State of Utah
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF RADIATION CONTROL

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40-8698

November 20, 1996

Mr. Joe Holonich
Uranium Recovery Branch
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: Plateau Resources Shootering Canyon Uranium Mill Near Ticaboo, Utah: State Inspection Results, Concerns Regarding Groundwater Protection, and Request for NRC Hydrogeologic Review.

Dear Mr. Holonich:

On October 16, 1996 representatives of the Utah Divisions of Water Quality (DWQ) and Radiation Control (DRC) conducted a site visit of the Shootering Canyon Uranium Mill near Ticaboo, Garfield County, Utah. We were met on site by several staff of Plateau Resources, including a Mr. Larry Bridger.

During our visit inspections were made of the tailings impoundment (disposal cells 1/3, and 2), cross-valley berm, tailings leachate recovery sump, groundwater monitoring well RM-7, main tailings dam, and the mill site facilities. Staff findings regarding this inspection, and review of documents provided us by Plateau Resources are found in the attached memorandum.

Of particular concern is the design and construction of the existing tailings impoundment. Our site visit and review of several Plateau Resources reports suggests additional efforts are needed in order to protect local groundwater quality. The purpose of this letter is to express our concerns in this regard.

We also request that the State's groundwater related concerns be explored and fully evaluated in the current NRC re-licensing process. We would anticipate such a review to include an evaluation of the current NRC approved design in light these concerns. Past construction of the existing tailings facility should also be evaluated to ensure it can perform as originally approved and to determine if it meets current NRC requirements and accepted engineering practice. As found necessary to protect human health, the environment, and Utah's groundwater resources, the NRC license requirements should be revised accordingly.

NLOS/1

If you have any questions or comments please contact Loren Morton of my staff at (801) 536-4250 or Mark Novak of the Utah Division of Water Quality at (801) 538-6146. We appreciate your assistance and cooperation in this effort.

Sincerely,

William J. Sinclair, Director
Division of Radiation Control

Attachment

LBM:lm

cc: Ken Webber, Plateau Resources (w/attach.)
Larry Mize, DWQ (w/attach.)
Scott Hacking, S.W. District Health Department (w/attach.)

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File: Plateau Resources Groundwater

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DEPARTMENT OF ENVIRONMENTAL QUALITY
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MEMORANDUM

TO: Bill Sinclair
Director

FROM: Loren Morton

DATE: November 8, 1996

SUBJECT: Plateau Resources Shootering Canyon Uranium Mill Near Ticaboo, Utah: Preliminary Staff Findings; On-site Inspection, File Review, and Groundwater Protection Concerns.

The purpose of this memorandum is to document an October 16, 1996 on-site visit of the Shootering Canyon uranium mill site near Ticaboo, Utah and to pass along preliminary staff review findings from file documents and reports provided by Plateau Resources.

During the staff file review comparison was made of existing conditions at the mill's tailings disposal facility and current State groundwater protection requirements. As a result of this effort, several technical concerns have surfaced which suggest detailed evaluation is in order. These preliminary findings and concerns are listed below.

1. Existing Tailings Pond Design and Remaining Capacity - as explained to us during our October 16, 1996 inspection and provided in several Plateau Resources documents, design of the existing tailings pond consists of three main layers, as outlined in Table 1, below. As described by Mr. Bridger, construction of the existing cells first included removal of all residual soils and alluvium, exposing hard bedrock (Entrada Sandstone). Thereafter, native clays were derived from a local borrow source and laid and compacted to form the underliner. Rounded gravel and pipage was then added to provide a filter or drainage blanket above the liner. Tailings were then placed in the disposal cells by slurry pipeline.

Table 1. Simplified Outline of Existing Tailings Pond Construction
Plateau Resources Shootering Canyon Uranium Mill

Layer No.	Description	Comment
1	Uranium Tailings	Thickness unavailable, but current volume of disposed tailings reported at 30,000 yd^3.
2	Filter Blanket	Thickness unavailable, but constructed with a drainage pipage network to collect tailings leachate. Pipage drains to sump at downstream toe of cross-valley berm.
3	Clay Liner	Constructed immediately over bedrock. Liner ranges between 2 to 6 feet thick. Reported permeability: 1.0E-7 cm/sec.
4	Bedrock (Entrada Sandstone)	Bedrock found immediately below clay liner. Loose soils (regolith and alluvium) removed prior to liner construction. Consequently, sandstone in intimated contact with clay liner. Depth to shallow aquifer about 130 feet.

After our inspection, Plateau Resources informed us that the existing tailings pond, above the cross-valley berm, contains approximately 30,000 yd^3 (18.6 acre-ft) of tailings (Plateau Resources, October 21, 1996). Other company information shows the original tailings impoundment was designed for 2,600 acre-ft (Woodward-Clyde, September, 1978, p. 2-18). Consequently, it appears that the tailings currently disposed in the impoundment represent less than 1% of the total disposal capacity approved by the NRC in 1979.

2. Projected Seepage from Approved Tailings Pond - Review of the original NRC Final Environmental Statement (FES) predicted seepage discharge from the completed tailings impoundment would be, on average, about 1 gal/min or 1.61 acre-ft/yr, and at worse case 55 acre-ft/yr (NRC, July, 1979, p. 3-15). This seepage volume distributed over the maximum surface area projected for the completed tailings facility, 65 acres (Woodward-Clyde, 9/78, p. 2-18 and Figure 6), results in an annual seepage rate of 0.024 ft/yr (0.29 in/yr) for average conditions, and 0.846 ft/yr (10.15 in/yr) for maximum conditions predicted by the NRC in 1979.

For comparison purposes, natural aquifer recharge near the mill site is very low. On average annual precipitation in nearby Bullfrog Basin is about 5.93 in/yr (1967-1990, Western Regional Climate Center). After you account for evapotranspiration, actual aquifer recharge rates will be much lower. On a water balance basis alone, seepage from the tailings impoundment must be carefully controlled to prevent pollution of existing groundwater

resources. As seen above, the NRC predicted maximum annual seepage (10.15 in/yr) is much larger than expected recharge rates to the shallow aquifer.

In contrast to the 1979 NRC predictions, Plateau Resources now provides water balance estimates that suggests normal operation of the tailings ponds will produce seepage losses of 15 gal/min or 24.21 acre-ft/yr (Plateau Resources, 3/1/96, Figure 3.1-2, p. 3-6). This more recent value is 15-times larger than the "average" seepage predicted previously in the 1979 NRC FES.

Inherent in Plateau's recent estimate is the assumption that the seepage losses predicted will occur from active disposal cell operations. This suggests the 24.21 acre-ft/yr seepage loss will be discharged from a much smaller area the NRC assumed in its 1979 FES. By way of illustration, if Plateau's predicted seepage loss is isolated to only disposal Cell No. 1, a moderate sized cell at the existing facility, the annual seepage rate would be distributed over about 2.75 acres, resulting in an annual seepage rate of 8.8 ft/yr (105.6 in/yr). If such seepage loss were to be distributed across all the existing disposal cells nos. 1 thru 5, about 20 acres, the resulting annual seepage rate would be 1.2 ft/yr (14.52 in/yr). Both of these recent Plateau Resources seepage estimates are much larger than the 5.93 in/yr annual average precipitation for the Bullfrog Basin. Once again, this estimate excludes evapotranspiration, which if included would increase the disparity seen between the tailings pond seepage and natural recharge to the local aquifer.

Consequently, based on the recent Plateau Resources seepage estimates and these considerations, it appears that operation of the existing tailings ponds has the potential to become a significant source of recharge to the local groundwater system.

3. Apparent Clay Liner Deterioration: Need for Repairs - during our October 16, 1996 visit it was apparent that the clay liner under the existing tailings cells had deteriorated due to neglect in the last 13 years since mill shut-down (1983, Woodward-Clyde, October 19, 1984, section 1.0). From our observations it was apparent that the clay liner had been cracked by dessication, particularly where exposed at its outer margins. Grasses and tamarisk bush had overgrown many areas on the tailings cells, including areas where clay liner was apparently exposed.

As a result, it appears that the much of the tailings disposal facility, particularly cells 4 and 5, may not have a clay liner which currently meets the maximum permeability requirements (1.0E-7 cm/sec) imposed by the original NRC license. Without this prior retrofit work, the apparent seepage discharges extrapolated above will be even greater, hence the risk to local groundwater quality will be commensurately larger.

The NRC should require Plateau Resources to evaluate existing permeability conditions of the clay liner and remediate as necessary. We would also strongly recommend that

consideration be given to improving the former liner technology in order to provide adequate contaminant seepage controls and protect Utah's groundwater resources.

4. Inadequate Liner Construction Quality Control Testing: Implications for Liner Permeability - review of the "As-Built" report for the cross-valley berm and tailings impoundment found no mention of core sampling and laboratory permeability testing, nor of field permeability testing to determine as-placed clay liner permeability (Woodward-Clyde, July 28, 1982, pp. 9-10 and Figure III-2). Consequently, it appears that little testing was done to confirm the field permeability of the clay liner met the specifications required by the NRC license (1.0E-7 cm/sec).

   Furthermore, the frequency for other construction quality control tests appears to have been somewhat limited at the time of original construction. Review of nuclear density tests conducted in the field to determine in-place soil density and moisture, show only 21 locations in the tailings impoundment were tested (ibid., Figure III-2). This equates to a density testing grid of about 1 test per acre. Review of the Plateau Resources as-built report leaves it unclear if multiple density tests were completed at these 21 locations to confirm compaction of each lift of clay liner material (ibid., Figure III-2). As a consequence, it appears that frequency of quality control testing performed in 1982 was lower than currently accepted norms for clay liner construction. In addition, Proctor, Atterburg limit, and soil gradation tests also appear infrequent in that they were limited to 1 test per 30,000 yd^3 of clay material placed (ibid., Appendix A, Table 3). Current accepted practice would suggest more frequent quality control testing is in order for clay liner construction.

   As a result of these findings, it appears some question exists about the actual field permeability of the clay liner under the existing tailings impoundment. Consequently, it is unknown if the existing facility can achieve the average annual seepage rate suggested in the 1979 NRC FES (1 gal/min or 1.61 acre-ft/yr).

5. Increased Bedrock Permeability Via Joints and Fractures - during our October 16, 1996 site visit we observed a number of open joints in outcrops of the Entrada Sandstone south of the cross-valley berm. Such fractures have the potential to increase permeability of the bedrock and hence decrease leachate and contaminant travel time to the water table below the tailings pond. In addition, our review of a Plateau Resources evaluation of the potential for contaminants to reach the water table, written in response to the 1982 leachate spill event, appeared to ignore the presence of such fractures (Woodward-Clyde, October 19, 1984, sections 3.0 and 4.0). Consequently, it appears that studies should be conducted to evaluate the potential for accelerated groundwater contamination.

   In addition, during our recent site visit we also observed healed joints in outcrops of the Entrada Sandstone south of the cross-valley berm, apparently filled with calcium carbonate. Their presence is of concern because the acidic leachate has a large potential to dissolve the

calcite deposits in the vertical joints and thereby greatly increase bedrock permeability. Such dissolution along these joints could cause higher rates of leachate travel to the water table above and beyond the rates originally predicted. Groundwater quality could be adversely impacted as a result.

As a result, the NRC should evaluate this possibility and ensure the tailings pond is adequately designed and constructed to prevent groundwater pollution via dissolution of the calcite healed joints.

6. Available Leachate Water Quality and Needed Information - preliminary information on the tailings leachate indicates it has a high total dissolved solids (TDS) and total uranium content, 15,900 mg/l and 4800 pCi/l, respectively (Plateau Resources 3/1/96, Appendix D, pp. D-10 and 11). Other water quality information shows tailings leachate, during initial operations in 1982, was extremely acidic with a pH of 1.1 (Woodward-Clyde, 10/19/84, section 5.0, paragraph 3). Based on these acidic conditions and the intimate contact of the leachate with ores, large concentrations of other metals commonly found with uranium deposits are expected, including, but not limited to: manganese, molybdenum, and vanadium. Added to these, a list of potential leachate contaminants from the mill circuit process must be included, such as ammonia, nitrate, nitrite, and organic solvents such as methylene chloride and acetone.

In contrast, shallow groundwater beneath the tailings ponds, at about 130 feet, appears to have a TDS content between 214 to 420 mg/l, (average = 312 mg/l, Plateau Resources 3/1/96, Appendix D, p. D-11). Consequently, it appears that the quality of groundwater beneath the existing tailings pond is worthy of protection from contamination. Under the Utah Ground Water Quality Protection Regulations (UAC R317-6), such high quality water is designated Class I groundwater and afforded the highest regulatory protection. In addition, shallow groundwater at the site also appears to have a very low total uranium content, ranging between 1 and 16 pCi/l (average = 6.12 pCi/l, Plateau Resources 3/1/96, Appendix D, p. D-11).

Review of the information listed in the March, 1996 re-licensing application suggests a significant amount of water quality information is needed in order to fully assess groundwater quality conditions beneath the tailings impoundment site. For example, information has not been provided on groundwater concentrations for: manganese, molybdenum, vanadium, ammonia, nitrate, nitrite, methylene chloride and acetone. In order to adequately protect Utah's groundwater, NRC should require Plateau Resources to fully characterize groundwater quality conditions for all uranium-related contaminants. At a minimum, such an assessment should focus on those contaminants known not to be attenuated during subsurface transport.

7. Historic Tailings Leachate Spills; Past Problems and Need for Prevention - information provided by Plateau Resources indicates that during the early days of initial operation in 1982 the leachate sump pump at the toe of the cross-valley berm failed on several occasions (Woodward-Clyde, 10/19/84, section 1.0). During these spill events, from May to September, 1982, approximately 2,000,000 gallons (6.13 acre-ft) of contaminated tailings leachate was discharged to the unlined drainage below the cross-valley berm (ibid.). After over-flowing the leachate collection sump, the contaminated wastewater was forced to run more than 1,000 feet over un-lined alluvium and bedrock before it accumulated over a clay apron constructed immediately upstream of the main tailings dam.

Plateau Resources accounts also reveal that this wastewater discharge was then commingled at the main dam with cooling water from the mill. The combined wastewaters then accumulated at the main dam to the point that the water level was 15 feet above and beyond the extent of the clay apron (ibid.). These high water levels undoubtedly caused contaminant seepage to the nearby bedrock.

Six measurements made by Plateau of the wastewater at the main dam showed it remained highly acidic for a period of two (2) years, with an average pH of 1.7 +/- 0.13 (June, 1982 to April, 1984, ibid., Sections 1.0 and 5.0).

Undoubtedly during the initial spill and for two years thereafter caused contaminants to be released to the bedrock foundation. Hence, a potential exists for tailings contaminants to pollute local groundwater resources. The fact that the October, 19, 1984 Woodward-Clyde report was draft, and apparently never finaled, suggests little effort has been made to assess and adverse impact caused by this spill. NRC should require Plateau resources to fully investigate and remediate any adverse impacts it may have caused.

In order to avoid compounding any existing problem that might have been caused by the spill in question, steps should be taken now to prevent this problem from re-occurring. It is especially important to do these upgrades to the tailings disposal facility now while it is still relatively small, and before mill operations begin which could hamper such improvements. For this reason, the NRC should undertake a thorough review and evaluation of the existing tailings disposal and leachate recovery systems and ensure that reliable technology and operational procedures have been applied.

REFERENCES

Plateau Resources Limited, March 1, 1996, " Source Material License No. SUA-1371, NRC Docket No. 40-8698", license renewal application to U.S. Nuclear Regulatory Commission.

Plateau Resources, October 21, 1996, transmittal letter from Mr. Larry Bridger to Mr. Mark Novak, Utah Division of Water Quality.

U.S. Nuclear Regulatory Commission, July, 1979, "Final Environmental Statement Related to Operation of Shootaring Canyon Uranium Project, Plateau Resources, Ltd.", NUREG-0583.

Western Regional Climate Center, http://wrcc.sage.dri.edu/, internet download of average daily climate measurements made at Bullfrog Basin, Utah from 1967 to 1990.

Woodward-Clyde Consultants, September, 1978, "Tailings Management Plan and Geotechnical Engineering Studies, Shootering Canyon Uranium Project, Garfield County, Utah, Docket Number 40-8698", unpublished consultants report.

Woodward-Clyde Consultants, July 28, 1982, "Earthwork Quality Control Overview and As-Built Drawings, Construction of Stage I Tailings Impoundment and Dam, Shootering Canyon Uranium Project, Garfield County, Utah", unpublished consultants report, 13 pp. plus appendices and plates.

Woodward-Clyde Consultants, October 19, 1984, "Infiltration Transport or Migration Rates of Radioactive Nuclides and Other Toxic Ions at the Shitamaring Canyon Mill Tailings Impoundment", draft unpublished consultants report.

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