THE NAVAJO NATION

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May 17, 2000

WM-63

Mr. Thomas H. Essig, Chief
Uranium Recovery and Low-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20558-0001

SUBJECT: Nuclear Regulatory Commission's Response to Department of Energy's Request for Re-Examination of Ground Water Compliance Strategy for the Uranium Mill Tailings Remedial Action Project Site at Mexican Hat, Utah

Dear Mr. Essig:

The Navajo Uranium Mill Tailings Remedial Action (UMTRA) Program is in receipt of your February 14, 2000 letter to the U.S. Department of Energy, Grand Junction Office (DOE-GJO) regarding the above subject matter. The Navajo UMTRA Program has concerns with the U.S. Nuclear Regulatory Commission's (NRC) re-examination conclusions. Your letter states that "we are unable to further evaluate the Navajo Nation's concerns at the Mexican Hat site, without specific technical information on those concerns." Our comments were submitted to DOE during the course of our review on the Mexican Hat UMTRA Site Observational Work Plan (SOWP) Rev. 0 (September 1994) and Rev. 1/Final (July 1998). This letter and the enclosed packet of comments are intended to provide that technical information.

Mr. Donald Metzler, UMTRA Project Leader at DOE-GJO, had agreed to install an additional downgradient monitoring well at the Mexican Hat site during a meeting between the Navajo UMTRA Program and DOE last year. However, he has used your letter to repudiate this agreement.

The NRC based its concurrence with a no-action approach to ground water clean up at the site on its review of the Remedial Action Plan (RAP, February 1993) for the surface clean-up and so has not reviewed the two SOWPS. The SOWP-Rev.0 was much more complete in its data presentation, including geologic well logs, water level data, aquifer-testing data, and chemical data not included in the RAP. Both the RAP and the SOWP-Rev. 0 have inadequate, limited, and misinterpreted data (see our comments on Rev. 0: 3-13 (3rd), 3-15 (1st), 3-22 (1st), and 3-41, where comment numbers refer to page numbers in the text).

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The following are our main concerns at the site, along with a list of the relevant comments in the two SOWPs. DOE revised its geologic model of the site between the two SOWPs, the final and much-improved version being quite distinct from that presented in the RAP. This revision leads to inconsistency in the naming of formations (Honacker Trail and Halgaito Shale) between the two SOWPs and between our two sets of comments on the SOWPs. We refer your reviewers to those documents for understanding the distinctions.

1. Lack of Demonstrated Geologic Isolation: DOE has based its assertion of vertical isolation on the occurrence of confined conditions for the first aquifer (lower unit of the Halgaito formation). Confined conditions were documented in only a single well (907), where a thick carbonate layer was pierced. Other downgradient wells and borings (934, 935, 936) were not confined, with only a few feet of water found in the well or boring. Contrary to what DOE states, there is a downward vertical hydraulic gradient from the shallow zone (water elevation of about 4200 ft. at the toe of the cell relative to water elevation in the lower Halgaito of about 4100 ft., see Plate 1 in Final SOWP). This vertically downward hydraulic gradient could drive highly contaminated water from the shallow zone to the "first water-bearing zone" (lower unit of the Halgaito). [Rev-0: 3-15 (1st), 3-40, 4-1; Final: 1 (number refers to comment number)]

2. Lack of Demonstration of No Contamination in the First Water-Bearing Zone: There is no clear data supporting lack of contamination in the first water-bearing zone. Well 907 is anomalous in that it taps some confined region not tapped by the other downgradient borings. Well 934 showed elevated uranium concentrations (one in excess of the MCL) through 1989, when the pH suddenly increased significantly (uranium is not soluble under high pH conditions). The other downgradient monitoring well, 935, had high pH conditions from the beginning, and so is not reliable for monitoring. The conclusion of non-contamination then must be based on a single well (934); however, this well has shown some indications of contamination from mill activities. [Rev-0: 3-23; Final: 1.c, 4, 34]

3. Poor Quality of Down-Gradient Wells: The high pH values observed in downgradient monitoring wells 934 and 935 (presumably due to grout contamination) preclude their use as reliable monitoring points in the lower unit of the Halgaito (first water-bearing unit). No other down-gradient monitoring points exist. [Final: 1.c, 2, and 34]

4. Adverse Impacts to Human Health and the Environment: DOE has done a very limited analysis of human health and environmental risk. There is clear evidence of animal use of the seeps (scat, paw and hoof prints) and of human use (rubbish, bicycle tire tracks) of the arroyo areas. DOE's conclusions of minimal risk have not been well documented. There is potential for seepage from the lower unit of the Halgaito into the adjacent San Juan River. [Rev-0: 3-1, 3-31, 3-38; Final: 6, 30 through 35]

Our feeling is that additional monitoring wells would resolve the enormous uncertainties at this site about the vertical isolation of the first water-bearing zone, possible contamination of that zone, and long-term health and environmental risks. All but three of the wells (909,934, and 935) installed at the site have been destroyed and two of those (934 and 935) show evidence of grout contamination based on very high pH and the other (909) is an upgradient well. Thus there are no existing wells to help resolve these issues.

Because the NRC based its decision on limited and misinterpreted data and DOE itself has made major revisions to its own conceptual model of the site, we respectfully request the NRC to review our comments in the two attached SOWP review documents and support our request for additional monitoring wells at the site. We would be happy to provide you with additional information or to discuss these issues with you and DOE via a conference call or at a meeting. If you have any questions, please call me at (520) 871-6982, or Michele Dineyazhe, UMTRA Environmental Specialist, at (520) 871-7594.

Sincerely,

Madeline Roanhorse, Director
Navajo AML Reclamation/UMTRA Department
Division of Natural Resources

cc w/ enclosure:
Melanie Wong, NRC
Arvin Trujillo, Navajo Nation

cc w/o enclosure:
Ray Plieness, DOE-GJO
Donald Metzler, DOE-GJO
Lee Gardner and Associates

Attachments: Navajo UMTRA Review of Rev. 0 UMTRA Project Site Observational Work Plan, Mexican Hat, Utah, USDOE-Albuquerque, September 1994

Navajo UMTRA Review of Final Site Observational Work Plan for the UMTRA Project Site at Mexican Hat, Utah, USDOE-GJPO, July 1998

MEXICAN HAT SOWP

3-1 Surrounding Water Use (first sentence). This statement is incorrect. Since contaminated ground water seeps into the nearby arroyos, some contamination must eventually find its way into the San Juan river. While the impact of this contamination may or may not be significant, it is misleading to make categorical statements of this nature.

3-5 THIRD PARAGRAPH. It would be useful to present a water budget analysis as was done for the Tuba City SOWP. Where did all that contaminated water go to?

3-7 Topographic Map (fig. 3.3). A better topographic map with more of a close-up view of the site is needed. This particular map is at such a large scale, and so indistinct in photocopy, that the topography in the vicinity of the site cannot be interpreted.

3-11 FIGURE 3.7. This figure is incomplete. The well screens are not shown and the water levels are not indicated.

3-13 Halgaito Shale Dry Prior to Milling Operations (second complete paragraph). As part of the justification that the impacted aquifer is only present because of milling activities and therefore doesn't need to be remediated as a permanent source of water, the text states that the uppermost aquifer (Halgaito Shale) was dry or nearly dry prior to milling operations. Upon what data is this statement based? Is there something in Banks (1959)? That information should be included in the report.

3-13 Fine-Grained Nature of Halgaito Shale (third full paragraph). The description of the Halgaito Shale as being fine-grained is misleading. There is a fair amount of coarser-grained material according to the borehole logs (Appendix A). In fact, the most common lithologies cited are siltstone and sandstone. Very little in the lithologic description appears to be shale. Probably more important than the lithology, in any case, is the degree of fracturing of the bedrock, and there is only a small amount of information of rock discontinuities recorded on many of the boring logs.

3-13 Hydraulic Testing (fourth full paragraph). Review of hydraulic testing data in the appendix showed that there were a number of problems with the tests. Data for these tests is presented in Appendix B of the report. For instance for the packer test on well 911 at interval 64.5 to 74.5 feet, the typical flow rate was 0.22 ft^3/min once "steady state" was achieved after the first minute, which is equivalent to 1.65 gpm. A value of 2.16 gpm was used for the calculation. A copy of what appears to be a computer printout of the data gives a "steady state" flow rate of around 1.6 gpm. In other tests at depth (ex., interval 94.5 to 104.5 ft on the same well), calculations were made on the early data before "steady state" conditions were achieved, in spite of the included packer-test protocol stating that only the steady state data should be analyzed. The high initial flow rate skewed the values for hydraulic conductivity calculated, yielding a value of 0.18 ft/d for hydraulic conductivity for the first part of the test. The actual value of hydraulic conductivity for this deeper zone is probably lower than the geometric mean calculated (0.014 ft/d). Thus, the conclusion that hydraulic conductivity decreases with depth is still valid. Two of the slug tests (on wells 934 and 935) had very anomalous water level response and results of the analysis of these data should not have been included in the geometric means.

3-13 Recharge to the Halgaito Shale (last paragraph). The text states that some recharge does occur as evidenced by a seep from the shale. There is further evidence of recharge. Water level data (Appendix B of the report) show a number of water level rise events, presumably in response to recharge. Water level rise of over 6 ft in the Halgaito Shale (well 934, 11/89 to 10/90) have been observed, and even greater rise in the Honaker Trail Formation is documented in the table. These marked responses to recharge over several years of record indicate that the aquifer is much more viable and permanent than stated in the text.

3-15 Halgaito Shale with No Potential as a Water Resource (first full paragraph). This statement, which is the crux of the decision not to perform active remediation at the site, is unsubstantiated. Even if recharge is limited, it is sufficient and regular enough to increase water levels in wells. The hydraulic conductivity of the upper portion of the aquifer (0.19 to 0.75 ft^3/d) is not in the range classified as "very low" and could indeed yield modest amounts of water to water supply wells. What is the basis for the statement that the aquifer is limited in areal extent? In general, there is no water level information on the borehole logs which would let one evaluate the lateral extent of saturated Halgaito Shale across the site.

3-15 Borehole Data Arguments in Support of "No Water Resource" View (third full paragraph). Arguments are made based on the occurrence or not of ground water within Halgaito Shale wells and borings to support the view that the aquifer does not constitute a water resource. Examination of the field data in the appendices indicates that many of the statements made here are misleading and do not necessarily support that view. These are reviewed one well at a time:

Well 905: the text states that water was not encountered in this well. This is because the well was not drilled deep enough. The total depth of this well is only 12 ft. If the well had been drilled another 40 ft or so, it is likely that water would have been encountered (based on water levels elsewhere at the site).

Well 910: This boring was stated as not encountering ground water. This well has very low yield and was grouted up immediately because of the presence of hydrogen sulfide. However well 910A which was drilled just a few feet away has a reasonable water yield. It is likely if more time had been allowed for boring 910 to produce water, some would have appeared.

Well 933: Also stated as not encountering ground water, the borehole log indicates that water did enter the well when it was allowed to stay open overnight.

Well 906: This well was stated as going dry shortly after its installation. This is because it was not drilled deep enough. The total depth is 11.75 ft. The well went dry during the dry summer months (July 1985) and then no more data were collected to see if it had recovered with the winter recharge.

Well 911: This well is screened below another permanently saturated zone monitored by well 912 (fig. 3.8). Review of the data indicate that the initial water level in this boring (Feb. 1985) at the time of the packer testing was 4231 ft. By April 13 it had dropped to 4199 ft and by April 22 to 4192 ft. At the next measurement in June the well was dry (i.e., water could no longer enter with the bottom of the screen at 4192 ft). This precipitous drop in water level could be explained by the well boring's having pierced an aquitard, and the water (and presumably any contaminants) having seeped down the boring/sandpack into the underlying formation.

Well 935: The text states that this well never contained sufficient water to be sampled. In November 1985 the water level was at 4053 ft. The bottom of the casing is at 4045 ft. This means that there should have been 8 ft of water in the well, potentially enough to obtain a sample and enough to indicate a reasonable saturated thickness.

Wells 910A, 912, and 934: These wells are cited as the only ones to have sufficient water for sampling.

The argument that some wells never yielded water can be explained because they were not drilled deep enough or insufficient time was allowed to let water flow into the boring. This piece of evidence is not valid. Two wells were stated to have gone dry, one because it was very shallow and one because it most likely pierced a perching aquitard; it also has an overlying saturated zone. This piece of evidence is not valid. Another well was stated as not having sufficient water to sample, however, there were 8 ft of standing water in the well on the one reliable water level measurement date. This piece of evidence is not valid. The other three wells are acknowledged to be water-bearing. None of the arguments based on well behavior presented in the text are convincing to indicate the Halgaito Shale is not a viable aquifer from a water resource standpoint.

3-15 Use of Halgaito as a Source of Water (last paragraph). The argument that the aquifer couldn't serve as a source of water because no pump would work in it is spurious. It would not be difficult to find a pump to remove the water, if there were a desire to do so.

3-16 Supplemental Standards for Halgaito Shale (top of page). One of the primary criteria for designating an aquifer as being of limited use is that the yield is less than 150 gallons per day (40 CFR §192.11(e)). It has not been demonstrated one way or the other how this aquifer behaves with respect to this criterion. No data have been reported on well yields in the permeable portion of the geologic unit. No discussion has been made with respect to the other criteria for designating an aquifer to be of limited use.

3-16 Water Table Map (first full paragraph). The text states that a water table map cannot be drawn for the Halgaito formation, however, we have found it is instructive to do so. There does appear to be a mound of ground water formed around the tailings pile. There does appear to be an upward gradient from the Honaker Trail. In addition, there appears to be a major discontinuity in water levels in both the Halgaito and Honaker Trail just northeast of well 906 and running roughly northwest-southeast. To the southwest the gradient is gentler and there appears to be a rapid drop in water levels across this discontinuity. One would suspect a fault in this location which is acting as a leaky barrier to ground water flow. The presence of a fault in this region is supported by the sharp drop in the elevation of the contact between the Halgaito Shale and the Honaker Trail Formation to the northeast in all three of the geologic cross-sections. When additional water level data are collected from all wells, water level contour maps for both aquifers (including superimposed maps to examine vertical hydraulic gradients) should be drawn.

3-17 PARAGRAPH 1. The word water in the third sentence should be replaced with the word wastewater.

3-17 PARAGRAPH 3. The statement that discharge from the seeps represents the total contribution of surface water is in error. Pages 3-13 and 3-14 indicate that seeps are a result of ground water.

3-19 PARAGRAPH 1. It is unclear why it is expected that the seep discussed here will cease flowing.

3-19 Cessation of Seep Flow (first three paragraphs). The text predicts the cessation of flow at seep 251 soon after completion of the disposal cell but says it is not possible to predict the cessation of seepage at the other two downgradient seeps (249 and 255). The seepage rate appears to follow a seasonal pattern, Figures 3.11 and 3.12, with flow declining into the dry summer months. Data over an entire year (preferably several years) needs to be collected to evaluate the permanence and seasonal variability of such seeps. Has the flow at seep 251 been checked and did it cease as predicted after the construction of the disposal cell? What is the magnitude of the winter time flows at the other two seeps? Is it similar to other winter time flows? Since the water levels are not declining in the upper aquifer (well data through 1993 data for the Halgaito Shale) it is likely that discharge from the seeps has not decreased either, except for the seasonal variations. If there is vegetation in the vicinity of the seeps, much of the winter seepage may be removed by evapotranspiration during the much more active summer growing season, thus reducing the apparent seep discharge.

3-22 Problems with Water Level Data (Appendix B, "Static Groundwater Levels" Table). This table has several errors which need to be corrected.

a) For both wells 909 and 910 there is a large difference (12 ft and 18 ft, respectively) in casing and ground elevation. Unless this is some very unusual form of well construction, the two should only differ by a couple of feet at most. I have assumed that the casing elevation is correct and the depth from top of casing is correct, so that the ground water elevation reported is also correct. Since these few data reported in the table are very important, the uncertainties about the elevations need to be removed.

b) Well 935 is completed in Halgaito Shale, not Honaker Trail Formation as stated in the table; both the well completion log and Fig. 3.4 indicate that it is a Halgaito well.

c) For this same well the water level measurement on 8/27/88 is almost certainly an error, off by 100 ft. The depth from top of casing was most likely 176.42 ft and not 76.42 ft. It is unlikely that the water level rose 103 ft in three years, especially in a well that "never contained a sufficient amount of water to obtain a sample".

d) There is a question about the completion zone for well 908; it appears to be completed in Halgaito Shale instead of Honaker Trail Formation. The boring log did not identify any formation contact, however it appears that the Honaker Trail is encountered at a depth of 183 ft. Cross-sections A-A' (fig. 3.6) and B-B' (fig. 3.7) indicate the depth of the contact at 125 ft. There is a great deal of siltstone and sandstone material between 125 feet and 183 feet that is described as reddish, which is the signature color of the siltstones and sandstones in the Halgaito. Below 183 ft the rocks are the gray to greenish color typical of the Honaker Trail. The boring was drilled to 197 feet, but at the time of completion (over two months later) was noted with a total depth of 163 ft. It appears that caving sealed off the bottom 34 ft of the boring. The well was screened between 145 and 160 ft, well above the apparent contact with the Honaker Trail.

e) The completion formation for 909 is unclear; the entire boring log to 80 ft is in Halgaito, however the well is screened from 130 to 150 ft and no geologic log is given for those depths. The missing geologic log should be included and the completion zone formation double-checked.

The greatest problem with the water level data is the paucity of it. Four of the Halgaito Shale wells (906, 910, 911, and 912) only have a short period of data, whereas other wells have data through 1994. Were these wells destroyed? They are not indicated as having been destroyed on Figure 3.4. If arguments are to be made about the extent and persistence of the uppermost aquifer, then as much data as possible should be collected on water levels. As soon as possible, DOE should start collecting frequent (preferably monthly) water level data on all the wells. There is certainly no data at this point supporting the idea that the aquifer is ephemeral and that the water levels are declining as the mound created by the tailings pile decays away. The statement that is made in the Executive Summary and in the Conceptual Site Model (Sec. 3.6) that the Halgaito Shale aquifer is returning to its pre-milling unsaturated state is untrue. Water levels were higher in most Halgaito wells (908, 910, 912, 934 and 935) in 1988 than they were in 1985. The one Halgaito well with a long record of water levels (934) had a higher water level in 1993 than in 1985.

3-22 Water Quality Data in Appendix B (first paragraph). The text states that all water quality data are provided in Appendix B, but after several careful searches no such data could be found. Inclusion of these data is very important to evaluate if sufficient data were collected and to examine temporal and spatial variability of the data which are only summarized by ranges in the tables in the report. A statistical analysis (such as mean and standard deviation, presented on a map base with values posted for each well, including the number of samples analyzed) would serve as a more informative summary than the current tables.

3-22 SECTION 3.4.1, last sentence and section 3.4.4, third paragraph. It should be noted in both these sections that ammonium ion can undergo biotransformation to nitrate and can thus be a significant source of nitrate.

3-23 PARAGRAPH 2. The background concentrations present in the background seeps indicate very poor water quality. Are we sure that these seeps are not contaminated?

3-23 Contamination of the Honaker Trail Formation (third paragraph). The text is correct in stating that nitrate and uranium are not higher in the downgradient Honaker Trail wells compared to the background wells. Other parameters are, however, and this issue is not addressed. The total dissolved solids, calcium, and sulfate, which are typical of the tailings leachate, are significantly higher. Also all five of the constituents listed on page 3-31 (end of second paragraph) as being indicative of dissolution of the ore (boron, nickel, potassium, silica, and sodium) are higher in concentration in the downgradient Honaker Trail wells than in the background wells. This evidence of contamination of the Honaker Trail needs to be seriously evaluated. Were sulfur-34 data collected on the Honaker Trail samples? That would be very useful data to examine.

3-23 Development of Monitoring Wells (next to last paragraph). One possible factor in the low yield of the monitoring wells is that they have never been properly developed. Repeated surge-block swabbing and bailing might improve their yield if that development has not already been performed. Well development records should be checked and included in the report, as should purge sheets during sampling to evaluate the recovery of the wells from purging. Also, there is likely to have been a perturbation in the water quality of the sample(s) from well 911 in 1985, due to the water injected in the course of the packer tests, if that water was not subsequently removed. Since the individual sample analyses were not available in Appendix B, it is not possible to evaluate whether this was the case or not.

3-26 TABLE 3.1, (footnotes "a" and "c"). Why are these data sets limited to data since 1990?

3-30 Low Yield at Well 910 (first paragraph). The text states that only a few liters of water were recovered at a depth of about 150 feet. This contradicts data provided in the appendix. The water level should have been at a depth of about 168 ft and the bottom of the screened interval at 180 ft (plus two feet of blank casing). There should have been about 14 feet of water in the casing, plus additional water in the sandpack, which should have produced more than just a few liters if it were bailed properly. The well purge sheets from the sampling events should be included in the report (particularly if they included before- purging and after-purging water levels, water levels at time of sample collection, and the time for each water level measurement, plus total volume purged: all standard data which should be included on a purge sheet) so that a qualitative (perhaps even semi-quantitative) evaluation of the well yield can be made.

3-30 FIFTH PARAGRAPH FROM THE TOP. Isotopic analysis of sulfur might also be used to confirm the hypothesis that the Honaker Trail formation has not been affected by site related ground water contamination.

3-31 Denitrification or Nitrification of Ammonium (fifth paragraph). The text is in error. Under oxidizing conditions, the transformation of ammonium is to nitrate in a process called nitrification. This will be the process occurring at the site and will yield higher concentrations of nitrate. Denitrification to nitrogen gas only occurs under reducing conditions, which are apparently not present at the site.

3-31 SECTION 3.5, "RISK EVALUATION". This section references two risk assessments that evidently have been completed by DOE contractors (Oak Ridge National Laboratory, and Jacobs Engineering Group, Inc.) but have not been submitted by the DOE for technical review. Does the DOE plan to complete a baseline risk assessment for the Mexican hat site? The risk evaluation section presented in the SOWP provides insufficient documentation to support its revisions. As such, the "risk evaluation" is not a suitable substitute for a well-documented baseline risk assessment carried out in accordance with standard risk assessment procedures. A thorough critique of the "risk evaluation" is not possible in the absence of the baseline risk assessment from which it is derived. However, two examples of problems with the risk evaluation stand out quite clearly: (i) the use of filtered seep-water samples in the exposure calculations, and (ii) the assumption that humans could not drink water from a contaminated seep (i.e., omitting the incidental ground water ingestion scenario).

3-33 PARAGRAPH 1. Why is additional risk information being added to this document and not to the baseline risk assessment document. Addition of this information to the baseline risk assessment would provide a complete review with all available information.

3-34 PARAGRAPH 1. Pathway 1 (of Figure 3.14) is described here as a direct human exposure pathway by ingestion of seep water. This pathway is not shown in the figure; in the figure, humans are only shown as secondary receptors.

3-38 PARAGRAPH 2. The statement that contaminant exposure via sediment or soil would be less than the exposure via seep water is not entirely true. Receptors of contaminants via sediment or soil include macroinvertibrates such as worms; these may in turn be ingested by other aquatic and terrestrial organisms.

3-40 to 3-41 Conceptual Site Model. The site conceptual model as presented here is contradicted in many instances by the data given in the report.

1) No human health risks from ingestion of contaminated ground water: There are no current exposure pathways for water ingestion, however, future pathways may

need to be evaluated (as they were at other UMTRA sites). This will depend on the ultimate determination of whether the contaminated aquifer could serve as a future source of water, a determination which is yet to be made.

2) Water in the Halgaito Shale is "primarily the result of milling operations":

a) unless water level data prior to milling operations exists, this is unknown and unsubstantiated.

b)" the extent of saturation is limited": the extent has not been defined; the aquifer is present 2.5 miles upgradient of the site at background seep 256 and is present downgradient of the site at least a half mile away at seep 924.

c) "the unit is returning to its natural, mainly unsaturated state": water levels have actually increased since the first measurements in 1985, so this statement is untrue.

3) The "aquifer meets the criterion for limited use based on limited yield": this has not been established. No data have been collected and/or presented that indicate that the yield of the aquifer is less than 150 gpd, the regulatory criterion. Where data are available, the hydraulic conductivity of the permeable portion of the formation (0.2 to 0.8 ft^3/d) and a saturated thickness of 10 to 20 ft should be able to produce a yield in excess of that discharge rate. The aquifer also does not qualify as being of limited use based on having a TDS in excess of 10,000 mg/l.

4) "Site contaminants have not affected ... ground water in the Honaker Trail Formation": This is contradicted by the presence of a number of constituents indicative of the tailings and process waste being higher in the downgradient wells compared to the background wells.

These contradictions and inconsistencies in the site conceptual model need to be resolved.

3-41 Assessment of Preliminary Data Needs (third full paragraph; also, Section 5.0 on p. 5-1). The text states that the data base is so extensive that no additional data are needed.

a) This is not the case, particularly with respect to water level data. Only one Halgaito well (934) has data after 1988. The other wells only have a few measurements in 1985 and some have a few more in 1988. This is not sufficient to determine the long-term viability of the aquifer. Water levels should be measured frequently (preferably on a monthly basis) in all wells at the site, assuming that all the wells indicated on Figure 3.4 as being active are still active. If the wells are no longer active, then a new plan needs to be devised to obtain these data.

b) The adequacy of the water quality data cannot be assessed since it was not included in the appendices, however, if it is as sparse as the water level data then there is likely to be a problem. The text states there was little variability in the data, however, this is not true for the water levels and may not be true for the water quality data. It is likely that additional sampling of water is also needed.
c) In addition, the current rates of seepage at the various seeps should be evaluated, particularly during the high flow period in the winter.
d) Slug testing was only performed on one of the Halgaito wells which does not allow for determination of the spatial variability of hydraulic conductivity. Additional aquifer testing would be necessary to support a very-low-permeability conceptual model.
e) The yield of the aquifer has not been tested in any consistent, quantitative manner, so that also needs to be done.
f) The lateral extent of the aquifer needs to be defined. An isopach map showing aquifer saturated thickness above the impermeable base should be drawn, with the data supporting that map clearly indicated.

4-1 Site-Specific Ground Water Compliance Strategy (last paragraph, and p. 4-3, second paragraph). The selection of the no remediation strategy for compliance at this site is based on an unsupported, contradicted site conceptual model and therefore may not be the correct approach for this site. Future beneficial uses and future human health risk are intimately linked to the site conceptual model (i.e., is this aquifer a potential source of water supply?) and those issues cannot be resolved until the conceptual model is resolved. 40 CFR is quite specific about what the criteria are for a "limited use" designation, and the aquifer has not been demonstrated to be of limited use under those regulations.

REVIEW OF FINAL SITE OBSERVATIONAL WORK PLAN FOR THE UMTRA PROJECT SITE AT MEXICAN HAT, UTAH USDOE-GJPO, JULY 1998

GENERAL COMMENTS

1. Justification for No-Action Alternative - Inaccurate Conceptual Model
The justification for a no-action remedial approach at this site is that there is no contamination in the uppermost aquifer (lower unit of the Halgaito Formation). No contamination is expected to occur in the future because the document indicates that there is vertical isolation with an upward hydraulic gradient. The validity of this conceptual model (ES-1, 4th paragraph; p. 3-37, 3rd paragraph) is strongly called into question by the poor quality and quantity of field data collected and the fact that water levels at the site contradict the hypothesis of an upward hydraulic gradient.

a. Limitations of Field Data: The geologic well logs are incomplete, with almost no data on when water was encountered in the wells. Some of the well completion logs are incomplete. Water level data and water quality data are very limited, with 7 of the 9 wells at the site being sampled during two years (1985 and 1988). The aquifer testing data is of poor quality (contradictions on data sheets) although the reinterpretation of the data performed for this version of the SOWP is a great improvement over the previous version by Jacobs Engineering. The poor quality and quantity of the field investigation makes it difficult to have confidence in the conclusions of the report. Perhaps DOE eliminated this site from consideration for active remediation early on and hence did not collect the data needed to make a through evaluation of the site.

b. Absence of Vertical Hydraulic Gradient: Plate 1 presents water level data for the site which contradicts the existence of an upward hydraulic gradient. The water levels for the upper unit of the Halgaito Formation (ex. well 912 and the various seeps shown in turquoise) are all higher than the contoured water levels for the lower unit (red lines) This shows that the upper unit is distinctly perched above the lower and that the vertical hydraulic gradient is in a downward direction. The one exception to this is well 907 which punctured a void at the approximate elevation of the water surface in the lower unit and suddenly became a flowing artesian well. It is very unclear what this well is tapping into that it became free flowing. Its water surface is similar to the water surface in the upper unit. Except for this one point, the majority of the water level data indicate that there is a downward hydraulic gradient which could potentially eventually carry contaminants in to the lower unit or may have done so already.

c. Wells 907 and 908 Not Adequate to Indicate Absence of Lower Unit Contamination: Neither of the wells cited in Table 3-3 (p. 3-18) as being downgradient are representative of the lower unit downgradient of the disposal cell. Based on Plate 1, well 908 is upgradient of the cell. Well 907 monitors an anomalous zone where the water level is not at all consistent with the water level in the lower unit (Plate 1). Wells 934 and 935 are the only wells located downgradient of the disposal cell with water levels consistent with the lower unit, but both contain such high pH water that the analytical results are suspect (p. 3-20, 5th paragraph). There is not nor has there been a valid downgradient monitoring point in the lower unit. It cannot be stated conclusively that there is no contamination in the lower unit.

d. Incompleteness of the Conceptual Model: There are a number of site phenomena that have been ignored when formulating the site conceptual model and so weaken the confidence in the model. These include:

(1) the abrupt drop in water levels downgradient of the disposal cell as visible on cross-section A-A;
(2) the anomalously high water level in well 907;
(3) the very high TDS, chloride-dominated water in well 934; and
(4) apparent lack of hydraulic connection between the lower unit and the San Juan River.

2. **Need for a Downgradient Monitoring Well in the Lower Unit.** Page 3-20, 5th paragraph. Both the high pH and the high TDS/chloride content (relative to other lower unit waters) of this well indicate it does not give samples representative of the lower unit. There has been some indication of milling contamination in this well (one nitrate value and one uranium value above MCLs). An additional monitoring well should be installed downgradient of the disposal cell, particularly since the absence of an upward vertical hydraulic gradient could allow contaminants from the upper unit to seep into the lower unit. This additional well should also provide us with information about hypothesized confined conditions at the site by carefully noting where water is first encountered.

SPECIFIC COMMENTS

3. **Cultural Uses.** Executive Summary, page 1. The impacts related to cultural uses are not addressed.

4. **NRC Certification of Non-Contamination of the Lower Unit.** Executive Summary, p.2. The NRC is cited as the source that the lower level is not contaminated. They made that finding based on the previous site conceptual model, which had numerous errors and which has been greatly revised in the present version of the SOWP. The NRC conclusion was therefore not based on a proper interpretation of the site data and should not be cited.

5. **Decrease in Contaminants.** Page 1-1, Section 1.1. The statement that the contaminants appear to be decreasing is not borne out by the data in the Appendix. For many of the contaminants, the trend is to no change, or to an increase in concentration. The limitation of the data available is that it is difficult to make such definitive statements about trends, given the lack of routinely monitored analytes, differences in collection and

analysis methods, lack of routinely monitored analytes, differences in collection and analysis methods, lack of information about the climate conditions for the time period prior to sampling, and the lack of use of all seep locations in making the statement. For example, a review of the recent data for Seep 249 indicate that alkalinity, strontium and nickel decrease, chloride, fluoride, molybdenum, nitrate, pH, sodium, conductivity, and potassium increase, no significant change in gross alpha, radium 226, radium 228 (although variable), sulfate, TDS and gross beta occurs, no significant change in magnesium (although increased) or manganese (although decreased) occurred.

6. **Additional Land Uses.** Page 3-3, Section 3.2.1. Additional land uses include hiking and cultural plant collection.

7. **Surrounding Water Use.** Page 3-3, Section 3.2.2, fourth sentence. It is stated that "no effect" will result from drainage of contaminated water into the San Juan River. This should be corrected.

8. **Figure 3-2.** Page 3-5. The figure should include the other wells, i.e., Nos. 907, 908 and others.

9. **Well 934.** Page 3-6, first paragraph. In addition to seeps that show elevated concentrations of COPCs, some of the ground water wells continue to show elevated COPC concentrations, e.g., 934. While later in the text Well 934 is described as potentially contaminated by grout, this is based on very limited (1992) data for pH only. Given lower pH levels prior to and following the data points in question, and the continued elevated concentrations of COPCs during these periods, elimination of this well does not seem warranted. Improper calibration or use of the pH meter may be the culprit.

10. **Metric Units.** Page 3-9, paragraph 1. The inclusion of metric units, as used in previous drafts, is recommended and possibly required by current Federal Law.

11. **Effect of Sewage Ponds.** Page 3-9, paragraph 2. Seepage from sewage ponds is unlikely to affect the seeps given that the closest seep is approximately half a mile away, most sewage based nitrogen is in the form of ammonium and the nitrate levels approximate that of the contaminated ground water. In addition, on page 3-11, it is stated that pond seepage has no effect on site related seeps since the ponds are in a different drainage basin. The lack of any sample analysis of the pond water weakens any supposition regarding source. If a source is to be identified, appropriate data should be collected.

12. **Lack of Information on Halgaito Formation.** Page 3-9, last paragraph. The limited information on the Halgaito Formation was gained from only four wells. Well logs indicate that very little water was present in Well 911 and no water came to the surface for Well 912 during drilling. It is unclear why additional wells were not drilled.

13. **Use of Halgaito Water.** Page 3-10, first full paragraph. It does appear that the water yield and the total resource available in the upper unit of the Halgaito Formation are low. This does not mean, however, that the resource should be discarded in favor of a more expensive (more distant or much deeper) source. The SOWP should recognize that any beneficial use of the Halgaito is limited by its contamination from mining activities.

14. **Lack of Hydraulic Connection to San Juan River.** Page 3-11, line 6 from top and line 10 from bottom. The report states that the San Juan River is a regional discharge area, however, that is not what is indicated by the water level map (Plate 1). The contours appear to be completely unaffected by the presence of the river (there is no bending towards the river) and the last contour is actually below river level, indicating that if there is a hydraulic connection the river is recharging the groundwater.

15. **North Arroyo Seeps.** Page 3-12. The first paragraph in this section states that "flow in these three seeps is continually decreasing". The SOWP does not contain sufficient data to support this statement; the conclusion relies on a comparison of 1990 vs.1997 data. There was no information on climate conditions, wet vs. dry years or season. The decreased flow in November vs. May in both years and at other seeps is likely a seasonal effect. Based on the discussion in this section, Seep 251 appears to be affected by seasonal fluctuations without necessarily showing any significant decrease in flow. Also, no data are provided for Seep 265. We believe the quarterly sampling should include a measure of flow rates.

16. **Geochemistry.** Page 3-13, Section 3.5, second paragraph. The first sentence should be revised to indicate that both filtered and nonfiltered samples were analyzed for some of the analytes.

17. **Nitrate Source.** Page 3-13, last sentence. In this sentence, the word "significantly" would be better replaced by "potential".

18. **Background Water Quality.** Page 3-15, second paragraph. The reliance on seeps to indicate background water quality is questioned. Elevated contaminant levels may be indicated in seep samples because of the influence of evaporation and increased precipitation of contaminants due to solubility changes at the seep/air interface.

19. **Sulfur Isotopes.** Page 3-15, last paragraph. Sulfur isotope measurements have not been described in any of the previous drafts. There is no information in this document on how the isotope values were determined, what data were used, or when and where the numbers were generated.

20. **Table 3-2.** Pages 3-16 and 3-17. The range of data (dates) used for any given column is inconsistent and limits comparisons.

21. **Table 3-3.** Page 3-18. Gross alpha and beta data are missing. In addition, data for well 934 should be included in the downgradient wells column. This well contains

elevated concentrations of sulfate, nitrate, arsenic, chromium, uranium, gross alpha and beta, selenium, TDS and others relative to wells 907 and 908.

22. **Figure 3-3.** Page 3-19. The reliance on median values is questioned. This means that the high measurements are eliminated from the comparison of sites. Use of the mean, together with the high value, would allow a better comparison of sites. For example, wells 907 and 908 are not contaminated relative to well 909; see table 3-3.

23. **Elimination of Well 934.** Page 3-20, fifth paragraph. The elimination of Well 934 is questioned. The first five analyses from 1985-1989 resulted in pH values between 7.4-8.47, within range of all other wells. It was not until 1990, five years after the well was installed, that the pH values increased to 11.17 and remained elevated until 1992. The pH values in 1997 have been variable and lower, but still higher than expected. It is possible that the pH analysis was flawed, and/or the well failed in some other way. Nonetheless, the earlier data from 1985-1990 indicate very high levels of COPCs and should be included in an assessment of this site.

24. **Figures 3-4 to 3-9.** Pages 3-23 to 3-28. The x-axis should be adjusted to reflect the actual time gaps between data points.

25. **Figure 3.6.** Page 3-25. In assessing the "downward trend" in COPCs, consider seep 249 where it is apparent that levels in 1997-98 are the same as those monitored in 1990-91. One data point taken in 1993 resulted in elevated concentrations of uranium. Between that data point and 1997 no further data samples were collected. The concentration then dropped backed to pre-1993 levels when measured again in 1997. These limited data points do not support the "trend" hypothesis. Similar data trends exist for nitrate in seep 249.

26. **Risk Evaluation.** Page 3-29. This section claims to develop a revised "risk evaluation" for the site (two risk assessments, one by Jacobs Engineering and one by Oak Ridge National Lab, were completed prior to the SOWP, and are referenced in the section). However no new calculations are presented in the SOWP. The exposure and risk tables presented in Appendix C are all reprints from the Oak Ridge assessment. Standard risk assessment practice, as defined in EPA guidance for remedial investigations, calls for evaluating reasonable maximum exposure (RME) risks both in the present and the future. Adding additional information to a full Baseline Risk Assessment would allow a complete review with all available information.

27. **Filtered Samples.** Page 3.29, third paragraph. The use of filtered samples is again questioned; it underestimates potential risks. Risk assessment requires the assessment of risk based on total concentration.

28. **Contaminants of Concern.** Page 3-31, first paragraph. Here U-238 is listed as a contaminant of concern. What about U-234? Also, what is the process by which COPCs were identified for the human health assessment and the ecological assessment?

29. Land Use Survey Data. Page 3-31, third paragraph. Recent site visits are cited as the basis of information supporting revised assumptions. Is this information a result of a survey of land use around and near the site? Where are the data so collected?

30. Seep Water Not a Complete Exposure Pathway for Humans. Page 3-31, fourth paragraph. The SOWP states that "ingestion of seep water was not considered a complete exposure pathway for humans..." It is reasonable to assume that some incidental ingestion (recreational exposure) of seep water will occur at the arroyos over the long-term. This could be especially true if residences happen to be built closer to the site in the future. Therefore the SOWP must also consider this pathway. The possibility of incidental ingestion of seep water, including cultural usage, also needs to be taken into consideration in the compliance strategy. The Navajo Nation has already requested that DOE place warning signs at the seep areas to preclude incidental ingestion of seep water.

31. Risk Levels for Pathways. Page 3-31, last paragraph. This section states that risk levels for pathways involving home-grown meat and milk are "below acceptable guidelines established by EPA." However, no calculations are provided other than those of the Oak Ridge study. Those Oak Ridge calculations show potentially significant risks for these pathways, for example, total hazard indices of 42.6 and 39.3, respectively, at Gypsum Creek and the North Arroyo.

32. Risk to Livestock. Page 3-33, Section 3.6.3. The conclusions in this section appear to rely on visual observation on only two days, four years apart. No interviews with cattle owners are cited, no analyses of vegetation were performed and no other calculations are presented to support the conclusion of this section that "exposure to water and vegetation ... would not result in adverse effects to sheep or cattle." The tables provided in Appendix C, derived from the Oak Ridge study, show potentially significant risks. Also, in the fourth paragraph, the first sentence states: "the variable flow of the seeps precludes the possibility of year-round exposure." This may be true, but the risk-evaluation also needs to consider possible toxicity from short-term exposures to seep water. This is particularly the case with acutely toxic chemicals such as nitrate. Additionally, the statement that salt cedar predominates near the seeps (paragraph 3) is questioned; other types of leafy, herbaceous vegetation have been observed. Overall, this section would be greatly improved if a full Baseline Risk Assessment had been performed at this UMTRA site.

33. Plant Adsorption. Page 3-34, first paragraph. The adsorption of contaminants onto the surfaces of plants can be an important mechanism for increased values. This possibility was not addressed.

34. Table 3-7. Page 3-37. The risks for aquatic and terrestrial organisms are not within EPA acceptable guidelines according to this table. The lack of any plan to prevent or reduce additional exposure needs consideration.

35. **Compliance Selection Framework.** Page 4-2, Figure 4-1. The risk evaluation documented the potential for unacceptable impacts to ecological receptors at the seep areas. However, nothing in the compliance selection framework indicates that this risk will be addressed.

36. **Filtered and Non-filtered Samples.** Page 4-3, first full paragraph. The sampling indicated here should provide for quarterly sampling and analysis, with and without filtration, for cadmium, chromium, gross alpha, gross beta, iron, molybdenum, radium 226, radium 228, selenium, uranium, and vanadium.