May 9, 2003

Mr. Donald R. Metzler, Technical/Project Manager
U.S. Department of Energy
Grand Junction Office
2597 B3/4 Road
Grand Junction, CO 81503

SUBJECT: REVIEW OF FINAL SITE OBSERVATIONAL WORK PLAN AND GROUND WATER COMPLIANCE ACTION PLAN FOR THE SHIPROCK, NEW MEXICO, URANIUM MILL TAILINGS REMEDIATION ACTION PROJECT SITE DOCKET WM-58

Dear Mr. Metzler:

In letters dated November 29, 2000, and August 5, 2002, the U.S. Department of Energy (DOE) submitted to the U.S. Nuclear Regulatory Commission (NRC) the Final Site Observational Work Plan (SOWP) and Ground-Water Compliance Action Plan (GCAP) for the Shiprock, New Mexico, uranium mill tailings remediation action project site. We have completed our review of both reports and concur with DOE's strategy with the following conditions:

1. DOE works to finalize institutional controls as described in section 3.5.1 by July 1, 2004. of the GCAP. Sampling results of soil and seeps in the floodplain indicate that uranium contamination is present at various levels from ground-water seepage and/or possibly windblown tailings. This should be taken into consideration when evaluating land use and land restrictions and wildlife mitigation strategies. DOE's strategy for the floodplain is natural flushing. Per 40 CFR Part 192.12, one of the conditions of the natural flushing option is the following:

   > Institutional control, having a high degree of permanence and which will effectively protect public health and the environment and satisfy beneficial uses of ground-water during the extended period and which is enforceable by the administrative or judicial branches of government entities, is instituted and maintained, as part of the remedial action, at the processing site and wherever contamination by listed constituents from residual radioactive materials is found in ground-water, or is projected to be found.

2. Further characterization of ground-water contaminant levels is needed in the floodplain east of test pits 1016 through 1021 (see Figure 2-19, July 2002 Final GCAP) by February 1, 2004. Delineation of the extent of contamination is necessary to assess the potential for tailings seepage to migrate into the river.

3. Continued monitoring and study of the contaminant flux from the disposal cell is needed. Ground water geochemistry should be monitored with additional well sites around the disposal cell. This is necessary to monitor the extent of tailings seepage into groundwater over time. The additional wells should be installed by February 1, 2004.

4. The NRC agrees with DOE's phased approach and DOE's plan to evaluate the performance of phase I prior to implementing phase II. Phase II should be implemented if necessary based on the performance of phase I and the NRC concurs with a flexible approach for phase II as long as the NRC staff is kept informed and concurs to any substantial changes.

If the above mentioned time lines are not achievable, DOE must provide the NRC with an extension request and a schedule for implementation. Our Technical Evaluation Report is enclosed. If you have any questions regarding this letter, please contact William von Till, the Project Manager for the Shiprock site, at (301) 415-6251 or by e-mail to RWV@nrc.gov.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/RA/

Susan M. Frant, Chief
Fuel Cycle Licensing Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Docket No.: WM-58

Enclosure: Technical Evaluation Report

cc: A. Kleinrath, DOE GJO
R. Plieness, DOE GJO
Madeline Roanhorse, Navajo EPA

3. Continued monitoring and study of the contaminant flux from the disposal cell is needed. Ground water geochemistry should be monitored with additional well sites around the disposal cell. This is necessary to monitor the extent of tailings seepage into groundwater over time. The additional wells should be installed by February 1, 2004.

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Our Technical Evaluation Report is attached. If you have any questions regarding this letter, please contact William von Till, the Project Manager for the Shiprock site, at (301) 415-6251 or by e-mail to RWV@nrc.gov.

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DATE	5/ 07 /03		5 /08/03		5 /08/03		5/12/03	

*See previous concurrence **OFFICIAL RECORD COPY**

Technical Evaluation Report
Final Site Observational Work Plan
and
Final Ground Water Compliance Action Plan
Shiprock, New Mexico Uranium Mill Tailings Remedial Action (UMTRA) Project Site

Date: May 14, 2003

Technical Reviewer: Ron C. Linton

Project Manager: William von Till

Summary and Conclusions:

The U. S. Department of Energy (DOE) submitted to the U. S. Nuclear Regulatory Commission (NRC) on November 29, 2000, a Final Site Observational Work Plan (SOWP) for the referenced site. The DOE submitted a Final Ground Water Compliance Action Plan (GCAP) to the NRC on August 5, 2002, for the site. The compliance strategy proposed for the floodplain is natural flushing, supplemented by active remediation via extraction of ground water from two recovery wells in the floodplain alluvium. The compliance strategy proposed for terrace east is active remediation via extraction of ground water from six recovery wells within the terrace alluvium until potential risks to humans and the environment is eliminated by removal of receptor pathways. The compliance strategy proposed for terrace west is ground water monitoring and the application of supplemental standards based on *limited use groundwater* due to the existence of widespread ambient aquifer contamination. Based on the reviewed information, staff concurs with the SOWP and the GCAP with the following conditions:

- Institutional controls are required in writing as proposed in section 3.5.1 of the GCAP.
- Further examination of ground water contaminant levels in the floodplain east of test pits 1016 through 1021 is required.
- Additional floodplain sampling is required to determine if windblown mill tailings contaminants are still contained on the floodplain surface.
- Continued monitoring and study of the contaminant flux from the disposal cell is required. Ground water geochemistry should be monitored at a few additional well sites around the disposal cell.

Background:

Regulatory Framework:

The Shiprock site is designated for remedial action as an inactive uranium ore processing site under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978, as amended (42 U.S.C. §7901 *et seq*.). UMTRCA directs the Environmental Protection Agency (EPA) to develop standards for remedial action at this and several other inactive uranium mill sites. Health and environmental protection standards for these sites are

published in 40 CFR 192. While surface reclamation under Title I is complete at most of the mill sites, ground water contamination persists. The UMTRA Amendments Act of 1988 (42 U.S.C. §7922 *et seq*.) authorizes the DOE to extend without limitation the time needed to complete ground water remediation at the listed sites.

Ground water remediation at inactive uranium ore processing sites is regulated by Subparts B and C of 40 CFR 192. Subpart B requires that site ground water concentrations meet supplemental standards or meet one of the following: background levels, maximum concentration limits (MCLs), or alternate concentration limits (ACLs) that have been shown to be protective of human health and the environment. DOE may apply supplemental standards in lieu of background levels, MCLs, or ACLs in certain situations as listed in Subpart C. The DOE compliance strategy at any of the listed Title I sites requires concurrence by the NRC in consultation with the States and local Indian Tribes.

Site Description:

The former mill site is located in Shiprock, New Mexico. The uranium mill operated at the site from 1954 until 1968 on property leased from the Navajo Nation. Approximately 1.5 million tons of ore were processed at the site yielding approximately 7.9 million pounds of U_3O_8 and 35.4 million pounds of V_2O_5. Milling ended in August 1968 and the lease reverted back to the Navajo Nation. As a result of UMTRCA legislation in 1978, mill infrastructure and two tailing piles were combined to form one 76 acre stabilized disposal cell completed in 1987.

The former mill was constructed on an ancient river terrace that is adjacent to the present San Juan River and floodplain. An approximately 50 to 60 foot high escarpment forms the contact between the floodplain and the river terrace. The terrace is covered by alluvium that varies from 10 to 20 feet thick and overlies the Mancos Shale that acts as an aquitard and forms the base of the terrace. Windblown loess is deposited over the terrace alluvium on the southern edge of the terrace where the terrace contacts the upland area. The eastern half of the river terrace (terrace east) is where the mill was located. Ground water in terrace east is derived primarily from the infiltration of mill process water. Ground water in the western half of the river terrace (terrace west) is derived from infiltration from past and current irrigation practices and ground water inflows from terrace east. The boundary of terrace east and terrace west ground water is gradational.

A high volume of water was used during the milling process. Raffinate solutions, as well as water that gathered contaminants in the washing process, were disposed of by evaporation in several mill holding ponds formally located on terrace east. This water/raffinate mix contained primarily metals and inorganic compounds. The cumulative volume discharged to the ponds over the 14 year life span of the mill is estimated at 1.99 billion gallons. Not all the water evaporated, a significant quantity infiltrated the underlying alluvium. The cumulative infiltration of contaminated water from the holding ponds to the terrace east alluvium is estimated at 85 million gallons. Virtually all the contaminated ground water in the alluvial material of terrace east is thought to be from the former ponds. Monitoring wells constructed in similar terrace alluvium on a river terrace to the south of the site were dry. This dry natural condition of the terrace alluvium exists because the Shiprock area receives approximately 7 inches of annual precipitation while the pan evaporation rate is

approximately 70 inches. For this reason, natural ground water recharge to the terrace alluvium from precipitation is limited or nonexistent.

Ground water has infiltrated the upper portion of the Mancos Shale on terrace east. Through time, ground water seepage from the terrace has contaminated ground water in the alluvial material of the current San Juan River floodplain. Some of the highest contaminant levels are on the floodplain at the base of the escarpment. Ground water contamination levels in terrace east and the floodplain are generally higher than on terrace west. Terrace west contains the Helium Lateral irrigation canal and a large irrigated area. One contamination source on terrace west is thought to be from irrigation water moving through the terrace alluvium and leaching metals from the underlying Mancos shale, while the second contamination source is ground water inflow from the former mill ponds.

Technical evaluation:

DOE has proposed compliance strategies that are different for the three hydraulically separate areas of the site: San Juan River floodplain, terrace east, and terrace west. Contaminants of concern (COC) derived from the baseline risk assessment are nitrate, sulfate, uranium, selenium, ammonium, manganese, and strontium.

Floodplain:

The compliance strategy proposed for the floodplain is natural flushing, supplemented by active remediation by extraction of ground water from the floodplain aquifer adjacent to the San Juan River. Ground water will be pumped for a period of 14 years from the most contaminated area of floodplain alluvium to a lined evaporation pond constructed on terrace east.

DOE has proposed a flow barrier and interceptor drain to be completed at a later date located in the floodplain at the base of the escarpment. The intent of the flow barrier is to intercept contaminated ground water moving from terrace east to the floodplain. The necessity for construction of the flow barrier will be evaluated after several years of monitoring the results of pumping and treating contaminated ground water. Ground water modeling based on active pumping and subsequent natural flushing of the floodplain predicts that the COCs will be within acceptable levels within 60 years.

Terrace east:

The compliance strategy proposed for terrace east is active remediation by extraction of ground water from the terrace alluvium until potential risks to humans and the environment have been eliminated by removal of receptor pathways. Removal of receptor pathways will occur when ground water in terrace east has been hydraulically disconnected from the seeps in Bob Lee Wash, Many Devils Wash, and at the base of the escarpment, causing the seeps to dry up. There will be no numerical COC endpoints because pumping should cause the terrace east alluvium to dry up as well. The terrace alluvium is thought to have been dry prior to milling activities.

Terrace west:

The compliance strategy proposed for terrace west is ground water monitoring and the application of supplemental standards based on *limited use groundwater* due to the existence of widespread ambient aquifer contamination. The ground water that exists in terrace west is from infiltration of irrigation water and from ground water that migrated from the former holding ponds. Ambient aquifer contaminant levels are thought to be related to irrigation water leaching contaminants from the Mancos Shale. Some of the nitrate concentrations are also believed to be derived from fertilizer use and septic field drainage.

Institutional Controls:

Shiprock, New Mexico, is served by public water. Ground water is not currently a source of drinking water. DOE will request that the Navajo Nation restrict the use of ground water near the Shiprock site during the remedial action period. The floodplain has been fenced off for animal grazing by the DOE and the Navajo Nation during the remedial action period. DOE has proposed entering into an agreement with the Navajo Nation to ensure that the artesian well number 648 remains open. The natural flushing remediation strategy of the floodplain contaminants has been modeled assuming that well number 648 will continue to produce at its current rate. None of these institutional controls are permanent into perpetuity and are only for the length of the remedial action.

Limitations:

Floodplain ground water contaminant concentrations east of test pits 1016 through 1021 have not been well defined. Ground water from the test pits has elevated contaminant levels, yet ground water isoconcentration maps in the GCAP show very low contamination levels between these points and the San Juan River. There is no data to support the low contamination levels depicted in the isoconcentration maps. Contamination levels in this area should be better defined.

Surface floodplain sediments have elevated levels of various contaminants. Two soil and sediment studies were discussed in the SOWP. The first study concluded that windblown tailings on the floodplain may not have been completely removed. These samples were taken with a scoop at the surface of the floodplain. The second study concluded that elevated contaminant levels may have been the result of sorption of contaminants from ground water onto soils of the floodplain. These samples were taken from both 1 foot and approximately 5 feet below the floodplain surface. Additional floodplain sampling may be required to determine if mill tailings contaminants are still contained on the floodplain surface.

The drainage of residual moisture from the disposal cell is not well known at this time. Estimates of drainage of residual moisture from the cell have ranged from 10,500 ft^3/yr to 5.68×10^5 ft^3/yr. These estimates vary widely. A significant amount of contaminated residual drainage from the cell may act to keep contaminant levels elevated and estimates

for achievement of compliance may have to be extended. The compliance strategy of natural flushing on the floodplain over the next 60 years may not be achieved and may have to be altered.

Consultation with DOE/Navajo Nation and current site status:

On March 4 and 5, NRC staff met with representatives of the DOE and the Navajo Nation to discuss the site status and perform a site visit. Many of the remedial actions outlined in the GCAP have been installed and operational as of the March 2003 site visit. Two recovery wells have been installed in the floodplain and four recovery wells have been installed in terrace east. Interceptor drains with collector sumps have been installed in Bob Lee Wash and Many Devils Wash. An 11 acre evaporation pond has been constructed and ground water from the recovery wells and the collection sumps is being pumped into the evaporation pond.

The Navajo Nation (verbal communication Madeline Roanhorse to William von Till) has concurred with the scope of work proposed in the GCAP and with the current remedial system constructed on site. The DOE has indicated that the construction of the flow barrier at the base of the escarpment will be done in a second phase of work, if site conditions warrant after further site study and monitoring. The Navajo Nation indicated that construction of the flow barrier should proceed as planned in the second phase of construction.