UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
URANIUM RECOVERY FIELD OFFICE
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DENVER, COLORADO 80225

MAR 16 1992

Docket No. WM-63/70

MEMORANDUM FOR: John J. Surmeier, Chief
Uranium Recovery Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

FROM: Ramon E. Hall, Director
Uranium Recovery Field Office
Division of Radiation Safety and Safeguards
Region IV

SUBJECT: MEXICAN HAT/MONUMENT VALLEY PREVIOUS CORRESPONDENCE

Allan Mullins called Ed Hawkins on March 6, 1992, and requested copies of our documentation on Mexican Hat/Monument Valley. Allan said that right now, all you wanted was documents generated by URFO. They are enclosed. They discussed the documents we received from DOE, but Allan did not want us to send them at this time. If you need them in the future, please give us some lead time, as there are about four linear feet of files. We would prefer to send them regular mail rather than express mail.

E F Hawkins
for Ramon E. Hall
Director

Enclosure:
As stated

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OCCUPATIONAL WORKER/VISITOR ORIENTATION

1.0 The risks of low-level occupational radiation exposure.

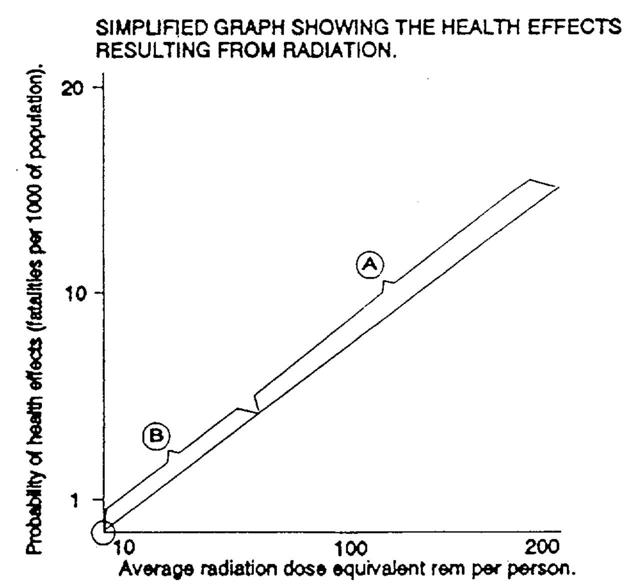
The effects of Radiation at high dose and dose rate are reasonably well understood. However, there is still considerable uncertainty about the effects of exposure to radiation at low dose and dose rate. This is because effects, if they exist at all, are masked by the "normal" occurrence of disorders which may or may not be due to radiation exposure.

To illustrate this point: The only observable effect of the exposure of a large number of people to low-level radiation may be the induction of a few cancers in addition to the thousands which occur naturally, years or even decades after the exposure has been incurred.

Secondly, we may be exposed to at least 1500 substances in our everyday lives (in addition to radiation) which can cause cancer.

There is also experimental evidence from work with animals and plants that exposure to radiation can have genetic effects, though none which can be attributed to the effect of exposure to radiation have so far been detected with certainty in man.

While keeping this in mind, it is still presumed that exposure to radiation even at the levels due to natural background may effect human health. It is generally assumed as a hypothesis that the probability of an effect is strictly proportional to exposure, right down to zero dose (see graph below).



2.0 PREGNANT WORKER'S GUIDE - POSSIBLE HEALTH RISKS TO CHILDREN OF WOMEN WHO ARE EXPOSED TO RADIATION DURING PREGNANCY

During pregnancy, you should be aware of things in your surroundings or in your style of life that could affect your unborn child. For those of you who work in or visit areas designated as Restricted Areas (where access is controlled to protect individuals from being exposed to radiation and radioactive materials), it is desirable that you understand the biological risks of radiation to your unborn child.

Everyone is exposed daily to various kinds of radiation: heat, light, ultraviolet, microwave, ionizing radiation and so on. For the purposes of this guide, only ionizing radiation (such as x-rays, gamma rays, neutrons, and other high-speed atomic particles) is considered. Actually, everything is radioactive and all human activities involve exposure to radiation. People are exposed to different amounts of natural "background" ionizing radiation depending on where they live. Radon gas in homes is a problem of growing concern. Background radiation comes from three sources:

	Average Annual Dose
Terrestrial-radiation from soil and rocks	50 millirem
Cosmic-radiation from outer space	50 millirem
Radioactivity normally found within the human body	25 millirem
	125 millirem*
Dosage range (geographic and other factors)	75 to 5,000 millirem

The first two of these sources expose the body from the outside, and the last one exposes it from the inside. The average person is thus exposed to a total dose of about 125 millirems per year from natural background radiation.

* Radiation doses in this document are described in two different units. The rad is a measure of the amount of energy absorbed in a certain amount of material (100 ergs per gram). Equal amounts of energy absorbed from different types of radiation may lead to different biological effects. The rem is a unit that reflects the biological damage done to the body. The millirad and millirem refer to 1/1000 of a rad and a rem, respectively.

In addition to exposure from normal background radiation, medical procedures may contribute to dose people receive. The following table lists the average doses received by the bone marrow (the blood-forming cells) from different medical applications.

X-Ray Procedure	Average Dose*
Normal chest examination	10 millirem
Normal dental examination	10 millirem
Rib cage examination	170 millirem
Gall bladder examination	170 millirem
Barium enema examination	500 millirem
Pelvic examination	600 millirem

*Variations by a factor of 2 (above and below) are not unusual.

NRC POSITION

NRC regulations and guidance are based on the conservative assumption that any amount of radiation, no matter how small, can have a harmful effect on an adult, child, or unborn child. This assumption is said to be conservative because there is no data showing ill effects from small doses; the National Academy of Sciences recently expressed "uncertainty as to whether a dose of, say, 1 rad would have any effect at all." Although it is known that the unborn child is more sensitive to radiation than adults, particularly during certain stages of development, the NRC has not established a special dose limit for protection of the unborn child. Such a limit could result in job discrimination for women of child-bearing age and perhaps in the invasion of privacy (if pregnancy tests were required) if a separate regulatory dose limit were specified for the unborn child. Therefore, the NRC has taken the position that special protection of the unborn child should be *voluntary* and should be based on decisions made by workers and employers who are well informed about the risks involved.

For the NRC position to be effective, it is important that both the employee and the employer understand the risk to the unborn child from radiation received as a result of the occupational exposure of the mother. This document tries to explain the risk as clearly as possible and to compare it with other risks to the unborn child during pregnancy. It is hoped this will help pregnant employees balance the risk to the unborn child against the benefits of employment to decide if the risk is worth taking. This document also discusses methods of keeping the dose, and therefore the risk, to the unborn child as low as is reasonably achievable.

RADIATION DOSE LIMITS

The NRC's present limit on the radiation dose that can be received on the job is 1,250 millirems per quarter (3 month).* Working minors (those under 18) are limited to a dose equal to one-tenth that of adults, 125 millirems per quarter. (See § 20.101 of 10 CFR Part 20.)

Because of the sensitivity of the unborn child, the National Council on Radiation Protection and Measurements (NCRP) has recommended that the dose equivalent to the unborn child from occupational exposure of the expectant mother be limited to 500 millirems for the entire pregnancy. The 1987 Presidential guidance specifies an effective dose equivalent limit of 500 millirems to the unborn child if the pregnancy has been declared by the mother; the guidance also recommends that substantial variations in the rate of exposure be avoided. The NRC (in § 20.208 of its proposed revision to Part 20) has proposed adoption of the above limits on dose and rate of exposure.

ADVICE FOR EMPLOYEE AND EMPLOYER

Although the risks to the unborn child are small under normal working conditions, it is still advisable to limit the radiation dose from occupational exposure to no more than 500 millirems for the total pregnancy. Employee and employer should work together to decide the best method for accomplishing this goal. Some methods that might be used include reducing the time spent in radiation areas, wearing some shielding over the abdominal area, and keeping an extra distance from radiation sources when possible. The employer or health physicist will be able to estimate the probable dose to the unborn child during the normal nine month pregnancy period and to inform the employee of the amount. If the predicted dose exceeds 500 millirems, the employee and employer should work out schedules of procedures to limit the dose to the 500-millirem recommended limit.

It is important that the employee inform the employer of her condition as soon as she realizes she is pregnant if the dose to the unborn child is to be minimized.

INTERNAL HAZARDS

This document has been directed primarily toward a discussion of radiation doses received from sources outside the body. Worker should also be aware that there is a risk of radioactive material entering the body in workplaces where unsealed radioactive material is used. Nuclear medicine clinics, laboratories, and certain manufacturers use radioactive material in bulk form, often as a liquid or a gas. A list of the commonly used materials and safety precautions for each is beyond the scope if this document, but certain general precautions might include the following:

1. Do not smoke, eat, drink, or apply cosmetics around radioactive material.
2. Do not pipette solutions by mouth.
3. Use disposable gloves while handling radioactive material when feasible.
4. Wash hands after working around radioactive material.
5. Wear lab coats or other protective clothing whenever there is a possibility of spills.

Remember that the employer is required to have demonstrated that it will have safe procedures and practices before the NRC issues it a license to use radioactive material. Workers are urged to follow established procedures and consult the employer's radiation safety officer or health physicist whenever problems or questions arise.

* The limit is 3,000 millirems per quarter if the worker's occupational dose history is known and the average dose does not exceed 5,000 millirems per year.

3.0 Basic Radiation Protection Concepts

A person can receive a dose of radiation from radioactive sources that are present either inside and/or outside the body.

Sources of radiation exposure outside of the body include: cosmic radiation, natural soil radiation, manmade sources such as medical diagnostic tests, dental X-rays, and radioactive mill tailings that may be present on UMTRA Project Sites.

Exposure from sources outside the body are reduced by, decreasing the amount of time spent around the source, by increasing the distance between yourself and the source, and by putting a shield between yourself and the source.

Sources of radiation exposure inside the body include: naturally radioactive sources that a person takes into their bodies on a fairly regular basis by eating, drinking, and breathing radon which is emitted from the earth. Other sources of internal exposure may include radioactive contamination that may be ingested or inhaled while a person is in a controlled area on the UMTRA Project.

Control intakes of unwanted radioactive material (contamination) by not eating, drinking, or smoking in a controlled area and by keeping contamination off your personnel clothing and skin. Contamination monitoring will be performed upon exiting a controlled area to ensure there is no detectable contamination on your person.

4.0 DOE-UMTRA and RAC radiation protection policies and procedures

The HP staff instructor performing your orientation will explain the site specific health physics procedures and requirements as they apply to you.

Your responsibility is to follow these instructions and to ask any question that you may have.

Emergency procedures for train operators will be covered in a separate training session.

During an emergency situation, visitors shall follow the instructions that are given by their escort.

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5.0 WATER RESOURCES PROTECTION

5.1 Introduction

The NRC staff has reviewed the Remedial Action Plan (RAP)(DOE, 1991) and auxiliary documents for the Monument Valley, Arizona and Mexican Hat, Utah UMTRA Project sites for compliance with EPA's proposed ground-water protection standards in 40 CFR Part 192, Subparts A-C. The NRC staff performed the review in accordance with EPA's proposed Ground-Water Protection Standards (EPA, 1987) and relevant portions of the NRC staff's Standard Review Plan for UMTRCA Title I Mill Tailings Remedial Action Plans (NRC, 1985).

Under the proposed remedial action, DOE plans to consolidate the tailings and other contaminated materials from the Monument Valley and Mexican Hat sites into a single disposal cell located at the Mexican Hat site. DOE has concluded that the proposed remedial action complies with the EPA ground-water protection standards, because: (1) the Monument Valley tailings will be relocated, and (2) hazardous constituents released from the proposed disposal cell at the Mexican Hat site will not exceed either the background or Maximum Contaminant Level (MCL) concentrations at the Point of Compliance (POC) within the uppermost aquifer during the 1,000 year design life of the cell. The uppermost aquifer at the Mexican Hat disposal site is the Honaker Tail Formation, which has been characterized as having poor water quality and a significant upward hydraulic gradient beneath the site. DOE does not propose to implement a POC monitoring program at the disposal site, because of the upward hydraulic gradient in the uppermost aquifer and the ineffectiveness of monitoring constituent releases under these hydrogeologic conditions. The NRC staff understands DOE's rationale for not proposing the POC monitoring, as required in the ground-water protection standards; however, NRC staff believes that an alternative monitoring program is necessary at the disposal site in order to meet the intent of the EPA regulation regarding cell performance.

The NRC staff, consistent with EPA's ground-water protection standards, distinguishes between the disposal of residual radioactive materials at the disposal site and the clean-up of existing ground-water contamination at the processing sites. Clean-up of existing ground-water contamination at the processing sites can be deferred to a later phase of the DOE program only after an adequate demonstration that public health and safety will not be adversely impacted by the deferral. The uppermost aquifer at the Mexican Hat site has not been affected by tailings seepage, because of the advantageous hydrogeologic conditions at the site. Current and projected ground-water use within the uppermost aquifer in the vicinity of the Mexican Hat disposal site is not expected to occur, because of the poor water quality (hydrogen sulfide) in the Honaker Trail Formation. The presence of hydrogen sulfide in the aquifer curtailed much of the exploratory drilling for characterization of the area, due to worker health and safety concerns. The shallow alluvial aquifer at the Monument Valley site is used as a drinking water supply by some residents. This aquifer is also contaminated from mill tailings seepage in some areas. The RAP contains descriptions of the hydrogeologic characterization for both sites; however, supporting information in the form of maps, measurements, data tables, calculations, and appendices are only provided for the Mexican Hat site. This information for Monument Valley is necessary for the NRC staff to independently verify the results and arrive at an agreement that ground-water restoration can be deferred to a later project phase.

5.2 Hydrogeologic Characterization

The hydrogeologic characterization provides the fundamental basis for evaluating whether the proposed Remedial Action Plan meets the ground-water protection requirements of 40 CFR 192 Subparts A-C. The characterizations at both the processing and disposal sites also provide the basis for assessing the potential human-health and environmental impacts of any existing ground-water contamination, and the appropriateness for DOE to defer ground-water restoration to a later phase of the project. The critical elements of the hydrogeologic characterization are the identification of: (1) Hydrogeologic Units; (2) Hydraulic and Transport Properties; (3) Geochemical Conditions and Extent of Contamination; and (4) Water Use. Details of these four elements are presented below.

5.2.1 Identification of Hydrogeologic Units

A. Monument Valley Site

The major hydrostratigraphic units that underlie the Monument Valley site are Recent and Triassic in age and are (in descending order): (1) alluvial and dune sands, (2) the Shinarump Member of the Chinle Formation, (3) the Moenkopi Formation, and (3) the DeChelley Sandstone. The alluvial and dune sands are fine-grained, unconsolidated deposits of more than 80 feet in thickness in the center of Cane Valley and thin toward the valley edges near the site. Ground water in the alluvial aquifer is unconfined and is encountered at depths of a few feet near the center of Cane Valley to more than 10 feet beneath the lower tailings pile. Ground water in the alluvial aquifer is recharged by occasional surface-water flows in the Cane Valley Wash and, to a lesser extent, by infiltration of precipitation. Shallow ground water may contribute to surface-water flow in the 'Frog Pond' located down-gradient from the tailings piles.

The Shinarump Member consists of lenticular cross-bedded units of sandstone, conglomerate, and mudstone. The Shinarump outcrops west of the tailings piles, with the thickness of the member ranging from 25 to 90 feet in the vicinity of the site. Ground water within the Shinarump is confined, most likely by the mudstone units within the member, and flows northward from the outcrop areas in the south.

The Moenkopi Formation is composed of shaley siltstone and sandstone. The Moenkopi is 50 to 60 feet in thickness beneath most of the site area; however, only 20 feet of the unit was encountered beneath the upper tailings pile. The Moenkopi forms an aquitard and confines the deeper DeChelley Sandstone.

The DeChelley Sandstone is described as a cross-bedded, fine-grained sandstone and is approximately 550 feet thick below the site. The confined ground water in the DeChelley flows northward from recharge areas south of the site.

B. Mexican Hat Site

The major hydrostratigraphic units that underlie the Mexican Hat site are (in descending order): (1) the Halgaito Shale Formation of the Permian-age Cutler Group, and (2) the Honaker Trail Formation of the Pennsylvanian-age Hermosa Group.

The Halgaito Shale is composed of a varied sequence of interbedded, very fine-grained, silty sandstone and siltstone. The Halgaito Shale ranges in thickness from 50 to 180 feet in the vicinity of the site. Ground water within the Halgaito in the vicinity of the site is restricted to perched zones and limited areas associated with the tailings piles. The Halgaito appears unsaturated in many locations surrounding the tailings piles; however, several seeps have been documented in the dry arroyos northeast of the tailings piles. The Halgaito is exposed throughout the site area where soil and alluvium have not covered the formation. An area of saturation exists within the Halgaito downdip and down gradient of the tailings piles and occurs under unconfined conditions. The ground water in the vicinity of the tailings piles is apparently derived directly from tailings fluid seepage, as indicated by the limited areal extent and chemical composition. Ground-water flow within the Halgaito is strongly influenced by bedding planes, vertical fractures, and joint patterns within the formation. These secondary permeability features diminish with depth. The Halgaito behaves as a confining layer (aquitard) at depths of over 100 feet, because of the relatively low permeability and reduction in fracture density.

The Honaker Trail Formation is characterized as a varied sequence of gray to white, fossiliferous limestone, interbedded with gray, massive sandstone, thinly-bedded red sandstone, minor red shale, and mudstone. The Honaker Trail is regionally extensive and reportedly not less than 300 feet thick in the vicinity of the site. The Honaker Trail Formation is underlain by the Paradox and Pinkerton Trail Formations of the Hermosa Group; however, these formations have not been encountered by DOE during the site characterization. The Honaker Trail outcrops approximately one mile west of the site and approximately one mile southwest of the community of Halchita. The Honaker Trail is fully saturated in the vicinity of the site and constitutes the uppermost aquifer in the area. Ground water in the Honaker Trail is confined by the overlying Halgaito Formation, and flows to the northeast. The potentiometric surface of the Honaker trail rises above the floor of Gypsum Creek and exhibits an upward hydraulic gradient over the site area.

The NRC staff has reviewed the DOE site characterizations performed at both the Monument Valley and Mexican Hat sites and agrees with the designation of the Honaker Trail Formation as the uppermost aquifer at the Mexican Hat site.

5.2.2 Hydraulic and Transport Properties

The characterization of these properties is necessary for the design of the disposal cell at Mexican Hat, and also the validity of deferring the ground-water restoration at both sites to a later project phase. The hydraulic conductivity and linear velocity calculations at the Monument Valley and Mexican Hat sites are summarized below.

A. Monument Valley Site

The alluvial aquifer at the Monument Valley site is described in the summary information of the RAP as being unconfined, with an average hydraulic gradient of 0.1, and an assumed effective porosity of 0.10. The calculated average linear ground-water velocity is 0.13 ft/day, given an average hydraulic conductivity of 1.3 ft/day. The alluvial aquifer has been described as being contaminated and is used as a drinking water source in some locations.

The Shinarump aquifer is described as confined with an average hydraulic conductivity of 1.3 ft/day, a measured effective porosity of 0.10, and an average hydraulic gradient of 0.01. The calculated average linear ground-water velocity is 0.13 ft/day.

Ground water in the DeChelley aquifer is also described as confined. The reported average hydraulic gradient is 0.01. The reported average hydraulic conductivity is 0.24 ft/day, and the measured effective porosity is 0.11. The resulting calculated average linear ground-water velocity is 0.02 ft/day.

Although the above information is presented in the RAP, there is no supporting information on monitoring well locations, well screen interval, potentiometric surface measurements, or distance to potential receptors. The supporting information is necessary for the NRC staff to independently verify the hydraulic and transport properties of the aquifers at the Monument Valley site.

DOE must provide the supporting hydraulic and transport characterization information for the Monument Valley site in the RAP. The NRC staff is unable to perform an independent verification of the ground-water characterization results for Monument Valley without the supporting information. Consequently, NRC staff cannot agree with the proposed deferral of ground-water restoration at Monument Valley without the independent verification. This is considered and Open Issue by NRC staff.

B. Mexican Hat Site

The hydraulic properties of the confining unit and the uppermost aquifer at the Mexican Hat site have been measured by packer tests performed in open boreholes, and slug tests performed in completed wells. The potentiometric surface, which defines the direction and gradient of ground-water flow, was measured in the Honaker Trail Formation (uppermost aquifer). The shallower Halgaito Shale Formation is largely unsaturated in the site vicinity and does not exhibit a potentiometric surface. Consequently, ground-water flow direction and gradient cannot be determined by potentiometric surface measurements for the Halgaito. Table 5.1 provides a summary of the measured hydraulic conductivities at the Mexican Hat site.

Table 5.1
Hydraulic Characteristics
Mexican Hat Site

GEOLOGIC UNIT	DEPTH INTERVAL (ft)	TEST METHOD*	HYDRAULIC CONDUCTIVITY K_h (ft/day)
Halgaito Shale	53.5 - 64.5	P	0.75
	64.5 - 74.5	P	0.27
	62 - 82	S	0.6
	74.5 - 84.5	P	0.19
	84.5 - 94.5	P	0.18
	94.5 - 104.5	P	0.014
Honaker Trail	106 - 116	S	0.1
	132 - 152	S	0.03
	145 - 160	S	0.4
	143 - 197	S	0.4
	170 - 187	S	0.4

* P = Packer Tests, S = Slug Tests

Ground-water flow within the Halgaito Shale has been assumed to follow the dominant fracture and joint directions and also parallel the down-dip direction of the formation. Several seeps, which are attributed to tailings seepage, have been identified in the dry arroyos down-gradient of the tailings pile. DOE has attempted to quantify the ground-water gradient and velocity in the down-dip direction by assuming the flow gradient as being equivalent to the bedding plane dip. The assumed hydraulic gradient within the Halgaito is 0.07 and the measured horizontal hydraulic conductivity is 0.20 ft/day. The calculated ground-water velocity, assuming an effective porosity range between 0.10 and 0.25, is 0.09 ft/day in the down-dip direction. Ground-water velocity in the Halgaito cannot be determined from potentiometric measurements in the directions dominated by fracture flow.

The NRC staff agrees with the assumption that ground-water in the Halgaito will generally follow the dip direction of the formation and the dominant fracture and joint patterns. The NRC staff does not believe it is practicable to fully quantify the flow paths, gradients, or velocities in the Halgaito totally Shale, given the fracture-dominated nature of the unit. The calculated velocity for the down-dip direction is a coarse estimate at best, given the influence of fracture flow.

Ground-water flow within the Honaker Trail aquifer is dominantly toward the northeast in the vicinity of the tailings piles. The measured average horizontal gradient is 0.024. The calculated average linear ground-water velocity is 0.012 ft/day, using an average horizontal hydraulic conductivity of 0.07 ft/day and an assumed effective porosity range of 0.10 to 0.20. A measurable upward vertical hydraulic gradient exists between the Honaker Trail aquifer and the shallower Halgaito Shale. The upward vertical gradient near the tailings pile was measured at approximately 0.09. The upward gradient in the vicinity of the tailings piles would preclude the likelihood of contaminant migration into the uppermost aquifer.

The NRC staff has reviewed the characterization of the hydraulic and transport properties for the Halgaito Shale and the Honaker Trail formation (uppermost aquifer) at the Mexican Hat site. The NRC staff agrees with the hydraulic and transport characterization performed at the Mexican Hat site.

5.2.3 Geochemical Conditions and Extent of Contamination

A. Monument Valley Site

The RAP provides general summary descriptions of the background ground-water quality at the Monument Valley site for the various aquifers beneath the site. The alluvial ("uppermost") aquifer is described as being contaminated by the milling process with a nitrate plume extending at least 2900 feet down-gradient from the site. There are no supporting data nor map representations of the Monument Valley contamination provided in the RAP. This information is necessary for the NRC staff to review DOE's proposal to defer ground-water restoration until a later project phase.

DOE must provide the supporting background characterization data and the contaminant plume characterization data in the RAP. The supporting information should include interpretative analyses on the changes and trends in ground-water quality through time and verification of the data quality of the geochemical information (major ion balances, and so forth) that supports the interpretive analyses. This is considered an Open Issue by the NRC staff.

B. Mexican Hat Site

Ground water within the Halgaito Shale Formation near the tailings piles has been primarily derived from the seepage of tailings fluids. The Halgaito Shale is largely unsaturated in other areas surrounding the site. Consequently, the Halgaito Shale is not considered an aquifer. The extent of the tailings seepage influence is limited to the vicinity of the tailings piles and is also expressed in several seeps situated in the dry arroyos immediately down-gradient of the tailings piles.

The uppermost aquifer (Honaker Trail Formation) is separated from the tailings pile by approximately 80 feet of low permeability clay and silt of the Halgaito Shale Formation. The uppermost aquifer is also isolated from the tailings fluids within the Halgaito by an upward hydraulic gradient between the Honaker Trail and the overlying lithologic units.

Native ground-water quality in the Honaker Trail Formation is relatively poor, with an average concentration of sulfate at 2136 mg/L and an average Total Dissolved Solids (TDS) concentration of 3467 mg/L. Additionally, hydrogen sulfide gas was encountered in many of the characterization borings and in wells in the upper portion of the aquifer. Water from the Honaker Trail would generally be classified as brackish of the sodium-calcium-sulfate type. Ground water from the Honaker Trail is significantly different from water in the overlying Halgaito Shale, which is predominantly derived from tailings seepage, and is characterized as a calcium-magnesium-sulfate type.

DOE lists several inorganic constituents as being identified above method detection limits in the Honaker Trail native ground water. These inorganic constituents are: Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Molybdenum, Net Gross Alpha, Nitrate, combined Radium–226 and –228, Selenium, Silver, and Uranium. NRC staff's review of *Table D.7.5 - Groundwater Quality Statistics by Parameter Honaker Trail Monitor Wells* ....,in Appendix D "Site Characterization," found several inconsistencies with the list provided in the RAP text. Barium is listed in Table D.7.5 as having 100% non-detects, while showing a maximum measured concentration above the method detection limit. Cadmium, Lead, Mercury, and Silver are listed as non-detects in Table D.7.5. DOE lists four inorganic constituents, (Arsenic, Net Gross Alpha, combined Radium–226 and –228, and Uranium) as equaling or exceeding the proposed EPA MCL in the Honaker Trail. Table D.7.5 indicates that Nitrate exceeds the proposed EPA MCL.

In addition, DOE lists several hazardous constituents or hazardous compound components listed in Appendix IX, 40 CFR § 264 were also identified. These constituents are: Aluminum, Antimony, Fluoride, Nickel, Vanadium, and Zinc. These constituents can also occur within the pore water of uranium mill tailings. Table D.7.5 does not show any detection of Antimony in the Honaker Trail.

The NRC staff has reviewed the information on the geochemical conditions within the uppermost aquifer at the Mexican Hat site. Several inconsistencies between the data table and text descriptions presented in the RAP are apparent from a review of the provided data tabulation. DOE must review and resolve these inconsistencies in the RAP. Additionally, DOE should provide verification in the RAP of the data quality of the geochemical information (major ion balances, and so forth) that supports the geochemical characterization. This is considered an Open Issue by the NRC staff.

5.2.4 Water Use

A. Monument Valley Site

Ground water from the alluvial aquifer in the vicinity of the Monument Valley site is used as a source of drinking water by residents up-gradient from the tailings site. Ground water from the DeChelley Sandstone is withdrawn for domestic use from one well down-gradient of the tailings site. The RAP does not provide any detail on alluvial ground-water use down-gradient of the tailings site or the potential impact of the identified contaminant plume on potential ground-water users down-gradient from the site.

B. Mexican Hat Site

There is no current ground-water use in the uppermost aquifer or in deeper ground-water systems within a two-mile radius of the Mexican Hat site. This has been confirmed by a search of the Navajo Tribal Utility Authority records, which indicated that there is no evidence of any producing wells in the area.

water

Attempts to develop the ground-water resource in the area were undertaken in the past, but potable ground water was not found. The RAP does not provide details on the current water system for the community of Halchita or residents near the tailings piles. The RAP identifies that, "Prior to construction of the current water supply system, the local residents obtained their water from windmills or wells located in Monument Valley, Arizona; or Bluff, Utah; or directly out of the San Juan River."

Domestic water for the community of Mexican Hat is obtained from a converted oil exploration well beneath the community, and the San Jun River. No other information is available for the ground-water supply, but DOE believes that the water is withdrawn from strata that are recharged directly from the San Juan River.

DOE should provide additional detail on the impact of the identified contaminant plume on potential ground-water users at the Monument Valley site. This information should include a map showing the location of the nearest potential water users that would be impacted by the contaminant plume. DOE should also provide details on the current water system for the community of Halchita near the Mexican Hat site. This additional information should be incorporated into the appropriate sections of the RAP. This is considered an Open Issue by the NRC staff.

5.3 <u>Conceptual Design Features to Protect Water Resources</u>

DOE proposes to relocate the tailings and contaminated materials from the Monument Valley, Arizona, site and incorporate them into the existing tailings pile at Mexican Hat, Utah. There are several features (both existing and proposed engineering) at the Mexican Hat site that will contribute to the water resources protection in the area. Two of the more important existing features are the arid to semi-arid climate at site and the hydrogeologic setting, which includes an upward hydraulic gradient between the uppermost aquifer and the overlying lithologic units.

DOE proposes to compliment the existing site features with engineered features that are also expected to protect the water resources. The engineered features are part of the multi-component cover system which is designed to reduce the likelihood of precipitation from coming in contact with the tailings. The multi-component cover includes (from top to bottom): (1) an erosion protection layer consisting of rock rip-rap, (2) a one-half foot sand bedding and drainage layer, and (3) two feet of compacted, bentonite-amended clay that forms a low-permeability radon barrier. The top of the cover is also slopped at a 2 percent grade to promote precipitation run-off and mitigate water ponding.

DOE has not included a frost-protection layer within the cover design, nor addressed the need for such a cover component. DOE has not provided any discussion on the capacity of the current design to withstand anticipated frost action, and maintain the designed cover integrity. Frost action can seriously compromise the effectiveness of the infiltration/radon barrier over time. See section 3.3.4 for additional discussion of this issue.

5.4 Disposal and Control of Residual Radioactive Materials

EPA's proposed standards in Subparts A and C of 40 CFR Part 192 require DOE to demonstrate that the disposal of residual radioactive material complies with site-specific ground-water protection standards and closure performance standards in four areas: (1) Water Resources Protection Standards for Disposal; (2) Performance Assessment; (3) Closure Performance Standards; and (4) Ground-Water Monitoring and Corrective Action Program. Details of these four compliance areas at the Mexican Hat site are provided below.

5.4.1 Water Resources Protection Standards For Disposal

The site-specific standards for disposal consist of three critical elements: (a) a list of hazardous constituents, (b) a corresponding list of concentration limits, and (c) a Point of Compliance. Each of these elements are discussed below.

5.4.1.1 Hazardous Constituents

DOE has identified twenty-five inorganic hazardous constituents that were either measured in pore-water samples or can reasonable be expected to occur in the Monument Valley and Mexican Hat tailings piles. DOE did not provide any detailed chemical analysis results for the tailings characterization at the Monument Valley site. DOE listed twenty-two constituents in Table D.7.6 (Appendix D "Site Characterization") that were identified in pore fluid samples at the Mexican Hat site. These constituents are: Aluminum, Ammonia, Antimony, Arsenic, Barium, Cadmium, Chromium, Copper, Fluoride, Net Gross Alpha, Lead, Mercury, Molybdenum, Nickel, Nitrate, combined Radium-226 and -228, Silver, Strontium, Tin, Uranium, Vanadium, and Zinc.

The NRC staff has reviewed the chemical characterization of the Mexican Hat tailings used to establish the list of hazardous constituents. The NRC staff agrees with the list of identified hazardous constituents from the Mexican Hat site; however, DOE should provide the detailed characterization data for the Monument Valley site. In addition, NRC staff has identified two minor discrepancies between the text descriptions presented in the RAP and the analytical results presented in Table D.7.6. The NRC staff review of Table D.7.6 did not find any analytical results for combined Radium-226 and -228. In addition, DOE described in the RAP text that the mean or median concentration of Selenium equaled or exceeded the proposed EPA MCL; however, Table D.7.6 lists Selenium as a non-detect. DOE should check the values and constituents presented in the text and table and clarify any inconsistencies.

5.4.1.2 Concentration Limits

DOE proposes to meet Maximum Concentration Limits (MCL) or background concentrations (BKG) of the identified hazardous constituents at the Point of Compliance in the Honaker Trail Formation, whichever are higher. DOE presented the hazardous constituents and concentration limits in Table E.3.2 of the RAP. This information is reproduced below in Table 5.2:

Table 5.2
Proposed Concentration Limits for Hazardous Constituents in the Honaker Trail Formation Mexican Hat Disposal Site

Hazardous Constituents	MCL (mg/L)	Background Concentration* (mg/L)	Proposed Concentration Limit
Antimony		0.006	0.006
Arsenic	0.05	0.05	0.05
Barium	1.0	0.05	1.0
Beryllium			NC**
Cadmium	0.01	0.001	0.01
Chromium	0.05	0.1	0.1
Cobalt		< 0.05	0.05
Copper		0.04	0.04
Cyanide		< 0.01	0.01
Fluoride		1.44	1.44
Net Gross Alpha	15 pCi/L	19.97 pCi/L	20 pCi/L
Lead	0.05	< 0.03	0.05
Mercury	0.002	< 0.0001	NC
Molybdenum	0.1	0.05	0.1
Nickel		0.05	0.05
Nitrate	44	11.1	44
Radium-226 and -228	5 pCi/L	5.5 pCi/L	5 pCi/L
Selenium	0.01	0.003	0.01
Silver	0.05	< 0.005	0.05
Sulfide		4.6	4.6
Thallium		< 0.01	NC
Tin		< 0.05	NC
Uranium	0.044	0.046	0.046
Zinc		0.006	0.006

* Represents the Maximum Observed or Statistical Maximum
** Concentration Limit not assigned because source term concentration is below the method detection limit

The NRC staff has reviewed the concentration limits proposed for the hazardous constituents at the Mexican Hat disposal site. Several discrepancies have been identified in the list of proposed Hazardous Concentration Limits. Cyanide is listed as a constituent in the uppermost aquifer; however, Cyanide is not in the characterization results for the Mexican Hat tailings or Honaker Trail Formation. Cyanide is identified within the Halgaito Shale Formation. Sulfide is reported as 64.4 mg/L in Honaker Trail (Table D.7.5), but is listed as 4.6 mg/L as a proposed concentration limit. The proposed Mercury concentration should be listed as the MCL, rather than as not assigned. Strontium has been identified in the tailings pore fluid, but a concentration limit has not been proposed for this constituent. In addition, DOE must provide the detailed tailings characterization data for the Monument Valley site in the RAP. The NRC staff considers this an Open Issue.

5.4.1.3 Point of Compliance

DOE identifies the Point of Compliance (POC) as the vertical plane extending downward into the Honaker Trail Formation from the hydraulically down-gradient limit of the riprap. The POC for the Mexican Hat disposal site is located to the northwest, north, and northeast of the disposal cell, as shown in Figure E.3.1 of the RAP. The Honaker Trail Formation has been designated as the uppermost aquifer beneath the disposal site. Discussion of the uppermost aquifer is presented in TER section 5.2.1. DOE does not propose to perform monitoring at the POC because of the upward hydraulic gradient between the uppermost aquifer and the overlying confining unit. Monitoring the uppermost aquifer under these hydraulic conditions would not provide any measure of detection of potential hazardous constituent releases from the disposal site.

The NRC staff has reviewed the information in the RAP and agrees with the designation of the Point of Compliance at the Mexican Hat disposal site.

5.4.2 Performance Assessment

DOE must demonstrate that the performance of the disposal unit will comply with EPA's ground-water protection standards in 40 CFR 192 Subparts A and C. DOE has identified two main areas of concern in meeting the compliance standards of 40 CFR 192 at the Mexican Hat disposal site. These concerns are: (1) compliance with the ground-water protection standards in the Honaker Trail Formation, and (2) the human health and environment risk associated with the seeps in the dry arroyos.

DOE states in the RAP that several components of the proposed cover design should provide adequate assurance that the disposal cell will meet the compliance standards. The combination of the filter bedding and the low-permeability radon/infiltration barrier should restrict infiltration through the tailings to at least the ambient annual recharge rate of 5×10^{-9} cm/s (Other places in the RAP indicate that cover components will limit infiltration to 5×10^{-8} cm/s. DOE should clarify these inconsistencies in the RAP). This assumption is based on recent field studies at two UMTRA Project sites that have climate and cover design characteristics similar to those at the Mexican Hat site. Consequently, DOE maintains that the moisture conditions in the radon barrier at the Mexican Hat site should closely approximate the measured moisture conditions at these two sites and remain unsaturated. DOE has not discussed the impact of frost heaving on the potential performance of the designed cover.

In addition to the cover design components, tailings seepage into the uppermost aquifer is not likely because of the upward hydraulic gradient between the Honaker Trail Formation and the overlying Halgaito Shale Formation. The advantageous hydrogeologic setting should assure that the remedial action will comply with the proposed EPA ground-water protection standards.

Tailings fluid within the unsaturated Halgaito Shale Formation reaches the surface in several seeps in the dry arroyos down-gradient of the disposal site. DOE has indicated that the present cover design should mitigate or eliminate the contribution of tailings fluids to theses seeps. However, the present cover design does not include a frost protection layer, and DOE has not provided any information or assessments of the present cover design performance under frost-heave conditions.

The NRC staff has reviewed the performance assessment information presented in the RAP and agrees that the advantageous hydrogeologic setting of the disposal cell should prevent tailings constituents from impacting the uppermost aquifer at the disposal site. DOE indicates that the designed cover components, in conjunction with the advantageous climatic conditions, will also reduce or eliminate the contribution tailings pore-fluids to the seeps within the Halgaito Shale Formation; however, DOE has not provided any information or analysis on the impact of frost heaving on the present cover design and the subsequent contribution to the Halgaito seeps. The NRC staff considers this an Open Issue.

5.4.3 Closure Performance Demonstration

In accordance with the closure performance standards of 40 CFR 192.02(a)(4), DOE is required to demonstrate that the proposed disposal design will (1) minimize and control contaminant releases to ground water and surface water, (2) minimize the need for further maintenance, and (3) meet initial performance standards of the design.

DOE has indicated the long-term active maintenance of the disposal cell has been mitigated by the proposed use of natural, stable materials in sufficient quantities to achieve a design life of at least 1000 years. However, as discussed in TER section 5.3, DOE has not provide any information or assessment of the potential impacts of frost heaving on the proposed cover design and the potential impact on contaminant releases to the ground-water system.

5.4.4 Ground-Water Monitoring and Corrective Action Plan

Pursuant to the proposed EPA ground-water protection standards in 40 CFR Part 192.02(a) and (b), DOE is required to implement a ground-water monitoring and corrective action program to be carried out during the post-disposal period. DOE will provide a Long-Term Surveillance Plan which will address various monitoring needs of the disposal cell.

DOE does not plan to conduct post-closure ground-water monitoring in the uppermost aquifer at the Mexican Hat disposal site because of the advantageous hydrogeologic setting, and because there has not been any observed tailings-related impacts in the Honaker Trail Formation from processing activities of over 30-years ago. DOE indicates that the water quality of the Gypsum Wash and north arroyo seeps will continue to be monitored, but no indication has been given concerning any concentration limits or relationships to cell performance.

The NRC staff has reviewed the site characterization information for the disposal site and agrees that monitoring of the uppermost aquifer will likely be ineffective in assessing the performance compliance of the disposal cell, given the advantageous hydrogeologic setting. However, DOE should provide a conceptual plan of monitoring existing tailings fluids and seeps in the Halgaito Shale, in order to achieve the intent of the ground-water monitoring provisions of the proposed EPA ground-water protection standards. The elements of this conceptual plan could include, but not be limited to; the anticipated volume of fluid contributed by (1) the compaction and consolidation of the combined tailings materials, (2) infiltration, and (3) flow contribution from the uppermost aquifer. This is considered an Open Issue by NRC staff.

DOE has also provided a summary of expected corrective action activities, based on credible failure scenarios. This summary is presented in Table 5.3.

Table 5.3
Corrective Action Plan Summary

FAILURE SCENARIO	REMEDIAL ACTION
Contaminated seepage emerges in artificially induced springs below the pile.	Modify cover to eliminate excess infiltration.
Ground-Water quality deteriorates; occurs off-site due to tailings seepage.	Perform a risk assessment, then modify cover and apply institutional controls (ground-water restoration impractical) or apply for supplemental standards.
Radon barrier cracks due to desiccation.	Replace high permeability filter layer with lower permeability filter layer.
Erosion protection layer siltates.	No action needed unless it increases infiltration or induces vegetation.
Vegetation threatens integrity of radon barrier.	Apply biointrusion layer.
Animals intrude into the pile.	Modify rock cover.
Frost heave affects pile.	Not realistic failure scenario (frost barrier is included in design).
Cover erodes	Not realistic failure scenario (pile is designed for PMP and PMF events).

The NRC staff has reviewed the corrective action summary and agrees with the proposed corrective actions, with the exception of the frost heaving affects.

DOE has indicated that a frost protection barrier has been included in the design; however, design drawings do not include a frost barrier. DOE should include a frost protection layer in the cover design or provide information and analyses that demonstrate that a frost barrier is not necessary. The NRC staff considers this an Open Issue.

5.5 Clean-Up and Control of Existing Contamination

DOE is required to demonstrate compliance with the EPA standards listed in 40 CFR Part 192, Subparts B and C for clean-up and control of existing ground-water contamination. The NRC staff considers that ground-water clean-up may be deferred, as provided for in the UMTRCA amendment of 1982. However, in order to defer clean-up of ground-water at the Monument Valley and Mexican Hat sites, DOE must demonstrate that (1) clean-up of the processing sites will not be impacted by the disposal, and thus, is separable from the disposal actions, and (2) that public health and safety will be protected.

DOE proposes to defer the compliance demonstration for clean-up of existing contamination. By virtue of moving the tailings to the Mexican Hat site, DOE has demonstrated that the disposal of the tailings will not impact ground-water clean-up at the Monument Valley processing sites. Ground-water clean-up of tailings seepage at the Mexican Hat site is not planned, because the seepage is restricted to the unsaturated zone in the Halgaito Shale. Contaminated water from the Halgaito Shale does form seeps along several dry arroyos downgradient of the disposal site. Many of these seeps are presently not active and are expected to continue to diminish with time. Seeps within the Gypsum Wash are relatively inaccessible and do not appear to provide a significant health risk.

The uppermost aquifer at the Mexican Hat site is unaffected by the tailings seepage, by virtue of the upward hydraulic gradient in the aquifer. Ground-water quality within the uppermost aquifer is relatively poor and is not currently being used. However, deferring clean-up of existing ground-water contamination can be made only after demonstration that public health and safety will not be adversely impacted by the deferral.

The NRC staff has reviewed the information provided for the characterization of the existing contamination at the Mexican Hat site. The NRC staff agrees that the existing contamination within the Halgaito Shale will likely diminish with time and does not present a significant impact to human health or the environment under present conditions. DOE should continue to monitor the Halgaito Shale seeps and reevaluate the health and environmental impact if conditions change.

DOE has not provided any supporting information in the RAP on the existing ground-water contamination at the Monument Valley site. The NRC staff cannot independently verify the existing ground-water characterization at the site for the purpose of evaluating DOE's proposal to defer restoration of existing ground-water contamination to a later project phase. This is considered an Open Issue by the NRC staff.

5.6 Conclusions

Based upon the review of the Remedial Action Plan, the NRC staff concludes that DOE's proposed remedial action has demonstrated compliance with the EPA ground-water standards, with the exception of the following issues:

1. DOE must demonstrate that by deferring ground-water clean-up at the Monument Valley and Mexican Hat sites that future public health and safety will not be affected.

2. DOE must provide the supporting hydraulic and transport characterization information for the Monument Valley site in the RAP. The NRC staff is unable to perform an independent verification of the ground-water characterization results for Monument Valley without the supporting information. Consequently, NRC staff cannot agree with the proposed deferral of ground-water restoration at Monument Valley without the independent verification.

3. DOE must provide the supporting background characterization data and the contaminant plume characterization data in the RAP. The supporting information should include interpretative analyses on the changes and trends in ground-water quality through time and verification of the data quality of the geochemical information (major ion balances, and so forth) that supports the interpretive analyses.

4. Several inconsistencies between the data table and text descriptions presented in the RAP are apparent from a review of the provided data tabulation. DOE must review and resolve these inconsistencies in the RAP. Additionally, DOE should provide verification in the RAP of the data quality of the geochemical information (major ion balances, and so forth) that supports the geochemical characterization.

5. DOE should provide additional detail on the impact of the identified contaminant plume on potential ground-water users at the Monument Valley site. This information should include a map showing the location of the nearest potential water users that would be impacted by the contaminant plume. DOE should also provide details on the current water system for the community of Halchita near the Mexican Hat site. This additional information should be incorporated into the appropriate sections of the RAP.

6. NRC staff has identified two minor discrepancies between the text descriptions presented in the RAP and the analytical results presented in Table D.7.6. The NRC staff review of Table D.7.6 did not find any analytical results for combined Radium-226 and -228. In addition, DOE described in the RAP text that the mean or median concentration of Selenium equaled or exceeded the proposed EPA MCL; however, Table D.7.6 lists Selenium as a non-detect. DOE should check the values and constituents presented in the text and table and clarify any inconsistencies.

7. Several discrepancies have been identified in the list of proposed Hazardous Concentration Limits. Cyanide is listed as a constituent in the uppermost aquifer; however, Cyanide is not in the characterization results for the Mexican Hat tailings or Honaker Trail Formation. Cyanide is identified within the Halgaito Shale Formation. Sulfide is reported as 64.4 mg/L in Honaker Trail (Table D.7.5), but is listed as 4.6 mg/L as a proposed concentration limit. The proposed Mercury concentration should be listed as the MCL, rather than as not assigned. Strontium has been identified in the tailings pore fluid, but a concentration limit has not been proposed for this constituent. In addition, DOE must provide the detailed tailings characterization data for the Monument Valley site in the RAP.

8. DOE indicates that the designed cover components, in conjunction with the advantageous climatic conditions, will also reduce or eliminate the contribution tailings pore-fluids to the seeps within the Halgaito Shale Formation; however, DOE has not provided any information or analysis on the impact of frost heaving on the present cover design and the subsequent contribution to the Halgaito seeps. DOE should provide this information in the RAP.

9. DOE should provide a conceptual plan of monitoring existing tailings fluids and seeps in the Halgaito Shale, in order to achieve the intent of the ground-water monitoring provisions of the proposed EPA ground-water protection standards. The elements of this conceptual plan could include, but not be limited to; the anticipated volume of fluid contributed by (1) the compaction and consolidation of the combined tailings materials, (2) infiltration, and (3) flow contribution from the uppermost aquifer.

10. DOE has indicated that a frost protection barrier has been included in the design; however, design drawings do not include a frost barrier. DOE should include a frost protection layer in the cover design or provide information and analyses that demonstrate that a frost barrier is not necessary.

11. DOE has not provided any supporting information in the RAP on the existing ground-water contamination at the Monument Valley site. The NRC staff cannot independently verify the existing ground-water characterization at the site for the purpose of evaluating DOE's proposal to defer restoration of existing ground-water contamination to a later project phase. DOE should provide this information in the RAP.

RESPONSES TO OPEN ISSUES

NRC DRAFT TECHNICAL EVALUATION REPORT

MAY 1, 1992

Responses to Summary of Open Issues (Table 1.1 dTER) by DOE subcontractor.

1. TAC (JEG)
2. TAC (JEG)
3. TAC (JEG)
4. RAC (MK-ES)
5. RAC (MK-ES)
6. TAC (JEG)
7. RAC (MK-ES)
8. RAC (MK-ES)
9. RAC (MK-ES)
10. RAC (MK-ES)
11. RAC (MK-ES)
12. RAC (MK-ES)
13. TAC (JEG)
14. TAC (JEG)
15. TAC (JEG)
16. TAC (JEG)
17. TAC (JEG)
18. TAC (JEG)
19. TAC (JEG)
20. RAC (MK-ES)
21. TAC (JEG)
22. RAC (MK-ES)
23. RAC (MK-ES)
24. RAC (MK-ES)
25. RAC (MK-ES)
26. RAC (MK-ES)
27. RAC (MK-ES)
28. TAC (JEG)
29. RAC (MK-ES)

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Mexican Hat/Monument Valley
DOCUMENT:	Preliminary Final Remedial Action Plan
COMMENT NO.:	1 - Technical Evaluation Report
COMMENTOR:	Nuclear Regulatory Commission
DATE:	May 1, 1992

An assessment is needed on the effect of the fracturing found in the Halgaito Shale on the stability of the disposal cell. (TER Subsection 2.4.1)

RESPONSE

RESPONSE BY:	Gerry Lindsey, TAC
DATE:	March 1, 1992

The section of the RAP (D.3.8.1 of Appendix D) on geomorphic hazards has been revised and includes a discussion on the effects of fracture control on drainages and the potential for head cutting and widening of adjacent arroyos. The jointed bedrock has had very little effect of the erosion of the two resistant bedrock layers. An upper resistant layer forms the divides bordering the cell and consequently comprise the foundation for the edges of the cell. A lower resistant layer, about 20 feet lower than the top of the upper layer, forms the bottoms of the drainages and is shown to be ungullied for the lengths of the major site drainage (Arroyo 1, Figure D.3.8). The resistant layers, consisting of cemented silty fine sandstone, have resisted ripping by D-9 Dozers and some blasting was required to excavate ditches.

The only evidence of instability of the upper layer is represented by occurrence of three nick points in the central arroyo (Arroyo 2, Figure D.3.8). These nick point coincide with the trend of a locally prominent fracture that dissects the drainage. The amended portion of the RAP recommends that erosion protection be placed in the gullies that head into the downslope toe of the cell. The design for the head of the arroyo has incorporated up to 150 feet of erosion protection from the toe ditch keyed in by full width trenches in the bottom of Arroyo 2. This design is more than adequate to resist head cutting.

PLANS FOR IMPLEMENTATION

Appropriate RAP sections were revised.

12/7

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 2 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

Additional information is needed on the rate of erosion and the erosion resistance of the material at the heads of the arroyos and the thickness, areal extent, stratigraphic position, and competency of the limestones which are intended to be foundations for engineered features. (TER Subsection 2.4.2)

RESPONSE

RESPONSE BY: Gerry Lindsey, TAC
DATE: March 1, 1992

The RAP section D.3.8.1 discussed in response to comment no. 1 was revised to address the erosion characteristics of each drainage relative to the drainage basin size and the resistance to erosion of upper and lower resistant layers that form the foundation of the cell and the arroyo bottoms respectively. The cemented silty fine sandstones beds that comprise these resistant layers, are shown to be ungullied in the drainage bottoms of both Arroyos 1 and 2 (Figure D.3.8, Appendix D). The erosion characteristics of these various strata of the Halgaito Shale member is demonstrated in the nearby canyon of Gypsum Creek which drains more than 150 sq. miles as compared with less than 0.6 sq. miles for Arroyo 1.

PLANS FOR IMPLEMENTATION

Section D.3.8.1 (Appendix D) has been revised.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Mexican Hat/Monument Valley
DOCUMENT:	Preliminary Final Remedial Action Plan
COMMENT NO.:	3 - Technical Evaluation Report
COMMENTOR:	Nuclear Regulatory Commission
DATE:	May 1, 1992

The RAP indicates that ditches will be protected by riprap whereas the engineered plans indicate that some ditches will not be protected by rock. This discrepancy needs to be reconciled by DOE.

RESPONSE

RESPONSE BY:	John McBee, TAC
DATE:	March 1, 1992

Comment acknowledged. Section D.3.8.1 (Appendix D) has been revised to be consistent with the Design Specifications and Drawings (Appendix B).

PLANS FOR IMPLEMENTATION

Appropriate RAP sections were revised.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 6 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

DOE should reevaluate the need for the low-permeability specification of 5×10^{-8} cm/s in the radon barrier design, or include additional field quality control procedures and field demonstrations in the RAP that will assure attainment of the low-permeability specification.

RESPONSE

RESPONSE BY: John McBee, TAC
DATE: March 1, 1992

Sections E.2.3 and E.2.3.1 (Appendix E) were revised to clarify the discussion of permeability of the radon barrier. Those sections were not intended to imply that there is a design specification of 5×10^{-8} cm/s for the radon barrier layer in the disposal cell cover. The permeabilities referenced are laboratory test values meant to give an estimated value for cover hydraulic conductivity.

PLANS FOR IMPLEMENTATION

Appropriate RAP sections were revised.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 13 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

DOE must demonstrate that by deferring ground-water clean-up at the Monument Valley and Mexican Hat site that future public health and safety will not be affected.

RESPONSE

RESPONSE BY: Clark Poore, TAC
DATE: March 1, 1992

The TAC has prepared additional sections (D.7.14 through D.7.24) for the RAP Appendix D which include a complete groundwater contamination characterization description of the Monument Valley site. Included are supporting data tables, figures, and calculations. Also a section describing the impact of contaminated groundwater on potential water users is included (D.7.23).

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 14 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

DOE must provide the supporting hydraulic and transport characterization information for the Monument Valley site in the RAP. The NRC staff is unable to perform an independent verification of the ground-water characterization results for Monument Valley without the supporting information. Consequently, NRC staff cannot agree with the proposed deferral of ground-water restoration at Monument Valley without the independent verification.

RESPONSE

RESPONSE BY: Clark Poore, TAC
DATE: March 1, 1992

TAC has prepared sections D.7.14 through D.7.24 for the RAP which include a complete groundwater contamination characterization of the Monument Valley site. This includes all hydraulic and transport characterization information and all supporting tables, figures, and calculations.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 15 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

DOE must provide the supporting background characterization data and the contaminant plume characterization data in the RAP. The supporting information should include interpretive analyses on the changes and trends in ground-water quality through time and verification of the data quality of the geochemical information (major ion balances, and so forth) that supports the interpretive analyses.

RESPONSE

RESPONSE BY: Clark Poore, TAC
DATE: March 1, 1992

TAC has prepared sections D.7.19 through D.7.23 for inclusion in the RAP which include complete characterization of background groundwater quality and downgradient groundwater quality. Groundwater quality changes through time are described. Supporting data, figures, and calculations are included. The data was collected and analyzed according to UMTRA quality assurance/quality control standard operating procedures. Because of the large amount of QA/QC data available, it can be sent in a separate package if required.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 16 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

Regarding geochemical conditions within the uppermost aquifer at the Mexican Hat site, several inconsistencies between the data table and text descriptions presented in the RAP are apparent from a review of the provided data tabulation. DOE must review and resolve these inconsistencies in the RAP. Additionally, DOE should provide verification in the RAP of the data quality of the geochemical information (major ion balances, and so forth) that supports the geochemical characterization.

RESPONSE

RESPONSE BY: Clark Poore, TAC
DATE: March 1, 1992

TAC has reviewed and updated all tables and corresponding text descriptions in Sections D.7.8 through D.7.12. The text has been revised where necessary. The data was collected and analyzed according to UMTRA quality assurance/quality control standard operating procedures. Because of the large amount of QA/QC data available, it can be sent in a separate package if required.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Mexican Hat/Monument Valley
DOCUMENT:	Preliminary Final Remedial Action Plan
COMMENT NO.:	**17 - Technical Evaluation Report**
COMMENTOR:	Nuclear Regulatory Commission
DATE:	May 1, 1992

DOE should provide additional detail on the impact of the identified contaminant plume on potential ground-water users at the Monument Valley site. This information should include a map showing the location of the nearest potential water users that would be impacted by the contaminant plume. DOE should also provide details on the current water system for the community of Halchita near the Mexican Hat site. This additional information should be incorporated into the appropriate section of the RAP.

RESPONSE

RESPONSE BY:	Clark Poore, TAC
DATE:	March 1, 1992

A survey of groundwater users at the Monument Valley site has been completed. A discussion of the impact of the contaminant plume on groundwater users is included along with maps of the contaminant plume and locations of groundwater users in Sections D.7.22 through D.7.23 of the revised RAP. Information on the current water system at the community of Halchita is included in section D.7.13 of the revised RAP.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE:	Mexican Hat/Monument Valley
DOCUMENT:	Preliminary Final Remedial Action Plan
COMMENT NO.:	18 - Technical Evaluation Report
COMMENTOR:	Nuclear Regulatory Commission
DATE:	May 1, 1992

NRC staff has identified two minor discrepancies between the text descriptions presented in the RAP and the analytical results presented in TABLE D.7.6. The NRC staff review of TABLE D.7.6 did not find any analytical results for combined Radium-226 and -228. In addition, DOE described in the RAP text that the mean or median concentration of selenium equaled or exceeded the proposed EPA MCL; however, TABLE D.7.6 lists selenium as a non-detect. DOE should check the values and constituents presented in the text and table and clarify any inconsistencies.

RESPONSE

RESPONSE BY:	Clark Poore, TAC
DATE:	March 1, 1992

TAC has reviewed and updated Table D.7.6 and revised corresponding text descriptions in Section D.7.9 of the RAP.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 19 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

Several discrepancies have been identified in the list of proposed hazardous concentration limits. Cyanide is listed as a constituent in the uppermost aquifer; however, cyanide is not in the characterization results for the Mexican Hat tailings or Honaker Trail Formation. Cyanide is identified within the Halgaito Shale Formation. Sulfide is reported as 64.4 mg/L in the Honaker Trail (Table D.7.5), but is listed as 4.6 mg/L as a proposed concentration limit. The proposed mercury concentration should be listed as the MCL, rather than as not assigned. Strontium has been identified in the tailings pore fluid, but a concentration limit has not been proposed for this constituent. In addition, DOE must provide the detailed tailings characterization data for the Monument Valley site in the RAP.

RESPONSE

RESPONSE BY: Clark Poore, TAC
DATE: March 1, 1992

Water quality analyses and interpretations for the tailings pore water at the Monument Valley site are included in Section D.7.20 of the revised RAP. As explained in the revised Section E.3.1.3, there will not be a POC at the Mexican Hat site. Therefore, Table E.3.2 has been removed.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 21 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

DOE should provide a conceptual plan of monitoring existing tailings fluids and seeps in the Halgaito Shale, in order to achieve the intent of the ground-water monitoring provisions of the proposed EPA ground-water protection standards. The elements of this conceptual plan could include, but not be limited to; the anticipated volume of fluid contributed by (1) the compaction and consolidation of the combined tailings materials, (2) infiltration, and (3) flow contribution from the uppermost aquifer.

RESPONSE

RESPONSE BY: Clark Poore, TAC
DATE: March 1, 1992

TAC has revised the RAP to include a conceptual monitoring plan in Section E.3.4 This plan recommends periodic monitoring of the Gypsum Creek seeps and any other seeps that may appear in Gypsum Creek or the North Arroyo downgradient from the disposal cell. Any fluid contributed as a result of surface remedial action or as cell failure at some time in the future would reach the seeps before any other potential monitoring point (POC monitor well in the uppermost aquifer, for example).

Fluid volume contributed by compaction and consolidation can be estimated. Infiltration of precipitation can be estimated. Flow contribution to the seeps from the uppermost aquifer cannot be estimated with available information.

PLANS FOR IMPLEMENTATION

Revise the RAP.

UMTRA DOCUMENT REVIEW FORM

COMMENT

SITE: Mexican Hat/Monument Valley
DOCUMENT: Preliminary Final Remedial Action Plan
COMMENT NO.: 28 - Technical Evaluation Report
COMMENTOR: Nuclear Regulatory Commission
DATE: May 1, 1992

Conflicting statements on the planned bentonite content of the radon barrier should be eliminated.

RESPONSE

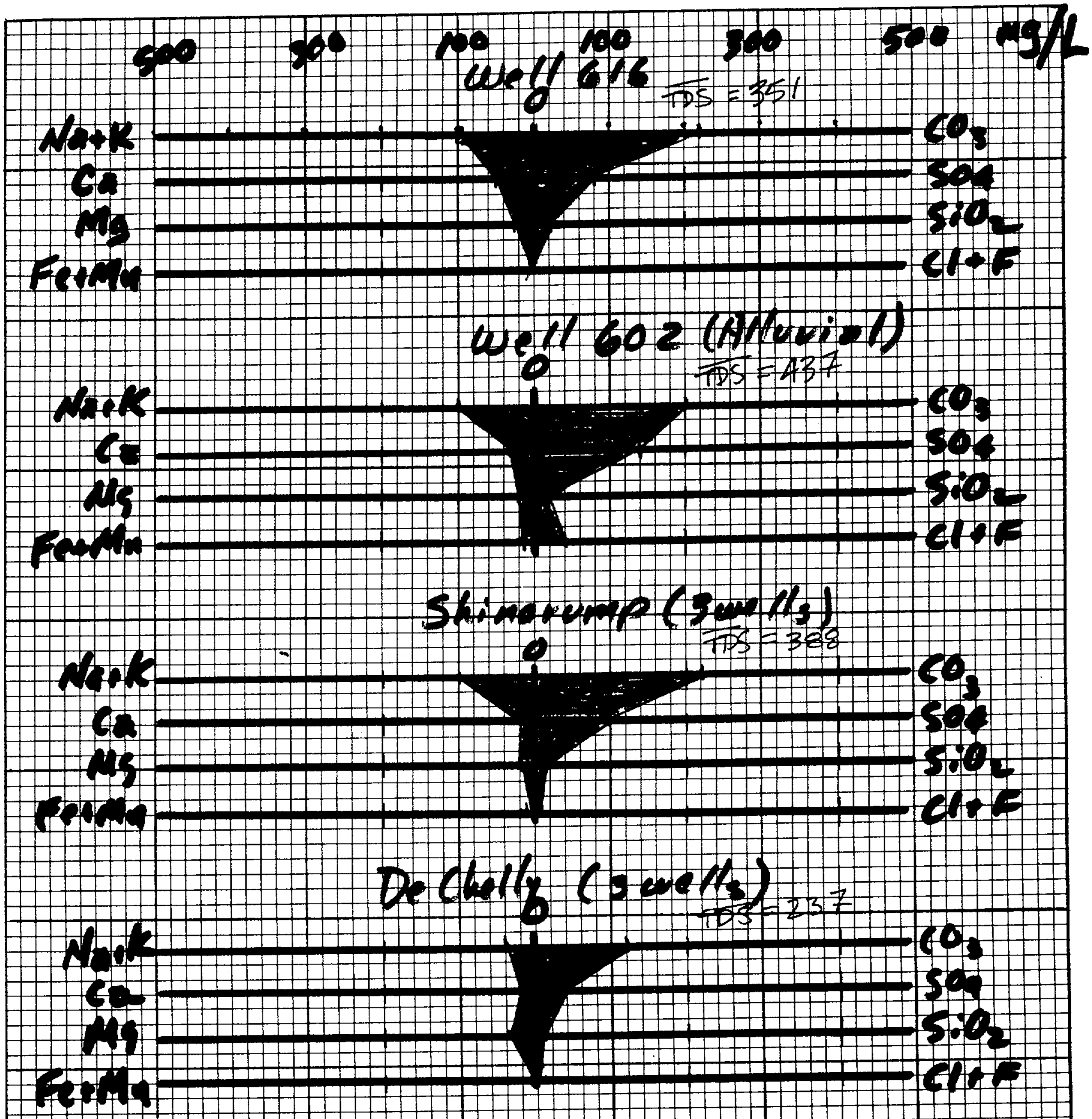
RESPONSE BY: John McBee, TAC
DATE: March 1, 1992

Comment acknowledged. Figures and text referencing the percent of bentonite to be added (in the Text, Appendix D, and Appendix E) were revised to be consistent with Appendix B i.e., 10%.

Fluid volume contributed by compaction and consolidation can be estimated. Infiltration of precipitation can be estimated. Flow contribution to the seeps from the uppermost aquifer cannot be estimated with available information.

PLANS FOR IMPLEMENTATION

Appropriate RAP sections were revised.



Monument Valley
General
GW chemistry 4/2/93

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