RAS 4708

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:
Alan S. Rosenthal, Presiding Officer
Dr. Richard Cole, Special Assistant

IN THE MATTER OF:	)	
	)	
INTERNATIONAL URANIUM (USA) CORPORATION	)	Docket No. 40-8681-MLA-11
	)	
	)	ASLBP NO. 02-795-02-MLA
(Source Material License Amendment, License No. SUA-1358)	)	July 29, 2002
	)	

SIERRA CLUB COMMENTS ON IUSA'S RESPONSE TO PRESIDING OFFICER'S REQUEST FOR ADDITIONAL INFORMATION

INTRODUCTION

On July 2, 2002, the Presiding Officer requested additional information from International Uranium (USA) Corporation (IUSA) regarding groundwater monitoring at the White Mesa Mill. On July 15, 2002, IUSA supplied the requested information.

Also in his July 2, 2002, Order, the Presiding Officer authorized Petitioner to comment on the significance of the supplied information. On July 22, 2002, the Presiding Officer extended the deadline for Petitioner's comments to July 29, 2002, and restricted the comments to the validity of IUSA and NRC Staff assertions that the data show that no tailings constituents have been released to groundwater.

In this timely, authorized filing, the Sierra Club will show that the information supplied by IUSA does not show that no tailings constituents have been released to groundwater.

Template = SECY-049

SECY-02

The data that was requested and supplied is outdated, incomplete, and/or unverifiable.

The data requested by the Presiding Officer was referenced in IUSA's May 1999 Groundwater Information Report. Hearing File F. The Utah State Division of Radiation Control (DRC) found the May 1999 report inadequate and sent IUSA a Request for Additional Information on February 7, 2002. Appendix 1. On September 8, 2000, IUSA responded with a 166-page document supplementing the May 1999 Report.

The DRC requested further information in a March 20, 2001, letter to IUSA and in meetings. A May 11, 2001, letter from IUSA documents the inadequacies of their previously submitted information, the kinds of information still required by the DRC, and IUSA's plans to supply the information. Appendix 2.

On June 22, 2001, IUSA filed a further supplement to the May 1999 Groundwater Information Report. In addition, IUSA has submitted hundreds of pages of documentation to the DRC related to the Ground Water Discharge Permit (GWDP) and the Chloroform Investigation. DRC prepared a list of these documents, which Petitioner provided earlier in this hearing. See Appendix 2 of Second Supplement to Sierra Club's Written Presentation, April 14, 2002. The Sierra Club has also prepared a list of documents on ADAMS that are related to IUSA's GWDP. Appendix 3.

Thus, the data in IUSA's July 15 filing is outdated and incomplete.

The September 9, 1981, D'Appolonia letter in IUSA's July 15, 2002, filing goes to great lengths to discount the possibility that water found in Well 7-2 could indicate a tailings cell leak. Well 7-2 was sealed during the tailings cell expansion program, precluding future sampling at that location. July 1991 report "Ground-Water Hydrology at the White Mesa Tailings Facility," (Accession No. ML012110414).

The September 9 D'Appolonia letter in IUSA's July 15th says, "Well 7-2 is one of five intermediate depth wells completed at a depth of 50 to 60 feet (30 to 40 feet above the local water table). The purpose of the intermediate depth wells is detection of a leak from the tailings cell." Water was detected in Well 7-2. It was determined that the source of the water was the unlined mill sedimentation pond (Baker's Lake). September 9 D'Appolonia letter. IUSA did not provide any raw data to support this determination.

The September 9 D'Appolonia letter raises more questions than it answers. Did subsequent sampling of Well 7-2 substantiate the conclusion about the source of water in Well 7-2? Is there a well log for Well 7-2? What materials went into Baker Lake? How is Baker Lake currently being monitored? What is the history of the other four intermediate depth wells?

The groundwater monitoring program at the White Mesa mill is embarrassingly shoddy. The amount of data is paltry, and there is no consistency in the type of data collected, the methodology used, or the location of data collection points. Therefore, it is impossible to draw meaningful conclusions from the data. Certainly the sketchy data do not support IUSA's assertions that no tailings constituents have been released to groundwater. As Ivan Weber (Petitioner's expert in tailings confinement systems) states, "No amount of rationalization or extrapolation from antique data can create a current, scientifically reliable picture of how the overall system works. In the meantime, the tailings cells continue to leak and deteriorate." Appendix 4 at 1.

The Utah State Division of Radiation Control is not satisfied with IUSA's tailings containment system or groundwater monitoring system.

The DRC is not satisfied with the construction of Tailings Cell 3. On November 28, 2001, DRC requested additional information from IUSA regarding the liner of Cell 3.

Petitioner William Love's Written Presentation, April 1, 2001, Attachment K. IUSA has not answered this request to date. What are they trying to hide?

License Condition 11.3 requires IUSA to sample five Point of Compliance (POC) monitoring wells (MW-5, -11, -12, -14, -15, and –17) on a quarterly basis. Hearing File 4 at 8 of 10. Amendment 8 renewed License SUA-1358 in 1997 and required that the samples be analyzed for chloride, potassium, nickel, and uranium.[1] The State of Utah does not believe that sampling for these four constituents will necessarily indicate the presence of tailings contaminants in the groundwater. Therefore, DRC has requested that IUSA also sample for gross alpha, nitrate, manganese, selenium, total uranium, ammonia, iron, tetrahydrofuran, and chloroform. August 23, 2002, State of Utah Notice of Violation and Groundwater Corrective Action Order, Docket No. UGW20-01.

On July 13, 2001, IUSA submitted a report to DRC entitled "Background for New Indicator Parameters, White Mesa Uranium Mill". Appendix 5. There is no historical data on some of these new indicator parameters; therefore we will never know the baseline for those parameters before the mill commenced operations.

Petitioner's expert Ivan Weber concurs with the DRC that the groundwater monitoring system is inadequate: "No amount of statistical analysis can overcome the very remote chances that this ground water monitoring system will actually detect contamination before the aquifer is damaged." Appendix 4 at 11

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1 Prior to 1997, groundwater monitoring samples were collected quarterly for 7 monitoring wells and the culinary water well. The samples were analyzed for pH, specific conductance, chlorides, sulfates, TDS, and U-nat. Groundwater samples were analyzed semiannually for arsenic, selenium, sodium, Ra-226, Th-230, and Pb-210.)

The supplied data cannot prove that the tailings cells have not leaked, because the data were obtained from a groundwater monitoring system that is fatally flawed.

In a March 7, 2002, letter, DRC asked IUSA to replace well MW-4. Appendix 6 at 7. It appears that well MW-4 was either logged incorrectly during drilling, or shows a real dip in the upper surface of the contact between the Burro Canyon formation (which contains the perched aquifer) and the Brushy Basin formation (mudstone that keeps water in the perched aquifer from traveling downward to the regional aquifer). A new well is needed to determine if the Brushy Basin formation has a thin spot, or a functional decrease in its ability to separate the aquifers. IUSA has not yet replaced the well.

Mr. Weber notes that well MW-4 was installed with such poor logging methods that its data should be disqualified. Further, the problems with this well lead him to question the veracity of the other wells. Appendix 4 at 1.

A July 13, 2001, POC report from IUSA to DRC states: "Cross-gradient, the lateral spacing between the POC monitoring wells ranges from approximately 500 to 700 feet. This spacing will be adequate for POC monitoring because naturally occurring hydraulic, physical, and kinetic mechanisms are present that will result in lateral spreading of constituents should cell leakage occur. The lateral spreading of constituents will facilitate cell leakage detection at the POC's." Appendix 5, TITAN Report at 3.1 (Location and Rationale of POC's).

A November 13, 2001, letter from IUSA to DRC regarding Hydraulic Test Data, Monitor Well 4, discusses the presence of at least 5 feet of sandstone conglomerate with a permeability of approximately 7 feet per day at WM-4. Appendix 7. This layer, which has also been identified by the temporary monitoring wells drilled in the vicinity of MW-

4, is below the perched water table of the Burro Canyon formation. This information is not contained in other descriptions of the geologic formations at the Mill. IUSA has not provided an analysis of how this new information affects the assumptions in Appendix 5 regarding "the naturally occurring hydraulic, physical, and kinetic mechanisms" that may cause lateral spreading of constituents should cell leakage occur, or the ability of the monitoring wells to detect contamination.

The Licensee has a bad habit of placing tailings ponds right ON TOP of wells and borings. The map on page B-6, Hearing File F, shows that the tailings cells were constructed on top of at least eight Dames and Moore borings. The July 1991 report "Ground-Water Hydrology at the White Mesa Tailings Facility" states that monitoring wells 6-1, 6-2, 7-1, 7-2, 8-1, 8-2 and MW-13 were sealed during the tailings expansion program. Accession No. ML012110414. Each of these wells and borings breached the natural geological formation on which IUSA improperly relies for its "defense-in-depth" tailings containment system. If any one of these wells or borings was not properly constructed and/or sealed, it could provide a preferential pathway for tailings contaminants, including the Molycorp lead, to reach groundwater.

There have already been at least two documented leaks at the White Mesa mill, and data suggests that there have been other leaks.

Of course, the most infamous leak at the White Mesa mill is the chloroform plume in the perched aquifer. The data supplied by IUSA on July 15 do not prove that the chloroform did not escape from the tailings cells.

Data from DRC split sampling in May 1999 and November 2000, combined with data from IUSA chloroform monitoring in 4th Quarter 2001 and 1st Quarter 2002, indicate that chloroform levels have gone up in wells TW 4-1, TW 4-2, TW 4-4, TW 4-7,

and TW 4-11, and that chloroform has spread for the first time into a new well, TW 4-14. Appendix 8. IUSA has done nothing to stop the chloroform from spreading or to clean up the groundwater that it has contaminated.

Less publicized, but equally important, is the massive leak from Cell 4.

On March 27, 2001, staff at the White Mesa Mill determined that the infiltration rate into the Leak Detection System of Tailings Cell 4-A exceeded the prescribed infiltration rate. In accordance with License Condition 11.3, which requires the Mill to notify the NRC within 48 hours if the flow rate to the detection system is greater than 1 gallon per minute (gpm), IUSA notified the NRC of the exceedance.

On April 27, 2001, IUSA reported the Cell 4-A leak to the NRC. Appendix 9. A follow-up report was submitted to the NRC on May 29, 2001. Appendix 10.

Tailings Cell 4-A was constructed in 1989, but -- according to IUSA -- "early problems with the synthetic liner installation limited its use to only solution storage, and no tailings solids have been discharged to the Cell" (emphasis added). Appendix 10 at 1. During the early years of operation, processing fluids evaporated in the cell, resulting in the deposition of solids that had been dissolved in the processing fluids. At the time the leak was detected, the cell had not been used for a number of years, but solid crystals and fluids from natural precipitation were present in the cell. Appendix 9 at 1 to 2.

By April 28, 2001, IUSA had pumped approximately 548,000 gallons of solution from the Cell 4 leak detection system, but the level of solution in the leak detection system still had not fallen. Appendix 9 at 3 to 4. From April 27 to May 29, IUSA was pumping at a rate of 11 gpm. As of May 29, nearly continuous pumping of the leaked solution was still taking place. The solution was pumped to Cell 3. Appendix 10 at 2.

IUSA determined that the leak was probably caused by a leak in the HDPE lining. The cause of the leak in the lining was not discussed. Therefore, there is no information regarding whether the leak resulted from a flaw in the liner or whether the solution in the cell might have impacted the liner or exacerbated a flaw.

IUSA plans to clean out Cell 4-A and replace it. Appendix 10 at 4. IUSA committed to provide an updated status report of their investigation and mitigative actions after the crystals from Cell 4-A have been removed. Appendix 10 at 5. There is no indication on the public record that the crystals in Cell 4-A have been removed.

IUSA stated, "There is no evidence nor expectation that there has been any seepage or release through the bottom clay liner into the environment." Appendix 10 at 2. No data is provided in the report to substantiate this statement. The results of the weekly monitoring of the depth to water in the Monitoring Wells adjacent to Cell 4-A have, apparently, not been released to the public. Appendix 10 at 4.

The leak from Cell 4-A is relevant to this discussion because it occurred in a containment/monitoring system that utilized a twelve-inch compacted clay liner under the synthetic liner. Even with the relatively impermeable clay layer available to transport the leaking solution to the leak detection system, Cell 4 leaked for at least 3 months before the leak was detected. Appendix 9 at 3. By comparison, Cell 3 could leak tailings solution saturated with Molycorp lead into the underlying crushed rock, soil and bedrock for years before it would ever be discovered by the painfully inadequate perforated pipe at the toe of the cell's dam.

The May 11, 2001, letter from IUSA to DRC indicates that the water level in well MW-4, to the east of the tailings impoundment, has risen 29 feet in 19 years. Wells to the north (MW-18 and MW-19) and a well at the base of Cell 4 (MW-11) have also

experienced a steady rise in their water level. Appendix 2 at 18 and 26. Are these higher levels attributable to leaks from the tailings ponds?

IUSA's July 15th filing indicates that levels of chloride and sulfide rose immediately after the Mill started operation and never returned to background levels. September 9, 1981, D'Appolonia letter at 4 and 7; Appendix B to TITAN Report at 6 and 8; and Umetco Minerals Corporation line graphs at 13 and 17. The D'Appolonia letter states, "elevated chloride levels usually indicate a leak of tailings water" and "the increase in sulfate concentration will still be substantially above background levels, thus indicating the probability of a leak." September 9 D'Appolonia letter at 2.

CONCLUSION

The additional information provided by IUSA at the Presiding Officer's request does not show that constituents from tailings cells at the White Mesa Mill have not reached groundwater. On the contrary, the information provided shows increased levels of chloride and sulfate in the groundwater, which are key indicators for leaks of tailings water. The information is also inadequate, incomplete, outdated, and contains unsubstantiated assertions. The Sierra Club has learned that the deeper we dig into information regarding the mill, the bigger the mess we find.

Sufficient uncertainty exists regarding the integrity of the tailings cells and the adequacy of the leak detection systems and groundwater monitoring system to warrant the preparation of an independent study of the mill. Data collected by IUSA and analyzed by IUSA's consultants are suspect because of the conflict of interest inherent in IUSA's ownership of the mill.

Further, sufficient uncertainty exists to warrant the preparation of an Environmental Impact Statement (EIS) on the Amendment Request to process radioactive

lead sulfide sludge from Molycorp's lanthanide mill in Mountain Pass, California, as well as on the mill's alternate feed program in general. Among other things, an EIS is needed to assess the real ability of the tailings confinement systems, leak detection systems, and groundwater monitoring systems to protect the area's groundwater, springs and seeps from the constituents present in alternate feed, including the lead and thorium in the Molycorp sludge.

All shipments of alternate feed, including the Molycorp sludge, should be stayed pending completion of the independent study and the EIS, in order to protect the public health and the environment from irreversible contamination.

Finally, the Molycorp material should not be processed or disposed at the Mill until the State of Utah awards a Ground Water Discharge Permit (GWDP) to IUSA. Many of the issues regarding the hydrogeology at the Mill will be resolved by the GWDP process.

Respectfully submitted,

John Weisheit, Chair
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Utah Chapter, Sierra Club
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435-259-1063

Enclosures: Appendices 1-10

I, John Weisheit, declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Dated at Moab, Utah
This 29th day of July, 2002

John Weisheit

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

INTERNATIONAL URANIUM (USA) CORPORATION	)	Docket No. 40-8681-MLA-11
	)	ASLBP NO. 02-795-02-MLA
(Source Material License Amendment, License No. SUA-1358)	)	July 29, 2002

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing SIERRA CLUB COMMENTS ON IUSA'S RESPONSE TO PRESIDING OFFICER'S REQUEST FOR ADDITIONAL INFORMATION have been served on the following persons by first class U.S. mail or by express mail this 29th day of July 2002, pursuant to 10 C.F.R. 2.712 and 2.1203. Additional service via electronic mail is indicated by asterisk.

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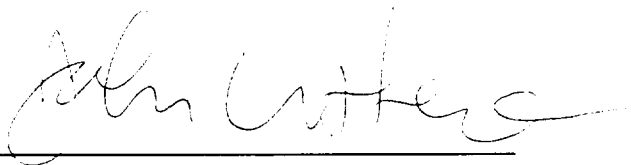

John Weisheit

Sierra Club Comments on IUSA's Response to the Presiding Officer's Request for Additional Information

List of Appendices

Appendix 1. February 7, 2002, letter from State of Utah, DRC, to IUSA.

Appendix 2. May 11, 2001 letter from IUSA to DRC.

Appendix 3. Sierra Club list of documents on ADAMS related to IUSA's GWDP

Appendix 4. Declaration of Ivan Weber.

Appendix 5. July 13, 2001, report from IUSA to Utah State DRC with attached October 7, 1994, TITAN report

Appendix 6. March 7, 2002, letter from Utah State DRC to IUSA.

Appendix 7. November 13, 2001, letter from IUSA to DRC re: Hydraulic Test Data, Monitor Well 4.

Appendix 8. Sierra Club table showing chloroform monitoring results.

Appendix 9. April 27, 2001, letter from IUSA to NRC, Re: Cell 4-A Leak Detection Report.

Appendix 10. May 29, 2001, letter from IUSA to NRC, Re: Cell 4-A Leak Detection System Follow-up Report.

Attachment 1

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF RADIATION CONTROL

Michael O. Leavitt
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February 7, 2000

Ms. Michelle R. Rehmann
Environmental Manager
International Uranium (USA) Corporation
Independence Plaza, Suite 950
1050 17th Street
Denver, CO 80265

Re: May, 1999 IUC Groundwater Information Report: **DRC Request for Additional Information Related to Site Hydrogeology**.

Dear Ms. Rehmann:

We have reviewed the May, 1999 International Uranium (USA) Corporation (IUC) Groundwater Information (GWI) Report for the White Mesa uranium mill near Blanding, Utah. During this review we also examined the July, 1994 Titan Environmental Report regarding local hydrogeology of the White Mesa facility.

As a result of both reviews, we have identified additional information and concerns that need to be resolved in order to move forward with issuance of a Utah Ground Water Discharge Permit (hereafter Permit). Please resolve the groundwater hydrology related issues listed in the attached document.

During our review, we discovered that hydrogeologic information for the White Mesa site was scattered among several documents. We also found that other groundwater related studies had been undertaken by IUC after completion of the July, 1994 Titan Environmental Report; which were not included in the May, 1999 GWI Report. In order to facilitate the review process, we recommend that the July, 1994 Titan Environmental Report be revised into one stand-alone document to include all currently available information, and resolve the attached Division of Radiation Control (DRC) information needs.

During our meeting of January 24, 2000 meeting we agreed that review of the engineering related issues was the highest priority; followed by groundwater hydrology considerations and others. By way of information, we have received your engineering plans and as-built reports in a transmittal dated February 2, 2000; which included six reports, as follows:

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF RADIATION CONTROL

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1. D'Appolonia Consulting Engineers, June, 1979, "Engineer's Report: Tailings Management System". This report was submitted to DRC previously.

2. D'Appolonia Consulting Engineers, February, 1982, "Construction Report: Initial Phase - Tailings Management System". This report is a new submittal to DRC.

3. D'Appolonia Consulting Engineers, May, 1982, "Engineer's Report: Second Phase Design - Cell 3 Tailings Management System". This report was submitted to DRC previously.

4. Energy Fuels Nuclear, March, 1983, "Construction Report Second Phase Tailings Management System".

5. Umetco Minerals Corporation, August, 1988, " Cell 4 Design Tailings Management System". This report is a new submittal to DRC.

6. Titan Environmental Corporation, September, 1996, "Tailings Cover Design White Mesa Mill". This report is a new submittal to DRC.

We will commence review of these engineering plans and as-built reports shortly. In the meantime, the attached hydrogeologic comments are intended to resolve other outstanding concerns and issues.

If you have any questions regarding the attached hydrogeologic information needs, please call Loren Morton of my staff at (801) 536-4262. Thank you for your continued cooperation in this matter.

Sincerely,

William J. Sinclair

WJS:LBM/lm

attachment (1)

cc: Larry Mize, DWQ (w/attach.)
Dianne Nielson, DEQ
Bill Von Till, NRC (w/attach.)
David Arrioti, DEQ District Engineer (w/attach.)

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File: IUC 11/30/99 Draft Ground Water Discharge Permit

Utah Division of Radiation Control

Request for Additional Information Related to Site Hydrogeology
International Uranium (USA) Corporation
White Mesa Uranium Mill
Near Blanding, Utah

February 7, 2000

Hydrogeologic Information Needs

To date, IUC has provided three reports which partially describe groundwater conditions at the site, these include: 1) the May, 1999 IUC Groundwater Information (GWI) Report, 2) a hydrogeologic evaluation found in the July, 1994 Titan Environmental Report [hereafter July, 1994 Titan Report], and 3) and a point of compliance report found in the October 7, 1994 Titan Environmental Report, Revision 1 [hereafter October, 1994 Titan Report]. A number of IUC semi-annual monitoring reports to the U.S. Nuclear Regulatory Commission (NRC), dated between February 26, 1993 and September 14, 1999, have also been provided to the Division of Radiation Control (DRC), some of which are listed below. After DRC staff review of these reports, the following constitute the hydrogeologic and groundwater related information needs:

1. Well / Piezometer / Boring Status Summary Table - review of the information provided shows that a large number of wells, borings, and piezometers have been installed at the IUC facility during design, construction, and operation of the mill. It appears that these borings and monitoring devices have been installed at different times and for different purposes during the life of the facility. Some of the installations appear to be in operation today; while others apparently have been plugged and abandoned. Due to the long history of the facility, the large number borings and devices installed, and the multiple reports wherein they are documented, a significant degree of confusion appears to exists about their current status. Consequently, we request that IUC prepare a comprehensive table to summarize the identity, location, purpose, construction details, and current operational status for all wells, piezometers, or borings installed at the facility. Data that should be listed in this table include: well/boring/piezometer name, date installed, ground surface elevation, total depth, purpose (well, geologic log, etc), boring diameter, depth to major geologic contacts (e.g., depth to bedrock, depth to Brushy Basin Member, etc.), depth to groundwater, water level measuring point stickup and elevation (wells and piezometers), current operational status, date and reason for plugging and abandonment.

2. Monitoring Well Completion Details - the groundwater related reports submitted to date fail to provide construction details for several groundwater monitoring wells at the White Mesa facility. As a result, we are unable to conclude if these wells conform to the construction requirements found in the EPA RCRA Ground-Water Technical Enforcement Guidance Document (TEGD), as outlined by the Utah Groundwater Quality Protection (GWQP) Rules [see Utah Administrative Code (UAC) R317-6-6.3(I)(6)]. Please provide the following information:

1. Well Drilling and Development Methods: All Wells - none of the groundwater related reports listed above discloses the drilling or well development methods used to install any of the monitoring wells at the White Mesa facility. Please provide information on well drilling and development methods for all of the existing and former monitoring wells installed at the facility.

2. Datum for Seven (7) Well Construction Diagrams - review of the July, 1994 Titan Report shows that the well completion diagrams for seven (7) wells are missing a relative elevation datum for the reported well construction details (ibid., Appendix A, wells MW-1 thru MW-5, MW-11 and MW-12). This missing vertical scale makes it unclear if the well construction details and depths referenced the local ground surface or the final well's water level measuring point. Please provide an elevation datum for each of the seven (7) wells mentioned above.

3. Well Completion Diagrams: IUC Wells Installed or Proposed - well completion diagrams have not yet been provided or need to be revised for 12 or more monitoring wells installed or proposed at the facility, including:

   1) Two (2) NRC Approved Monitoring Wells - please submit completion diagrams for wells MW-14 and MW-15.

   2) Six (6) Wells and Piezometers Reported Installed at Facility - please provide completion diagrams for wells MW-20 and MW-22 (2/28/95 Energy Fuels Nuclear [EFN] Report, Table 20), and piezometers #9-1, #9-2, #10-1, and #10-2 (7/94 Titan Report, Table 2.3, and Figure F1).

   3) Three (3) Proposed IUC Wells - please submit completion diagrams for three shallow aquifer monitoring wells to be located south of Tailings Cell 4, including: SMW-1, SMW-2, and SMW-3 (7/94 Titan Report, Figure 4.1),

   4) All Other Additional Wells - please provide completion diagrams for any other wells or piezometers installed at the facility after completion of the July, 1994 Titan Report.

   5) Monitoring Well MW-4 - please revise the well completion diagram for well MW-4 to include all details of well construction. Review of the July, 1994 Titan Report shows that the boring for well MW-4 was over-drilled and then back-filled before the well screen was installed (ibid., Appendix A, Figure 5). However, the well completion diagram provided failed to provide several important construction details related to this over-drilling, including: 1) total depth of the boring, 2) depth interval backfilled, and 3) thickness of the lowermost bentonite seal installed below the well casing foot. Please provide a revised well completion diagram accordingly.

6) Monitoring Well MW-3 - the completion diagram provided for this well did not include a geologic log (7/94 Titan Report; Appendix A, Figure 4). As a result, we are unable to confirm the hydrostratigraphic interval within which this well is completed. Please revise the well completion diagram to include the geologic log for this well.

Please ensure that a geologic log is provided on the well completion diagrams requested above. Well completion diagrams should disclose all key elements of well construction in conformance with the EPA RCRA TEGD (e.g. Section 3.5), including, but not limited to: drilling method to install boring, boring diameter and total depth, casing diameter, screened and filter pack intervals, depth/location and type of annular seals, casing/screen/filter pack construction materials, type of screen, ground surface elevation, etc.

4. Identification of Water Level Measuring Points: All Wells - none of the IUC groundwater related reports submitted disclose or describe the physical location of the groundwater water level measuring point at each monitoring well. Please ensure that this point is clearly marked and identified at each wellhead, and a description thereof provided for DRC review.

5. Discrepancy of Water Level Measuring Point Elevations: Wells MW-11, MW-12, and MW-17 - reported elevations for the water level measuring point for three (3) different wells has varied from one IUC report to another. In the case of wells MW-11 and MW-12, these elevations have varied between 1.63 and 1.87 feet, see Table 1, below. However, for well MW-17 the discrepancy is extremely large, over 82 feet. Please resolve these discrepancies and provide the true water level measuring point elevation for all three wells.

Table 1. IUC Water Level Measuring Point Discrepancies

	Reported Water Level Measuring Point Elevation (feet, amsl)			
IUC Reference	MW-11	MW-12	MW-17	MW-19
July, 1994 Titan Report, Table 2.3	5,611.08	5,609.45		
July, 1994 Titan Report, Appendix B	5,609.45	5,611.08		
August 13, 1999 IUC Letter	5,610.89	5,609.21		
Range of Discrepancy:	1.63 feet	1.87 feet		
February 28, 1995 EFN Report, Table 19			5657.58	5575.06
February 28, 1995 EFN Report, Table 20			5575.06	5655.05

Range of Discrepancy:			82.52 feet	79.99 feet

6. Discrepancies in Well Completion Dates: MW-11, MW-12, and MW-13 - the July, 1994 Titan Report states that wells MW-11, MW-12, and MW-13 were installed in October, 1982 (ibid., Table 2.3). However, Appendix B of the same report states that water level measurements were made in these three (3) wells in January of the same year. Please provide the correct the well completion dates for these wells.

9. Additional Geologic Information - a Permit applicant must provide geologic and hydrologic information, including well logs for a 1-mile radius around the facility [UAC R317-6-6.3(E)]. Review of the July, 1994 Titan Report suggests that several items of geologic information are missing for wells installed at the facility and need to be provided, including:

   1. Geologic Formation Interpretation - most of the geologic logs found in the July, 1994 Titan report include lithologic descriptions, but did not designate any geologic formation or formation contacts (ibid., Appendix A). As a result, we are unable to confirm the structural contour map found in Figure 2.6. At a minimum, please provide and justify the depth to the Burro Canyon Formation / Brushy Basin Member contact for the following monitoring wells and borings:

      1) Monitoring Wells - MW-1, MW-2, MW-3, MW-4, MW-5, MW-11, and MW-12,

      2) Dames & Moore Borings - No. 3, No. 9, No. 12, No. 19, and No. 28,

      3) Former Monitoring Wells - including wells MW-6, MW-7, MW-8, and MW-13, which apparently have been plugged and abandoned.

      4) Additional Wells - installed after completion of the July, 1994 Titan Report, including, but not limited to: 1) the three (3) proposed wells south of the tailings cells [7/94 Titan Report, pp. 46-48 and Figure 4.1], and 2) any exploratory wells installed in compliance with the August 23, 1999 Ground Water Corrective Action Order.

   2. Geologic Logs for Wells Installed or Proposed - review of the July, 1994 Titan Report (Figure 2.1) shows that geologic logs are missing for a number of wells at the facility. These logs will facilitate the review of the local subsurface geology, and may allow confirmation of the depths and elevation of the Burro Canyon Formation / Brushy Basin Member contact in the vicinity of the White Mesa facility. Well logs missing include, but are not limited to the following wells:

1) Two Water Supply Wells Named "17" - two different water supply wells are found on the site plan map which have the same name, "17". One is located east of the mill site, the other southeast of the "Jones" well (see 7/94 Titan Report, Figure 2.1). Please provide geologic logs and well completion diagrams for these wells. We also suggest that IUC provide a unique name or identification for each of these wells.

2) Four (4) Former Monitoring Wells - it appears that four (4) former monitoring wells have been plugged and abandoned as a result of additional tailings cell construction at Existing Cells 3 and 4A, including IUC wells MW-6, MW-7, MW-8, and MW-13 (7/94 Titan Report, Table 2.3). No geologic logs, well completion diagrams or well plugging and abandonment reports were found for these wells in the July, 1994 Titan Report. Please provide the geologic logs, well completion diagrams, and plugging and abandonment reports for these four (4) monitoring wells.

3) Five (5) Dry Wells and Piezometers - apparently five (5) wells and piezometer have been installed at the White Mesa facility that failed to encounter groundwater, including well MW-16, and piezometers #9-1, #9-2, #10-1, and #10-2 (7/94 Titan Report, Table 2.3). None of the IUC reports submitted to date includes any geologic logs or well completion diagrams or details for these five (5) wells. Please provide this information for DRC review.

4) Proposed Nested Angle Borings - two (2) nested angle borings have been proposed along the west margin of Existing Tailings Cell 4A (7/94 Titan Report, pp. 45-46 and Figure 4.1). Please provide the geologic logs for these borings.

10. Land Survey Information - a Permit applicant must submit plans and specifications relating to the construction, modification, and operation of discharge systems at the facility [UAC R317-6-6.3(J)]. Part 3 of the Utah Water Quality Regulations also requires engineering reports for wastewater disposal systems to be prepared by a Utah registered professional engineer (UAC R317-3-1.2(A)(1)]. Certified land surveys to determine local survey coordinates and elevations are essential to the preparation of acceptable engineering reports. Unfortunately, none of the reports submitted to date provide tables of local coordinates or elevations for key tailings discharge and monitoring facilities.

However, we recognize that the Permit will be issued long after the White Mesa mill was constructed; and that certain elements of the facility are no longer accessible for survey today due to burial during construction or by tailings disposal operations. Consequently, our request for land survey information is organized into two parts, as outlined below:

1. Accessible Discharge Related Facilities - for discharge related facilities that are accessible today please provide a new land survey, certified by a Utah licensed engineer or land surveyor, to determine local survey coordinates and elevations. These facilities include:

1) Tailings Ponds - please provide local survey coordinates for the top and outer toes of the tailings pond berms, and all related appurtenances that are exposed at the surface (e.g., piping, spillways, etc.).

2) Existing Groundwater Monitoring Wells - please provide local survey coordinates for all monitoring wells at the facility, including, but not limited to: MW-1, MW-2, MW-3, MW-4, MW-5, MW-11, MW-14, MW-15, MW-17, MW-18, MW-19, MW-20, and MW-22. For each well please include the following data and survey accuracy (EPA RCRA TEGD, Section 3.5): local horizontal survey coordinates (± 0.5 foot), ground surface elevation (± 0.01 foot), and elevation of groundwater water level measuring point (± 0.01 foot).

3) Three Proposed Monitoring Wells - apparently installed south of Tailings Cell 4, including SMW-1, SMW-2, and SMW-3.

4) Exploratory or Temporary Wells - recently installed near IUC well MW-4 in response to the August 23, 1999 Ground Water Corrective Action Order.

5) Water Supply Wells - please provide local survey coordinates for the five (5) deep water supply wells installed on site, including water wells WW-1 thru WW-5 (7/94 Titan report, Appendix A). Please ensure that all these wells are also located on the site plan map, especially WW-5 which has to date not been plotted thereon (ibid., Figure 2.1).

6) Nearby Stock-watering Wells - please provide local survey coordinates for all of the stock-watering wells found near or adjacent to the White Mesa facility, as listed in the July, 1994 Titan Report (Figure 2.1), or this request for information.

2. Inaccessible Discharge Related Facilities - for facilities that are inaccessible for survey today due to burial by disposal operations, please provide the following information from existing IUC survey data:

1) Tailings Pond Details and Elevations - we anticipate that essential design and construction details for the tailings ponds will be provided in the engineering design plans, specifications, and/or construction as-built reports, e.g., tailings pond floor location and elevations; interior slopes, elevation of internal pipes, sumps or pumps, etc. If after receipt and review of these materials, soon to be submitted, we determine additional information is necessary, we will contact you accordingly.

2) Existing and Proposed Wells and Geologic/Soil Exploratory Borings - no local survey coordinates have been provided for a number of borings and wells have been installed or proposed for installation on site, including, but not limited to:

1) Deep Dames & Moore Exploratory Borings - including No. 3, No.9, No. 12, No. 19, and No. 28 (ibid., Appendix A),
2) Former Monitoring Wells - including MW-6, MW-7, MW-8, and MW-13 that have been plugged and abandoned,
3) Proposed Angle Borings - located west of Tailings Cell 4A, including Borings A-1 and A-2. Please include direction and angle of said borings (ibid., Figure 4.1).
4) Dry Wells and Piezometers - including well MW-16, and piezometers #9-1, #9-2, #10-1, and #10-2 (ibid., Table 2.3).

Please provide local survey coordinates and ground elevations for all these wells and borings.

11. Groundwater Water Level Information - a Permit applicant must provide a hydrologic description of the discharge facility, including groundwater flow directions and gradient [UAC R317-6-6.3(E) and (I)(1)]. Review of the IUC reports submitted shows several discrepancies in groundwater water level data provided. Please resolve the following items in order complete and correct existing groundwater flow direction and gradient information:

1. Discrepancies in Reported Groundwater Elevations: November 19, 1992 - review of the July, 1994 Titan Report shows that the reported groundwater elevations in Table 2.3 for a November 19, 1992 sampling event are inconsistent with values provided in Appendix B of the same report for the same day. Please resolve these discrepancies which range from 0.01 to 1.67 feet, and are summarized in Table 2, below.

Table 2. Discrepancies in Reported Water Level Elevations: November 19, 1992

	Reported Water Level Elevation (ft, amsl)		Delta Elevation (ft, amsl)		Reported Water Level Elevation (ft, amsl)		Delta Elevation (ft, amsl)
Well ID	Table 2.3	Appendix B		Well ID	Table 2.3	Appendix B	
MW-1	5572.77	5572.55	0.22	MW-11	5508.55	5507.10	1.45
MW-2	5503.43	5503.46	0.03	MW-12	5499.77	5501.44	-1.67
MW-3	5471.58	5471.46	0.12	MW-14	5491.05	5490.81	0.24
MW-4	5530.15	5530.16	0.01	MW-15	5490.34	5491.04	-0.70
MW-5	n/a	5500.89	5500.89				

2. Reported Groundwater Elevation: MW-17, August, 1994 - the reported water table elevation in well MW-17 for August, 1994, 5,570.2 feet, is approximately 80 feet higher than any other groundwater elevation reported for this well in any of the IUC reports submitted to DRC (see 2/28/95 EFN Semi-annual Report, Table 19). Please resolve this apparent outlier.

3. Reported Depth to Groundwater: MW-19, August, 1994 - review of the February 28, 1995 EFN Semi-annual Report shows reported water level elevation of 5,490.36 feet, which corresponds with a depth to groundwater of 164.69 feet, based on the reported water level measuring point elevation of 5575.06 (ibid., Table 19). However, the July, 1994 Titan Report says the total depth of MW-19 is 149 feet. Please resolve this error.

12. Future Need for Special Plugging Measures for Water Supply Well WW-2 - as you recall, a Permit applicant is required to demonstrates that the discharge can be controlled and will not migrate into or adversely effect the quality of any other waters of the state [UAC R317-6-6.3(G)]. During DRC review of the July, 1994 Titan Report, we discovered that the current construction of water supply well WW-2 has created a potential open conduit between the shallow and deep confined aquifer. This conclusion is based on the following observations:

    1. Supply Well WW-2 Driller's Log - the driller's log shows that a very long annular gravel pack was installed between the 15 inch boring and the 9-7/8 inch steel casing, across a depth of 100 feet to the bottom of the casing at 1,250 feet below ground surface (BGS, ibid., Appendix A, well drillers report). This annular gravel pack must be very permeable, in that its particle size was reported to range from 3/8 to 3/4 inch (ibid.). Below the 1,250 foot depth, the well was constructed with a simple 635 foot long open hole completion across the Entrada and Navajo Sandstones(total depth = 1,885 feet, ibid.). A submersible pump was then installed inside the well casing at a depth of about 1,000 feet BGS (May, 1999 IUC GWI Report, p. A-21). No information was provided regarding any annular seal at the bottom of the 10 inch steel casing; which leaves the possibility for fluids in the annular space to flow around the casing shoe and into the well casing.

    2. Monitoring Well MW-18 Completion Diagram - nearby to Supply Well WW-2, is found IUC monitoring well MW-18, where groundwater was found at a depth of about 91.4 feet below ground surface (7/94 Titan Report, Appendix A). Depth to the upper Brushy Basin Member contact was reported to be about 139 feet below ground surface (ibid., Peel Environmental Services well completion diagram). This leaves a saturated interval of approximately 39 feet in the shallow unconfined aquifer open to the annular gravel pack of WW-2.

3. Comparison of Potentiometric Surfaces - comparison of the well completion diagrams shows that water level in the deep aquifer is lower than the shallow aquifer; hence the shallow groundwater can flow downward into the deep system. This evidence is found in the higher level in MW-18, located at a depth of about 91 feet BGS and the head in the deep system at about 450 feet BGS (7/94 Titan Report, Appendix A, MW-18 well completion diagram and WW-2 well driller's report). Furthermore, the apparent downward hydraulic gradient is likely greatly exacerbated during periods of pumping.

As a result, it is apparent that a potential avenue of hydraulic communication may exist in the annular space of supply well WW-2. Such a conduit could result in degradation of the deep aquifer groundwater quality; especially if tailings pond seepage was to adversely impact the shallow aquifer and find its way to the vicinity of WW-2.

However, we have determined that the potential for pollution of the deep aquifer is small as long as well WW-2 is being actively pumped, and any annular seepage removed by the pumping action. However, if and when supply well WW-2 is closed and abandoned, cascading water from the shallow aquifer may not be removed and with time could pollute the deep Entrada/Navajo Sandstone aquifer.

In order to prevent this possibility, it will be important to complete special measures for plugging and abandoning supply well WW-2, presumably at the time of mill site closure. Since this is not an imminent activity at your facility, we propose that a condition be added to the draft Permit to require IUC to prepare a plan for approval at some future date regarding the special measures needed to adequately plug and abandon this well.

13. Monitoring, Testing and Evaluation Plan for Other Supply Wells - in order to fulfill the requirements of UAC R317-6-6.3(G), as mentioned above, it is important to evaluate all the deep supply wells at the facility to ensure they have adequate annular seals to isolate the deep and shallow aquifers. Review of the driller's logs provided in the July, 1994 Titan Report suggest that annular leakage is possible in three (3) other supply wells at the facility, including: WW-1, WW-4, and WW-5. This conclusion based on: 1) the driller's report that surface seals were limited to depths of 18 to 125 feet for these supply wells, and 2) the geologic log of nearby monitoring well MW-18 which suggests the base of the shallow aquifer is found below 125 feet. Please provide additional information to confirm and document construction of the these water supply wells at the facility. In the event that IUC is unable to document and justify how adequate annular seals were constructed in these supply wells, please provide a plan for solving this problem.

14. Nearby Groundwater Water Rights - a Permit applicant must disclose the location of all water wells, including the status and use of said wells, within a 1-mile radius of the discharge [UAC R317-6-6.3(D)]. DRC review of the groundwater wells and water rights listed in the May, 1999

IUC GWI Report (Figure A-3 and Table A-4) shows that seven (7) water rights were omitted, as outlined in Table 3, below. Please revise the July, 1994 Titan Report (Table 1.1 and Figure 1.3) and the May, 1999 IUC GWI Report (Figure A-3 and Table A-4) to include these missing wells and water rights. One water right owned by a Mr. Lorenzo Hawkins, appears to be located a short distance southwest of the tailings ponds, and may pose a point of exposure should groundwater under the tailings ponds become contaminated.

With regards to the terminated water rights listed in Table 3, below, please conduct a field survey and submit evidence to confirm that these water wells in fact were not drilled, or were plugged and abandoned.

15. Revised Site Plan Map - a Permit applicant should include a site plan map of all water wells within a one-mile radius of the discharging facility [UAC R317-6-6.3(D)]. Figure 2.1 of the July, 1994 Titan Report provides a map of most borings, monitoring wells, exploratory wells at the time of report issuance. However, several wells, borings, and piezometers have been omitted from this drawing, including, but not limited to: supply well WW-5, boring No. 21, piezometers #9-1, #9-1, #10-1, and #10-2, and former monitoring wells MW-6, MW-7, MW-8, and MW-13 (see discussion above). Certain other wells have also been installed and exploratory borings drilled by IUC after completion of the July, 1994 Titan Report. In addition, some water rights have been omitted from the IUC tabulation, at least one of which appears downgradient and in close proximity to the tailings ponds (see Table 3, above, Lorenzo Hawkins well). Please revise the Site Plan Map to ensure it is complete in its representation of all wells (monitoring, supply, Stock-watering, etc.), borings, and piezometers installed at or adjacent to the White Mesa facility.

Attachment 2

40-8681

INTERNATIONAL
URANIUM (USA)
CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 628 7798 (main) • 303 389 4125 (fax)

May 11, 2001

VIA FACSIMILE AND EXPRESS COURIER

Mr. William J. Sinclair
Director, Division of Radiation Control
Utah Department of Environmental Quality
P.O. Box 144850
168 North 1950 West
Salt Lake City, UT 84114-4850

Reference: March 20, 2001 UDEQ letter and Request for Additional Site Hydrogeology Information in response to IUSA September 8, 2000 Revised Groundwater Information Report
Ground Water Discharge Permit Application for White Mesa Mill:

Dear Mr. Sinclair:

International Uranium (USA) Corporation ("IUSA") appreciated receiving the comments from the Utah Department of Environmental Quality ("UDEQ") Division of Radiation Control ("DRC") transmitted by letter dated March 20, 2001, in response to IUSA's scheduled submittal of September 8, 2000. Thank you for meeting with us on April 25 to discuss DRC's comments. As we discussed at the meeting, IUSA has prepared a revised, accelerated schedule to respond to DRC's March 20 comments while also preparing a number of the other technical submittals required for the Groundwater Discharge Permit ("GWDP").

As shown on the enclosed revised schedule, IUSA will need until mid-June to complete and submit all responses required to the March 20 response and request for additional information, in accordance with the scope discussed for each item on April 25. To help ensure that the planned scope of our technical submittals is as DRC requested, we have outlined below our understanding, based on our discussion with DRC, of the form of response IUSA should provide to each item. But in addition to submittal of these responses, IUSA and our independent engineers, hydrologists, and geochemists are simultaneously preparing a number of other technical submittals, all of which, as shown on the enclosed accelerated schedule, are projected for delivery to DRC during the months of July and August.

NMSSOI Public

We also transmit herewith selected items which were more readily available and did not require compilations or organization by IUSA. We have noted transmittal of these items in the summary below.

IUSA will continue to make every effort to resolve technical information items as completely as possible, given availability of historic information, and we appreciate DRC's agreement to accept information from historic reports, where appropriate, as had been discussed in our March 1999 meetings, when original data prove to be unavailable. In addition, further searches for historic information have been successful in locating much of the information you requested.

For ease of reference, the request language contained in your letter of March 20 (the Request for Information, or "RFI")) is repeated in the same order as used in the letter, indicated in italics below.

Remaining Open Issues (February 7, 2000 DRC RFI)

1. *Well Construction Diagrams and Geologic Logs [p. 2, Item 2.C and p. 4, Item 3] - several wells, piezometers, and/or boring remain without well completion diagrams and geologic logs, as already provided, see discussion below*

   1. *Seven Wells and Piezometers [p. 2, Item 2.C.2] - we acknowledge that seven (7), not six (6), wells and piezometers are at issue here, including three (3) wells, MW-20 thru MW-22, and four (4) piezometers: MW9-1, MW9-2, MW10-1, and MW10-2. We appreciate the new survey coordinates provided for these seven (7) installations. However, the September 8, 2000 IUC Revised GIR failed to provide well completion diagrams for these seven (7) wells and piezometers. Please provide the required well completion diagrams, and geologic logs for these seven (7) installations. In the event that this information has been lost, please provide a schedule for completion of video and geophysical logging to collect the required information.*

      COMPLETED
      As discussed during our meeting on April 25, IUSA has engaged Harold R. Robert, P.E., to assist in searches of IUSA Denver files and Umetco files in Grand Junction. Mr. Roberts, a licensed professional engineer, has been involved with the White Mesa Mill since its construction, and as such is an asset in searching for the records DRC requested. Mr. Roberts also searched Mill archives, offices, and office files. Having completed those searches during the week of April 30-May 4, Mr. Roberts concluded that records transfer information provided to him at the time of closure of IUSA's Grand Junction office appears to be correct; that is, records regarding the Mill were transferred to the Mill, while records regarding the Mines were transferred to the Dove Creek office, and those were later sent on to the Fredonia office. Mr. Roberts believed this to be evident by the fact that raw data from the 1994 drilling campaign were found in Mill archives he searched;

therefore, he has reported that he believes it would be fruitless to search for the same records in Fredonia. As a result, the expanded search he performed at the Mill and Umetco's Grand Junction office is the final search of records.

As a result of these searches, IUSA has located constant head pressure tests for several of these MW's and borings. IUSA is organizing and sorting these data, and will submit the results in the June data transmittal as shown on the proposed accelerated schedule. IUSA has also searched Mill archives, offices, and office files for:

(1) Well completion diagrams for MW-20, -21, -22
(2) Well logs for MW9-1, MW9-2, MW10-1, and MW10-2

During this search, IUSA located working files and field notes from drilling of wells MW-20, -21, and -22. In addition, IUSA located what appears to be a Table and pages from a report by D'Appolonia, which gives data for shallow borings 9-1, 9-2, 10-1, and 10-2. IUSA is reviewing these data and will transmit to DRC, in the June data transmittal shown on the proposed accelerated schedule, the well logs and completion diagrams found in the files of the table and pages from the D'Appolonia report.

SCOPE OF RESPONSE, BASED ON DRC/IUSA MEETING OF APRIL 25, 2001 (the "APRIL 25 MEETING")
DRC and IUSA noted that video logging may be impractical in cased wells. IUSA is to consider different potential means of geophysical logging, if IUSA does not locate well completion diagrams and well logs for all of the above wells.

IUSA noted that a conceptual model of the site, reported by geologists, existed prior to the Mill siting, and this conceptual model has been corroborated by Mill licensing activities. DEQ noted that the Brushy Basin contact is the geologic feature of interest to DRC, and concurred that, irrespective of the number of data points available, there will remain uncertainty in defining the top of the Brushy Basin throughout the Mill property. DRC indicated that it would not be necessary to pull casing in order to log these wells, but asked IUSA to consider geophysical means of establishing the contact. For this item, DRC was particularly interested in:

(1) Attempt to define the contact in these wells.
(2) Consider whether any geophysics might be used, if well logs cannot be located.
(3) Determine whether or not the dry wells located the contact.
(4) Completion diagrams would be best, but at a minimum, find the top and bottom of the screened interval.

2. *Three Wells Formerly Named SMW-1 thru SMW-3 [p.2, Item 2.C.3] - from the description provided, it is clear that after installation these three (3) wells were actually named MW-20, MW-21, and MW-22. We also acknowledge that new survey coordinates have already been provided for these three (3) wells (9/8/00 IUC Revised GIR, LANDesign map Sheet 1 of 1). In addition, DRC staff has also visited each of these during the last split groundwater sampling event in November, 2000. However, please provide the following information still found lacking for these three (3) wells:*

   (1) Geologic logs - that locate the depth to the upper Brushy Basin Shale contact,
   (2) Well completion diagrams, and
   (3) Dates of well installation.

   COMPLETED
   This is same request, essentially, as (A) above. Searches were performed as described under 1.1. above. IUSA located working files and field notes from drilling of wells MW-20, -21, and –22. As discussed under item 1. above, IUSA also located what appears to be a Table and pages from a report by D'Appolonia, which gives data for shallow borings 9-1, 9-2, 10-1, and 10-2. IUSA is reviewing these data and will transmit the any geologic (well) logs, completion diagrams, or dates of installation found in the files or the table and pages from the D'Appolonia report, in the June data transmittal shown on the proposed accelerated schedule.

   SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 24 MEETING
   It was agreed that items 4A and 4B may be combined as one response, and the scope of both responses would be as defined above under item 4A.

3. *Four Geotechnical Borings: GH-1 thru GH-4 [p. 4, Item 3.A.4] - from review of the September 8, 2000 Revised GIR, it is clear that four (4) geotechnical borings were also installed near the tailings cells in conjunction with wells MW-20 thru MW-22; as a part of studies completed for the NRC and EPA (9/8/00 IUC Revised GIR, pp. 4-5). Apparently these borings were named GH-1, GH-2A, GH-3 and GH-4. We acknowledge receipt of field and laboratory permeability data from these four (40 borings in the September 8, 2000 Revised GIR (Attachment 10, Tables C-5 and C-6). However, this report also explained how other information was collected from these borings, including:*

   (1) Wireline geophysical logs,
   (2) Wireline video logs
   (3) Geologic logs

Please provide reliable survey coordinates and all geophysical, video and geologic logs made for these four (4) borings.

COMPLETED
Searches were performed as described under 1.1. above. Geologic logs have been located. A video log that appears to relate to at least two of the borings has been located, and is being reviewed by IUSA. A copy of the video log will be included in the June transmittal to DRC.

The Umetco 1994 report (referred to by DRC as the "Peel Report") is being reviewed by IUC.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING

For the above-referenced survey coordinates, DRC indicated that it is acceptable to approximate locations, if surveys are impractical. IUSA will designate those coordinates for which locations have been approximated. The Umetco 1994 report (also located) shows, in a work plan, the planned locations for these points. IUSA is to approximate these on a map, and estimate coordinates. IUSA reported that it seems likely that we will not be able to find the boring locations in the field, however.

4. *Former Monitoring Wells [p. 4, Item 3.A.4 and 3.B.2] - apparently IUC has been unsuccessful in their attempts to provide information on former monitoring wells now abandoned. However, additional information is required, as follows:*

(1) Well MW-13 - after IUC's unsuccessful attempt to locate this information (9/8/00 IUC Revised GIR, pp. 12 & 16), DRC staff found the required well MW-13 data in a March, 1983 Energy Fuels Nuclear (EFN) Construction Report for Cell 3 (Appendix D, see 11/1/82 D'Appolonia Consulting Engineers letter report). Please provide reliable survey coordinates for this well.

COMPLETED
Searches were performed as described under 1.1. above. Mr. Roberts copied data from a D'Appolonia report of 11/11/1982. IUSA has also located a letter to NRC that showed a map indicating where this well would be after Cell 4 was constructed. It is now inside Cell area. Copies of the report and letter to NRC will be provided to DRC.

IUSA is approximating coordinates from information IUSA has located.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING

The "reliable" coordinates that DRC has requested may be estimates, because the well location is now inside the Cell 4A area. IUSA will designate the points as estimates.

(2) *Wells MW6-1, MW6-2, MW7-1, MW7-2, MW8-1, and MW8-2 - please explain what efforts were completed to locate the required well completion diagrams and geologic logs for these six (6) former wells. In the event that new efforts find this information, please provide it with reliable survey coordinates for each well at your earliest convenience.*

COMPLETED
Searches were performed as described under 1.1. above. IUSA was able to locate installation data for these shallow borings. This information will be organized and transmitted to DRC with the June transmittal package.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
IUSA is to provide DRC with descriptions of IUSA's search for logs and completion diagrams. If estimation of coordinates becomes necessary, DRC agreed that it is acceptable to approximate locations, if surveys are impractical. IUSA will designate those coordinates for which locations have been approximated.

5. *Resolution Plan and Schedule for Well MW-3 [p. 2, Item 2.C.6] - we acknowledge your inability to produce a well completion diagram and geologic log for well MW-3. This information is essential for determination of aquifer thickness and elevation of the Brushy Basin Shale upper contact. At this time, it appears that there are only two options to resolve this problem:*

(1) *Wireline Video and Geophysical Logs - to locate the screened intervals in the well, and depth/elevation of the Brushy Basin Shale upper contact.*

(2) *Install a Confirmation Boring - in the event that the geophysical logs are unsuccessful in locating the Brushy Basin Shale upper contact, a confirmation boring may need to be installed near well MW-3 to allow an adequate geologic log to be assembled.*

Please provide a plan and schedule for these resolution activities for well MW-3 within 30-days of receipt of this letter.

COMPLETED
In the Groundwater Information Report Revision Package ("GIRRP"), IUSA submitted construction detail from the Titan Hydrogeologic Report (it had been copied from D'Appolonia). The detail does not show geology on this detail, and the contact is not shown. It appears that this well was only drilled to 96 feet,

based upon this report. In addition, searches were performed as described under 1.1. above. These searches failed to yield a more detailed geologic log for this particular well.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
IUSA will continue to discuss with DRC the feasibility and need for defining the Brushy Basin contact at this location. IUSA notes that the top of Brushy Basin throughout our entire site, which is in excess of 5,000 acres, cannot be quantified in complete precision, because there would always be too few data points. The site conceptual model, however, which has been published and available for public comment since the Environmental Assessment was first published in 1980, supports the general conclusion that the Brushy Basin is present as a confining unit beneath the site. This is evidenced in a number of ways, including: Pressure head observed in wells drilled to the underlying Entrada/Navajo sandstones; observed contact in canyons adjacent to the site; observed contact seepage at the contacts; historical descriptions of regional lithology, by independent geologists; and observed presence of the contact in wells drilled throughout the site.

DRC had requested a schedule describing IUSA's plan to resolve the above questions, submitted within 30 days of the March 20 letter. IUSA and DRC agreed that IUSA is to prepare a proposed revised schedule for GWDP submittals, in light of the delays experienced by IUSA in compiling the requested information and by DRC in reviewing IUSA's previous submissions. IUSA has prepared a revised, accelerated schedule to respond to DRC's March 20 comments while also preparing a number of the other technical submittals required for the Groundwater Discharge Permit GWDP.

As described in the introduction to this letter, IUSA will need until mid-June to complete and submit all responses required to the March 20 response and request for additional information, in accordance with the scope discussed for each item on April 25.

With regard to this technical issue, IUSA is to provide DRC with its approach to defining the top of contact at this location. Options could include geophysical logging, or possibly drilling a confirmatory boring. IUSA agreed to discuss this with our technical consultants, and then will ask for a meeting to discuss their recommendations with DRC.

2. *Plan and Schedule for Rehabilitation of Monitoring Well MW-4 [new item] - we acknowledge that no additional well construction information is available for MW-4. Close review of the available IUC information indicates that the base of the well's screened interval is about 13 feet above the Brushy Basin Shale upper contact (7/94 Titan Report, Appendix A, well completion diagram). After consideration that chloroform has been detected in this well, it is clear that the potential exists for dense non-aqueous liquid*

(DNAPL) contaminants to go undetected with this well configuration. As a result, we see no other option but to ask IUC to complete one of the following activities:

1. *Re-perforate Well MW-4 - by cutting new perforations in the well casing, below the existing screen interval, to allow well access to the aquifer interval in question, or*

2. *Installation of a Second Well - in the immediate vicinity of well MW-4 to provide a screened interval that is in direct contact with or is screened across the Brushy Basin Shale upper contact.*

Please provide a plan and schedule for one of these activities for well MW-4 within 30-days of receipt of this letter.

COMPLETED
The schedule for our responses is as previously discussed in this letter.

With regard to this technical question, prior to meeting with DRC on April 25, IUSA asked our independent hydrology consultants to review the data for MW-4. HydroGeoChem (HGC) reported that the well completion diagram is in error, and that the geophysical log depicts the correct contact of the Brushy Basin. The hydrologist found that the MW-4 well completion diagram provided in Appendix A of Titan, 1994, conflicts with the geophysical log of MW-4, which is also provided in Appendix A of the same report. In the well completion diagram, the Brushy Basin contact is apparently depicted at a depth of approximately 125 ft bls, and in the geophysical log, the Brushy Basin contact is depicted at 108 ft bls. The geophysical log is stated to be the more accurate value, based on the lithologic logs of nearby temporary wells TW4-1, TW4-2, TW4-7, TW4-8. In these logs, the Brushy Basin contact is noted at approximately 103 ft, 105 ft, 98 ft, and 105 ft bls, respectively. Based on this information, the actual depth of the contact at MW-4 is reported by HGC as being most likely 108 ft bls.

In the Chloroform Report (IUC/HGC, 2000) memorandum, HGC notes its disagreement with DRC's statement that "it is clear that the potential exists for non-aqueous liquid (DNAPL) to be undetected at the well". Rather, HGC reports that the data clearly point to the opposite conclusion. For example, HGC reported that, because the screened interval at MW-4 extends to a depth of 112 ft bls, any DNAPL that might potentially be present would, therefore, be expected to enter the well casing. As discussed in the Chloroform Report, however, there is no evidence of DNAPL at MW-4, in any of the other temporary wells, or in the vicinity of the abandoned scale house leach field which is considered to be the original source of the chloroform in the perched water. This conclusion is based on all of the following facts:

(1) Low soil gas concentrations
(2) Maximum groundwater chloroform concentrations that are more than three orders

of magnitude less than the solubility of chloroform, as detailed in IUC, 2000

(3) Multi-depth sampling of MW-4 did not indicate increasing chloroform concentrations with depth in the well bore, as would be expected if DNAPL existed at MW-4.

Based on the above facts, and because of the close proximity of temporary wells to MW-4 (TW4-7 is within approximately 30 feet of MW-4), HGC determined that there is no need to rehabilitate or re-perforate MW-4, nor to install additional wells near MW-4. IUSA notes that the individual performing these analyses and providing the above recommendation is an experienced hydrologist with particular expertise in evaluating movement of organics in the subsurface. For DRC's reference, the hydrologist's resume and technical memorandum dated April 23, 2001, is transmitted herewith.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING

DRC noted that due to the presence of chloroform in MW-4, DRC regards this well as a focus of attention, and wants very clear indication as to the location of the contact. DRC noted that the top of the Brushy Basin is, as discussed earlier in the meeting, irregular due to its depositional environment. DRC hypothesized that it may vary "considerably" in the few feet between MW-4 and the five temporary wells drilled near it.

DRC recommended that IUC respond that it believes that 125' is the wrong value, and provide support for that statement. In response to this specific request, IUSA transmits herewith the independent hydrologist's technical memorandum.

IUSA is to provide DRC with its approach to further defining the Brushy Basin contact at this location. Options could include geophysical logging, or possibly drilling a confirmatory boring. DRC suggested considering gamma to look at the contact through the casing, or to consider the feasibility of using EM or neutron-density logging. IUSA agreed to discuss this with our technical consultants, and then ask for a meeting with DRC to discuss this well.

3. *Additional Geologic Information [p. 4, Item 3 and p. 11, Item 11.A] - several requested items from the February 7, 2000 DRC RFI remain unresolved, including:*

   1. *Missing IUC Reports - several existing consultants reports have yet to be provided to the DRC. Please provide the following reports:*

      (1) Reports Available to Titan Environmental - as listed in Table 2.2 and the References section of the July, 1994 Titan Environmental Report, including:

         (1) February, 1981 D'Appolonia Consulting Engineers, "Assessment of the Water Supply System, White Mesa Project, Blanding, Utah"

(2) *July, 1991 Hydro-Engineering, "Ground-Water Hydrology at the White Mesa Tailings Facility"*

(3) *June, 1994 Peel Environmental Services, "Groundwater Study, White Mesa Facility"*

COMPLETED
Searches were performed as described under 1.1. above. IUSA located 1994 Umetco, 1993 Peel, and 1991 HydroEngineering Reports. IUSA has not located the 1981 D'Appolonia report, and regrets to report that it believes it may not be possible to locate that particular report. However, as noted under 3.1.(3) below, IUSA did locate three additional reports prepared by D'Appolonia, dated September 9, September 28, and November 30, 1981. These are being copied and will be included in the June transmittal to DRC.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
DRC would like the above reports. IUSA transmits herewith the 1994 Umetco, 1993 Peel, and 1991 HydroEngineering Reports.

(2) *Report(s) Prepared for NRC / EPA - including reports to document drilling and hydrogeologic investigations related to existing wells MW-20 thru 22 and geotechnical borings GH-1 thru GH-4 (see discussion above).*

COMPLETED
Searches were performed as described under 1.1. above. IUSA located, during the search of the Mill records, some working files and field notes or data.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
These additional wells and borings were installed as part of the investigation performed by Umetco during the time that the Mill was being considered as a candidate site for disposal of the Monticello tailings. As we discussed, after the decision was made by DOE not to relocate the Monticello tailings to the Mill, the work on these investigations abruptly ceased. No final reports were prepared, and IUSA received no final reports from Umetco during Mr. Roberts' check of Umetco files. However, IUSA located, during the search of the Mill records, some working files and field notes or data, which IUSA is currently organizing and copying, to be transmitted to DRC in the June package.

(3) *Any Other - report related to groundwater hydrology or geology of the site.*

COMPLETED
Searches were performed as described under 1.1. above. IUSA located three additional reports prepared by D'Appolonia, dated September 9, September 28,

and November 30, 1981. These are being copied and will be included in the June transmittal to DRC.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
IUSA is to report to DRC the results of these searches to DRC. IUSA reports above regarding having located the three additional D'Appolonia reports. IUSA has identified no other reports at this time related to groundwater hydrology or geology of the site.

2. *Dames and Moore Borings 3 and 9 [p. 4, Item 3.A.2] - please provide reliable survey coordinates for these two borings at the facility.*

COMPLETED
IUSA is attempting to determine the approximate locations of these borings from historical maps. This information will then be used to approximate the locations on a map.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
DRC agreed that it is acceptable to approximate locations. IUSA will designate those coordinates for which locations have been approximated.

3. *Test Well 17 (East of Mill Site) [p. 4, Item 3.B.1] - we recognize that IUC believes this former test well has been plugged and abandoned. However, please provide the following information for this well: date of well installation, geologic log, well completion diagram, reliable survey coordinates, and a plugging and abandonment report.*

COMPLETED
Mr. Roberts assisted IUSA in reevaluating information on deep wells. Searches were performed as described under 1.1. above. IUSA located, during the search of the Mill records, logs for the deep wells and completion descriptions. This information is being organized and copied, and will be transmitted to DRC in the June package. In addition, Mr. Roberts has developed a deep well summary memorandum describing the test well and other deep wells, which includes a drill date (February 23, 1977) for the test well. Mr. Roberts is continuing to investigate whether or not the "test well" was plugged. The results of this evaluation, together with Mr. Roberts' report on the deep wells, will be included in the June transmittal package to DRC.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
DRC had requested completion diagrams. IUSA reported that construction details are on the driller's report, and asked if these would suffice. DRC indicated that if no other records exist, then the construction details would be acceptable.

4. *Five Dry Wells and Piezometers [p. 5, Item 3.B.3] - apparently IUC was unsuccessful in its attempts to locate the requested information for dry wells MW-16, MW9-1, MW9-2, MW10-1, and MW10-2. However, additional information is required, as follows:*

   (1) Well MW-16 - DRC staff found a well completion diagram and geologic log for this well in the February, 1993 Peel Environmental Services Report (Appendix A).

   (2) Wells MW-16, MW9-1, MW9-2, MW10-1, and MW10-2 - please explain what efforts were completed to locate the required well completion diagrams and geologic logs for these four (4) dry wells. In the event that new efforts find this information, please provide it at your earliest convenience.

COMPLETED
Searches were performed as described under 1.1. above. IUSA located, during the search of the Mill records, logs for the deep wells and completion descriptions. IUSA has also located packer tests for MW16-19 and well logs. The packer test results for MW 16-19 and the 1993 Peel report are being reviewed by IUSA and HGC, for inclusion in a new data table of hydrogeologic parameters. The information used to prepare the data table will be transmitted, together with the table, to DRC in the June package.

5. *Two Nested Angle Borings Near Cell 4A [p. 5, Item 3.B.4] - please explain what efforts were made by IUC to locate the requested information for these two (2) borings. Should new efforts locate this data, please submit it at your earliest convenience.*

COMPLETED
IUSA has reviewed the Work Plan in Appendix F of the 1994 Umetco report. As detailed in response to item 1.1. above, having completed the searches described in 1.1. during the week of April 30-May 4, Mr. Roberts concluded that records transfer information provided to him at the time of closure of IUSA's Grand Junction office appears to be correct; that is, records regarding the Mill were transferred to the Mill, while records regarding the Mines were transferred to the Dove Creek office, and those were later sent on to the Fredonia office. Mr. Roberts believed this to be evident by the fact that raw data from the 1994 drilling campaign were found in Mill archives he searched; therefore, he has reported that he believes it would be fruitless to search for the same records in Fredonia. As a result, the expanded search he performed of the Mill locations is the final search of records.

As a result of these searches, IUSA has also located constant head pressure tests for these borings. Geologic logs have been located. As stated in response to 1.3. above, a video log

that appears to relate to at least two of the borings has been located, and is being reviewed by IUSA. A copy of the video log will be included in the June transmittal to DRC.

IUSA is organizing and sorting these data, and will submit the results in the June data transmittal as shown on the proposed accelerated schedule.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
As stated above, these additional wells and borings were installed as part of the investigation performed by Umetco during the time that the Mill was being considered as a candidate site for disposal of the Monticello tailings. As we discussed, after the decision was made by DOE not to relocate the Monticello tailings to the Mill, the work on these investigations abruptly ceased. No final reports were prepared, and IUSA received no final reports from Umetco during Mr. Roberts' check of Umetco files. However, IUSA located, during the search of the Mill records, some working files and field notes or data, which IUSA is currently organizing and copying, to be transmitted to DRC in the June package.

4. *Land Survey Information [pp. 5-6, Item 4, p. 9, Item 9, and p. 13, Item 13] - we acknowledge submittal of two (2) IUC maps of the facility, including:*

   1. *August 28, 2000 LANDESIGN Site Control Map - prepared by LANDESIGN Engineers, Surveyors and Planners of Grand Junction, Colorado, Sheet 1 of 1, Rev. 1 (submitted as a part of the September 8, 2000 IUC Revised GIR). This drawing included a data table of survey coordinates, and a simple relative position plot for many of the requested facilities at the White Mesa site.*

   2. *IUC Topographic Map - provided to the DRC by Mr. Ron Hochstein of IUC on June 13, 2000. This detailed topographic map, prepared by an unknown party, provides location details for many of the site facilities, including but not limited to: footprint of tailings ponds, tailings pond berms, site roads, mill site, mill site product and process storage tanks, ore storage pad, wildlife ponds, topsoil storage pads, mill process buildings, administration building, current truck scale building, and mill site process wastewater pond ("Roberts Pond"). This map was reportedly prepared at 1:3,600 scale (1" = 300 ft), as derived from photogrammetry data collected for the site in February, 1999.*

   Review of these two (2) IUC maps shows that much of the information requested in the February 7, 2000 DRC RFI has been provided on one map or the other, with the exception of the following items and concerns:

   3. *Combination of Site Plan and Topographic Maps [p. 9, Item 9] - for ease of reference and to facilitate preparation of future DRC hydrogeologic cross-sections and other maps it is essential for all the required elements to be*

presented on a single map. For this reason, DRC staff request that IUC combine the above site control and topographic maps into a single map. Please ensure that the accessible discharge related facilities are shown on the combined map, including, but not limited to [p.5, Item 4.A.1 thru 5, and 4.B.2]: tailings ponds, tailings pond berms, existing groundwater monitoring wells, former wells and piezometers, water supply wells, exploratory borings, dry wells and piezometers, and the chloroform investigation temporary wells.

COMPLETED
IUSA attempted to combine the above noted maps. IUSA is investigating the best means of resolving survey issues. IUSA will then develop maps and cross-sections.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
As discussed with DRC, the existing forms of the maps noted above do not line up exactly. IUSA has begun considering options, and Mr. Roberts has met with the surveyors. IUSA offered to submit, as an interim response, the current form of combined map. IUSA noted that this map would not show exact locations of surveyed points relative to the contour locations, and DRC finds this acceptable as an interim response. DRC clarified that its interest is in knowing where wells are located relative to features of the site, such as ponds or stockpiles. DRC needs x, y, and z coordinates for the wells. IUSA will transmit, in the June package, a draft map combining the two above-noted maps, noting that the locations are approximate relative to the contours. IUSA will continue in its efforts to resolve survey issues, and will, upon resolution of such issues, then prepare updated cross sections and other maps, including perched zone water elevation contour maps and water surface elevation contour maps. These contour maps will be periodically updated by IUSA and provided to DRC.

4. *Nearby Stockwatering Wells [p.6, Item 4.A.6] - nearby stockwatering wells constitute potential points of exposure for the facility. Please provide survey coordinates, including ground surface elevations for both the Jet Pump and Jones stockwatering wells located near the facility.*

COMPLETED
IUSA is attempting to determine the approximate locations of these stockwatering wells. This information will then be used to approximate the locations on a map.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
DRC agreed that it is acceptable to approximate locations. IUSA will designate those coordinates for which locations have been approximated.

5. *Nearby Contact Seeps and Springs [p. 13, Item 13] - nearby seeps and springs at the edge of White Mesa also form potential points of exposure for the facility. Please provide survey coordinates and ground surface elevations for all contact seeps and springs near the facility.*

COMPLETED
In the September 8, 2000 GIRRP submittal to DRC, IUSA submitted aerial photos, as DEQ agreed would be acceptable. As reported in the GIRRP, IUSA could not, however, provide detailed land survey locations for all contact seeps and springs, because such features vary depending on a number of hydrogeologic conditions. IUSA submitted a current map showing water surface elevations for the perched groundwater zone. The water surface elevations in the perched groundwater zone generally decrease near the margins of the canyons, where the perched groundwater zone thins and is discharged. IUSA transmitted in Attachment 10 of the GIRRP an aerial photograph showing vegetative patterns indicative of seepage along the nearest canyon margins, which, based on our meeting of April 7, 2000, we understood to be sufficient for the present purposes.

SCOPE OF RESPONSE, BASED ON DRC/IUSA MEETING OF APRIL 25, 2001
In addition to the foregoing response, DRC requested that IUSA now also attempt to develop survey coordinates for those seeps which appear to have been developed in the past. Evidence of development would be the presence of pipes (flowing or not) or stock tanks. IUSA will conduct field reconnaissance to attempt to define locations of such features and will also, as DRC suggests, evaluate means of approximating, with reasonable accuracy, the x, y, and z coordinates for such features. Hand-held GPS may provide sufficient resolution, or historic maps may be used to approximate locations and elevations of these features. IUSA will investigate methods of mapping those well-defined features, and will discuss its findings with DEQ.

6. *Confirmation of DRC Estimated Scalehouse Leachfield Coordinates [new item] - after comparison of the site plan map from the October 4, 2000 chloroform investigation report (Figure 11) with the IUC topographic map provided on June 13, 2000, we have estimated the survey coordinates of the septic tank drainfield located a short distance Southwest of the existing truck scale house. Please confirm the accuracy and content of the DRC estimated survey coordinates for this leachfield, as provided in Table 1, below:*

Table DRC 1. Estimated Survey Coordinates: Former IUC Truck Scale House Leachfield

Corner	*Easting (feet)*	*Northing (feet)*
Northwest	*2,580,735*	*322,330*
Northeast	*2,580,800*	*322,330*
Southeast	*2,580,800*	*322,260*
Southwest	*2,580,735*	*322,260*

COMPLETED
IUSA is evaluating the above coordinates. The searches defined above under 1.1. yielded engineering drawings which depict the design location of the historic scalehouse leachfield. IUSA will use the drawings to estimate the coordinates of this particular leachfield.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
IUSA noted that it would like to prepare more complete maps that could include the above feature, after the survey results are reviewed. IUSA notes that the review of the survey data may alter IUSA's interpretation of the above results.

IUSA was requested by DRC to include this feature on maps that would be provided to DRC.

7. *Submittal of Survey Coordinates for Related Facilities [new item] - after review of the IUC information provided to date, DRC staff have determined that additional related facilities at the site need to be located on the combined site plan and topographic map, including but not limited to:*

   (1) Existing Administration Building Septic Tank Drainfield - reportedly located a short distance North-Northwest of the truck scale house.

   (2) Former Administration Building Septic Tank Drainfield - once located southeast of the main office building.

   (3) Former Laboratory Wastewater Storage Tank and Drain Pipe - including the location of the above ground tank that was once located on the North side of the mill administration building and the pipe that drained it to the mill site wastewater catch pond ("Roberts Pond').

   (4) Former Mill Site Sedimentation Pond - also known as the fly-ash pond (6/79 D'Appolonia Design Report, Sheet 4 of 16).

   (5) Former Solid Waste Landfill - located near one of the wildlife ponds East of the mill site.

Please ensure that the survey coordinates for all of the related facilities outlined above are accurately plotted on the combined map also requested.

COMPLETED
The searches defined above under 1.1. yielded engineering drawings which depict the design locations of these features. To the extent possible, IUSA will use the drawings to estimate the coordinates of these features.

SCOPE OF RESPONSE, BASED ON DRC/IUSA MEETING OF APRIL 25, 2001
IUSA noted that it would like to prepare more complete maps that could include the above features, after the survey results are reviewed. Other corrections to the survey database should be performed first. Then, these maps would be provided to DRC.

5. *Explanation for Increasing Groundwater Head Trends [p. 14, Item 14] - we appreciate the description of the number of wells and the magnitude of head increase seen in wells at the facility (9/8/00 IUC Revised GIR, p. 26). However, as outlined in the March 13, DRC Request for Confirmation (RFC) letter, DRC staff will complete the final water table contour and isopach thickness maps for the shallow aquifer (3/13/01 DRC letter, pp. 4-5). This leaves two remaining items from the February 7, 2000 DRC RFI that continue to be unresolved, as outlined below:*

   1. *Plan and Schedule for Additional Monitoring Wells or Piezometers [p.15, Item 14.C] - we have reviewed your September 8, 2000 response and found it failed to address the need to identify the root cause for the increasing head trend. As explained previously it is likely that the rising groundwater levels observed is likely due to some artificial source of groundwater recharge. Consequently, such a study will require the installation of additional wells and/or piezometers in order to identify the source of the man-made recharge. In order to facilitate this effort, DRC staff have prepared several figures to guide your planning, as described below:*

      (1) *DRC Corrected Well Hydrographs - have been prepared for existing monitoring wells at the facility, based on corrected groundwater elevation data provided you in the March 13, 2001 DRC RFC letter, see Attachment 1, below. These hydrographs establish that the wells with the greatest increases in groundwater head include (in decreasing order): MW-4, MW-19, MW-18, and MW-11.*

COMPLETED
IUSA has, in the Chloroform Investigation, provided (based on discussions with DRC) qualitative data as to potential sources of increasing water levels observed on the eastern portion of the Mill property. However, we understand DRC's request that IUSA further investigate the increasing water levels in certain wells. We are currently reviewing this issue to determine the best way to answer DRC's questions. We will submit a final response to these questions in our June 22, 2001 submittal.

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
At the April 7, 2000 meeting, DRC indicated that the objective of evaluating water level increases would be to provide contour maps using local water level data to show how the perched groundwater zone has behaved over time.

As IUSA and DRC discussed, IUSA will take responsibility for preparing water table contour and saturated thickness maps for the perched groundwater being monitored at the Mill. As we discussed, IUSA is responsible for maintaining water levels and water quality data in databases for a number of regulatory purposes. To optimize management of these data, IUSA will need to continue to generate these databases, but will be happy to provide DRC with electronic copies as the databases are updated. In addition, IUSA will task independent hydrologists to assist us in preparation of contour maps, using the correct interpretive tools based upon the distribution of the data at the site. IUSA requested assistance from our independent hydrologists, HGC, in reviewing the contour maps prepared by DRC. A technical memorandum was prepared by HGC regarding this review, which identifies concerns and limitations with respect to use of computer-aided plotting packages when data are unevenly distributed. HGC's memorandum is transmitted herewith. IUSA will make cautious use of such packages, and will produce hand-contoured maps when the data distribution indicate this to be a more appropriate method.

(2) *DRC Water Table Equipotential Map: September, 2000 - this water table contour map prepared from IUC water level data collected in September, 2000 includes groundwater head data from most of the existing monitoring wells at the site, plus all the chloroform investigation wells recently installed. Review of this DRC map suggests that the artificial groundwater recharge source is located North and East of wells MW-4 and MW-19, see Attachment 2, below.*

COMPLETED
Please see responses to item 5.1.(1) above.

(3) *DRC Delta Head Contour Map - the magnitude of increased head in each IUC well was calculated by DRC staff after review of the hydrograph trends seen in Attachment 1. DRC staff took selected heads from the spring of 1983 as representative of baseline conditions at the facility. From this, increases in head were calculated for each well thru Summer, 2000. These head increases (Delta Head values) were then tabulated and contoured on a map; see Attachment 3, below. This map suggests that the artificial source of groundwater recharge is located east of MW-4 and MW-19.*

Please provide a plan and schedule for the installation of additional monitoring wells and/or piezometers to locate the source of the artificial groundwater recharge apparent North and East of wells MW-4 and MW-19.

COMPLETED
Please see response to item 5.1.(1) above.

2. *Additional Groundwater Quality Data [p. 15, Item 14.D] - we acknowledge that your chloroform investigation report will address groundwater quality issues and the potential for other contaminants as indicators of chloroform discharge (10/4/00 IUC Chloroform Report). We have also received your September 15, 2000 Groundwater Background Water Quality Report. This issue and both of these reports will be reviewed at a later date.*

6. *Shallow Aquifer Field Permeability: Copies of Notes, Calculations, and Data [pp. 11-12, Item 11.B] - the September 8, 2000 IUC response referred to your failure to locate copies of original laboratory permeability data. In contrast, our original February 7, 2000 request was for copies of notes, calculations, and data for the field permeability tests conducted on monitoring wells, borings, and piezometers at the facility. To reiterate, please provide the following:*

   1. *Field notes and data collected from each field permeability test, and*

   2. *Detailed description and justification of calculations and analysis methods used to determine permeability. In the event that test data from certain wells was re-analyzed, please explain why re-analysis was required.*

After submittal and review of this information, DRC staff will prepare a summary table of all available permeability data and ask for IUC concurrence.

In the event that the information requested above cannot be provided, please submit a plan and schedule for field permeability testing of all shallow aquifer wells and piezometers at the facility.

COMPLETED
Searches were performed as described under 1.1. above. In addition, HGC is compiling some of its field notes and a discussion of analytical techniques for the tests conducted at MW-4 and MW-19. IUSA and its consultant will compile, review, and table any data located. Updated tables and associated data (when available) will be provided to DRC. Based on this complete review of available hydraulic data, IUSA will evaluate any potential need to conduct selected pump tests on wells for which adequate data are not available.

The drilling and logging data indicate that the physical characteristics of the rocks beneath the Mill vary considerably both vertically and laterally. Therefore, in June of 2000, IUSA discussed with DRC the appropriateness of attempting to use the limited data available to create a "contour" map based on specific data for specific bore holes. The feasibility of such an approach may be limited in view of the fact that hydraulic properties of this stratum, which have been determined from 12 single, well-pumping/recovery tests and from 30 packer tests yielded a broad range of hydraulic

properties, which will not reasonably lend themselves to a defensible contouring approach. Furthermore, the depositional history and composition of the Burro Canyon Formation is such that one would expect random variability rather than mapable contours from one point to another.

In response, DRC indicated that, in some situations, it is possible to convert permeability test results to log values and create contour maps of the log values. DRC indicated that they would want to see the field notes first. DRC stated an interest in first reviewing the data and field notes, then determining how best to present the results. DRC suggested that IUSA submit a phased approach encompassing these two elements, in the GIRRP. IUSA discussed this issue further with DRC on August 14, and agreed to create a map showing the point-specific permeability values as part of the GCI Report. This report was transmitted under separate cover, and as per the Chloroform Investigation schedule. See Figure 2, Permeability of Perched Groundwater Zone in cm/s, in Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill near Blanding, Utah (IUSA and HGC, October 4, 2000).

SCOPE OF RESPONSE, BASED ON DRC/IUSA APRIL 25 MEETING
IUSA will compile data requested by DRC, will review such data, and will table the data in a format compatible with DRC's draft tables and spreadsheets that DRC provided to IUSA. To ensure integrity of the database used by IUSA for the Mill's regulatory purposes, and to preserve DRC's position of the reviewer of Mill technical submittals made to DRC, IUSA will then maintain such tables and spreadsheets for use in preparing technical submittals for DRC including data plots, contour maps, etc., and will provide DRC with copies of these same tables and spreadsheets.

IUSA is committed to bringing the GWDP approval process to completion as soon as possible. With the added help of Mr. Roberts, who has the most complete historical knowledge of Mill activities, IUSA believes it has made considerable progress since our last submission in collecting the additional information being requested by DRC. In addition, in order to make up for some delays in accumulating the historical information, we have already initiated work on other GWDP tasks that were initially to run in series following completion of GIRRP comments, but which now, in the accelerated schedule, are being managed concurrently.

If you have any questions or comments regarding this letter, please contact me at (303) 389-4130.

Yours truly,

David C. Frydenlund
Vice President and General Counsel

Enclosures

cc/att: Larry Mize, UDEQ Division of Water Quality
Loren Morton, UDEQ Division of Radiation Control
Bill von Till, NRC
Michelle R. Rehmann
Harold R. Roberts

cc w/out att: Dianne Nielson, UDEQ
Dave Arrioti, S.E. Utah Health Department

attachment 3

DOCUMENTS on ADAMS RELATED TO INTERNATIONAL URANIUM (USA) CORPORATION (IUSA), WHITE MESA MILL, GROUND WATER DISCHARGE PERMIT (GWDP) from the STATE OF UTAH, DIVISION OF RADIATION CONTROL (DRC): NRC DOCKET NO. 40-8681

Accession Number: ML012270225
Title: Letter Report Groundwater Monitoring Program Assessment Recommended Operational Phase Program White Mesa Project Blanding, Utah.
Document Date: 11/30/81
Estimated Page Count: 68
Document Type: Letter
Author Affiliation: Ground Technology, Inc

Accession Number: ML012010414
Title: "Ground-Water Hydrology at the White Mesa Tailings Facility."
Document Date: 7/31/91
Estimated Page Count: 100
Document Type: Environmental Report
Author Affiliation: Hydro-Engineering, LLC

Accession Number: ML012010153
Title: "Groundwater Study, White Mesa Facility, Blanding, UT."
Document Date: 1/31/93
Estimated Page Count: 179
Document Type: Environmental Report
Author Affiliation: Umetco Minerals Corp

Accession Number: ML012010117
Title: Appendix D, "Water Quality Data," to Groundwater Study, 1994 Update, White Mesa Facility, Blanding, UT.
Document Date: 6/30/94
Estimated Page Count: 110
Document Type: Environmental Report
Author Affiliation: Umetco Minerals Corp

Accession Number: ML993470117
Title: Transmittal of Report on Eight Other Parameters Discussed in LDEQ Transmittal Letter of August 23, 1999 - Utah DEQ Notice of Violation and Groundwater Corrective Action Order, UDEQ Docket No UGQ-20-OI, Issued on August 23, 1999
Document Date: 11/29/99
Estimated Page Count: 57
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML993470118
Title: Transmittal of Report on Eight Other Parameters Discussed in LDEQ Transmittal Letter of August 23, 1999 - Utah DEQ Notice of Violation and Groundwater Corrective Action Order, UDEQ Docket No UGQ-20-OI, Issued on August 23, 1999
Document Date: 11/29/99
Estimated Page Count: 57
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML993470168
Title: Licensee Observations Regarding Comments from the Utah Department of Environmental Quality Division of Radiation Control Dated November 29, 1999 on the Environmental Assessment for the White Mesa Uranium Mill Reclamation Plan
Document Date: 12/7/99
Estimated Page Count: 5
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML993500066
Title: Letter discussing 991216 meeting re groundwater discharge permit for the White Mesa Mill, per resolving major policy issues.
Document Date: 12/13/99
Estimated Page Count: 10
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML993620338
Title: Follow-up to Meeting of December 16, 1999, to Discuss Groundwater Discharge Permit for the White Mesa Mill and November 19, 1999 Proposal.
Document Date: 12/22/99
Estimated Page Count: 6
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML993620315
Title: Follow-up to Meeting of December 16, 1999, to Discuss Groundwater Discharge Permit for the White Mesa Mill
Document Date: 12/22/99
Estimated Page Count: 7
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003727531
Title: Transmittal of Program for Delineation of Elevated Chloroform in Perched Groundwater at MWA, for Chloroform Investigation Phase 4 - Utah DEQ Notice of Violation and Groundwater Corrective Action Order, UDEQ Docket No. UGQ-20-01.
Document Date: 1/28/00
Estimated Page Count: 2
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003727550
Title: PROGRAM FOR DELINEATION OF ELEVATED CHLOROFORM IN PERCHED GROUNDWATER AT MW-4
Document Date: 1/28/00
Estimated Page Count: 50
Document Type: Program Review
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003679546
Title: PROGRAM FOR DELINEATION OF ELEVATED CHLOROFORM IN PERCHED GROUNDWATER AT MW-4
Document Date: 1/28/00
Estimated Page Count: 50
Document Type: Report, Miscellaneous
Author Affiliation: Geochem Ventures International, Hyro Geo Chem, Inc, International Uranium (USA) Corporation, Knight Piesold, LLC

Accession Number: ML003679526
Title: Letter forwarding International Uranium Corporation report
Document Date: 1/28/00
Estimated Page Count: 2
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003684405
Title: Revised Draft Schedule for Submittals and Follow-up Actions Relative to the Groundwater Discharge Permit for the White Mesa Mill
Document Date: 2/11/00
Estimated Page Count: 4
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003692496
Title: February 11, 2000 IUC Revised Draft Schedule for Submittals and Follow-up Actions Relative to the Groundwater Discharge Permit for the White Mesa Mill
Document Date: 3/9/00
Estimated Page Count: 2
Document Type: Letter
Author Affiliation: State of UT

Accession Number: ML003696190
Title: UDEQ Approval of February 11, 2000 IUSA Revised Draft Schedule for Submittals and Follow-up Actions Relative to the Groundwater Discharge Permit for the White Mesa Mill, with Key Conclusions as to the Scope of Each GWDP Element
Document Date: 3/24/00
Estimated Page Count: 3
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003696201
Title: UDEQ Approval of February 11, 2000 IUSA Revised Draft Schedule for Submittals and Follow-up Actions Relative to the Groundwater Discharge Permit for the White Mesa Mill
Document Date: 3/24/00
Estimated Page Count: 2
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003733347
Title: Letter from State of Utah, Department of Environmental Quality acknowledgement of nine different ICU submittals provided in response to 08/23/1999 notice of violation and order.
Document Date: 7/3/00
Estimated Page Count: 14
Document Type: Letter
Author Affiliation: State of UT, Dept of Environmental Quality

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Accession Number: ML003730375
Title: Revised Schedule for Submittals and Follow-up Actions Relative to the Groundwater Discharge Permit for the White Mesa Mill, for UDEQ Review and Approval
Document Date: 7/5/00
Estimated Page Count: 3
Document Type: Letter
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003730380
Title: Drawing:Draft Revised Schedule for White Mesa Mill GWDP Submittals - 07/05/00
Document Date: 7/5/00
Estimated Page Count: 1
Document Type: Drawing
Author Affiliation: International Uranium (USA) Corporation

Accession Number: ML003760521
Title: Revised Schedule for White Mesa Mill GWDP Submittals - 08/22/00
Document Date: 8/22/00
Estimated Page Count: 1
Document Type: Graphics incl Charts and Tables
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML003752416
Title: Submittal of Groundwater Information Report Revision Package for the Groundwater Discharge Permit for the White Mesa Mill
Document Date: 9/8/00
Estimated Page Count: 166
Document Type: Environmental Report
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML003752609
Title: Submittal of Summary of Groundwater Background Water Quality and other Water Quality Studies for the White Mess Mill
Document Date: 9/15/00
Estimated Page Count: 321
Document Type: Environmental Report, Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML003760563
Title: Investigation of Elevated Chloroform Concentrations in Perched Groundwater at White Mesa Uranium Mill Near Blanding,Utah
Document Date: 10/4/00
Estimated Page Count: 164
Document Type: Report, Miscellaneous
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML012010068
Title: International Uranium Corporation Appreciation Letter for Comments Recieved from Utah Department of Environmental Quality Division of Radiation Control Transmitted by Letter Dated 3/20/01.
Document Date: 5/11/01
Estimated Page Count: 34
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML012010074
Title: (Draft for Comment) Revised Schedule for White Mesa Mill GWDP Submittals-05/11/01.
Document Date: 5/11/01
Estimated Page Count: 1
Document Type: Drawing
Author Affiliation: Umetco Minerals Corp

Accession Number: ML012270250
Title: International Uranium (USA) Corporation White Mesa Mill Topographic Map - 1999 Contour Base.
Document Date: 6/22/01
Estimated Page Count: 1
Document Type: Drawing
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML012270157
Title: Follow up to International Uranium (USA) Corp 05/11/2001 letter re additional information on revised groundwater information report.
Document Date: 6/22/01
Estimated Page Count: 144
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML012540085
Title: Letter forwarding copy of video tape from the 1994 drilling program at White Mesa site.
Document Date: 6/26/01
Estimated Page Count: 1
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML011990175
Title: Background for new indicator parameters/ground water discharge permit application for White Mesa mill.
Document Date: 7/13/01
Estimated Page Count: 38
Document Type: Letter, Report, Miscellaneous
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML012820272
Title: Compliance Ranges for Groundwater Protection Ground Water Discharge Permit Application, White Mesa Mill.
Document Date: 10/3/01
Estimated Page Count: 44
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML020840376
Title: Letter from Loren B Morton re Request for Copies of the Division of Radiation Control Results from Split Groundwater Sampling Event.
Document Date: 10/11/01
Estimated Page Count: 25
Document Type: Letter
Author Affiliation: State of UT, Dept of Environmental Quality, Div of Radiation Control

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Accession Number: ML013240517
Title: Evaluation of Hydraulic Test Data, Monitor Well 4 Ground Water Discharge Permit Application, White Mesa Mill.
Document Date: 11/13/01
Estimated Page Count: 35
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML013270221
Title: Transmittal of documentation on closure activities related to the White Mesa Mill mill area sedimentation pond. Correspondence to the NRC from Umetco Minerals followed by authorization from the NRC for closure of the pond & analytical results attached.
Document Date: 11/16/01
Estimated Page Count: 16
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML020220145
Title: Letter providing written request to relay several questions that arose during review of the 12/31/98 Knight-Piesold report entitled, "Methodology for Calculation of Flux Through the Cell 3 Liner, White Mesa Mill."
Document Date: 11/28/01
Estimated Page Count: 10
Document Type: Letter
Author Affiliation: State of UT, Dept of Environmental Quality, Div of Radiation Control

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Accession Number: ML020780420
Title: White Mesa Mill - Request for Additional Information and Installation of New Monitoring Well Adjacent to MW-4.
Document Date: 3/7/02
Estimated Page Count: 11
Document Type: Letter
Author Affiliation: State of UT, Dept of Environmental Quality, Div of Radiation Control

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Accession Number: ML021190412
Title: Transmittal of 4th Quarter 2001 and 1st Quarter 2002 Chloroform Monitoring Data from International Uranium (USA) Corporation.
Document Date: 4/19/02
Estimated Page Count: 18
Document Type: Environmental Monitoring Report, Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021340272
Title: Chloroform Investigation Schedule
Document Date: 5/3/02
Estimated Page Count: 3
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021300383
Title: March 7, 2002 letter from Bill Sinclair re additional information on construction & testing done on Monitor Well 4 at White Mesa Mill site.
Document Date: 5/8/02
Estimated Page Count: 3
Document Type: E-Mail
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021630010
Title: IUC - Temporary Well and Piezometer Installation/Completion Report, Utah DEQ NOV & Groundwater Corrective Action Order.
Document Date: 5/9/02
Estimated Page Count: 29
Document Type: Report, Technical
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021400354
Title: International Uranium (USA) Corporation - Interim Action Involving Pumping and Reuse of Chloroform Contaminated Water.
Document Date: 5/10/02
Estimated Page Count: 5
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021640365
Title: Work Plan for Installation of Additional Monitor Wells Further Delineation of Chloroform Plume on White Mesa Mill Site.
Document Date: 5/16/02
Estimated Page Count: 19
Document Type: Letter, Report, Miscellaneous
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021690266
Title: International Uranium (USA) Corporation Work Plan for DNAPL Investigation.
Document Date: 5/23/02
Estimated Page Count: 19
Document Type: Letter
Author Affiliation: International Uranium (USA) Corp

Accession Number: ML021640370
Title: International Uranium (USA) Corp., Work Plan for Hydraulic Testing of Perched Zone Monitor Wells at White Mesa Mill Site.
Document Date: 5/24/02
Estimated Page Count: 12
Document Type: Letter, Report, Miscellaneous
Author Affiliation: International Uranium (USA) Corp

(This list is not a complete list of the documents related to IUSA/DRC correspondence related to the GWDP and Chloroform Investigation.)

attachment 4

July 28, 2002

Critique by Ivan Weber of IUSA Response to Presiding Officer's Request for Additional Information pertaining to Ground Water

The additional documents submitted by IUSA, at the request of the Presiding Officer, provide no new data or interpretations to create any scientific comfort, neither about the probability of tailings liquid contamination of ground water, nor about the capacity of the ground water monitoring scheme's adequacy for detecting leakage. Instead, the IUSA pattern is continued, consisting of 1) reliance on extremely old, very sparse data taken from wells of questionable methodological veracity, placed in a manner that does not remotely approach an adequate ground water monitoring system to support a particularly porous tailings cell liner system; 2) unsubstantiated, optimistic interpretations of data from wells that probably should be thrown out and replaced, as well as on 20-year old contentions that the monitoring wells are functioning as intended, but without adequate data to support those contentions, or to support the adequacy of the original monitoring plan; 3) continued, pervasive reliance on the supposition of natural attenuation in the underlying aquifer, which, IUSA contends, is unusable anyway; and 4) resistance to the creation of an adequate ground water monitoring system, particularly in response to ongoing Utah DRC requests for replacement of well MW-4 , offering verification of critical contact depth of subsurface geological strata. The relevance of this sophistry to the proposed alternative feed materials processing is clear, even in the "incremental" terms for which IUSA's counsel campaigns. No amount of statistical analysis can overcome the very remote chances that this ground water monitoring system will actually detect contamination before the aquifer is damaged. No amount of rationalization or extrapolation from antique data can create a current, scientifically reliable picture of how the overall system works. In the meantime, the tailings cells continue to leak and deteriorate.

As we have stated previously, the facility is extremely likely not only to leak severely at present, but also to have leaked very significant quantities of highly contaminated tailings process fluids in the past. The ground water monitoring system design indifferently accepts that probability, we contend, as expressed in the "defense-in-depth" strategy presented by IUSA's consultants. We are still presented with two diametrically opposite theories, which we are asked to accept at face value, relying on them simultaneously, however unreconciled:

- "Defense-in-depth" natural, geochemical attenuation, which supposes that it is acceptable for these extremely acidic waters to percolate downward through inadequate, very permeable containment basins.
- Dispersed, widely separated ground water monitoring wells, at least one of which (MW-4) was installed with such poor logging methods that it should be disqualified, leading us inevitably to question the veracity of the others.

IUSA presents nothing in these additional, old reports to show that the system possesses completeness beyond previously available documents. Statistical analyses postulated by IUSA do nothing to simulate the monitoring completeness that would warrant, together with adequacy of basin containment liners, consideration of an alternate feed authorization.
The IUSA situation was, and remains, a ground water contamination disaster in the making.

We respectfully submit these comments on the recent IUSA responses, and can only add that the many Utah DRC requests for additional information and additional monitoring well drilling are, at least, reasonable steps in the right direction. New investigations and new data, however, are required to construct a scientifically responsible picture of what the facility is doing to the aquifers before authorization of alternative process feeds.

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge. Executed on this 28th day of July, 2002.

Sincerely,

Ivan Weber
Principal/Owner ,Weber Sustainability Consulting
953 First Avenue, Salt Lake City, Utah 84103
(801)355-6863 / (801)651-8841 cellular, phyto@utah-inter net

attachment 5

40-8681

INTERNATIONAL URANIUM (USA) CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 628 7798 (main) • 303 389 4125 (fax)

July 13, 2001

Mr. William J. Sinclair, Director
Division of Radiation Control
State of Utah, Department of Environmental Quality
168 North 1950 West
P.O. Box 144850
Salt Lake City, UT 84114-4850

Mr. William J. Sinclair

Re: Background for New Indicator Parameters/Ground Water Discharge Permit Application for White Mesa Mill

Dear Mr. Sinclair:

As promised to you in the May 11, 2001 revised submittal schedule, we are enclosing a copy of the Background for New Indicator Parameters Report for potential additional sampling parameters in monitoring wells located at the White Mesa Uranium Mill (the "Mill"). This Report has been prepared by Roman Z. Pyrih & Associates as an evaluation of background for a proposed list of indicator parameters, in response to Division of Radiation Control (DRC) requests for an expanded monitoring program at the Mill. Consistent with our discussion, the report recommends use of intra-well statistical approaches defined by EPA for RCRA groundwater monitoring, to determine background for any new monitoring parameters that are included in the GWDP as indicators of potential releases from the regulated units.

We request that DRC provide initial comments on the Report by August 1, 2001. We can then finalize the Report by August 15th, and utilize the Report for the basis of the Compliance Level Report, which is due to be submitted to DRC on August 10, 2001.

If you have any questions, please feel free to contact me at (303) 389-4160.

Very Truly Yours,

Harold R. Roberts
Vice President – Corporate Development

Enclosures

cc/att: Larry Mize, UDEQ Division of Water Quality
Loren Morton, UDEQ Division of Radiation Control
R. William von Till, NRC
Michelle R. Rehmann
Stewart J. Smith
Roman Pyrih

cc w/out att: Dianne Nielson, UDEQ
Dave Arrioti, S.E. Utah Health Department
Ron F. Hochstein, IUSA
David C. Frydenlund, IUSA

NMSSOIPUBLIC

Background for New Indicator Parameters

White Mesa Uranium Mill

July 13, 2001

Submitted by
International Uranium (USA) Corporation
to
Utah Division of Radiation Control

Prepared by
Roman Z. Pyrih & Associates, Inc.
17326 West 57th Avenue
Golden, CO 80403

Introduction

This report provides the rationale for a draft list of monitoring parameters to be included in a Groundwater Discharge Permit (GWDP) to be issued by the Utah Department of Environmental Quality (UDEQ), for the White Mesa Uranium Mill (Mill) which is located in Blanding, Utah. The report addresses regulatory and technical issues that justify the choice of monitoring parameters and proposes a methodology for delineating background for the new parameters. Compliance levels will be addressed in a subsequent report. When integrated into the GWDP, the monitoring parameters and compliance levels that are assigned to the parameters will provide further assurance that the monitoring demonstrates protection of groundwater quality at the Mill.

This report and recommendations were prepared based on a thorough review of the following:

- UDEQ administrative rules for groundwater quality protection;
- The draft GWDP and statement of basis provided by UDEQ for the Mill;
- UDEQ GWDPs issued for other 11e.(2) sites in Utah;
- Various hydrogeologic reports on the Mill to include Titan's Hydrogeologic Evaluation (1994) and Point of Compliance (1994), IUSA's Groundwater Information Reports (1999 and 2000), and Summary of Groundwater Background Water Quality (2000);
- Numerous correspondences between IUSA and UDEQ;
- Historical groundwater data from the Mill and recent semi-annual effluent reports.

Hydrologic Conditions at the Mill

In the area of the Mill, groundwater occurs in three strata: the Dakota Sandstone, the Burro Canyon Formation, and the Entrada/Navajo Sandstones. Within the Dakota Sandstone and the Burro Canyon Formation, groundwater is found in a single groundwater perched zone above bentonitic mudstones and claystones. The saturated thickness of the perched zone thins to the south of the Mill where it discharges as springs into dissecting canyons. Downgradient of the Mill, groundwater from the perched zone cannot be used for irrigation or domestic consumption because of the natural poor quality of the water and the low yield rates of the perched zone. At the Mill, the tailings cells are constructed within the unsaturated, Dakota Sandstone. Any leakage of tailings solutions would have to seep through 100 feet of unsaturated material before reaching the perched zone.

The Entrada/Navajo Aquifer is the principal artesian aquifer in the area that is used regularly for irrigation and domestic consumption. At the Mill, the Entrada/Navajo Aquifer is separated from perched water in the Dakota Sandstone and Burro Canyon

Formation by more than 1,200 feet of low permeability, unsaturated strata. The combination of low permeability, thick unsaturated strata and the artesian pressures within the aquifer provides a physical and hydrologic barrier to seepage of tailings solutions.

Although the perched groundwater beneath the Mill cannot be classified as a useable aquifer, it does provide the earliest groundwater horizon for the detection of tailings cell leakage. The perched groundwater is in the path of any seepage from the cells and, as such, can provide early detection of any cell leakage. In order to protect the Entrada/Navajo Aquifer, monitoring the overlying perched groundwater must be designed to detect constituents that are indicative of tailings effluents.

Monitoring data collected since 1979 indicates that the groundwater in the perched groundwater zone is of poor and variable water quality. Groundwater is perched above mudstones and claystones that are sources of trace metals that have been detected in the monitoring wells in the area. Moreover, slow groundwater velocities allow the perched water to equilibrate with local mineralogy, dissolving sulfate from the rock to concentrations that elevate the total dissolved solids of the groundwater into the poor water-quality range.

To be truly protective of the Entrada/Navajo Aquifer, the successful monitoring program must recognize the natural variability of the perched groundv ater quality. The program must be designed to differentiate chemicals that are natural constituents of the perched groundwater from chemicals that may be contributed by seepage from the facilities. The interpretation of the monitoring data must recognize that certain constituents will show a range in concentration that is natural and expected in low-quality groundwater.

Groundwater Classification

Groundwater quality standards, as listed and adopted in Utah Administrative Code, R317-6, are the basis for UDEQ issuing a GWDP. The standards cover physical characteristics of groundwater such as color, odor, and pH; inorganic chemicals such as cyanide, fluoride, and total nitrate/nitrite; 10 metals regulated in drinking water; an extensive list of organic chemicals; and natural and man-made radionuclides. The Executive Secretary reserves the right to establish permit-specific groundwater quality standards for any pollutant not specified in the Administrative Code.

Under the Utah Administrative Code, classes of groundwater are established based on background levels of total dissolved solids (TDS) and on the absence or presence of contaminants at concentrations exceeding the groundwater quality standards. Class II groundwater, described as "drinking water quality", has TDS greater than 500 mg/L but less than 3,000 mg/L, and no contaminant concentration that exceeds groundwater quality standards listed in the code. Class III groundwater, described as "limited use", has TDS greater than 3,000 mg/L but less than 10,000 mg/L, or one or more contaminants that exceed the groundwater quality standards listed in the code.

Based on historical TDS data, perched groundwater in cross-gradient monitoring wells MW – 2 and 4, and in downgradient monitoring wells MW- 3, 12, 14, 15, and 17 would be classified as Class III, limited use groundwater. Based on the TDS criteria alone, perched groundwater in upgradient monitoring wells MW- 1, 18 and 19 and downgradient wells MW- 5 and 11 would be classified as Class II, drinking water quality groundwater.

Groundwater analyses from the May 1999 split sampling reported manganese at levels that exceed the U.S. EPA secondary drinking water standard of 0.05 mg/L in upgradient wells MW- 1 and 19 and downgradient wells MW- 5 and 11. Also, perched groundwater from all the wells across the Mill site exceeds the U.S. EPA secondary standard for sulfate. Historical data and the May 1999 sampling indicate sulfate in a range between 600 and 2,220 mg/L in perched groundwater from these wells, compared to the U.S. EPA drinking water standard of 250 mg/L. Sulfate is the predominant component of total dissolved solids (TDS) criteria, and it is the TDS criteria that dictate groundwater classification in the Utah Administrative Code.

Elevated manganese and sulfate make perched groundwater from wells MW – 1, 5, 11, 18 and 19 unfit as drinking water. For this reason, it would be justifiable to classify the perched groundwater as Class III, and not Class II.

According to the Administrative Code, at the discretion of the UDEQ, an entire aquifer or parts of the aquifer may be classified according to the quality of the groundwater that is present. Parts of an aquifer may be classified differently. Boundaries for class areas can be delineated so as to enclose distinct groundwater classes depending upon existing water quality and/or hydrogeologic properties.

However, assigning the perched groundwater at the Mill to two classes (Class II and Class III) is not justified either hydrologically or geochemically. All the monitoring wells collect groundwater from the same perched groundwater zone, and virtually all of the wells indicate a perched groundwater zone of Class III water quality that is unsuitable as drinking water due to manganese and/or sulfate content.

Groundwater Protection Levels

Groundwater protection levels, based on groundwater class, have been written by UDEQ into GWDPs to set limits on pollutant concentrations which are not to be exceeded in any compliance well. For Class II groundwater, groundwater protection limits (GWPLs) for contaminants can be set at 0.25 times the groundwater protection standards listed in the Code, or at 1.25 times the concentration determined to be the background level. The GWPLs are more lenient for Class III groundwater and can be set at 0.5 times the groundwater protection standards or at 1.5 times the concentration determined to be the background level. However, UDEQ has the flexibility to adopt other, more appropriate

forms of determining groundwater protection if the use of GWPL formulas mandate protection levels that are realistically unattainable.

Draft GWDP

The draft GWDP prepared for the Mill in November, 1999, by UDEQ stipulated GWPLs that were to be applied to all groundwater compliance wells at the Mill. Not having the opportunity to review or validate any historical groundwater monitoring data, the UDEQ based the GWPLs on the assumption that none of the listed chemicals occur in detectable quantities as background concentrations, and calculated the GWPLs as a fraction of the groundwater quality standard as directed in the Administrative Code. All GWPLs assigned in the draft GWPL were determined by multiplying the groundwater quality standard by the applicable factor, that is, 0.25 or 0.50 for Class II or Class III groundwater, respectively.

Four inorganic compounds and one field parameter were stipulated in the draft GWDP; namely, ammonia, nitrate + nitrite, cyanide, fluoride, and pH. Ammonia was included on the basis that the reagent is used in the milling process and could be an indicator of mill-effluent seepage; and nitrate and nitrite are geochemically mobile degradation products of ammonia. Cyanide and fluoride have been required at another 11e.(2) discharge facility permitted by UDEQ. To the ten metals listed in the Administrative Code that have groundwater quality standards, UDEQ stipulated an additional five metals; namely, beryllium, nickel, manganese, molybdenum, and vanadium. UDEQ justified the inclusion of these parameters in the draft permit by their likely presence in tailings effluent or by their being included as a requirement in GWDPs for other 11e.(2) facilities in Utah. Also, a long list of organic compounds (including chloroform) was included in the draft GWDP. Their inclusion was justified on the basis that the US NRC has identified such compounds as contaminants in 11e(2) tailings; that such compounds have been reported in alternate feed material delivered to the Mill; or that the compounds have been required in a GWDP for another Utah permitted 11e.(2) disposal facility.

There was no reason to include cyanide as a GWPL parameter in the draft GWPL. The tailings effluent from the Mill is highly acidic which precludes the long-term existence of cyanide in tailings solution or tailings seepage. Cyanide was not detected in the analysis of the slimes drain water conducted in 1991 and would not be a key indicator of discharge from the Mill. Indeed, cyanide was not reported (at a detection limit of 0.01 mg/L) in the historical data from 1989 and 1990 in MW - 1, 2, 3, 4, 5, 11, 12, 14 or 15.

There was no reason to include fluoride as a GWPL parameter in the draft GWPL. Although no historical data on fluoride exists, the May 1999 sampling of perched groundwater indicated fluoride concentrations in the range between 0.17 and 0.95 mg/L in upgradient and downgradient wells across the entire Mill site. Fluoride would not be key indicator of discharge from the Mill.

There was no reason to include beryllium as a GWPL parameter in the draft GWPL. Although no analyses of tailings effluent are available for beryllium, the trace metal

would not be a predominant component of tailings solutions and would not be a key indicator of discharge from the Mill. Beryllium was not detected at <0.001 mg/L in the perched groundwater from any of the monitoring wells sampled in May 1999, nor was beryllium ever reported in the historical data (at levels above a 0.001 mg/L detection limit) in MW - 1, 2, 3, 4, 5, 11, 12, 14 or 15 from 1991 through 1994, or in MW - 17, 18 or 19 in 1993 or 1994. That beryllium is required as a GWPL parameter at another 11e.(2) facility with a Utah permit, in itself, does not justify its inclusion as a parameter at the White Mesa Mill site.

There was no reason to include molybdenum as a GWPL parameter in the draft GWPL. In adding molybdenum to the list, UDEQ cited the presence of about 7 mg/L molybdenum in tailings slurry. The basis for the reference was laboratory testwork reported in the 1978 Dames and Moore Environmental Report. Subsequent to this laboratory testwork, actual analyses of tailings water from the slimes drain indicated molybdenum concentrations at 0.44 mg/L. Molybdenum would not be a key indicator of discharge from the Mill.

Draft Ground Water Protection Limits (GWPLs)

The November 1999 GWDP proposed for the Mill was drafted under the assumption that background concentrations for all chemical parameters of concern listed in the GWDP were at non-detect levels. Under this assumption, UDEQ assigned GWPLs based on Utah groundwater quality standards factored for Class II or Class III groundwater. By factoring the water quality standards, the GWPLs for many parameters became more restrictive than even U.S. EPA drinking water standards.

Sampling results for the Mill demonstrate that the naturally poor quality of the perched groundwater produces results which are not consistent with GWPL, based on drinking water standards. For example, the results of the May 1999 split sampling would have exceeded the proposed GWPLs for nitrate + nitrite, manganese, mercury, selenium, and for chloroform. Upgradient monitoring wells MW – 1, 18 and 19, cross-gradient monitoring well MW – 4, and downgradient monitoring wells MW – 3, 4, 5, 11, 12, 14 and 15 would have been "out-of-compliance." Moreover, when comparing the proposed GWPLs to historical data, most of the monitoring wells would have exceeded the proposed GWPLs for arsenic, cadmium, molybdenum, nickel, selenium and vanadium at one or more times in the past. Using the November, 1999, draft GWDP as a guide, the monitoring wells that would have been "out-of-compliance" are summarized in Table 1.

In order to eliminate an immediate and erroneous "out-of compliance" situation in downgradient and upgradient monitoring wells across the Mill, background concentrations have to be used in assigning protection ranges and not simple factoring of groundwater quality standards. For many of the GWPL parameters stipulated in the draft GWPL, background concentrations in the perched groundwater at the Mill are above non-detect levels.

Table 1

Parameters and Monitoring Wells that Would be "Out-of-Compliance" with Draft Ground Water Discharge Permit (November, 1999)

Parameter	Protection Limit	Monitoring Wells	
		Historical Data	May 1999 Sampling
Ammonia	Class III GWPL	None	None
	Class II GWPL	None	None
Cyanide	Class III GWPL	None	None
	Class II GWPL	None	None
Fluoride	Class III GWPL	None	None
	Class II GWPL	None	None
Nitrate + Nitrite	Class III GWPL	None	MW-4
	Class II GWPL	None	MW-4
Arsenic	Class III GWPL	MW-2, 3, 4, 12, 13, 15	None
	Class II GWPL	Also MW-1, 5, 11	None
Barium	Class III GWPL	No Data	None
	Class II GWPL	No Data	None
Beryllium	Class III GWPL	None	None
	Class II GWPL	None	None
Cadmium	Class III GWPL	MW-11, 12	None
	Class II GWPL	MW-11, 12	None
Chromium	Class III GWPL	None	None
	Class II GWPL	None	None
Copper	Class III GWPL	No Data	None
	Class II GWPL	No Data	None
Lead	Class III GWPL	No Data	None
	Class II GWPL	No Data	None

Table 1 (continued)

Manganese	Class III GWPL	No Data	MW-1, 3, 4, 11, 14, 15, 17, 18
	Class II GWPL	No Data	Also MW-12
Mercury	Class III GWPL	No Data	MW-5, 12
	Class II GWPL	No Data	MW-5, 12
Molybdenum	Class III GWPL	MW-2, 4, 12, 14, 15	None
	Class II GWPL	Also MW-1, 3	None
Nickel	Class III GWPL	MW-2, 3, 4, 12, 15	None
	Class II GWPL	Also MW-4, 5, 11, 14, 18	MW-3
Selenium	Class III GWPL	MW-1, 2, 3, 5, 11, 13, 15	MW-4, 15
	Class II GWPL	Also MW-4, 12, 14	Also MW-3, 19
Silver	Class III GWPL	No Data	None
	Class II GWPL	No Data	None
Vanadium	Class III GWPL	None	None
	Class II GWPL	MW-15	None
Zinc	Class III GWPL	No Data	None
	Class II GWPL	No Data	None

Background Concentrations for GWPL Parameters

Developing backgrounds for GWPL parameters must recognize that the Mill has been in operation for over twenty years. The underlying assumption in any assignment of background must be that the existing monitoring wells or any new wells that are drilled and installed for the purpose of background delineation are sampling groundwater that is still indicative of background conditions (with the exception of MW-4, which is the subject of the Mill's chloroform investigation, the occurrence of which was traced to a non-tailings source). The assumption is also that seepage from the tailings cells has not occurred, nor has the groundwater in the wells been affected by milling operations. Chemical constituents listed in the draft GWDP occur naturally in detectable quantities as background concentrations across the Mill.

Historical data can be used to provide the basis for determining background concentrations for several GWPL parameters. And, water-quality data that will be generated in the future on new GWPL parameters from existing wells or from new monitoring wells will be indicative of water quality that is unaffected by milling operations.

In the November, 1999, draft GWDP, UDEQ assigned GWPLs that were factored limits of standards from Utah's Administrative Code or some other advisory. As seen in the following discussion of the individual parameters, factored GWPLs lead to erroneous "out-of-compliance" situations. In a subsequent section of this report, an EPA-recommended statistical alternative to factored GWPLs will be discussed which is the basis for IUSA's detection-monitoring reporting to the U.S. NRC. This appropriate alternative would eliminate spurious "out-of-compliance" situations by establishing compliance ranges on a well-by-well, or intrawell basis.

Ammonia (as N) - On the assumption that slimes-drain water is representative of the liquids associated with tailings, seepage could contain as much as 1,761 mg/L NH_3 (as N). There are insufficient data in the historical data to define background levels for ammonia for specific wells. The historical data, however, suggest that ammonia is ubiquitous in the perched groundwater throughout the Mill site. In 1989, for example, ammonium was reported in groundwater from all the monitoring wells except MW – 2 and 3, at concentrations ranging between 0.1 and 0.7 mg/L. Ammonia was not detected (at a detection level of 0.1 mg/L) in monitoring wells MW – 2 and 3, located midgradient and downgradient of the tailings cells. In the split sampling conducted in May 1999, ammonia was detected in most upgradient and downgradient wells at concentrations ranging between 0.1 and 0.5 mg/L. Ammonia was not detected (at a detection limit of 0.05 mg/L) in upgradient well MW – 19 nor in cross-gradient well MW – 2. There is no groundwater quality standard for ammonia in the Administrative Code. UDEQ assigned a GWPL for ammonia of 12.5 mg/L NH_3 (as N) which was based on the U.S. EPA draft health advisory of 25 mg/L NH_3 (as N) and factored for Class III groundwater.

Nitrate + Nitrite (as N) - There are no historical data on which to base background levels for nitrate + nitrite in each well. During the May 1999 split sampling, nitrate + nitrite was detected in upgradient well MW – 19, at a concentration of about 1.3 mg/L, and in most downgradient wells, at a concentration range between 0.1 and 0.3 mg/L. Nitrate/nitrite levels in groundwater from monitoring well MW – 4 were anomalous at about 10 mg/L. As indicated in a separate Chloroform Investigation Report, these results reflect a nitrate/nitrite source other than the tailings cells. In the Administrative Code, the groundwater quality standard for total nitrate + nitrite is 10.0 mg/L (as N).

Arsenic - Arsenic was detected in tailings slimes-drain water at a concentration of 0.28 mg/L. Historical data are available for arsenic in groundwater at most of the monitoring wells across the Mill site. Concentrations range between an average 0.002 mg/L in upgradient well MW – 1 to an average 0.005 mg/L in downgradient well MW – 12. During the May 1999 split sampling, arsenic concentrations did not exceed 0.003 mg/L in any of the monitoring wells. Utah's groundwater quality standard for arsenic is 0.005 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.0025 mg/L. A factored GWPL for arsenic based solely on the groundwater quality standard creates an immediate and erroneous "out-of-compliance" situation in upgradient and downgradient wells based on existing water-quality data. Protection levels for arsenic need to be developed on a well-by-well (i.e., intrawell) basis considering the naturally-occurring range in background.

Barium - Barium was not detected in tailings slimes-drain water. There are no historical data with which to define background levels for barium in each well. During the May 1999 split sampling, barium concentrations did not exceed 0.03 mg/L in any of the monitoring wells. Utah's ground water quality standard for barium is 2.0 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 1.0 mg/L.

Cadmium - Cadmium was reported in tailings slimes-drain water at about 4.2 mg/L. There are limited historical data from 1989 through 1994 to indicate background levels range between 0.001 and 0.007 mg/L across the Mill site. During the May 1999 split sampling, cadmium was detected in monitoring wells MW – 3 and 14 at concentrations of about 0.002 mg/L. The ground water quality standard for cadmium is 0.005 mg/L, and the UDEQ's factored GWPL for Class III groundwater would be 0.0025 mg/L. A factored GWPL for cadmium based solely on the groundwater quality standard creates an immediate and erroneous "out-of-compliance" situation in several downgradient wells based on existing water-quality data. Protection levels for cadmium need to be developed on an intrawell basis considering the naturally-occurring range in background.

Chromium - Chromium was reported in tailings slimes-drain water at a concentration of 1.0 mg/L. There are very little historical data on chromium. Analyses of groundwater sampled in 1989 and 1990 throughout the Mill site failed to detect chromium at a detection level of 0.01 mg/L, but split sampling in May 1999, reported chromium in most monitoring wells at concentrations generally below 0.013 mg/L. The groundwater quality

standard for chromium is 0.1 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.05 mg/L.

Copper - Tailings slimes-drain water was analyzed for copper and reported to contain 177 mg/L. There are no historical data with which to define background levels for copper. During the May 1999 split sampling, copper concentrations were ubiquitous across the Mill site but did not exceed 0.007 mg/L in any monitoring well. Utah's groundwater quality standard for copper is 1.3 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.65 mg/L.

Lead - Lead was reported in tailings slimes-drain water at a concentration of 0.21 mg/L. There are no historical data with which to define background levels for lead. During the May 1999 split sampling, lead was not detected at a detection level of 0.001 mg/L. Utah's groundwater quality standard for lead is 0.015 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.0075 mg/L.

Manganese - The concentration of manganese in slimes-drain water was reported to be about 128 mg/L. There are insufficient data in the historical record to define background levels for manganese in the monitoring wells at the Mill site. However, chemical analyses of groundwater from several stock wells in the area of the Mill suggest that manganese and iron are ubiquitous in the perched groundwater. In the split sampling conducted in May 1999, manganese was detected in the perched groundwater from upgradient and downgradient monitoring wells. The highest concentrations were reported in perched groundwater from MW – 3 and 14, at about 2 mg/L. There is no groundwater quality standard for manganese in the Administrative Code. UDEQ assigned a GWPL for manganese of 0.02 mg/L based on a US EPA drinking water program reference dose of 0.04 mg/L (which is even lower than EPA's drinking water secondary MCL of 0.05 mg/L) and factored for Class III groundwater. A factored GWPL for manganese based solely on the EPA's reference dose creates an immediate and erroneous "out-of-compliance" situation in upgradient and downgradient wells based on the May 1999 sampling. Protection levels for manganese need to be developed on an intrawell basis using the naturally-occurring range in background.

Mercury - The tailings slimes-drain water was never analyzed for mercury and very limited historical data are available, primarily from 1989 and 1990. Mercury was not detected in any of the monitoring wells at a detection limit of 0.0002 mg/L. During the May 1999 split sampling, mercury was found in monitoring wells MW – 5 at about 0.002 mg/L and in MW-12 at about 0.003 mg/L. Utah's groundwater quality standard for mercury is 0.002 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.001 mg/L. A factored GWPL for mercury based solely on the groundwater quality standard creates an immediate and erroneous "out-of-compliance" situation in downgradient wells MW- 5 and 12, based on the May 1999 sampling. Protection levels for mercury need to be developed on an intrawell basis using the naturally-occurring range in background.

Selenium - The concentration of selenium in slimes-drain water was reported to be about 0.64 mg/L. Historical data are available on selenium in groundwater for most of the monitoring wells across the Mill site. Concentrations range between an average 0.003 mg/L in upgradient well MW – 1 to an average 0.008 mg/L in downgradient wells MW – 11 and 15. During the May 1999 split sampling, all the monitoring wells with the exception of downgradient well MW – 5 detected selenium. The highest concentrations were reported from MW – 4 and 15, at about 0.04 and 0.05 mg/L, respectively. Utah's groundwater quality standard for selenium is 0.05 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.025 mg/L. A factored GWPL for selenium based solely on the groundwater quality standard creates an immediate and erroneous "out-of-compliance" situation in several monitoring wells based on data from the May 1999 sampling. Protection levels for selenium need to be developed on an intrawell basis considering the naturally-occurring range in background.

Silver - Silver was reported in tailings slimes-drain water at a concentration of 0.005 mg/L. There are no historical data with which to define background levels for silver across the Mill site. During the May 1999 split sampling, silver was not detected at a detection level of 0.001 mg/L. Utah's groundwater quality standard for silver is 0.1 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.05 mg/L.

Vanadium - Actual analyses of tailings water from the slimes drain indicated vanadium concentrations to be about 165 mg/L. Although elevated in tailings slurry, vanadium is not very mobile in the subsurface, and is quickly attenuated in its movement by any number of geochemical mechanisms. Limited monitoring data from 1989 and 1990 failed to detect vanadium (at levels above a 0.01 mg/L detection limit) in most of the monitoring wells. Only groundwater from MW - 15 reported vanadium between 0.01 and 0.03 mg/L. There is no groundwater quality standard for vanadium in the Administrative Code. UDEQ assigned a GWPL for vanadium of 0.03 mg/L based on a groundwater quality standard developed for another Utah 11e.(2) facility and factored for Class III groundwater.

Zinc - Zinc was reported in slimes-drain water at about 50 mg/L. There are no historical data with which to define background levels for zinc across the Mill site. During the May 1999 split sampling, naturally-occurring zinc was detected in groundwater from every well sampled. Zinc concentrations ranged between 0.003 mg/L in MW - 15 and about 0.05 mg/L in MW – 3. Utah's groundwater quality standard for zinc is 5.0 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 2.5 mg/L.

Organic Chemicals - The only organic chemical that was reported at elevated concentrations in tailings slimes-drain water was acetone (about 513 ug/L). There are limited historical data for organics in groundwater across the Mill site. Monitoring of groundwater failed to detect acetone, 2-butanone, carbon disulfide, chloroform, or methylene chloride. The May 1999 split sampling did discover elevated chloroform in monitoring well MW – 4, but its occurrence was traced to a non-tailings source. Utah's

groundwater quality standard for trihalomethanes such as chloroform is 0.1 mg/L, and UDEQ's factored GWPL for Class III groundwater would be 0.05 mg/L.

Several organic compounds have been reported in alternate feed materials that have been received at the Mill for processing. The concentrations of these compounds are miniscule, however, and would not be indicators of discharge from the facility. During the split sampling conducted in May 1999, 4,4'-DDT was reported at 0.046 ug/L in MW - 15. This pesticide is not associated with any milling operation but was found in groundwater at the Mill site.

It would be advisable to develop intrawell protection levels for chloroform, 4,4'-DDT, and for the polycyclic aromatic hydrocarbons (PAHs) that are components of kerosene. Kerosene is used in the Mill's solvent extraction circuit and small quantities of kerosene are discharged to tailings as entrained organic in the aqueous effluent.

New Background Parameters

The White Mesa Mill has been operating under a U.S. NRC detection monitoring program that mandates quarterly sampling of the perched groundwater zone for four constituents that are indicative of classes of chemicals (chloride, potassium, nickel, and uranium). A background range for these parameters has been developed over the years using the Shewhart-CUSUM Control Chart method. The backgrounds should be acceptable to UDEQ for assigning protection levels for these parameters.

The constituents or parameters that are monitored under the U.S. NRC monitoring program were chosen based on the following criteria:

(1) high concentration levels in tailings slimes drain water;
(2) low concentrations in groundwater across the Mill site;
(3) high geochemical mobility in groundwater; and
(4) indicators representing cation and anion chemistry, a trace metal, and a radionuclide.

The selected constituents are key indicators of potential leakage from the tailings cells. Unlike most of the metals present in potential tailings seepage, chloride, potassium and nickel are "conservative", which means that these constituents are far less affected by the geochemical processes that would attenuate the mobility of typical metals in groundwater. Conservative constituents travel at the speed of the groundwater and are not retarded by natural attenuation. As such, these constituents serve as an early warning to the arrival of groundwater contaminants. Two of the indicator constituents (nickel and uranium) were listed as GWPL parameters in the draft GWDP.

As demonstrated by the November 1999 draft GWDP, backgrounds have to be determined on other parameters to avoid misleading "out-of compliance" situations from

developing while monitoring the perched groundwater zone. These new parameters should include chemicals that are:

(1) regulated under Utah's Administrative Code with a groundwater quality standard or by Executive Secretary's decision;
(2) present in tailings effluent at concentrations sufficient to impact the perched groundwater if seepage ever occurs; and
(3) detected as a natural constituent of the perched groundwater at the site.

To avoid erroneous or misleading "out-of-compliance" situations, backgrounds should be developed for the following parameters: ammonia, nitrate + nitrite, arsenic, cadmium, chromium, copper, lead, manganese, mercury, selenium, vanadium, zinc and organics to include chloroform, 4,4'-DDT, and the polyaromatic hydrocarbons associated with kerosene.

To facilitate the gathering and analysis of background data, the new parameters should be prioritized based on the criteria listed above. A prioritized list of parameters would consist of the following: nitrate + nitrite, arsenic, manganese, selenium, and chloroform. For arsenic and selenium, historical monitoring data already exist to permit background delineation.

These new parameters would not be intended to replace the key indicators of the NRC compliance program, but rather to augment the program to meet UDEQ objectives.

Background Evaluation Protocols

Extensive monitoring data from 1981 through the 1990s have been compiled for many of the wells across the Mill site. These monitoring data include perched groundwater analyses for TDS; analyses for the major ions (sodium, potassium, calcium and magnesium; chloride, sulfate and alkalinity); and analyses for natural uranium and the radionuclides, Ra-226, Ra-228, Th-230 and Pb-210. Also, historical data from 1980 through 1996 are available on arsenic and selenium, and from 1989 through 1994 on cadmium and molybdenum, and from 1989 and 1990 on ammonia, chromium, mercury, and vanadium.

With some parameters such as nickel and natural uranium, the data base from which to determine background in some wells is extensive. With other parameters such as arsenic, selenium, and the radionuclides, the historical data should be adequate to assign a background range at most monitoring wells. However, additional sampling and analyses will be needed to develop backgrounds for parameters or wells not analyzed extensively in the past.

The historical data indicate a high variability in the concentration of constituents among wells in the perched groundwater zone across the entire Mill site. Individual monitoring wells in the perched groundwater zone will require different compliance ranges for

different GWPL parameters. Just as the TDS is not uniform in groundwater throughout the Mill site, neither is background for the constituents. None of the parameters are expected to have backgrounds which are "universal" across the Mill site. It is for this reason that UDEQ's methodology used in assigning GWPLs in the draft GWDP evoked so many "out-of-compliance" situations.

Individual wells in the perched groundwater zone will require a well-by-well allocation of background levels for parameters of concern. For this reason, the U.S. EPA's intra-well statistical approach, commonly referred to as the Shewhart – CUSUM control chart method, will continue to be followed in delineating background and compliance ranges. This statistical method has been successfully used for several years in the Points of Compliance reporting to the U.S. NRC.

This approach consists of plotting standardized constituent concentration data versus time and, in essence, continuously developing and refining a background range for the constituent being analyzed, at an individual well. Compliance is then evaluated by comparing the standardized concentrations against predefined upper bounds which are based on standard deviations. The Shewhart-CUSUM control chart method is described in detail and illustrated for monitoring indicator constituents in the 1994 Points of Compliance report for the Mill. Relevant sections of the Points of Compliance report and the EPA's description of this statistical approach to evaluating groundwater monitoring data are attached as Appendix A.

Background has been developed over the years for the key parameters (chloride, potassium, nickel, and uranium) under the Mill's U.S. NRC detection monitoring program. The historical monitoring data for arsenic and selenium, when analyzed by the Shewhart-CUSUM protocols, should develop background ranges that would be acceptable to UDEQ for evaluating compliance. For new parameters where the historical data-base is limited or non-existent, background levels would be developed over the next few years using the Shewhart-CUSUM control chart method to analyze the monitoring data.

Points of Compliance
White Mesa Uranium Mill

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1.0 INTRODUCTION

This report presents the rationale for location, and compliance criteria for ground water Points of Compliance (POCs) for the Energy Fuels Nuclear Inc. (EFNI) White Mesa Uranium Mill. The purpose of the POCs is to provide timely detection of potential leakage from the tailings disposal cells at the mill site, and to assure protection of the underlying Entrada/Navajo Aquifer.

The POCs for the mill site are existing monitoring wells WMMW-5, WMMW-11, WMMW-12, WMMW-14, and WMMW-15. In addition, a proposed POC monitoring well will be located adjacent to tailings cell No. 4A. The POC monitoring wells are located hydraulically downgradient of tailings disposal cells No. 3 and No. 4A and screened in the ground water perched zone of the Burro Canyon Formation. These wells will be monitored quarterly for the indicator constituents chloride, potassium, and nickel. Approved statistical methods, as per the Environmental Protection Agency (EPA, 1989), will be employed to evaluate whether the perched ground water zone has been affected by cell leakage.

2.0 CURRENT SITE CONDITIONS

This section presents a summary of the current site hydrogeologic conditions as they pertain to POC issues.

2.1 Site Hydrogeology

Ground water occurrence within the proximity of the White Mesa Uranium Mill has been documented in three strata: the Dakota Sandstone, the Burro Canyon Formation, and the Entrada/Navajo Sandstones. An evaluation of the occurrence of ground water at the mill site is presented by EFNI (1994a).

Dakota Sandstone and Burro Canyon Formation

The ground water occurrence within Dakota Sandstone and Burro Canyon Formation in proximity of the mill site is in the form of a single perched ground water zone. The ground water is perched above the Brushy Basin Member of the Morrison Formation which consists of

bentonitic mudstones and claystones. The saturated thickness of the perched ground water zone varies from 55 feet north of the site and thins to less than 5 feet to the south where it discharges into the adjacent canyons as evidenced by springs and productive vegetation patterns.

Downgradient of the mill, (i.e. between the mill and dissecting canyons) the ground water in the perched zone cannot be used for irrigation or domestic consumption because of the natural poor quality of the water (Section 2.2) and low yield rates of the perched zone. Documented pumping rates from on-site wells completed in the Burro Canyon Formation are less than 0.5 gallons-per-minute (gpm). Even at these low rates, the wells are typically pumped dry within a couple of hours.

At the mill site, the tailings disposal cells are sited within the unsaturated, Dakota Sandstone. If cell leakage were to occur from the tailings cells, tailings-related constituents would have to migrate through approximately 110 feet of unsaturated material before reaching the perched ground water zone. The travel time for constituents to reach the perched ground water zone has been estimated to range from 50 to 150 years (EFNI, 1994a).

In terms of compliance monitoring, the perched ground water zone provides the earliest horizon for detection of tailings cell leakage because it is closest to the potential release point. Although the perched ground water zone cannot be classified as a useable aquifer, it would be considered a pathway for constituents (EPA, 1992), and under 40 CFR § 264.97 can be used for POC monitoring.

Entrada/Navajo Sandstone Aquifer

The ground water present within the Entrada/Navajo Sandstones is the first useable aquifer of significance documented within the mill area. The Entrada/Navajo Sandstone aquifer (Entrada/Navajo Aquifer) is an artesian aquifer and is used regionally for irrigation and domestic consumption.

At the mill site, the Entrada/Navajo Aquifer is separated from the perched ground water zone within the Dakota Sandstone and Burro Canyon Formation by more than 1,200 feet of unsaturated, low permeability formations. The combination of low permeability, thick unsaturated strata and the artesian pressure within the aquifer provides a positive natural physical and hydraulic barrier that will protect the Entrada/Navajo Aquifer from being impacted by potential tailings cell leakage.

In terms of compliance monitoring, the Entrada/Navajo Aquifer would not be included in POC monitoring for the following reasons:

- Timely detection of tailings cell leakage and protection of the Entrada/Navajo Aquifer can be accomplished by monitoring the overlying perched ground water zone within the Dakota Sandstone and Burro Canyon Formation; and

- Timely detection of tailings cell leakage cannot be accomplished by monitoring the Entrada/Navajo Aquifer because it is separated from the tailings cells by more than 1,200 feet of low permeability, unsaturated strata.

2.2 Perched Water Quality

Water quality data has been collected at the White Mesa facility since 1979 and is presented in Appendix A of this report. Evaluation of the data indicates that in the perched zone:

- Water quality is poor and variable, and
- Operations at the White Mesa Uranium Mill have not impacted water quality.

Figure 1, which presents Stiff diagrams for wells upgradient of the tailings facility, demonstrate that water quality at the White Mesa Mill is variable in the perched ground water zone. Examination of the Stiff diagrams indicates that sulfate is the dominant anion but the dominant cation varies for the wells. At the Windmill and Jet Pump Well, magnesium is the dominant cation; at well WMMW-18, calcium is the dominant cation; at well WMMW-19, sodium is the dominant cation; and at well WMMW-1, calcium and sodium are present in approximately equal (milliequivalent) proportions. Figures 2 and 3 show that the cation variability continues throughout the mill site.

Water quality variability is likely the result of several factors, including:

- Slow ground water velocities that allow water to equilibrate with local mineralogy,
- Mineralogic variability within the Burro Canyon Formation,
- Partial penetration of some wells into the top of the underlying Brushy Basin Member, and
- The decrease in saturated thickness of the perched zone south of the site.

As discussed below, the interaction of these factors leads to variability of water type (dominant cation) and also variability of other constituents.

A discussion of the water velocity within the perched ground water zone is presented by EFNI (1994a). Water velocity is expected to decrease as the saturated perched zone thickness decreases south of the site. Along the edges of the saturated zone, ground water likely becomes stagnant. Large calcium, alkalinity and sulfate concentrations at wells located at the edge of the perched zone indicate that the perched water probably is saturated with calcite, and possibly with gypsum, which is a result of stagnant or very slow movement of water in the perched zone.

The mudstones of the Brushy Basin Member are expected to be a source of minor concentrations of trace metals. In general, large concentrations of trace metals such as arsenic, molybdenum and selenium, are found in shales, as compared to sandstones (Parker, 1967). According to boring and well completion logs (EFNI, 1994a), several wells were screened across the Burro Canyon Formation/Brushy Basin Member contact, including WMMW-2, WMMW-3, WMMW-4, WMMW-5, WMMW-11, WMMW-12, and WMMW-15. Small concentrations of arsenic, molybdenum, and selenium are occasionally detected in these wells.

Thinning of saturated thickness and related slow ground water velocities also account for the generally poor quality of the water. For example, the average total dissolved solids (TDS) concentrations for site wells in the perched water zone range from 1271 to 5052 milligrams-per-liter (mg/l) and average sulfate concentrations range from 656 to 2956 mg/l. These ranges of concentrations also have been documented in sandstone and shale units in other semi-arid regions (Hem, 1989) with natural poor water quality. According to Utah Administrative Code, R448-6, ground water with TDS of 3,000 to 10,000 mg/l is classified as Class III - Limited Use. A number of upgradient, transgradient and downgradient wells, including wells WMMW-3, WMMW-4, WMMW-12, WMMW-14, WMMW-15, WMMW-17 and WMMW-19, would fall into this classification, indicating the poor quality of the perched water. Because of the poor quality of the water and low well yield of the water within the Burro Canyon Formation, its expect future uses are minimal.

3.0 POINTS OF COMPLIANCE

This section presents the compliance monitoring program, including location and rationale for the POCs, indicator constituents, and data evaluation protocol.

3.1 Location and Rationale of POCs

Lateral POC Location

The POCs for the White Mesa Uranium Mill are the existing monitoring wells WMMW-5, WMMW-11, WMMW-12, WMMW-14, and WMMW-15. In addition, a proposed monitoring well will be located adjacent to tailings cell No. 4A. The locations of the POC wells are shown in Figure 4.

The POC locations were chosen based on the guidance set forth in the document entitled "RCRA Ground-Water Monitoring: Draft Technical Guidance" (EPA, 1992)." The POC monitoring wells are located hydraulically downgradient of and adjacent to tailings disposal cells No. 3 and No. 4A, and are screened in the perched ground water zone. The ground water levels and flow directions present in the perched water zone are also shown in Figure 4.

Cross-gradient, the lateral spacing between the POC monitoring wells ranges from approximately 500 to 700 feet. This spacing will be adequate for POC monitoring because naturally occurring hydraulic, physical, and kinetic mechanisms are present that will result in lateral spreading of constituents should cell leakage occur. The lateral spreading of constituents will facilitate cell leakage detection at the POCs.

The mechanisms causing lateral spreading include:

- Potential leakage from a tailings disposal cell will first enter the unsaturated Dakota Sandstone where it will spread laterally as well as vertically aided by the presence of low permeability layers (stringers) and capillary suction; and

- The flow regime within the perched water zone of the Burro Canyon Formation is one of flow through a porous media. As such, constituents entering the ground water will be subject to transport processes of advection, dispersion, and diffusion. While advection (ground water flow) will transport constituents downgradient, both dispersion and diffusion mechanisms will cause lateral spreading of constituents in the ground water. Diffusion will cause lateral spreading set up by constituent concentration gradients within the ground water. Hydraulic dispersion will cause lateral spreading due to flow through pore channels. The magnitude of dispersion spreading is scale dependent and may range several orders of magnitude for various geologic media (Neuman, 1990).

Lateral spreading of constituents by naturally occurring mechanisms will increase the likelihood of detection at the POCs. Therefore, the POCs monitoring wells will provide timely detection of leakage from the tailings disposal cell.

Vertical POC Location

The POC monitoring wells are completed in the perched ground water zone of the Burro Canyon Formation. POC monitoring wells are not proposed for the Entrada/Navajo Aquifer because more than 1,200 feet of unsaturated, low permeability formations isolates the aquifer from the tailings cells, and because this aquifer is not the first occurrence of ground water to be affected should leakage from the tailings cells occur.

As presented in Section 2.1, the perched ground water zone is considered a potential constituent pathway, and it is located closest to the tailings cells. Therefore, monitoring of the Burro Canyon Formation perched ground water zone will provide timely detection of tailings cell leakage, if it occurs, and will be protective of the water quality of the Entrada/Navajo Aquifer.

3.2 Compliance Monitoring Program

The compliance monitoring program will consist of quarterly sampling of the POC monitoring wells. Each sampling event will consist of ground water sampling and ground water elevation determination. Ground water sampling will be conducted using the procedures set forth in the Ground Water Monitoring Plan (EFNI, 1994c) and the Quality Assurance Project Plan (EFNI, 1994b).

Indicator Constituents

Potential leakage from the tailings cells will be evaluated by analyzing the perched zone ground water for indicator constituents present in the tailings. For the purpose of POC monitoring, the slimes drain water is considered representative of liquids associated with the tailings. Water quality indicator constituents were chosen based on the following criteria:

- High concentrations in tailings slimes drain water,
- Low concentrations in site ground water,
- Conservative chemical characteristics, and
- Representation of chemical classes; that is, a cation, an anion, and a trace metal.

Constituents that meet these criteria are chloride, potassium and nickel. Table 1 lists average concentrations of chloride, potassium and nickel for the POC wells, in addition to concentrations in tailings cell No. 2 slimes drain water. As shown in Table 1, the concentrations in slimes drain water of chloride (3191 to 2573 mg/l), potassium (251 to 286 mg/l) and nickel (7.2 to 12 mg/l) are one to three orders of magnitude larger than concentrations in the POC wells.

In addition to the high concentrations in the slimes drain water, chloride, potassium and nickel were chosen as indicator constituents for the following reasons:

- Chloride has been used as a conservative tracer for a number of years (Davis and others, 1985) and has been shown to travel at the same rate as water (Kaufman and Orlob, 1956). Conservative tracers, such as chloride, do not readily adsorb onto soil materials or precipitate unless present in very large concentrations. Evidence of the conservative nature of chloride is that chloride is the dominant anion in ocean water.

- Potassium is somewhat conservative, depending on the presence of clays. Potassium is subject to adsorption by illite clay and to cation exchange by most clays. Potassium has been used as a tracer when it is a component of leachate (Davis and others, 1985) and to determine transport properties (Leonhart and others, 1985). The tailings cells are underlain by sandstone, so potassium retardation due to reaction with clays should be minor.

- Nickel was selected as an indicator constituent as representative of trace metals in the slimes drain water. Nickel is not considered to be conservative; however, it is less readily adsorbed and therefore, travels more readily in solution than other metals, such as lead, copper and zinc (Kinniburgh and Jackson, 1981). Nickel adsorption by clay is decreased by the presence of sulfate (Bansal, 1985), and sulfate is plentiful in slimes drain water and perched ground water. Hence, adsorption of nickel should be minor.

Other constituents, such as pH, sodium, magnesium, calcium, sulfate and arsenic, were not included as water quality indicators for a number of reasons. For example, pH is affected by soil constituents, such as calcareous materials. Calcareous materials react with low pH solutions, resulting in pH increase. Boring logs (EFNI, 1994a) indicated the presence of calcareous stringers and zones underlying the site. The presence of these materials in the unsaturated zone provides a protective geochemical barrier to potential movement of trace metals from the tailings cells. However, potential movement of solutions from the tailings cells would be recognized sooner by monitoring chloride, which is less affected by reactions with soil materials.

In addition to potassium and chloride, slimes drain water contains other major cations and anions, including sodium, magnesium, calcium and sulfate. These parameters were not chosen as potential tracers because they also are major constituents in the perched ground water, as discussed in Section 2.2.

Arsenic occurs as an anion in solution and, therefore, has different chemical behavior than most metals. For example, arsenic adsorbs readily at a pH of about 4.5 but desorbs at higher pH values, whereas most metals do not adsorb until the pH is much higher than 4.5. The slimes drain water pH typically is in the range of 1.5 to 3. If this water were to percolate into the underlying materials, the pH would gradually increase as suggested above. The result would be that arsenic in percolating water would tend to adsorb well before other metals, such as nickel. Therefore, arsenic is not considered to be useful as an indicator parameter.

3.3 Statistical Analysis of Monitoring Data

Statistical methods will be employed to analyze the ground water monitoring data at the POCs and to evaluate compliance. The statistical analysis will be conducted using recommended EPA intra-well comparison techniques for RCRA facilities (EPA, 1989). Intra-well comparison techniques will be employed because, as discussed in Section 2.2, the spatial variability of the ground water quality precludes definition of background ground water quality over the large areal extent of the mill site.

The intra-well comparison technique used will be a control chart based method. Control chart methods are widely used as a statistical tool in industry because they are relatively simple to use and they provide a visual tool for detecting trends and abrupt changes in concentration levels.

3.3.1 Compliance Evaluation

The control chart method used for evaluating compliance will be the combined Shewhart-CUSUM control chart method. The combined Shewhart-CUSUM control chart method consists of plotting standardized constituent concentration data versus time. Compliance is then evaluated by comparing the standardized concentrations against predefined upper bounds which are based on standard deviations. Combined Shewhart-CUSUM control charts for the POC monitoring wells and the indicator constituents are presented in Appendix B. The calculations used to develop these charts are presented in Appendix C. The control charts presented in Appendix B were constructed using the water quality data presented in Appendix A. All of the charts were constructed with a starting sampling date of March 24, 1994 so that each chart would

cover the same time period. Water quality data collected prior to March 24, 1994 were used to calculate the population mean and standard deviation used in control chart construction.

To construct a combined Shewhart-CUSUM control chart, the constituent concentration data must first be standardized. The constituent concentration data is standardized using the following equation:

$$Z_i = (\overline{X_i} - \mu)\frac{\sqrt{n_i}}{\sigma}$$

where:

Z_i= standardized mean,
X_i = average concentration of sample event,
μ = mean population concentration,
σ = population standard deviation, and
n_i= number of measurements during sample event.

In addition to the standardized mean, the cumulative sum for the standardized data must also be calculated. The cumulative sum is equal to:

$$S_i = \max[0, (Z_i - k) + S_{i-1}]$$

where:

S_i = present cumulative sum,
S_{i-1} = previous cumulative sum,
Z_i = standardized mean, and
k = reference value = 1 (EPA, 1989)

Once the concentration data is standardized, the data is plotted versus time. Two upper bounds are also plotted with the data, h and SCL. The upper bound h is a statistical upper bound for the cumulative sum data, while SCL is an upper bound for the standardized mean data. EPA (1989) recommends setting h equal to 5 and SCL equal to 4.5 for ground water monitoring.

Compliance is evaluated by comparing the cumulative sum data to the upper bound h, and the standardized mean data to the SCL upper bound. If the cumulative sum data exceeds the h upper bound or the standardized mean data exceeds the SCL upper bound, this would indicate a

statistically significant increase in constituent concentration. For the White Mesa Uranium Mill, this would indicate potential cell leakage.

The control charts presented in Appendix B show that based on water quality data taken after March 24,1994 the POC monitoring wells do not show impact from mill operations. As future quarterly water quality data is collected, the control charts in Appendix B will be updated and compliance evaluated. If sampling of a POC monitoring well indicates exceedance of the h upper bound or the SCL upper bound using the combined Shewhart-CUSUM control charts, a confirmatory sampling program will be initiated. The confirmatory sampling program will consist of monthly sampling of the affected well for a minimum period of six months. The minimum sampling period of six months was chosen to provide a statistically significant population for evaluating outliers and seasonality.

After the confirmatory sampling program is complete, the POC ground water quality data will be analyzed using an Analysis of Variance (ANOVA) as per EPA (1989) guidance. The ANOVA would be used to determine if the water quality data collected during the confirmatory sampling program are statistically different from the water quality data collected before the confirmatory sampling program. If the data are significantly different, a corrective action plan will be prepared.

Water Quality Data Adjustments

During the water quality monitoring period, the control charts for each POC well will be updated after each sampling round. However, before the control charts are updated, the water quality data may need to be adjusted to account for seasonal trends and non-detection values. Although the site water quality data does not exhibit a consistent trend of seasonality, methods to adjust the water quality data for seasonality and the presence of non-detect values are presented by the EPA (1989), and will be used, if appropriate, for the POC control charts at the mill site.

4.0 CONCLUSIONS

The POCs for the White Mesa Uranium Mill are existing monitoring wells WMMW-5, WMMW-11, WMMW-12 WMMW-14, and WMMW-15. In addition, a proposed POC monitoring well will be located adjacent to the southeast corner of tailings cell No. 4A. The POC monitoring wells are located along the southern (downgradient) edge of tailings disposal cells No. 3 and No. 4A, and are screened in the perched ground water zone within the Burro

Canyon Formation. The perched ground water zone cannot be classified as a useable aquifer, however, monitoring of the perched ground water zone will be protective of the Entrada/Navajo Aquifer because it will allow timely detection of tailings cell leakage, should it occur.

The POC monitoring program will employ approved EPA statistical methods to evaluate whether the perched ground water zone has been affected by tailings cell leakage. The statistical methods used will be based on intra-well methods because the natural spatial variability of the site ground water quality precludes definition of a background water quality.

The intra-well statistical method will be based on combined Shewhart-CUSUM control charts. Control charts have been constructed for three indicator constituents, chloride, potassium, and nickel for the site. Selection of these indicator constituents was based on constituent concentrations present in the tailings cell No. 2 slimes drain water.

Compliance within the perched ground water zone will be evaluated quarterly by plotting standardized concentration data on the control charts and comparing the data to upper bounds as defined by the method. If sampling of a POC monitoring well indicates exceedance of an upper bound using the Shewhart-CUSUM control charts, this would trigger a 6-month confirmatory sampling program to determine if the data are statistically significant. If the data are significantly different, a corrective action plan will be prepared.

attachment 6

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March 7, 2002

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Re: November 12, 2001 HGC Evaluation of Hydraulic Test Data at MW-4 White Mesa Uranium Mill Site Blanding, Utah: **Request for Additional Information and Installation of New Monitoring Well Adjacent to MW-4.**

Dear Mr. Roberts,

We have reviewed the November 12, 2001 Hydro Geo Chem (HGC) submittal referenced above. During this review, we determined that additional information is required. Please resolve the concerns and provide all information requested below:

1. Missing 1994 Pump Test Data (0.92 gpm Rate) – the November 12, 2001 HGC report provides a pump test drawdown plot for test work apparently conducted by Peel Environmental Services (Peel) in 1994 (ibid., Attachment 2). However, the HGC submittal failed to include the raw water level or drawdown measurements for this 0.92 gallons per minute (gpm) pump rate test. Please provide the raw data that corresponds to this test. Please also provide a complete description of how this test was conducted, data analysis methods used, and any corrections to the drawdown data made in the analysis. Until this information is provided, we are unable to confirm any HGC conclusions or interpretations regarding this pump test.

2. Need to Revise Interpretation of Brushy Basin Contact Depth in Well MW-4 – the depth to the Jurassic-age Brushy Basin shale (Jmb) in well MW-4 is a critical issue in that it forms the basal boundary of the uppermost aquifer, and may significantly control local groundwater flow directions and chloroform transport. Unfortunately the depth of the Jmb contact in this well has been a matter of dispute. Previously, the DRC relied on the 1979 D'Appolonia well completion diagram (7/94 Titan Report, Appendix A), which indicated the Jmb contact was found in MW-4 at a depth of 125 feet below ground surface (ft bgs). On this basis, the DRC asked IUC to re-perforate well MW-4 or install a confirmation boring or well nearby to resolve this issue [3/20/01 DRC Request for Additional Information (RAI), p. 3 and 6/7/01 Chloroform Investigation RAI, Attachment 1, p. 7]. In response to this request, IUC cited a Umetco Minerals Corporation geophysical log (7/94 Titan Report, Appendix A), which indicated the Jmb contact in well MW-4 is found at a depth of 108 ft bgs (6/22/01 IUC

Report, p. 8). Later in an October 5, 2001 meeting DRC staff raised concerns about interpretation of this geophysical log, in that the neutron porosity portion of the log showed a dramatic decrease in porosity below a depth of about 110 ft. This decrease in porosity may have been caused by a sandstone bed, which in turn would suggest the Jmb contact is found at a lower depth in the well.

More recently, review of the 1999 HGC high rate pump test of well MW-4 sheds new light on this issue. During the September 29, 1999 high rate pump test the maximum drawdown measured was 41.024 feet, which corresponds to a water level depth of 108.49 ft bgs, see Table 1 below. If the base of the uppermost aquifer was truly found at a depth of 108 ft bgs in well MW-4, then the shallow aquifer would have been completely de-watered at this point during the pump test, and the pumping rate would have fallen to zero.

In contrast, well MW-4 continued to yield 9.1 gallons per minute (gpm) even after the water level fell below the 108 ft bgs interval. Furthermore, the pump yield was steady at this point until HGC shut the pump off at 45 minutes into the high rate test. This well pumping response suggests that the Jmb contact is located at a depth greater than 108.49 feet in well MW-4. This observation conflicts with the earlier Umetco geophysical log interpretation that placed the Jmb contact at a depth of 108 ft bgs.

Table 1. Summary of 9/99 HGC High Rate Pump Test of Well MW-4
(from 10/15/01 HGC electronic files Mw4dwnt2.dat and Mw4test2.pmp)

Pumping Time (min)	Pump Rate (gpm)	Measured Drawdown (ft)	Equivalent Water Level Depth		Pressure Transducer Depth [3] (ft bmp)	Pump Depth [4] (ft bmp)	Comment
			(ft bmp) [1]	(ft bgs) [2]			
0.0	0	0.0	69.03 [5]		110	120	Initial water level before pumping
43.3	9.1	40.5414	109.57	108.01	110	120	
43.733	9.1	41.024	110.05	108.49	110	120	Maximum drawdown
44.467	9.1	40.5414	109.57	108.01	110	120	
45.0	0.0						Pump turned off

Footnotes:
(1) Equivalent water level depth below well measuring point (D_{bmp}) for maximum drawdown (D_{max}) calculated as follows:
$D_{bmp} = D_{wli} + D_{max} + W_s$, where:
D_{wli} = initial water level in well before pumping begins (ft bmp),
D_{max} = maximum drawdown observed during pump test (ft).
W_s = well's water level measuring point stick-up above ground surface (ft). For IUC well MW-4, stick-up = 1.56 ft.
(2) Water level depth below ground surface (D_{bgs}) calculated as follows: $D_{bgs} = D_{bmp} - W_s$
(3) Pressure transducer depth in well MW-4 provided in a 12/21/01 HGC facsimile. In this submittal, HGC explains the 110 ft bmp depth determined by length of transducer cable available at the time of the high rate pump test (9/28/99).
(4) Pump depth provided in 12/24/01 telephone call from Stewart Smith (HGC) to Loren Morton (DRC).
(5) Initial depth to groundwater for the 1999 high rate pump test, 69.03 ft bmp, was provided to DRC in a 12/12/01 HGC facsimile.

Additional pump test details provided by HGC indicate that the pressure transducer was set at a depth of about 110 feet below measuring point (ft bmp), while the Grundfos submersible pump was set at about 120 ft bmp in well MW-4 before the high rate test began (see 9/29/01 HGC fieldnotes and 12/21/01 HGC facsimile to DRC). Well construction details show the screened interval in well MW-4 is between 92 and 112 ft bgs. Consequently, the pressure transducer was set above and the Grundfos pump set below the base of the well screen in the

high rate test of MW-4 (see Table 1, above). Arguments could be made that IUC could have placed the pressure transducer at a greater depth to better test the location of the Jmb contact in well MW-4 (see Figure 1, below). As reported, the transducer was not set lower than 110 ft bmp at the time of the high rate pump test due to the limited length of the transducer cable (12/21/01 HGC facsimile). Despite this constraint, DRC staff have concluded that a pumping water level below the 108 ft bgs interval combined with a sustained well yield during this portion of the pump test both suggest the Jmb contact is deeper than 108 ft bgs.

These findings directly conflict with the Umteco geophysical log and have other significant implications for calculation of aquifer permeability from the MW-4 September, 1999 HGC pump test work. Please resolve the DRC concerns listed below.

3. Need to Install New Well and Correct Partial Penetration Effects in Well MW-4 Pump Tests – review of the November 12, 2001 HGC Report shows that at the time of the September, 1999 pump test that well MW-4 only partially penetrated the shallow aquifer. This finding is based on the following observations:

   A. High Initial Water Level in Well – review shows that before pumping commenced the initial water level in the well was 24.53 feet above the screened interval (see Figure 1 below). As a result, well MW-4 was screened across only a portion of the shallow aquifer, and

   B. Jmb Contact Below 108 ft bgs - from the DRC pump test findings above it appears that the Jmb contact is found below the 108 ft bgs interval, and perhaps as deep as 125 ft bgs as shown in the 1979 D'Appolonia well completion diagram (7/94 Titan Report, Appendix A). As depicted by D'Appolonia, the screened interval in well MW-4 does not reach the base of the shallow aquifer, but is limited to an interval of 92 to 112 ft bgs.

   Such partial penetration causes a significant vertical hydraulic gradient near the well screen, which in turn artificially increases the rate of drawdown during a pump test (Driscoll, pp. 249-252). This artificially high drawdown results in artificially low hydraulic conductivity results unless corrections to the measured drawdown are made during analysis of the pump test drawdown data (ibid.).

   To make these corrections, it is necessary to know the degree of partial penetration in well MW-4, which in turn requires determination of the true Jmb contact depth in this well. Please install a new monitoring well immediately adjacent to MW-4 that accurately determines the Jmb contact depth, then determine the degree of partial penetration in existing well MW-4 and correct the 1992 Peel and September, 1999 HGC drawdown data accordingly.

4. Missing Description and Justification for Proprietary Pump Test Analysis Software: 1999 Pump Test Results – review of the November 12, 2001 HGC Report and discussions with Mr. Stewart Smith indicate that the 1999 HGC pump test data for well MW-4 were analyzed with proprietary computer software owned by HGC, i.e., WHIP (11/12/01 HGC Report, Figures 6 and 7, and personal communication, Stewart Smith). Because this software is proprietary, it is difficult for the DRC staff to ascertain and confirm the reliability of the software used to analyze the well drawdown results from well MW-4. To resolve this issue, please provide the following:

A. Additional Disclosure and Justification – please disclose the governing equations and solution techniques used in the HGC WHIP program to analyze the 1999 MW-4 drawdown data. Please provide a disclosure and evaluation of the WHIP input variables that are sensitive in the solution for aquifer hydraulic conductivity. Please provide independent comparisons or case studies that confirm how WHIP can produce reliable pump test analysis, as compared with other commercial or public domain software that has been peer-reviewed by the groundwater technical community, or

B. Use Other Analysis Software – that has undergone peer review by the groundwater technical community to analyze the 1999 MW-4 pump test drawdown data. Such other software may be either commercially available or public domain software.

5. Need to Evaluate and Correct Aquifer Dewatering Effects on Well MW-4 Measured Drawdown Data – for some unconfined aquifer pump test solution techniques, aquifer de-watering can cause artificially high drawdown response in a well during pumping, and a significant under-estimation of hydraulic conductivity. For example, the Jacob-Cooper solution technique requires the measured drawdown values to be adjusted in the event that pumping de-waters the aquifer by more than 20 percent during the test (Driscoll, pp. 918-919)

   In order to determine if aquifer de-watering is of concern for the 1999 HGC low or high rate pump tests, it will be essential to determine the depth to the Jmb contact in well MW-4, as outlined by our request for a new well, discussed above. If the solution technique used by the HGC WHIP program is sensitive to aquifer de-watering, please correct the observed drawdown data for aquifer de-watering before it is analyzed to determine aquifer permeability.

6. Concerns with HGC Vertical Permeability Distribution Interpretation – the November 12, 2001 HGC Report indicates that a break in the drawdown slope in well MW-4 was caused by a high permeability zone encountered in the well. Because the geologic log for this well is cryptic, and because there is no other means of independently verifying this claim, it is critical that careful scrutiny be applied to the drawdown and recovery pump test data for this well. After careful consideration, DRC staff are unable to concur with your interpretation for the following reasons:

   A. Apparent Lack of Unique Solution: 1999 Drawdown Response High Rate Data – review of the November 12, 2001 HGC Report shows that at the same time that the vertical break occurred in the drawdown response data, at about 30 minutes into the test, HGC suddenly increased the pumping rate from 6.4 to 9.4 gpm (see Figure 1 below). As a result, the near vertical response in the drawdown curve is a product of both the pump rate increase and possible changes in aquifer characteristics.

      Another factor that must be considered is casing storage, which is a function of the pumping rate. Because the pumping rate increased, one can expect a degree of water storage will exist temporarily in the casing while the system adjusts to a new equilibrium. During this time of transition, casing storage will cause an artificial increase in drawdown slope, which could also explain the near vertical slope at about 30 minutes into the high rate test.

In light of these compounding factors, please justify how a unique solution for the head response can be generated when three different independent variables are at play. Lacking any additional justification, we will conclude that the drawdown side of the high rate pump test is inconclusive and does not support the presence of any high permeability zone at about 30 minutes into the test (~ 92 ft bgs).

B. Apparent Lack of Unique Solution: 1999 Recovery Response High Rate Data – the water level recovery portion of the 1999 high rate test shows two different recovery slopes are apparent in the MW-4 recovery response (see Figure 1 below). The transition of these two different recovery slopes occurs at about 53 minutes into the test (which corresponds to a drawdown equivalent interval of about 25 feet). Prior to 53 minutes, well MW-4 exhibited a recovery rate of about 1.83 ft/min. After this point, the well recovered at a 47% higher rate, 2.69 ft/min. However, it is important to note that at this same 53 minute time interval, the water level in well MW-4 rose above the top of the well screen located at a depth of 92 ft bgs. Consequently, it appears that the increase in the well recovery rate above and beyond this point is the product of partial penetration effects in well MW-4.

As a result of these findings, DRC staff conclude that the results of the 1999 HGC high rate pump test are inconclusive and therefore do not support previous IUC claims that a higher permeability zone exists in well MW-4 near the depth of about 92 ft bgs (25 feet of drawdown).

7. Concerns with Comparisons Made to the 1992 Peel Pump Test Results - with regard to comparisons ~~HGC made between the 1999 HGC high rate pump~~ test and the 1992 Peel low rate pump test, the DRC staff have concluded that it is premature to make such comparisons for the following reasons:

A. Higher Frequency of HGC Data Collection - the HGC test data appear to be a better data set for pump test analysis purposes, in that the head response data were collected on a constant interval of every 2 seconds during the 118 minutes of testing. In contrast, the 1992 Peel test, was based on head response data collected on 11 different time intervals that varied from 0.9 to 47 minutes each over a 333 minute duration of the test (2/93 Peel Report, Appendix C).

B. Lack of Evaluation of Effects of Partial Penetration – the February, 1993 Peel Report failed to evaluate the effects of partial penetration in well MW-4 as a part of the analysis. Until this evaluation is made for both the 1992 Peel data and the 1999 HGC data, it would be inappropriate to compare these pump tests and their respective hydraulic conductivities calculated.

C. Unexplained Adjustments to Drawdown Data – the 1992 Peel Report did make adjustments to the head response data to correct for aquifer de-watering. Unfortunately, no information was provided in the report to justify how or explain the basis for these adjustments. Since the true depth to the Jmb contact is currently unknown in well MW-4, it appears that the Peel adjustments were without foundation. Consequently, after installation of the confirmation boring requested above, please determine the total saturated thickness for the 1992 Peel pump tests and revise the de-watering corrections in the February 1993 Peel Report.

8. Need to Revise Hydrogeologic Cross-Section: Correlation of Conglomeratic Zones - review of Figure 9 of the November 12, 2001 HGC Report shows a number of important geologic data were omitted from or inaccurately displayed on the HGC hydrogeologic cross-section, including:

   A. Missing Well Total Depth – the total depth of the temporary wells was not included on the HGC cross-section for any of the wells displayed. Please revise the section to include this information. In one case, TW4-3, the elevation of the well's total depth, 5491 feet above mean sea level (ft amsl), falls below the lowest elevation provided on the cross-section (see Attachment 1, below).

   B. Missing Jmb Contact Elevations – the elevation of the Jmb contact in each well has also been omitted from the HGC cross-section. This information is important in order to understand the relationship between the conglomeratic zones and the base of the shallow aquifer. Please revise the cross-section to include these data.

   C. Missing Conglomeratic Zones – review of the IUC geologic logs for the eight temporary wells found on the HGC cross-section shows several conglomeratic zones have been omitted from the figure, including:

      1) Conglomeratic Zone Above the Jmb Contact – including a 12.5 foot thick zone in TW4-9 (see Attachment 1, below).

      2) Conglomeratic Zones Below the Jmb Contact – review of the IUC geologic logs for the wells in question show that conglomeratic zones were also observed at or below the Jmb contact in 5 of the 8 wells displayed on the HGC section (see Attachment 1 below). These include wells TW4-5, TW4-9, TW4-3, TW4-7, and TW4-6.

      Please revise the cross-section to include all lithologies found in each well.

   D. Thinner Conglomeratic Zones in Two Wells – the HGC cross-section indicates that the conglomeratic zones in two separate wells were approximately 5 feet thick, including TW4-4 and TW4-6. However, review of the IUC geologic logs shows that these conglomeratic intervals were only 2.5 feet thick. Please revise the cross-section for these two wells.

   After DRC revision of the HGC hydrogeologic cross-section it is apparent that several isolated conglomerate zones occur in the Brushy Basin Shale that are not likely hydraulically connected. This is not unreasonable in that these conglomeratic zones in the Cretaceous-age Burro Canyon Formation (Kbc) were deposited in a fluvial depositional environment.

   In a similar fashion, the Kbc conglomeratic zones seen above the Jmb contact may also be disconnected hydraulically. Please justify why the Kbc conglomeratic zones, found in the eight wells are hydraulically connected to one another. Please explain how such interconnection is possible in light of the above discussion of how the 1999 HGC high rate pump test was inconclusive in demonstrating the presence of a high permeability interval at a depth of about 92 ft bgs in well MW-4.

9. Problems with Estimated Thickness of the Alleged High Permeability Zone in Well MW-4 – we acknowledge that the November 12, 2001 HGC report made an attempt to estimate the thickness of the alleged high permeability interval in well MW-4 near the 92 ft bgs depth. However, based on the above comments and discussion the presence of such a high permeability zone near the 92 ft bgs interval in well MW-4 is unsupported. Consequently, the above issues, including partial penetration and aquifer de-watering during the pump tests, among others, must be resolved first before DRC staff will consider the HGC arguments regarding the thickness of the alleged zone in question.

10. Request for Additional Monitoring Well Near MW-4 - based on these findings, we conclude that well MW-4 does not fully penetrate the shallow aquifer. Determination of true local aquifer permeability at MW-4 will require correction of the partial penetration effects on pump test drawdown and determination of true aquifer thickness in this well. In addition, well MW-4 is the focus of an ongoing chloroform contamination investigation. Partial penetration in this well has the potential of underestimating true chloroform concentrations in the shallow aquifer at this location due to the effects of remote screen placement (6/7/01 DRC Request for Information, Attachment 1, p. 4, Item 1C). Therefore, in light of the above mentioned concerns and shortcomings regarding completion and aquifer permeability testing of well MW-4, we request that IUC install an additional monitoring well immediately adjacent to MW-4 that fully penetrates the shallow aquifer. Please provide a work plan and schedule for installation of this new monitoring well.

In order to expedite both the State groundwater permitting process and the chloroform contamination investigation, please resolve the above concerns and provide the requested monitoring well workplan within 30 days of receipt of this letter. If it would be helpful, we happy to meet with you to discuss these issues and concerns. If you have any questions regarding the above comments and concerns, please call Loren Morton of my staff at (801) 536-4262. Thank you for your cooperation in this matter.

Sincerely,

William J. Sinclair
Director

WJS/LBM:lm

attachments: References
Figure 1
Attachment 1

cc: Bill von Till, NRC-Washington, D.C. (with attachments)

F:\...\MW-4PumpTest.doc
File: IUC Groundwater Permit, Hydrogeologic Reports

References

Driscoll, 1986, Groundwater and Wells, 2nd Ed., Johnson Division, St. Paul, Minnesota, 1089 pp.

Hydro Geo Chem, Inc., September 28-29, 1999, unpublished fieldnotes by Stewart Smith from pump test work performed on IUC well MW-4, submitted to DRC on 10/18/01, pp. 15-27.

Hydro Geo Chem, Inc., October 15, 2001, 6 electronic data files named Mw4dwnt1.dat, Mw4test1.dwn, Mw4test1.pmp, and Mw4dwnt2.dat, Mw4test2.dwn, Mw4test2.pmp; received by DRC on 10/18/01.

Hydro Geo Chem, Inc., November 12, 2001, "Evaluation of Hydraulic Test Data at MW-4 White Mesa Uranium Mill Site Blanding, Utah", unpublished consultants report, 10 pp., 9 figures, 3 attachments.

Hydro Geo Chem, Inc. December 12, 2001, facsimile transmission of depth to groundwater before the 1999 HGC pump tests in IUC well MW-4, unpublished consultants information, 1 p.

Hydro Geo Chem, Inc., December 21, 2001, facsimile transmission regarding pressure transducer depth during 1999 HGC pump tests of IUC well MW-4, unpublished consultants data, 1 p.

International Uranium Corporation, June 22, 2001, "March 20, 2001 UDEQ Letter and Request for Additional Site Hydrogeology Information in Response to IUSA September 8, 2000 Revised Groundwater Information Report", unpublished company response, 20 pp., 14 attachments. Includes June 21, 2001 HydroGeoChem Inc. Report entitled "Review of 1994 Drilling Program Results", unpublished consultants report, 5 pp., 1 table, 1 figure, 3 attachments.

Peel Environmental Services, February, 1993, "Groundwater Study White Mesa Facility Blanding, Utah", unpublished consultants report, approximately 55 pp., 5 appendices.

Utah Division of Radiation Control, March 20, 2001, "September 8, 2000 Revised Groundwater Information Report: Groundwater Discharge Permit Application for White Mesa Mill: Request for Additional Site Hydrogeology Information", unpublished agency information request, 10 pp., 3 attachments.

Utah Division of Radiation Control, June 7, 2001, "October 4, 2000 IUC and HGC Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill Near Blanding, Utah: August 23, 1999 Utah Division of Water Quality Notice of Violation and Groundwater Corrective Action Order; Docket No. UGW20-01: Request for Additional Information.", unpublished agency request, 2 pp., 8 attachments (Attachment 1: DRC "Findings and Requested Information Regarding the October 4, 2000 IUC/HGC Chlorform Investigation Report", 9 pp.).

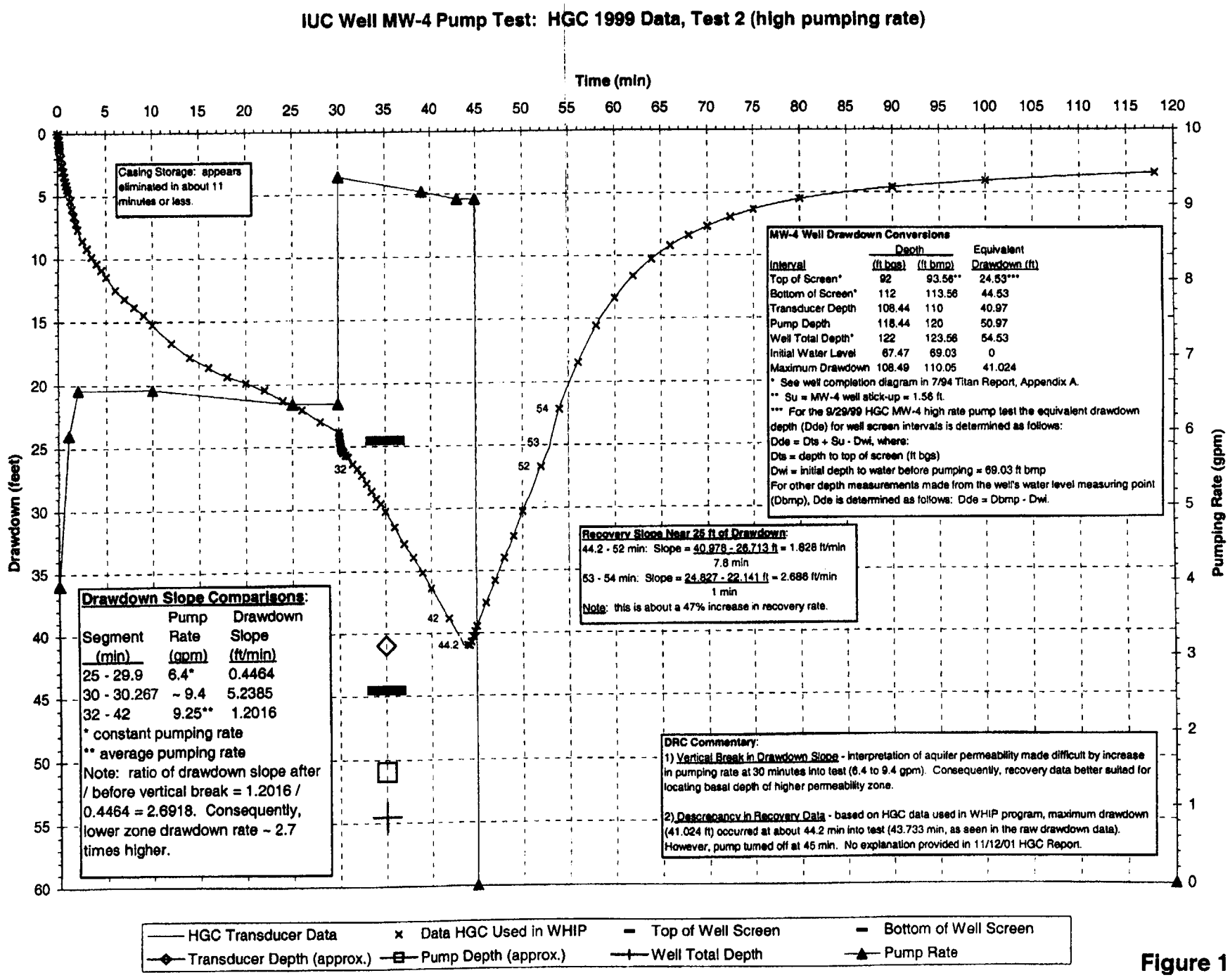

IUC Well MW-4 Pump Test: HGC 1999 Data, Test 2 (high pumping rate)
Time (min)
Drawdown (feet)
Pumping Rate (gpm)
Casing Storage: appears eliminated in about 11 minutes or less.
MW-4 Well Drawdown Conversions
Interval | Depth (ft bgs) | Depth (ft bmp) | Equivalent Drawdown (ft)
Top of Screen* 92 93.56** 24.53***
Bottom of Screen* 112 113.56 44.53
Transducer Depth 108.44 110 40.97
Pump Depth 118.44 120 50.97
Well Total Depth* 122 123.56 54.53
Initial Water Level 67.47 69.03 0
Maximum Drawdown 108.49 110.05 41.024
* See well completion diagram in 7/94 Titan Report, Appendix A.
** Su = MW-4 well stick-up = 1.56 ft.
*** For the 9/29/99 HGC MW-4 high rate pump test the equivalent drawdown depth (Dde) for well screen intervals is determined as follows:
Dde = Dts + Su - Dwi, where:
Dts = depth to top of screen (ft bgs)
Dwi = initial depth to water before pumping = 69.03 ft bmp
For other depth measurements made from the well's water level measuring point (Dbmp), Dde is determined as follows: Dde = Dbmp - Dwi.
Recovery Slope Near 25 ft of Drawdown:
44.2 - 52 min: Slope = 40.978 - 26.713 ft / 7.8 min = 1.828 ft/min
53 - 54 min: Slope = 24.827 - 22.141 ft / 1 min = 2.686 ft/min
Note: this is about a 47% increase in recovery rate.
Drawdown Slope Comparisons:
Segment (min) | Pump Rate (gpm) | Drawdown Slope (ft/min)
25 - 29.9 6.4* 0.4464
30 - 30.267 ~ 9.4 5.2385
32 - 42 9.25** 1.2016
* constant pumping rate
** average pumping rate
Note: ratio of drawdown slope after / before vertical break = 1.2016 / 0.4464 = 2.6918. Consequently, lower zone drawdown rate ~ 2.7 times higher.
DRC Commentary:
1) Vertical Break in Drawdown Slope - interpretation of aquifer permeability made difficult by increase in pumping rate at 30 minutes into test (6.4 to 9.4 gpm). Consequently, recovery data better suited for locating basal depth of higher permeability zone.
2) Descrepancy in Recovery Data - based on HGC data used in WHIP program, maximum drawdown (41.024 ft) occurred at about 44.2 min into test (43.733 min, as seen in the raw drawdown data). However, pump turned off at 45 min. No explanation provided in 11/12/01 HGC Report.
HGC Transducer Data
Data HGC Used in WHIP
Top of Well Screen
Bottom of Well Screen
Transducer Depth (approx.)
Pump Depth (approx.)
Well Total Depth
Pump Rate

Figure 1

IUC MW-4 Pump Test Analysis: Compare HGC Hydrogeologic Cross-section With IUC Geologic Logs										
11/12/01 HGC MW-4 Pump Test Report								= calculated fields		
		Wells on HGC Hydrogeologic Cross-section								
		TW4-5	TW4-9	TW4-3	TW4-2	TW4-7	TW4-1	TW4-4	TW4-6	TW4-8
G.S. Elevation (ft amsl)		5,638.75	5,636.11	5,631.21	5,622.76	5,619.87	5,617.56	5,612.30	5,607.33	5,619.93
DRC		HGC Conglomeratic Zone Elevations (ft amsl)								
Estimates	Top	5541	5561	5557	5543	5545	5554	5539	5538	
From	Bottom	5536	5561	5551	5525	5532	5523	5534	5533	
11/12/01 HGC										
Report,		Conglomeratic Zone Calculated Depths (ft bgs)								
Figure 9		97.75	75.11	74.21	79.76	74.87	63.56	73.30	69.33	
(North to South		102.75	85.11	80.21	97.76	87.87	94.56	78.30	74.33	
Section,										
TW4-5 to TW4-6)		Conglomeratic Zone DRC Approximate Thickness (ft bgs)								
		5	10	6	18	13	31	5	5	
DRC Review of IUC Geologic Logs (see cross-sections in 6/7/01 DRC RFI, Attachment 6)										
IUC Source Report:		1	1	1	1	1	1	2	2	
Kd / Kbc										
Contact	Top	38	38	37.5	35	27.5	27.5	17.5	22.5	27.5
Elevation (ft bgs):		5,600.75	5,598.11	5,593.71	5,587.76	5,592.37	5,590.06	5,594.80	5,584.83	5,592.43
		Conglomeratic Zone Depths (ft bgs)								
Uppermost	Top	97.5	75	75	77.5	75	65	75	70	97.5
Conglomerate	Bottom	102.5	85	80	97.5	87.5	95	77.5	72.5	120
Zone		5	10	5	20	12.5	30	2.5	2.5	22.5
DRC Thick. Check:		OK	OK	OK	OK	OK	OK			
Next Lower	Top		90							
Conglomerate	Bottom		102.5							
Zone			12.5							
Elevation, Top (ft bgs):			5,546.11							
Elevation, Bottom (ft bgs):			5,533.61							
Jmb										
Contact	Top	102.5	104	97.5	105	97.5	105	90	95	102.5
Elevation (ft bgs):		5,536.25	5,532.11	5,533.71	5,517.76	5,522.37	5,512.56	5,522.30	5,512.33	5,517.43
Next Lower	Top	110	112.5	125		107.5			95	102.5
Conglomerate	Bottom	115	115	132.5		110			97.5	112.5
Zone		5	2.5	7.5		2.5			2.5	10
Elevation, Top (ft bgs):		5,528.75	5,523.61	5,506.21		5,512.37			5,512.33	5,517.43
Elevation, Bottom (ft bgs):		5,523.75	5,521.11	5,498.71		5,509.87			5,509.83	5,507.43
Lowest	Top									117
Conglomerate	Bottom									120
Zone										3
Elevation, Top (ft bgs):										5,502.93
Elevation, Bottom (ft bgs):										5,499.93
Well										
TD	Bottom	120	120	140	120.5	120	110	112.5	97.5	125
Elevation, Bottom (ft bgs):		5,518.75	5,516.11	5,491.21	5,502.26	5,499.87	5,507.56	5,499.80	5,509.83	5,494.93
IUC Source Reports										
1) 1/28/00 IUC Chloroform Report, Appendix: TW4-1, TW4-2, TW4-3, TW4-5, TW4-7, TW4-8, and TW4-9.										
2) 10/4/00 IUC Chloroform Report, Appendix C: TW4-4 and TW4-6.										
										Attachment 1

attachment 7

INTERNATIONAL
URANIUM (USA)
CORPORATION

Independence Plaza, Suite 950 • 1050 Seventeenth Street • Denver, CO 80265 • 303 628 7798 (main) • 303 389 4125 (fax)

November 13, 2001

40-8681

VIA OVERNIGHT DELIVERY

Mr. William J. Sinclair
Director, Division of Radiation Control
Utah Department of Environmental Quality
P.O. Box 144850
168 North 1950 West
Salt Lake City, UT 84114-4850

Re: Evaluation of Hydraulic Test Data, Monitor Well 4
Ground Water Discharge Permit Application, White Mesa Mill

Dear Mr. Sinclair:

As promised to Loren Morton during our meeting of October 18, 2001, attached is a report prepared by Hydro Geo Chem, Inc., summarizing the hydraulic tests conducted on Monitor Well 4 in 1999 and 1992. This information was presented and discussed during the meeting of October 18, and we agreed to formalize the information in support of the Groundwater Discharge Permit Application.

If you have any questions on the attached report, please feel free to contact me at (303) 389-4160.

Very truly yours,

Harold R. Roberts
Vice President – Corporate Development

cc/att: Larry Mize, UDEQ Division of Water Quality
Loren Morton, UDEQ Division of Radiation Control
R. William von Till, NRC
Michelle R. Rehmann, IUSA
Stewart J. Smith, Hydro Geo Chem
Roman Z. Pyrih

cc: w/out att: Dianne Nielson, UDEQ
Dave Arrioti, S.E. Utah Health Department
Ron F. Hochstein, IUSA
David C. Frydenlund, IUSA

NMSSO/ Public

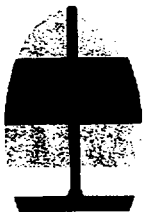
EVALUATION OF HYDRAULIC TEST DATA AT MW-4
WHITE MESA URANIUM MILL SITE
BLANDING, UTAH

Prepared for:

INTERNATIONAL URANIUM (USA) CORPORATION
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, CO 80265

Prepared by:

HYDRO GEO CHEM, INC.
51 West Wetmore Road, Suite 101
Tucson, Arizona 85705-1678
(520) 293-1500



November 12, 2001

HYDRO GEO CHEM, INC.

Environmental Science & Technology

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1. INTRODUCTION

This report is pursuant to a meeting between International Uranium (USA) Corporation (IUSA), Utah Department of Environmental Quality (UDEQ), and Hydro Geo Chem, Inc. (HGC) on October 18, 2001. The purpose of this report is to document the results of hydraulic tests conducted at perched monitoring well MW-4, located at the White Mesa Uranium Mill near Blanding, Utah, during 1999. The results of hydraulic tests conducted in 1999 are compared with results of tests conducted in 1992. Implications of test results with regard to lithology, perched zone permeability, and transport of chloroform near MW-4 are discussed. This report is intended to support the ongoing investigation of elevated chloroform concentrations in perched water near MW-4 discussed in IUSA and HGC, 2000, and IUSA and HGC, 2001, and to help resolve hydrogeologic issues raised by UDEQ that are related to both the chloroform investigation and Groundwater Discharge Permit detection monitoring at the site. Background information for this site is available in IUSA and HGC, 2000.

2. WATER LEVELS AND HYDRAULIC GRADIENT NEAR MW-4

Figures 1 through 4 are water level contour maps for August 1990, August 1994, December 2000, and October 2001. Although water levels on the east side of the site were difficult to define prior to the installation of perched wells MW-18, MW-19, and MW-22, a southerly gradient has existed near MW-4 from 1994 through the present time, and likely existed prior to that time. This is reasonable considering site topography and the presence of canyons along the northwest, west, and east sides of the site, into which perched water is known to discharge via springs. In the absence of artificial recharge sources, the hydraulic gradient can be expected to naturally change from southwesterly on the west side of the site, to southerly, as one moves from west to east across the site, towards the canyon on the east side of the site. This southerly gradient likely existed between MW-4 and the source of the chloroform in MW-4 (the abandoned scale house leach field, as discussed in IUSA and HGC, 2000) prior to 1994.

Beginning in 1994, water levels in MW-4 began to rise and the hydraulic gradient steepened. A more westerly component of flow began to occur in the vicinity of the abandoned scale house leach field at about that time due to enhanced recharge to the northeast, as discussed in IUSA and HGC, 2000. As discussed in IUSA and HGC, 2001, additional temporary perched monitoring wells are planned to the west and northwest of MW-4, and phased installation of piezometers is planned in the northeast portion of the site, to further investigate these changes and to further delineate the chloroform in the perched water near MW-4.

3. HYDRAULIC TESTS AT MW-4

In the following sections, hydraulic tests conducted at MW-4 in 1992 are compared with tests conducted in 1999. The results of these tests are then related to the vertical permeability distribution and lithology near MW-4.

3.1 1992 Tests

Peel conducted pump tests at MW-4 in 1992. Two tests were performed; one at a constant pumping rate of 0.46 gallons per minute (gpm) (reported in UMETCO, 1994) and one at a constant pumping rate of 0.92 gpm (apparently not previously reported). Both tests demonstrate similar behavior and yield similar results, as will be discussed below.

Attachments 1 and 2 are plots of the drawdown data for these two tests, which include Peel's calculation of transmissivity for the "late time" data. An interpretation of the "early time" data (which is not really "early time" because the behavior of the data is the same through the first 3⅓ hours of the 0.46 gpm test, and through the first 1⅔ hours of the 0.92 gpm test) is provided in a box at the top of the drawdown plot in both figures. In both cases, this "early time" data forms a nearly straight line on the semi-log plot until a break in slope occurs at a drawdown of approximately 2½ to 3 feet (approximately 95 feet below top of casing(btoc)). It is perfectly valid to interpret this "early time" data using the Jacob-Cooper methodology in the same way that Peel did for the "late

time" data, after the break in slope occurred, because nearly straight lines occur both before and after the break.

As shown in the figures, a hand-fit line to the "early time" data yields a transmissivity of 152 gal/day/ft (20.3 ft^2/day) for the 0.46-gpm test, and 161 gal/day/ft (21.6 ft^2/day) for the 0.92-gpm test. These values are approximately 39 and 26 times higher, or about an average of a little more than 30 times higher than the values calculated for the "late time" (post-slope-break) drawdown data.

The "early-time" data for the 0.46-gpm test was also re-interpreted by HGC using WHIP, a well hydraulics interpretation package developed and marketed by HGC (Figure 5). A transmissivity of 22.8 ft^2/day was obtained, which is very close to the hand-fit results for the same data.

3.2 1999 Tests

Two tests were conducted at MW-4 in 1999. At this time, water levels in MW-4 were more than 20 feet higher than in 1992. A low rate test, where the well was pumped at increasing rates of approximately ½, 1½, and 2 gpm, was performed using a bladder pump. The purpose of conducting the test at increasing pumping rates was to determine if non-linear well efficiency effects may be influencing the drawdown in the well, resulting in underestimation of transmissivity. The results indicated that such effects were negligible. A high rate test, at rates of approximately 6 to 9 gpm,

was performed using a Grundfos™ submersible pump. In both tests, water levels in the well were continuously monitored using a GeoKon™ pressure transducer and data logger.

The results of the two tests are shown in Figures 6 and 7. A transmissivity of 38.4 ft²/day was obtained for the low rate test, and a transmissivity of 21.5 ft²/day for the high rate test. The fit is superior for the low rate test and therefore the results of this test are considered more reliable. The results of the high rate test, in which water levels were drawn down into the range of the 1992 tests, are, however, nearly identical to the results of the 1992 tests.

Figure 8 shows the raw water level data collected during the high rate test at MW-4. As shown in the figure, a distinct break in slope occurs in the drawdown and recovery portions of the curve at a depth of approximately 95 ft btoc. The rate of drawdown increases when water levels drop below this depth, and the rate of recovery increases when water levels rise above this depth.

3.3 Vertical Permeability Distribution at MW-4

The hydraulic test data collected at MW-4 to date indicate that a reduction in permeability occurs below a depth of about 95 feet btoc at MW-4, and that this depth therefore coincides with the base of a higher permeability zone or layer at that location. The break in slope in the Peel test data from 1992 is interpreted as occurring upon dewatering of that higher permeability layer at about 3⅓ hours into the 0.46 gpm test (or about 1⅔ hours into the 0.92 gpm test). At the start of each test

only the lower 2½ to 3 feet of the layer was saturated. Once this layer was desaturated near the well, most of the water entering the well was derived from materials below that layer. Because the rate of drawdown increased by about a factor of 30 once the upper layer was dewatered, the materials below 95 feet btoc are interpreted as having a much lower permeability than the material immediately above.

Attachment 3 provides a calculation of the permeability of the saturated portion of the layer above 95 feet btoc. The average permeability of the entire saturated thickness at that time is calculated as:

$$\frac{21 ft^2 / day}{17 ft} = 1.2 ft / day$$

assuming a depth to Brushy Basin of 108 ft below land surface (bls) and a saturated thickness of 17 feet at that time. As calculated in Attachment 3, the permeability of the saturated portion of the high permeability layer is approximately 7 ft/day.

3.4 Correlation of Vertical Permeability Distribution at MW-4 to Lithology Logged at Nearby Temporary Wells

Figure 9 is a north-south cross section from TW4-5 through TW4-6. TW4-7, located approximately 30 feet west of MW-4, is the well closest to MW-4. Approximate intervals of conglomeratic sandstone logged in these wells are depicted. As shown, wells close to MW-4 have

a conglomeratic interval with a base ranging from about 90 ft bls to about 95 ft bls. This zone most likely correlates to the higher permeability zone revealed by hydraulic tests at MW-4. Because this zone exists below the perched water table at all temporary perched wells north of MW-4, it likely influences the movement of perched water and transport of chloroform in the vicinity of MW-4. Based on the 1992 hydraulic tests at MW-4, at least the lower 2½ to 3 feet of this zone has a higher permeability than underlying materials.

3.5 Estimated Thickness of the Higher Permeability Zone at MW-4

The transmissivity of 38 ft^2/day estimated from the 1999 test at MW-4 yields an average permeability of approximately 1 ft/day (assuming a saturated thickness of 40 feet at that time), which is about the same as estimated from the 1992 data.

The thickness of the higher permeability zone, assumed to correlate with the conglomeratic material logged in nearby temporary wells, can be approximated as:

$$\frac{38 ft^2 / day}{21 ft^2 / day}(3 ft) = 5.5 ft$$

assuming the permeability of the zone is constant over its thickness, that the permeability of the material above and below the zone is about the same, and that most of the water supplied to the well is from the high permeability zone. However, the well screen only extends to about 92 feet bls, and

it is unclear how far above the screen that water from the formation could enter the annular space. Such calculations are therefore suspect because the thickness of the saturated portion of the perched zone above the well screen that can contribute water to the well is uncertain. Based on the well construction diagram, it's possible that water could enter the annular space at depths as shallow as the bentonite seal at 86 ft bls.

Regardless of the thickness of the higher permeability zone at MW-4, the data show that at least the lower portion of this zone (the lower 2½ to 3 feet) has a permeability sufficiently high to have allowed chloroform migration from the abandoned scale house leach field to MW-4 over a 20-year period. The estimated permeability of 7 ft/day for this zone at MW-4 is more than 3 times higher than would be needed to transport chloroform from the abandoned leach field to MW-4 in 20 years, assuming a porosity of 20% and an average hydraulic gradient of 0.016 ft/ft. The actual transport time would depend on the average permeability of this zone between the leach field and MW-4, which could be as low as approximately one third of the calculated value of 7 ft/day at MW-4.

4. CONCLUSIONS

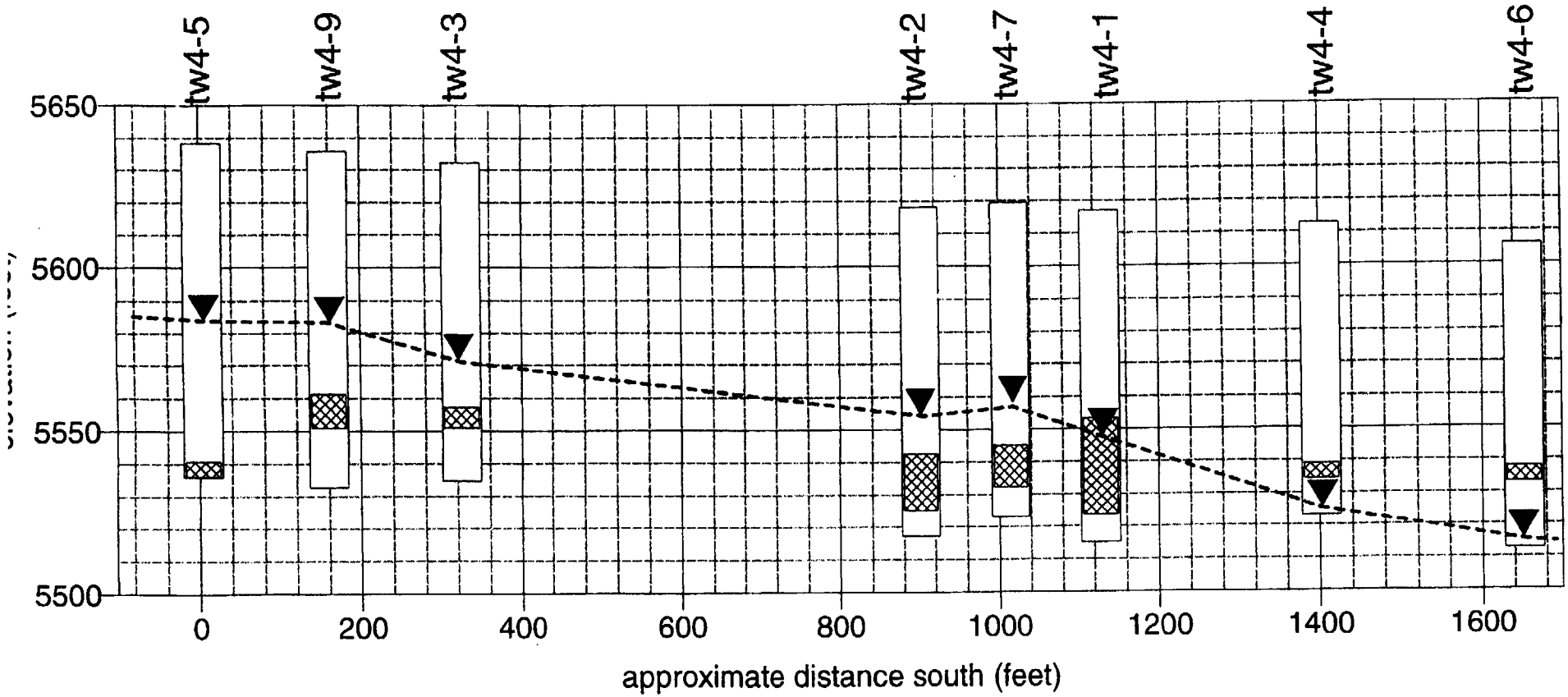
Hydraulic test data from MW-4 and lithologic logging of nearby temporary wells indicate that a conglomeratic zone at least 5 ft thick with a permeability of approximately 7 ft/day near its base exists at MW-4. Conglomeratic materials have been logged in all temporary wells between MW-4 and the upgradient abandoned scale house leach field, which is the most likely source for the chloroform in MW-4. Because this conglomeratic material is present below the perched water table in the temporary wells upgradient of MW-4, it could have significantly influenced perched water movement and chloroform transport between the abandoned leach field and MW-4. The calculated permeability of the lower few feet of this layer at MW-4, 7 ft/day, is more than sufficient to have resulted in chloroform transport to MW-4 over a 20-year period.

5. REFERENCES

International Uranium (USA) Corporation (IUSA) and Hydro Geo Chem (HGC), 2000. Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill near Blanding, Utah. Submitted to UDEQ.

IUSA and HGC, 2001. Update to "Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill near Blanding, Utah." Submitted to UDEQ.

Umetco Minerals Corporation, 1994. Groundwater Study, 1994 Update. White Mesa Facility, Blanding, Utah. Submitted to United States Nuclear Regulatory Commission.



EXPLANATION:

conglomeratic sandstone

10/01 water table

APPROXIMATE INTERVALS OF CONGLOMERATIC SANDSTONE LOGGED IN TEMPORARY WELL BORINGS

Approved	Date	Reference	Figure
			9

attachment 8

CHLOFORM MONITORING DATA: WHITE MESA MILL

WELLS	CHLOROFORM (ug/l)				
North of Cells	5/11/99	11/30/00	11/7-9/01	1/21/02	3/26-27/02
MW-1	1..2	1.0			
MW-18	<1.0	.07			
MW-19	<1.0	< 1.0			
East of Cells					
MW-4	4,700	5,030.0	5,200		4,700
TW4-1		2,550.0	3,200		3,200
TW4-2		4,250.0	5,300		5,100
TW4-3		770.0	170		11
TW4-4		4.1	2,900		3,400
TW4-5		250.0	260		260
TW4-6		1.0	ND		ND
TW4-7		610.0	1,100		1,500
TW4-8		130.0	180		190
TW4-9			49		41
TW4-10			270	14	16
TW4-11			3,000	4,700	4,900
TW4-12			47		45
TW4-13			ND		ND
TW4-14			ND		3,200
TW4-15			590		
South of Cells					
MW-17	1.0	3.4			
South Edge of Cells					
MW-5 (cell 2)	1.0	1.0			
MW-12 (cell 2)	1.0	1.0			
MW-11 (cell 3)	1.0	1.0			
MW-14 (cell 4A)	1.0	1.0			
MW-15 (cell 4A)	1.0	1.0			
South & West of Cells					
MW-3	0.9	1.0			
MW-2	1.0	1.0			

Data from:

October 12, 2001 International Uranium Corporation White Mesa Mill: DRC Groundwater VOC Results - 5/99 and 11/00 Split Sampling Event, enclosed in letter from Loren B. Morton, DRC, to Michelle Rehmann, IUSA, October 12, 2001.

4th Quarter 2001 and 1st Quarter 2002 Chloroform Monitoring Data from International Uranium (USA) Corporation, April 19, 2002.

attachment 9

INTERNATIONAL
URANIUM (USA)
CORPORATION

6425 S. Hwy. 191 • P.O. Box 809 • Blanding, UT 84511 • 435-678-2221 (phone) • 435-678-2224 (fax)

April 27, 2001

Mr. William Von Till
Project Manager/Hydrogeologist
U.S. Nuclear Regulatory Commission
11545 Pike
Two White Flint North
Rockville, MD 20852-2738
Mail Stop T7J8

RE: Cell 4-A Leak Detection Report
Source Material License No. SUA-1358
Docket No. 40-8681

Dear Mr. Von Till:

This letter transmits to the U.S. Nuclear Regulatory Commission ("NRC") the preliminary investigative report of the recent apparent exceedance of the prescribed infiltration rate into the Leak Detection System of Tailings Cell 4-A at the International Uranium (USA) Corporation ("IUSA") White Mesa Uranium Mill (the "Mill").

Per License Condition 11.3.D of the above referenced license, the Mill is to notify the NRC by telephone within 48 hours of determination of a flow rate into the leak detection system greater than 1 gallon per minute (>1 gpm) and submit a report within thirty days which details the mitigative actions taken and their results.

Mill staff determined on March 27, 2001 that the infiltration rate into the leak detection system appeared to exceed the 1 gpm level and subsequently notified IUSA's Corporate Management on that date. IUSA Corporate Management notified the NRC of the apparent excessive infiltration rate via telephone on March 28, 2001.

The attached report discusses the history of Cell 4-A, mitigative actions currently underway and their results to date, additional planned mitigative actions, and suggested corrective action to prevent a reoccurrence of this problem.

NMSSOIPublic

If you have any questions or concerns regarding this matter, please, do not hesitate to contact me at (435) 678-2221.

Sincerely;

William N. Deal
Manager, White Mesa Mill
International Uranium (USA)
Corporation.

Attachments

cc: central file
Ron Hochstein
Ron Berg
Michelle Rehmann
David Frydenlund

CELL 4-A LEAK DETECTION REPORT

Submitted by

INTERNATIONAL URANIUM (USA) CORPORATION

WHITE MESA MILL

License No. SUA-1358

Docket No. 40-8681

April 27, 2001

1.0 INTRODUCTION

License Condition 11.3.D.3 of Source Material License SUA-1358 for International Uranium (USA) Corporation's ("IUSA's") White Mesa Mill (the "Mill") states the following:

> "Upon indication that the LDS fluids originated from the disposal cell, the licensee shall determine the flow rate through the liner by the calculation method in paragraph B of this license condition. If the flow rate is equal to or greater than one gallon per minute, the licensee shall:
>
> 1. Evaluate the cause of the liner distress and take appropriate and timely actions to mitigate the leak and any consequent potential impacts;
> 2. Continue to measure and record LDS "depth to fluid" measurements weekly; and
> 3. Notify NRC by telephone within 48 hours, in accordance with License Condition 9.2, and submit a written report within 30 days of notifying NRC by telephone, in accordance with License Condition 9.2. The written report shall include a description of the mitigative action(s) taken and a discussion of the mitigative action results."

During a review of pump rates from the Leak Detection System for Tailings Cell 4-A by Mill staff on March 27, 2001, the flow rate was calculated to be in excess of 1.0 gallon per minute (gpm). Subsequently, on that date Mill staff notified IUSA's Corporate Management via telephone of the apparent excessive infiltration into the leak detection system and, after further review of all available information, IUSA Corporate Management notified the NRC via telephone, on March 28, 2001. At that time, IUSA committed to submit this report by April 27, 2001 as per License Condition 11.3.D.3.

This report will detail the Cell 4-A history, preliminary analysis of the cause of the infiltration into the leak detection system, mitigative efforts and their results, to date and, finally, proposed mitigative actions.

2.0 CELL 4-A HISTORY

Tailings Cell 4-A was constructed in 1989, and was temporarily placed in service in approximately late December 1989 with the pumping of vanadium solvent extraction raffinate to the Cell. Since 1994 there has been no solution, other than natural precipitation, pumped into Cell 4-A. No tailings sands have ever been placed into this Cell.

The Cell covers approximately 40 acres and is lined with a 40 millimeter (40 mil) high density polyethylene (HDPE) liner over approximately 12 inches of compacted clay. The leak detection system for Cell 4-A consists of a series of perforated pipes imbedded in gravel, above the clay layer, in a herring-bone layout beneath the HDPE liner. The main leak detection pipe extends

from the southwest corner of the Cell towards the northeast corner, with collector pipes extending diagonally from the main leak detection pipe. A collection pipe is connected to the main pipe and extends to the top of the Cell in the southwest corner beneath the HDPE liner.

In order to determine whether there is any moisture in the leak detection system and aid in the estimation of the level of the liquid, a ½ blowpipe is placed into the collection pipe. A submersible pump is also placed down the leak detection collection pipe to remove any solution that may accumulate.

The leak detection system has been monitored and data collected since March 1, 1990 as per Standard Operating Procedures contained in the Environmental Protection Manual Section 3.1 and 3.2, Appendix E. The data for the past year is included as Attachment 1 of this report and the entire database is available for review at the Mill. Historically, when the depth to fluid in the leak detection system exceeded 119 feet (the depth to fluid is measured from the top of the collection pipe to the fluid level) the system was considered to be "dry", as there was insufficient solution to pump.

There have been several instances since March 1990 when the depth to fluid in the leak detection system has risen to between 98 and 105 feet. In all of these previous occurrences, Mill staff has been able to pump the system "dry" and maintain a flow rate of less than one gallon per minute.

During the past several years, the HDPE liner on the side walls of the cell has been damaged by wind and has separated at the seams in a number of locations. Mill staff has attempted to stabilize these damaged areas by securing the liner using wooden planks. However, due to the damaged panels on the side walls of the Cell it is possible for natural precipitation (rain or snow) to infiltrate beneath the HDPE liner and potentially reach the leak detection system.

3.0 ANALYSIS OF CURRENT INFILTRATION RATE

The levels of solution in the leak detection system began to rise in December of 2000 (see Graph 1, Cell 4-A Depth to Solution and Attachment 1); however, the Mill staff was always able to pump the system dry and the calculated flow rate was less than the 1 gpm level over the relevant calculation period.

During late January and early February 2001, the leak detection system was not pumped as the pump was frozen, which is typical for this time of the year. Also during this period of time the blow tube was frozen and broken. Consequently, sporadic depth readings were obtained during this period. During this period, on January 25, 2001 the system was pumped and a flow rate of 1.74 gpm was estimated. Due to the freezing problems experienced and the change in density of the solution, the Mill Staff does not have much confidence in that reading.

In mid-February, the pump was thawed, but an electrical problem prevented pumping the system until February 28, 2001. During the latter half of February, the blow tube was also replaced. It

was at this time that the high level was detected in the leak detection system and pumping of the system began.

During the week of March 26, 2001, the Mill staff determined the pump flow rate from the leak detection system and calculated the infiltration rate into the system. Based on that data, it appeared that the infiltration rate into the leak detection system had exceeded 1 gpm as early as January 25, 2001 and again on March 19, 2001. The calculated flow rates for those two dates are 1.74 gpm and 1.73 gpm, respectively. Since March 20, 2001 the pump has been running almost continuously and the estimated flow rate from the leak detection system has ranged from 1.85gpm to 4.09gpm since that date

The potential causes for the infiltration into the leak detection system are:

a) Initially, Mill staff suspected that the increased amount of infiltration into the leak detection system could be attributed to the heavy amounts of precipitation received at the Mill during late fall and early winter of 2000 (see Attachment 2, Precipitation Record and Graph 2, WMM Monthly Precipitation). Such precipitation events have appeared to impact the leak detection system in previous years, although a direct correlation is difficult to show with the data.

b) Mill staff also suspected that the current excessive infiltration rate into the leak detection system may be the result of the aforementioned precipitation infiltrating beneath the liner then freezing, causing a pooling effect as the weather warmed. It seems possible that this scenario could in fact affect the infiltration rate into the leak detection system and subsequent pumping rate from the system.

c) Another potential cause of the infiltration is due to a mechanical fault of a check valve, which was located on the discharge of the Cell 4-A sump pump. This pump is on the surface of the crystals in Cell 4-A and is used to pump any liquid that may have accumulated in Cell 4-A to Cell 3. The leak detection system pump also pumped into the same discharge line through a check valve. During one pumping event, when the sump pump was operating, the check valve failed and the solution from the sump pump was pumped into the leak detection system. The volume of fluid pumped is unknown.

d) A potential leak in the HDPE lining under the area in which solution crystals have formed.

4.0 MITIGATIVE EFFORTS CURRENTLY UNDERWAY

Since March 28, 2001 the pumps in the leak detection system have been operating continuously. The piping of the leak detection pump and the Cell 4-A sump pump has been changed such that each pump has a dedicated discharge line which pumps solutions to Cell 3. Since March 28, 2001, approximately 548,000 gallons of solution have been pumped from the leak detection system. The level of solution in the leak detection system has not fallen and remains at

approximately 94 feet. Currently, efforts are (and have been) underway to obtain a pump[1] with greater capacity for use in the leak detection system.

When possible, the sump pump in Cell 4-A is also run to pump any solution from the interior of Cell 4-A to Cell 3. Typically this pumping occurs after each precipitation event. In addition to the sump pump, the Mill staff is also purchasing a pump for the slimes drain in order to drain that system as well.

Pumping and monitoring of the Cell 4-A leak detection system, slimes drain and sump pump will continue, until the infiltration rate into the system is stabilized or stops.

5.0 FUTURE MITIGATIVE ACTIONS

Coincidental to the increased infiltration of the leak detection system, IUSA has been investigating the removal of the crystals from Cell 4-A. Two methods have been considered including mechanical removal and dissolution, with the latter being the preferred alternative. Preliminary test work at the Mill indicates that a very mild caustic solution will effectively dissolve the crystals. The process would involve addition of solution to the crystals using a sprinkler system followed by a period of time to allow the solution to dissolve the crystals. Once sufficient solution is generated it will be pumped from Cell 4-A to Cell 3 and the cycle will be repeated. It is estimated that once the process is started it will take approximately two to three months to remove all of the crystals from the Cell. Once the crystals are removed from the cell, the Cell will be empty.

Quarterly sampling of the Point of Compliance (POC) wells was also recently completed, with the results from this sampling event expected next week. When received, Mill and IUSA Corporate staff will review the sampling data; however, it is not expected that the data will indicate any impact from the increased flow in the leak detection system.

6.0 CONCLUSIONS

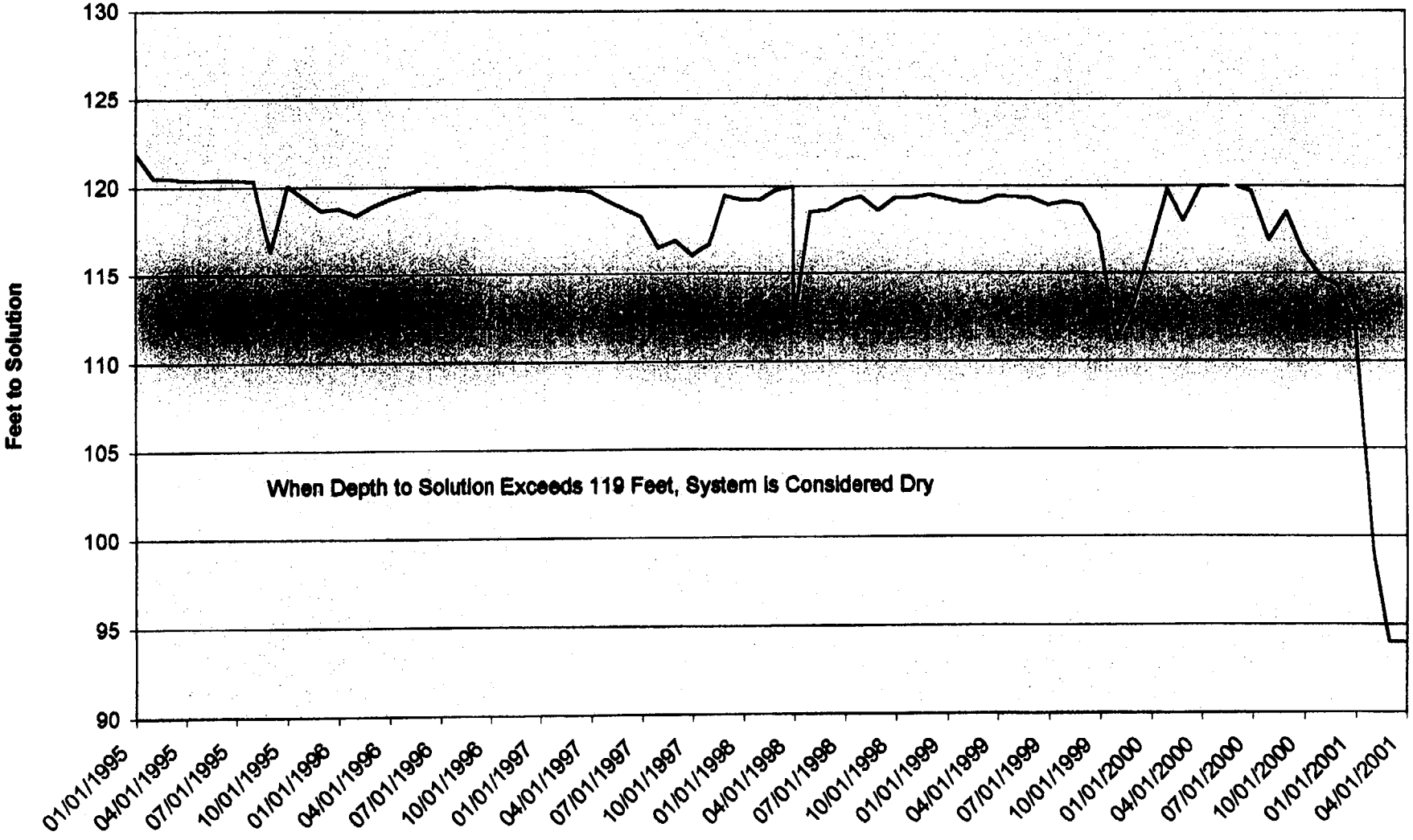
At this time, there is insufficient data available to develop any substantial conclusions regarding the cause of the increased infiltration into the leak detection of Cell 4-A. As stated above, the current pumping program, including the pumping of solutions from the interior of the cell, will continue until the system appears to be dry.

In the interim, if the level in the leak detection system fails to drop, even after the installation of the larger pump, IUSA will initiate the removal of the crystals using the dissolution process. The initial focus will be around the sump pump area, in the southwest corner of Cell 4-A.

An updated status report of this investigation will be issued in 30 days, outlining any new data and/or courses of action to be undertaken.

[1] The pumps used in this application are specialty pumps primarily constructed of titanium components. The Mill's historical supplier no longer carries this type of pump and as a result the Mill staff are currently evaluating other potential suppliers.

Graph 1
Cell 4-A LD Depth to Solution



attachment 10

INTERNATIONAL
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CORPORATION

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May 29, 2001

Mr. William Von Till
Project Manager/Hydrogeologist
U.S. Nuclear Regulatory Commission
11545 Pike
Two White Flint North
Rockville, MD 20852-2738
Mail Stop T7J8

RE: Cell 4-A Leak Detection System Follow-up Report
Source Material License No. SUA-1358
Docket No. 40-8681

Dear Mr. Von Till:

This letter transmits to the U.S. Nuclear Regulatory Commission ("NRC") the follow-up investigative report of the recent apparent exceedance of the prescribed infiltration rate into the leak detection system ("LDS") of Tailings Cell 4-A at the International Uranium (USA) Corporation ("IUSA") White Mesa Uranium Mill (the "Mill").

While Cell 4-A has a double liner system and there is no evidence or expectation of any release to the environment through the bottom clay liner, the Mill is required, under License Condition 11.3.D of its license, to notify the NRC by telephone within 48 hours of determination of a flow rate into the LDS greater than 1 gallon per minute (>1 gpm) and submit a report within thirty days which details the mitigative actions taken and their results.

Mill staff determined on March 27, 2001 that the infiltration rate into the LDS appeared to exceed the 1 gpm level and subsequently notified IUSA's Corporate Management on that date. IUSA Corporate Management notified the NRC of the apparent excessive infiltration rate via telephone on March 28, 2001. IUSA submitted a preliminary report to the NRC on April 27, 2001.

The attached report discusses the results of mitigative actions currently underway, additional planned mitigative actions, and suggested corrective actions.

As NRC is aware, Cell 4-A is not in use and its synthetic liner is in need of repair before it can be put into use. IUSA is currently in the process of updating the Cell 4-A design, with

the intent of removing the existing crystals in the cell and installing a new synthetic liner system.

If you have any questions or concerns regarding this matter, please, do not hesitate to contact me at (435) 678-2221.

Sincerely;

William N. Deal
Manager, White Mesa Mill
International Uranium (USA)
Corporation.

cc: William J. Sinclair
Ron Hochstein
Ron Berg
Michelle Rehmann
David Frydenlund

CELL 4-A LEAK DETECTION FOLLOW-UP REPORT

Submitted by

INTERNATIONAL URANIUM (USA) CORPORATION

WHITE MESA MILL

License No. SUA-1358

Docket No. 40-8681

May 29, 2001

1.0 INTRODUCTION

The White Mesa Mill (the "Mill") is currently operated by International Uranium (USA) Corporation ("IUSA") under Source Material License SUA-1358 (the "Mill License"). The Mill's tailings Cell 4-A was originally constructed and permitted by the NRC in January of 1990. Its liner system consists of two liners: a 40 ml HDPE synthetic top liner and a twelve inch compacted clay bottom liner. Between the two liners is a leak detection system ("LDS"). In addition, there is a slimes drain system on the top surface of the synthetic liner. The Cell was initially used for storage and evaporation of process solutions. Early problems with the synthetic liner installation limited its use to only solution storage, and no tailings solids have been discharged to the Cell. During the early years of operation the evaporation of process solutions resulted in the precipitation of dissolved solids into the bottom of the Cell. No additional process solutions have been added to the Cell for several years, but the original crystals have remained. The Cell has not been in use for several years, and, as the NRC is aware, its synthetic liner is in need of repair before the Cell can be put into use. IUSA is currently in the process of updating the design of Cell 4-A with the intent of removing the existing crystals and installing a new synthetic liner system for the Cell.

While Cell 4-A has a double liner system, and any leakage through the top synthetic liner is designed to be pumped out through the LDS and, in any event prevented by the bottom clay liner from being released to the environment, an excessive rate of flow from the synthetic liner to the LDS would indicate that the system is not performing as designed and mitigative actions would be required by the licensee.

License Condition 11.3.D.3 of the Mill License states the following:

> "Upon indication that the LDS fluids originated from the disposal cell, the licensee shall determine the flow rate through the liner by the calculation method in paragraph B of this license condition. If the flow rate is equal to or greater than one gallon per minute, the licensee shall:
>
> 1. Evaluate the cause of the liner distress and take appropriate and timely actions to mitigate the leak and any consequent potential impacts;
> 2. Continue to measure and record LDS "depth to fluid" measurements weekly; and
> 3. Notify NRC by telephone within 48 hours, in accordance with License Condition 9.2, and submit a written report within 30 days of notifying NRC by telephone, in accordance with License Condition 9.2. The written report shall include a description of the mitigative action(s) taken and a discussion of the mitigative action results."

During a review of pump rates from the LDS for Tailings Cell 4-A by Mill staff on March 27, 2001, the flow rate was calculated to be in excess of 1.0 gallon per minute (gpm). Subsequently, on that date Mill staff notified IUSA's Corporate Management via telephone of the apparent

excessive infiltration into the LDS and, after further review of all available information, IUSA Corporate Management notified the NRC via telephone, on March 28, 2001. At that time, IUSA committed to submit a preliminary report by April 27, 2001 as per License Condition 11.3.D.3. In the April 27, 2001 report, IUSA committed to sending a follow-up report within 30 days of the date of that report.

License Condition 9.2 states that "All written notices and reports to the NRC required under this license, with the exception of incident and event notifications under 10 CFR 20.2202 and 10 CFR 40.60 requiring telephone notification, shall be addressed to the Chief, Uranium Recovery and Low-Level Waste Branch, Division of Waste Management, Office of Nuclear Material Safety and Safeguards".

It should be emphasized that, while notification has been given to NRC and mitigative actions are required under License condition 11.3.D, as a result of the increased flow rate to the LDS, there is no evidence nor expectation that there has been any seepage or release through the bottom clay liner into the environment. As a result, there has been no incident or event requiring notification under either 10 CFR 20.2022 or 10 CFR 40.60.

This report will review the results of the mitigative actions taken to date and further analysis of the cause of the infiltration into the LDS and proposed mitigative actions.

2.0 RESULTS OF MITIGATIVE ACTIONS TO DATE

Since the submittal of the preliminary investigative report on April 27, 2001, the LDS has been pumped nearly continuously (the pump was shut down for several hours on May 17, 2001 for maintenance) at a pump rate of approximately 11.0 gpm. The transfer pump in Cell 4-A has operated intermittently to pump solution from the interior of Cell 4-A to Cell 3.

The levels in the LDS have dropped 1.55 feet (18.6 inches) since the preliminary report was written.

3.0 ANALYSIS OF CURRENT INFILTRATION RATE

The potential causes for the infiltration into the LDS are:

a) Initially, Mill staff suspected that the increased amount of infiltration into the LDS could be attributed to the heavy amounts of precipitation received at the Mill during late fall and early winter of 2000. Such precipitation events have appeared to impact the LDS in previous years, although a direct correlation is difficult to show with the data, and in no previous years has the flow rate to the LDS exceeded 1.0 gpm.

   It now appears that this scenario is not the cause of the increased flow rate in the LDS, as enough time has elapsed to pump out any precipitation that may have accumulated beneath the HDPE liner from precipitation.

b) Mill staff also suspected that the current excessive infiltration rate into the LDS may be the result of the aforementioned precipitation infiltrating beneath the liner then freezing, causing a pooling effect as the weather warmed. It seems possible that this scenario could in fact affect the infiltration rate into the LDS and subsequent pumping rate from the system.

   As stated above, however, it now seems unlikely that this is the cause of the increased flow in the LDS as enough time has elapsed to pump out any such pooling of solution.

c) Another potential cause of the infiltration is the mechanical failure of a check valve, which was located on the discharge of the Cell 4-A sump pump. This sump pump is on the surface of the crystals in Cell 4-A and is used to pump to Cell 3 any liquid that may have accumulated in Cell 4-A. The LDS pump also pumped into the same discharge line as the sump pump, through a check valve. During one pumping event, when the sump pump was operating, the check valve failed and the solution from the sump pump was pumped into the LDS. The volume of fluid pumped is unknown.

   This scenario has also been ruled out, as the maximum volume that could have been injected into the LDS due to equipment failure is far less than what has been pumped from the system.

d) A potential leak in the HDPE lining under the area in which solution crystals have formed.

   This now seems to be the most likely cause of the increased flow into the LDS.

4.0 ONGOING MITIGATIVE EFFORTS

Since March 28, 2001 the pumps in the LDS have been operating nearly continuously. The piping of the leak detection pump and the Cell 4-A sump pump have been changed such that each pump has a dedicated discharge line, which discharges solutions to Cell 3.

As stated earlier in this report, the level of solution has dropped approximately 1.55 feet since the writing of the preliminary report. Operation of this pump will continue until the LDS is pumped out.

The Mill also purchased a pump for the slimes drain in order to drain that system as well; however, this pump had to be installed in the LDS when the leak detection pump failed. Another pump has been ordered for installation into the slimes drain.

Pumping and monitoring of the Cell 4-A LDS, slimes drain and sump pump will continue, until the infiltration rate into the LDS is stabilized or stops.

5.0 FUTURE MITIGATIVE ACTIONS

As mentioned above and in the preliminary report, IUSA has been investigating the removal of the crystals from Cell 4-A, in connection with the redesign and reconstruction of Cell 4-A. Both mechanical removal and dissolution of the crystals have been considered, with the latter being the preferred alternative. Preliminary test work at the Mill indicates that a very mild caustic solution will effectively dissolve the crystals. The process would involve the addition of solution to the crystals using a sprinkler system followed by a period of time to allow the solution to dissolve the crystals. Once sufficient solution is generated it will be pumped from Cell 4-A to Cell 3 and the cycle will be repeated. It is estimated that once the process is started it will take approximately three to four months to remove all of the crystals from the Cell. Once the crystals are removed from the cell, the Cell will be empty.

Currently, a work plan, accompanied by a Safety Analysis Plan (SAP), is being developed to begin the crystal dissolution and removal as discussed in the above paragraph. This plan should be finalized in the next few days, and will be submitted to the NRC for review prior to implementation.

The results from the recent quarterly sampling of the Point of Compliance (POC) wells have been received and reviewed by Mill and IUSA Corporate staff. As expected, the data did not indicate any impact from the increased flow into the LDS. Mill environmental staff has been instructed to monitor the depth to water in Monitor Wells adjacent to Cell 4-A on a weekly basis. The results of these monitoring efforts will be available for review by NRC at the Mill.

6.0 CONCLUSIONS

At this time, there is still insufficient data available to develop any final conclusions regarding the cause of the increased infiltration into the Cell 4-A LDS; however, it appears most likely at this time that a leak may have developed in the HDPE liner below the surface of the crystals.

As stated above, as ongoing mitigative actions, the current pumping program, including the pumping of solutions from the interior of the cell, and the weekly monitoring of depth to water in the monitoring wells adjacent to Cell 4-A, will continue until the system is dried out.

As a long-term mitigative action, IUSA will, subject to NRC approval, finalize and implement a work plan to remove the crystals using the dissolution process, and remove the contents from the cell.

As Cell 4-A has a double liner system, there is no evidence or expectation that this increased flow rate to the Cell 4-A LDS has resulted in, or will result in, a release to the environment.

An updated status report of this investigation and mitigative actions will be submitted to NRC within 30 days after completion of implementation of the removal of the crystals from Cell 4-A, outlining any new data and the results of the mitigative actions.