge of ground water in the upper and lower sandstone units is principally by ground water underflow.

Background ground water quality in the upper and lower sandstone units was determined by analyzing ground water samples from monitor wells in areas adjacent to the Spook tailings site that are not affected by uranium recovery operations. In the upper sandstone unit, ambient background ground water quality is affected by the presence of naturally occurring mineralization related to an alteration front underlying the Spook site. This ground water is characterized by concentrations of uranium and selenium that exceed the proposed EPA maximum concentration limits (MCL). In the middle shale unit and the lower sandstone unit, concentrations of all ground water constituents are below the proposed EPA MCLs.

Ground water contaminants related to the tailings pile are present in the saturated zone of the upper sandstone unit. These contaminants form a plume extending approximately 4000 ft (1220 m) downgradient from the Spook pit. The plume maximum width is approximately 2500 ft (760 m) (based on nitrate ground water concentrations above background levels). In the upper sandstone

unit, concentrations of nitrate, uranium, selenium, and chromium and radium-226 and -228 activities exceed the proposed EPA MCLs and maximum background concentrations. Elevated uranium and selenium concentrations and radium-226 and -228 activities result from uranium mining and milling and from natural occurrences related to the alteration front. High concentrations of nitrate do not occur naturally in the upper sandstone unit ground water; concentrations of nitrate above a background level of approximately 10 milligrams per liter (mg/L) are a result of the uranium milling operations. For this reason, the conservative nitrate anion may be used as an indicator of the maximum extent of tailings-related ground water contamination in the upper sandstone unit. Ground water in the middle shale unit and the lower sandstone unit is not contaminated as a result of milling operations at the Spook site and concentrations of all constituents are below the proposed EPA MCLs.

Ground water from the upper sandstone unit in the Spook site vicinity is not used as a source of drinking water or for any other beneficial purposes. The poor ground water quality results from naturally occurring uranium mineralization, human activities related to uranium exploration and mining, and the marginal yield. Alternative supplies of good-quality ground water are readily available from the confined lower sandstone unit, from deeper confined aquifers in the lower part of the Wasatch Formation, and from the underlying Fort Union Formation. Several water supply wells in the Spook site vicinity derive ground water from aquifers below the upper sandstone unit for domestic purposes and stock watering.

2.2 WATER SAMPLING PLAN

No ground water monitoring is required for the long-term surveillance program at the Spook disposal site to comply with ground water protection standards or to demonstrate disposal cell performance. The DOE has adequately justified that the proposed supplemental standards are protective of human health and the environment and has demonstrated that the proposed remedial action comes as close to meeting the otherwise applicable standards as is reasonable under the circumstances. Consequently, the U.S. Nuclear Regulatory Commission has concurred in the use of supplemental standards at the Spook disposal site and the exemption of both the compliance and performance elements of ground water monitoring requirements (NRC, 1989).

3.0 LIST OF CONTRIBUTORS

The following individuals contributed to the preparation of this document.

Name	Contribution
R. Heydenburg	Author
C. Slosberg	Text processing
J. Torline	Technical editing

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NRC (U.S. Nuclear Regulatory Commission), 1989. *Final Technical Evaluation Report for the Proposed Remedial Action at the Spook Tailings Site, Spook, Wyoming*, prepared by the Division of Low-Level Waste Management and Decommissioning, U.S. Nuclear Regulatory Commission, Washington, D.C.

CODE OF FEDERAL REGULATIONS

40 CFR Part 192. "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," U.S. Environmental Protection Agency, 1993.

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