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March 11, 2002

VIA FACSIMILE AND EXPRESS COURIER

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Fuel Cycle Licensing Branch
Mail Stop T-8A33
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Re: U.S. Nuclear Regulatory Commission letter of January 14, 2002
White Mesa Uranium Mill
Source Material License No. SUA-1358
Docket No. 40-8681

Dear Mr. Leach:

International Uranium (USA) Corporation ("IUSA") hereby responds to your letter dated January 14, 2002 to Mr. Ron Hochstein, IUSA President and Chief Executive Officer. In this letter, IUSA addresses each of the questions posed in your letter regarding IUSA's practice of stockpiling alternate feed on the ore pad at the White Mesa Uranium Mill (the "Mill"). For ease of reference, the questions are addressed below in the same order as presented in your January 14 letter. In addition, IUSA also responds to NRC's question regarding the adequacy of the Mill's surety to cover the cost of disposing of stockpiled material, in the hypothetical event that the Mill were to be shut down prior to another processing run. Finally, IUSA responds to the questions relating to groundwater protection and dust mitigation specific to the Maywood Amendment request, mentioned in NRC's letter to IUSA dated November 30, 2001.

BACKGROUND

IUSA manages conventionally mined uranium ores, as well as alternate feed uranium ores, by stockpiling the material on the Mill's ore pad until the next Mill run. In fact, the practice of accumulating sufficient stockpiles of ore prior to initiating processing activities is quite common in the mining industry because more time is required to mine ore than is needed to process it. Similarly, more time is needed to complete excavation and/or delivery of alternate feed ore than is needed to process it. Neither the Mill's license nor any other applicable regulations prohibit the Mill from stockpiling ore to maximize the benefits of a processing campaign. Rather, both the Mill's initial license application and subsequent alternate feed license amendment applications have anticipated stockpiling conventional mined and alternate feed ores pending processing

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campaigns, for reasons of operational and economic efficiency. The Mill has, since its inception, processed ore on a campaign basis, the schedules for which have been adjusted as processing economics demand.

Prior to the Mill's very first processing campaign, some 1 million tons of mined ore was stockpiled on the Mill's ore pad. A similar quantity of ore from the then licensee's mines was stockpiled during 1989-1991. By comparison, some 250,000 tons, or approximately one-fourth the previously stockpiled tonnage, are currently stockpiled for the upcoming alternate feed ore processing campaign.

As a general rule, the management of alternate feed ores, like the management of conventionally-mined ores, must be and is performed in full compliance with the Mill's NRC license and amendments as well as the Mill's Utah Division of Air Quality Approval Order for the White Mesa Mill ("Air Quality Permit" or "AO"). These activities also are subject to the Mill's ALARA Program, which seeks to ensure that all such activities satisfy applicable standards, but also satisfy the traditional As Low As Reasonably Achievable (or,"ALARA") work practice standard. Indeed, IUSA's data show that management of alternate feed ores produces less radon and particulate emissions than mined ores do, and that radon and particulate emissions from mined ores are consistently well below all applicable standards.

The NRC monitoring program in place at the Mill is designed to detect potential releases to groundwater from Mill operations and the management of mined ores and alternate feed ores prior to processing. And, since the management of mined ores has produced no significant airborne emissions or releases to groundwater at, or even near regulatory limits, it is even less likely that alternate feed ores will produce such emissions or releases to groundwater. For the reasons detailed herein, the same conclusions would be true in the event that IUSA were to manage Maywood Material prior to processing. However, at the request of the State of Utah, IUSA has agreed to monitor for additional parameters, similar to the list it used prior to 1997. And will propose additional analyses to provide data for further confirmation that the management of alternate feed ores will have no cumulative impact on groundwater.

In addition to the following responses to NRC's questions regarding potential air and water quality impacts from alternate feed ore management, IUSA includes a response to NRC's question regarding the adequacy of the Mill's surety for the cost of disposing of stockpiled material, in the hypothetical event that the Mill were to be shut down prior to another processing run.

NRC QUESTION

1. "Potential dust control of these alternate feed piles and the consideration of radon airborne contamination, including cumulative impacts."

IUSA RESPONSE

IUSA understands this question to ask what, if any, measures are used to control the potential for dust and radon generation from alternate feed ore stockpiles, and what, if any, cumulative impacts may result from the potential airborne dust or radon from alternate feeds that are being temporarily stored in such stockpiles prior to processing at the Mill.

The approach to control of potential airborne dust from stockpiles at the Mill is multi-faceted, and addresses the key areas of mitigation, application of ALARA principles, and monitoring. As detailed in the following subsections, the Mill complies with Federal and State requirements by having in place a Dust Suppression Program, which is intended to mitigate the potential for airborne dust to be generated from ores stockpiled at the site, as well as from the site in general. Additional, specific measures may be applied to particular alternate feed ores, depending upon physical factors that influence the potential for such material to generate airborne dust (e.g., moisture or clay content of the material). The Mill also carries out extensive monitoring to ensure that dust mitigation measures are effective in protecting the workers, the public, and the environment.

IUSA's program for suppressing dust from the Mill site, as outlined below, will continue to be performed routinely. In addition, examples of additional measures to be employed on a feed material-specific basis for ALARA purposes are presented below.

DUST SUPPRESSION PROGRAM

IUSA routinely employs an extensive Dust Suppression Program at the Mill, in accordance with the following permits and licenses:

1. September 11, 1997 Utah AO (noted above)

2. NRC License Renewal Application for theWhite Mesa Mill, Sections 2.0 , and 4.0

The following subsections describe the dust suppression measures IUSA performs in accordance with the forgoing permit and license requirements.

<u>Utah Air Quality Approval Order</u>

The AO specifies the steps the Mill must take for fugitive dust management. The AO requires that all unpaved roads and operational areas be water or chemically sprayed to maintain opacity at or below 20 percent. IUSA satisfies this requirement, and in fact uses an even more protective standard, requiring watering every dry day, every windy day, and any time any dust is visible, even if conditions are below 20 percent opacity. The AO also requires the following:

1. That unpaved haul and access roads, and the Mill area itself, have at least one inch of gravel cover or be watered to meet the 20 percent opacity requirement.

2. Watering of ore storage piles as conditions warrant.

3. Watering of disturbed areas.

4. Limiting the speed of compactors to 3 mph.

5. Minimum moisture content of 4 percent for dumped materials.

6. Limiting the speed of heavy equipment to 3 mph during loading and 12 mph dumping operations.

7. Minimum dumping equipment height during unloading.

8. Water spraying the tailings retention areas as needed.

9. Spraying, as required, of soil and overburden stockpiles.

Dust mitigation measures undertaken beyond the requirements in the AO have included:

1. Water sprays used during unloading of materials having physical properties warranting such additional measures, for example the Heritage Material.

2. Additional gravel placed on routes used to transport alternate feed ores.

1991 Mill NRC License Renewal Application

The August 1991 NRC License Renewal, Section 4.1.1 specifies dust and fume control measures that are used in each area of the Mill circuit, the ore stockpiles, and the laboratory. In accordance with this section, the ore stockpiles are inspected at least weekly, watered as necessary, and the water application logged. IUSA records demonstrate that inspections are more frequent than required by the license.

Alternate Feed License Amendment Applications

In general, for all stockpiled ore, including alternate feed ores, the efficiency of airborne contamination control measures is determined once the material is in the stockpile. As with all conventional mined ore or alternate feed ore stockpiles, the Mill radiation staff inspects the ore stockpile area daily to determine whether or not any additional control measures are required. As noted above, the Mill license renewal application contains requirements that the Mill meets for ensuring that the potential for airborne dust generation from mined ores is mitigated. In addition, in applications for alternate feed ores, IUSA includes measures that will be taken to ensure that airborne dust generation is mitigated. For example, in the case of the Molycorp material, Section 4.1 of the Molycorp Amendment Request, Control of Airborne Contamination, states that:

> The efficiency of airborne contamination control measures during the material handling operations will be assessed after the Uranium Material is

> received at the Mill. Appropriate dust suppression techniques will be implemented as per the Mill Standard Operating Procedures. Airborne particulate samples and breathing zone samples will be collected in those areas during initial material processing activities and analyzed for gross alpha. The results will establish health and safety guidelines, which will be implemented throughout the material processing operations.
>
> Personal protective equipment, including respiratory protection as required, will be provided to those individuals engaged in material processing. Additional environmental air samples will be taken at nearby locations in the vicinity of material processing activities to ensure adequate contamination control measures are effective and that the spread of uranium airborne particulates has been prevented.

Similar language is found in other IUSA license amendment applications to the NRC for the alternate feeds it has applied to process. A recent review shows that this language appears in Section 4.1 of the applications for the Heritage Material; the Linde Material; Ashland 1 and 2; W.R. Grace; and Cameco.

APPLICATION OF ALARA PRINCIPLES TO INTERIM ORE MANAGEMENT

IUSA notes that, while the ore pad airborne control measures routinely applied are sufficient to provide protective interim management of most feed materials, added measures are available and may be utilized in certain circumstances for low-volume, high moisture content materials that contain elevated components of potential concern, such as metals. As with all conventional and alternate feed ores, the Mill routinely applies ALARA measures to interim management of the material prior to processing. Such ALARA practices include air monitoring appropriate to the feed material.

In addition, consistent with its ALARA program, IUSA evaluates the potential for other types of particulates that could potentially become airborne, and supplies additional information to NRC for particular alternate feed ores. A case in point is found in IUSA's letter of January 5, 2001, regarding the Molycorp Material, in which IUSA reported the following:

> Based on discussions with Molycorp...air monitoring data for an operation in which Molycorp handled comparable lead material indicated there were no results exceeding either the OSHA PEL limit (0.05 mg/m^3) or the OSHA Action Level (0.03 mg/m^3) for area and breathing zone samples. Molycorp has indicated that it believes that there will be no significant airborne lead exposures resulting from the handling of the lead sulfide pond material at IUSA, because it has essentially identical composition and moisture content as the material handled during this operation. As Molycorp indicates, the air monitoring results showed that the use of respiratory protection was not necessary to meet worker protection requirements for lead, because the results were below both action levels and the PEL for lead.

As an added precaution, during initial offloading of the material, IUSA will analyze breathing zone and area airborne samples for total lead to ensure that the values obtained are below the PEL limit and Action Level for lead listed above. If either of these values are met or exceeded, IUSA will require use of respiratory protection until and unless monitoring data indicate that this requirement may be safely reduced. In addition, depending upon initial lead results, IUSA will determine the frequency to be used for any follow-up air lead analysis during offloading of the material.

Finally, IUSA understands, based on a review of lead sulfide toxicity reports and discussions with Molycorp's Industrial Hygienist, that meeting the OSHA PEL limit and OSHA Action Level listed above is more protective for a lead compound such as lead sulfide, the form of lead in the material, than for more bioavailable lead compounds, because the OSHA and NIOSH standards are typically designed to be conservative, in that they typically protect against the more bioavailable form of a chemical. The bioavailability of lead sulfide is low relative to certain other more bioavailable forms of lead. As reported in Impact of Lead-Contaminated Soil on Public Health (U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Agency for Toxic Substances and Disease Registry, Charles Xintaras, ScD., May 1, 1992):

> The impact of exposure to lead-contaminated soil on PbB levels is also influenced by the chemical and physical form of the lead. Data from animal feeding studies suggest that the oral bioavailability of lead sulfide and lead chromate is significantly less than the bioavailability of other lead salts (oxide, acetate) (Barltrop and Meek 1974)." "The reduced bioavailability of lead from mine tailings may be related to its chemical form (lead sulfide) and its larger particulate size. (p. 12-13)

In other words, in addition to the airborne dust mitigation measures detailed above that reduce the potential for public exposure to airborne dust, mitigation measures may be applied during early receipt of certain alternate feed ores. In general, during initial offloading of alternate feed ores, IUSA analyzes breathing zone and area airborne samples for specific constituents of concern, such as (in the example above) total lead, to ensure that the values obtained are below the applicable OSHA PEL limits and Action Levels. If either of these values are met or exceeded, IUSA would require use of respiratory protection until and unless monitoring data indicate that such protection is no longer necessary. In addition, depending upon initial results, IUSA will determine the frequency to be used for any follow-up air analysis during offloading of the particular alternate feed ore.

Following further with this Molycorp example, in a subsequent letter to the NRC dated March 20, 2001, IUSA committed to performing additional ALARA measures in

managing the Molycorp material [Note that item 1 below is intended to ensure ALARA with respect to protection of groundwater and surface water, which is further addressed in response to NRC question 2, below.]:

1. The material will be placed on a concrete pad that will be bermed around the edges to contain moisture. The pad near the sample plant will be modified to handle this material (including removal of the concrete dividers and temporary berming of the edges). In addition to the foregoing pad, a concrete pad near the trommel screen will also be used. We believe that the concrete pads will be sufficient to handle all of the material. However, if the volume is greater than that which can be accommodated on the concrete pads, comparable methods will be considered for the excess volume.

2. Due to the high moisture content of the Molycorp material, IUSA anticipates that the routine dust suppression program detailed above will be adequate to mitigate any dusting potential. However, should conditions warrant further measures to prevent potential windborne contamination from the piles one of two methods will be considered: application of a surfactant; or, covering of the piles with reinforced plastic. The final configuration of the piles will determine which application will be used.

3. To minimize the duration between receipt of the material and processing, the Molycorp material will be processed prior to the processing of either the Linde or Ashland material.

In any event, 10 CFR Part 40, Appendix A licensed uranium mill operations and waste management are designed to, and expected to, safely contain and control all forms of lead, a routine constituent in uranium mill tailings (see NUREG 1620, Rev.1, at p. 4-9). Consistent with IUSA's ALARA program, added air sampling appropriate to the alternate feed ore will be considered on a feed-specific basis.

AIR SAMPLING

The Mill monitors for radon and radon daughters (which includes thoron), as well as airborne particulates. For the purpose of demonstrating the potential radiological impact of stockpiling alternate feed ores at the Mill on workers, the general public, and the environment, two sets of data are discussed and compared herein. Radiological monitoring results obtained during two distinct time periods are compared: the first is a period during which processable quantities of conventional mined ore were stockpiled at the Mill (1989-1991); the second time period is the recent two years (2000-2002), during which alternate feed ores were stockpiled. This comparison involves only ores stored on the ore pad, and does not consider ores stored in 55-gallon drums, because those ores are contained, and the potential for radon emanation or uranium particulate generation from closed containers is negligible.

The data from 1989 represent a time period during which ore was being stored for a two-year period, and the uranium content of the mined ore was relatively high. This comparison should represent the most significant difference between conventional mined

ore and alternate feed ore. During the period from 1989 to 1991, conventional mined ore was accumulated and stored until approximately 980,000 tons of uranium ore, with an average uranium content of 0.389%, was available to process. This equates to a U-Nat activity of approximately 2,600 pCi/g.

For an equivalent period of time, from 2000 to 2002, alternate feed ores, which presently consist of 164,811 tons of Ashland 1 material, 69,990 tons of Linde material, and 3,608 tons of Heritage material are in the process of being stockpiled on the ore pad. The weighted average uranium concentration in these three alternate feed ores is 0.036%[1]. This equates to a U-Nat activity of approximately 240 pCi/g. Therefore, while the tonnage of alternate feed ore stored on the ore pad from 2000–2002 is approximately 25% of the tonnage of mined ore that was stored on the ore pad in 1989-1991, the uranium activity of the alternate feed ore is only approximately 10% of the uranium activity of the mined ore, for an equivalent volume of ore. As will be shown below, the radon and particulate data demonstrate that the mined ores resulted in no emissions approaching either the Federal limits set for protection of workers, the public, or the environment, and that the alternate feed ores result in even lower values than the mined ores.

Radon

Radon Emission Source Term

Uranium ore processing and subsequent tailings disposal presents pathways for release of radon to the environment. The major pathways for radon release occur from ore storage, ore crushing and grinding, and the mill tailings disposal site. In response to NRC's question, this discussion will focus on ore storage prior to processing. Radon release from the ore storage area depends on (1) radium content of ore; (2) emanating power (coefficient) of ore or tailings; (3) radon diffusion coefficient in ore; (4) physical characteristics, including configuration of ore storage; and (5) storage time. The quality of the ore received varies with respect to ore concentration, grade, and size.

Radon emanating from an ore storage area may be estimated by calculation of the Radon Emission Source Term, following methods detailed in NRC Reg. Guide 3.59 "Methods For Estimating Radioactive and Toxic Airborne Source Terms For Uranium Operations" March 1987; or by implied concentration of antecedent radon from measured radon daughter working level concentrations. Estimating the radon emission source term can be accomplished using the flux factor; in most cases, the NRC staff estimates radon release by using a conservative radon flux factor of 1 pCi Rn-222/m^2*s per pCi/g of Ra-226. By using that flux factor, only the area of the ore stockpile and the average radium content need be known to calculate annual radon releases as follows.

Assuming the uranium was in secular equilibrium with its daughter progeny in the unprocessed mined ore stockpiled at the Mill during 1989-1991, the Ra-226 activity would be 2,600 pCi/g. The radon emission source term for the period 1989-1991, during

[1] The uranium activities of the three cited alternate feed ores are based on the natural uranium content of each, as determined by alphaspectroscopy performed on a composite sample taken at the Mill from each of these ores.

management of mined ores, is estimated at approximately 4,250 Ci Rn-222 per year, assuming the entire ore pad area of 12.8 acres was covered (see attached calculation sheet). The actual measured average Ra-226 concentration of the different alternate feeds stored at the Mill during 2000-2002 is 110 pCi/g. This value was determined by alpha spectroscopy of the individual alternate feed ores. Conservatively assuming that the entire ore pad area of 12.8 acres was used for management of alternate feed material, the radon source term for the period 2000-2002 is estimated at 180 Ci/year of Rn-222. Therefore, the radon source term associated with the alternate feed ores being managed in 2000-2002 would be approximately 23 times less than that of the mined ore material managed during 1989-1991.

Assuming a linear relationship between the radon emission source term and impact to the public or to the environment, as NRC has in generic assessments, it can be concluded that the management of alternate feed ores in stockpiles poses significantly less potential hazard than the management of conventional ores associated with normal mining practice. This also does not factor in the significantly larger volume of 11e.(2) byproduct material that must be managed in perpetuity from processing conventional ores. However, as discussed below, the radon levels from both conventional mined ores and alternate feed ores are well within regulatory limits.

Radon Daughter Working Levels (WL)

Radon Daughter Working Levels (WL) (note that radon daughters include thoron) were measured each month throughout the ore stockpiles, at various locations for the periods of 1989 – 1991 and 2000 – 2002. These results are illustrated in Graph I (attached). It is interesting to note that over the period of 2000 – 2002, when alternate feed ores are being managed in stockpiles, there have been very few measured radon daughter concentrations above the minimum detectable activity (MDA) of 0.011 WL. Conversely, when mined ore was stockpiled, over the period of 1989 – 1991, the measured radon daughter levels were all above the MDA.

As noted above, the tonnage of mined ore stockpiled in the time period 1989 – 1991 was approximately four times the amount of alternate feed ore stockpiled during 2000 – 2002. Although during the 1989 – 1991 time period, the radon daughter concentrations were measurable above the MDA, the maximum concentration measured was still low. At 0.07 WL, the maximum concentration of radon daughters measured during storage of the mined ore was less than 22% of the allowable radon concentration contained in 10 CFR Part 20, Appendix B for occupational exposure. The average radon concentration over this period was more than an order of magnitude lower, at 0.027 WL. This level of radon emission, measured at a point in the center of the Mill yard, is only 8.0% of the concentration allowed for worker exposure. In addition, radon is measured on a weekly basis at the nearest residence, with the result typically being nondetectable.

In this context it is worth noting that the EPA has found that with respect to uranium mill tailings piles "the risk from radon emissions diminishes rapidly with distance from the tailings pile (declining by a factor of three for each doubling of the distance beyond a few hundred meters)" (see EPA, Final Environmental Impact Statement for Standards for the

Control of Byproduct Materials from Uranium Ore Processing," Vol. 1 at 10-12, September 1983).

In other words, even when mined ore was stockpiled at the Mill, the radon levels in the center of the plant were a small fraction of the occupational exposure level for workers. Furthermore, atmospheric dispersion between the center of the ore pad, where these low levels are measured, and the nearest resident reduces the radon and decay progeny below detectable limits. We conclude, therefore, that the stockpiling of both conventional uranium ore and alternate feed ore is not deleterious to workers or to the public, is in compliance with all applicable standards, and is in keeping with the principles of ALARA.

Airborne Particulates

As part of the environmental protection program required by the Mill's NRC license, the Mill monitors air quality and collects vegetation samples both on- and off-site. Data from these programs are published in the Mill's Semi-annual Effluent Report. Air quality monitoring stations are in place between the Mill and the nearest resident locations. These include a station located near the closest resident (north of the Mill), the White Mesa Community (3.3 miles SSE of the Mill), as well as a station near the ore pad. An additional air monitoring station, which IUSA installed at the request of the Ute Mountain Ute Tribe to provide added monitoring capability between the Mill and the White Mesa Ute Community, has been operational for approximately three years. The Ute Mountain Ute Tribal Environmental Department participates in data gathering at this station, and has been receiving copies of data collected at the station. Prior to this year, data from this station only had been sent to the Tribal Environmental Director; however, IUSA is voluntarily adding the data collected at this station into the Mill's Semi-annual Effluent Reports, beginning with the most recent reporting period.

All air particulate monitoring results from every station have remained below State standards and standards required under the Mill's NRC license. The uranium, thorium, and lead-210 particulate data presented in the semi-annual reports show no evidence of increasing air quality impacts from management of alternate feed ores, when compared with air quality monitoring results from periods during which the Mill has stored conventionally mined ores. In fact, as detailed in the following section, air quality monitoring results indicate that management of alternate feed ores produce even lower levels of constituents at these monitoring stations than storage of conventionally mined ores, the storage of which has never resulted in an exceedance of NRC standards.

A review of all the available off-site air quality data indicates that during periods when there was a significant quantity of conventionally-mined ore stored on site, the on- and off-site air quality monitoring results were somewhat higher than during periods of Mill inactivity. However, it should be noted that even during peak operational periods, the air quality parameters never exceeded the applicable standards specified in the Mill's AO, or the Mill's NRC license.

Uranium particulate samples for the comparative periods 1989 – 1991 and 2000 – 2002 have been taken each month at various locations throughout the mill stockpile area.

Continuous uranium airborne particulate samples also have been taken at five boundary environmental monitoring stations (see attached Figure). The results of two environmental monitoring stations BHV-1 and BHV-5 are compared to the environmental background monitoring station BHV-3, and are also compared against each other for the comparative ore management periods. Environmental monitoring station BHV-5 is located nearest to the center of the ore storage area approximately 400 meters distant from the center of the storage area, in the southeasterly direction. The environmental monitoring station BHV-1 is located at the mill boundary directly north of the center of the storage area, approximately 1.6 miles away. Environmental monitoring station BHV-3 is located approximately 9 miles directly west of the Mill site, and due to it's remote location, it is the station from which data have been gathered to represent background radionuclide particulate concentrations in the Mill site area. Samples are collected continuously at each of the current monitoring stations, and the samples are analyzed for the radioisotopes U-Nat, Ra-226, Th-230, and Pb-210.

Graph II (attached) presents the results for U-Nat only, because it is the parent radioisotope of the uranium decay chain and represents the element the Mill recovers. It should be noted that U-Nat particulate concentrations at each location are equal to or less than the background U-Nat particulate concentrations from Station BHV-1, over both periods 1989-1991 and 2000-2002. The maximum value obtained over the comparative periods are 9.0×10^{-14} µCi/mL at BHV-5 for the period 1989 – 1991 and 1.0×10^{-14} µCi/mL at BHV-5 for 2000 – 2002. It is noteworthy that these values are 10.0% and 1.0% respectively of the permissible effluent limits found in 10 CFR Part 20 Appendix B.

Uranium airborne particulate samples are collected over the entire ore storage area every month for personnel exposure assessment. The values average over the Mill yard storage area for the two periods 1989-1991and 2000-2002 are, respectively, less than 5.0% and less than 1.0% of the allowable derived air concentration (DAC) levels for U-Nat.

A similar comparison can be made of the thorium content (Th-232) found in natural uranium ores stockpiled on the ore pad from 1989-1991 and the alternate feed ores presently managed at the Mill. It should be noted that most uranium ores contain some concentrations of natural thorium (Th-232). The uranium ores received at the Mill between 1989-1991 were mined in the Colorado Plateau and the Arizona Strip areas. The uranium mineral in these ores was "Uraninite" which is more commonly called pitchblende, which frequently contains higher levels of Th-232 than other types of domestic uranium ore. Uraninite contains approximately 46.5 to 82.2% uranium and as much as 45.3% Th-232. Based on this information, one can compare the radiation dose levels due to thorium contained in mined uranium ores and alternate feed ores.

If we assume, as noted above, that the conventional mined ore from the period of 1989-1991 had an average uranium content of 0.389%, and using the primary mineral pitchblende, this ore would also contain approximately 0.379% Th-228, plus Th-228. This equates to a specific activity of 853 pCi/g of ore.[2] The measured mean Th-232

[2] This is based upon the natural thorium content of each material as determined by alphaspectroscopy as follows: Line, Th-232, 0.59 pCi/g; and Ashland I, Th-232, 3.6 pCi/g. The thorium activities of the three cited alternate feed ores are based on the natural thorium content of each, as determined by alphaspectroscopy performed on a composite sample taken at the Mill from each of these ores.

activity of the alternate feed material Ashland I, Linde, and Heritage ores currently stockpiled at the Mill is 7.2 pCi/g of material, which is approximately two orders of magnitude less than the activity due to thorium in the mined ores. There is very little natural thorium in the Ashland I and Linde materials, which comprises 98.5% of the alternate feed ore presently managed at the Mill, while the Heritage material comprises just 1.5% of the alternate feed ore presently managed at the Mill.

In any event, NRC has found that even when Th-232 and its daughter products "are present in amounts comparable to the natural uranium concentration in the ore". . . "the impact of these isotopes is relatively inconsequential" (NUREG-0706, Vol. I at 6-21).

Cumulative impacts

Based on the data detailed in this section, radon or airborne particulate levels associated with the storage of alternate feed ores are either so low as to be immeasurable, or are a small fraction of allowable effluent levels. The levels measured during the storage of alternate feed ores fall well below allowable effluent levels, as well as the levels measured during management of mined ores, and the particulate values measured during management of mined ores are also a fraction of the allowable effluent levels. We conclude, therefore, that there are no added or cumulative airborne particulate or radon impacts due to management of alternate feed ores, because the stockpiling of both conventional uranium ore and alternate feed ore is not deleterious to the worker nor to the public, is in compliance with all applicable standards, and is in keeping with the principles of ALARA.

Maywood Material

As detailed in IUSA's Amendment Request (June 2001), although the Maywood Material originated from uranium and thorium- bearing monazite sands, a good portion of the thorium was removed in the thorium recovery processes at Maywood Chemical Works. The Th-232 content for the Maywood Site overall ranges from non-detectable to 3,800 pCi/g with a preliminary estimated overall average of approximately 970 pCi/g. While this Th-232 content is not as low as most of the other alternate feed ores the Mill has received, it is comparable to that of mined ores that the Mill is licensed to receive.

The radiation safety program which exists at the Mill, pursuant to the conditions and provisions of NRC License Number SUA-1358, and applicable Regulations of the Code of Federal Regulations, Title 10, is adequate to ensure the maximum protection of the worker and environment while temporarily managing the Maywood material on the ore pad prior to processing, and is consistent with the principle of maintaining exposures of radiation to individual workers and to the general public to ALARA levels. Radiological doses to members of the public in the vicinity of the Mill will not be elevated above levels previously assessed and approved. As described in Section 1.2 of the Maywood Amendment Request of June 15, 2001, the average Th-232 level in the Maywood Material is comparable to that of mined ores that the Mill is licensed to receive. Therefore, IUSA anticipates that there will be no incremental public health, environmental, or safety concerns resulting from the management of the Maywood Material prior to its being processed. However, as stated above, the efficiency of

airborne contamination control measures during the material handling operations will be assessed after the Maywood Material is received at the Mill, in accordance with the programs detailed in the previous section of this letter, to ensure that contamination control measures are effective and that the spread of uranium and thorium airborne particulates is prevented or minimized.

NRC QUESTION

2. "Potential groundwater contamination concerns from the alternate feed material lying uncovered on an un-lined surface on the ore pad, including cumulative impacts."

IUSA RESPONSE

In response to this question regarding concerns that groundwater could potentially be impacted by alternate feed ore managed on the ore pad prior to processing, the following describes protective site-specific or material-specific fate and transport considerations, and the monitoring programs that are intended to confirm that groundwater is not impacted.

FATE AND TRANSPORT CONSIDERATIONS

Precipitation, whether in the form of rainfall or snow, that falls on ore stockpiles managed prior to processing at the Mill, will evaporate, infiltrate the stockpile, or run off onto the ore pad. Evapotranspiration rates at the Mill are high – estimated to be as high as 61 inches per year. Some infiltration into mined or alternate feed ore stockpiles is beneficial in that such moisture helps to maintain the moisture content of the stockpiles, thereby minimizing the potential for dusting. To ensure that there is no loss of stockpiled ore materials from the ore pad due to precipitation, the entire Mill site, including the ore pad that is used to store conventional and alternate feed ore stockpiles, is graded to drain to the tailings system. There is no mechanism for surface runoff from any precipitation that may have contacted the stockpiles to leave the site. As noted below, the ore paid is also underlain by crushed limestone, to inhibit water infiltration, and any potential surface runoff would drain to the on-site tailings system.

Alternate feed ores managed on the ore pad may contain radionuclides, heavy metals (such as lead) and low concentrations of organic compounds (such as chlorinated solvents or fuel hydrocarbons). In order for these constituents to reach groundwater, they would have to be transported from the feed stockpiles, through the surface of the ore pad, and downward through more than approximately 60 feet of underlying vadose zone materials to the perched water zone.

The primary transport mechanism would be via dissolution into any waters percolating through the stockpiled materials. These waters would originate as precipitation at the site, or as pore waters existing within the feed materials when delivered to the site, or both. Volatile organic compounds (VOCs) might also be transported in the vapor phase via diffusion. Should organic compounds exist as a separate phase liquid, gravity driven

migration of this liquid could, in theory, also occur. However, IUSA does not accept alternate feed ores containing organic compounds as separate phase liquids.

Mobility of radionuclides and metals

Radionuclides and heavy metals (such as lead) typically have low solubility except under conditions of below neutral pH. Metal species likely to exist in some of the mined ores that may temporarily be stored on the ore pad typically consist of sulfide species, which have generally low solubility under near neutral pH conditions. Oxidation of these sulfides could result in mobilization of metal species; however, the oxidation process typically will be slow for most of the metal sulfides, including lead sulfide.

The potential for oxidation should not be significant during the relatively short time periods the ores are managed on the ore pad, and because of the dry conditions at the site. In addition, most metals, such as lead, are strongly adsorbed onto sulfides, organic material, iron oxyhydroxides, and clays, which reduces their mobility. And, as noted, the ore pad at the site is underlain by compacted, crushed limestone. Should dissolved heavy metal species be mobilized as a result of oxidation and rainfall infiltration, and if they are not subsequently retarded by adsorption, the species would be expected to precipitate as either carbonates, such as lead carbonate, or as hydroxides within the limestone layer upon seepage into that layer. The same process would occur in the subsurface beneath the ore pad, in the carbonaceous sandstones that underlie the entire site.

Organic Constituents

In addition to metals and radionuclides, organic constituents such as petroleum hydrocarbons or other organics may be present in some conventionally mined and alternate feed ores, but in extremely low concentrations. Organic compounds such as petroleum hydrocarbons and some chlorinated compounds may be present in alternate feed ores temporarily stored on the ore pad. However, these compounds typically are present in low concentrations when measured in situ prior to loading the ore for shipment to the Mill. When the alternate feed ores arrive at the site, the concentrations of many of the species are usually below detectable limits, and are also expected to be further reduced during storage as a result of volatilization and biodegradation. For these reasons, the compounds are not likely to be mobilized at significant dissolved concentrations in any precipitation that may contact and percolate into the alternate feed ore stockpiles.

Furthermore, materials currently managed on the ore pad have a high clay content and low permeability. The low permeability, combined with the low precipitation and high annual evaporation at the site, further reduce the potential for infiltration to insignificant levels.

In summary, for the reasons listed below, it is unlikely, that constituents present in alternate feed ores would result in groundwater contamination at the site because (1) past groundwater monitoring at the site has not indicated any impact from mined or alternate feed uranium ore stored on the ore pad in the past, and (2) a number of conditions and mechanisms exist to mitigate the potential transport of constituents to groundwater. These include:

1. Low annual precipitation (< 12 inches) and high annual evapotranspiration (as high as 61 inches) at the site reduce the amount of water available to potentially infiltrate the stockpiled materials and eventually percolate to groundwater.

2. The slope of the ore pad (designed to contain runoff and drain any runoff to the tailings cells) and the compaction of the pad surface reduce the potential for infiltration because:

   a. compaction of the surface materials reduces their permeability, and,
   b. the ore pad slope increases the ratio of runoff to infiltration.

3. The low permeability of native sandstone materials underlying the ore pad would reduce the rate of any downward percolation of any moisture that actually infiltrates the ore pad.

4. The potential for solute transport is low. Reasons for the low potential for metals transport include:

   a. the generally low solubility of heavy metals and radionuclides at near neutral pH;
   b. the existence of metals as sulfide species having low solubility;
   c. the low rate of oxidation of metal sulfides to more soluble species under the relatively dry site conditions and within the short time periods that the materials are stockpiled onsite;
   d. the strong sorption potential of metals to sulfides, clays, organic materials, and iron oxides;
   e. the presence of crushed limestone underlying the ore pad which would cause precipitation of metal species to carbonates or hydroxides; and,
   f. the presence of calcareous native materials beneath the ore pad that would have the same effect as above.

5. Reasons for the low potential for organic constituent transport include:

   a. The low concentrations of organic compounds present in alternate feed materials delivered to the site (and no organic compounds as separate phase liquids);

   b. The reduction in concentration of VOCs due to volatilization and the potential for biodegradation of VOCs and other organic constituents during temporary storage on the ore pad.

<u>Additional Work to Verify Fate and Transport Assumptions</u>

Work that is planned for additional characterization of the ore pad includes: (1) modeling of potential infiltration into existing ore stockpiles and potential for downward percolation into the ore pad, and (2) measurement of the vertical permeability of a

Work that is planned for additional characterization of the ore pad includes: (1) modeling of potential infiltration into existing ore stockpiles and potential for downward percolation into the ore pad, and (2) measurement of the vertical permeability of a representative (and accessible) portion of the ore pad using a ring infiltrometer. The results of the ring infiltrometer test will be used as input to analytical and/or numerical models to be used to help quantify the potential for transport of dissolved constituents from stockpiled materials to groundwater.

The scheduling of the ring infiltrometer test will depend on the site weather; in particular, the tests will be performed when daily low temperatures are above freezing, which is anticipated to occur during the month of May. Computer codes that are anticipated to be used in the modeling effort include HELP3[3], SOIL COVER[4], and TRACRN[5]. HELP3 and SOIL COVER would be used to estimate potential infiltration into stockpiles from precipitation, and potential seepage from the base of the ore stockpiles. The potential seepage estimate and the estimate of vertical permeability from the ring infiltrometer tests can be used as input to TRACRN. TRACRN would then be used to simulate the potential movement of solutes to groundwater. HELP3 modeling can be performed prior to infiltrometer testing. Due to the need for infiltrometer results as for vertical permeability input to TRACRN, those modeling efforts will commence immediately following completion of the ring infiltrometer test. As soon as weather permits performance of the ring infiltrometer test, anticipated in May, IUSA will submit a schedule for completion of the modeling.

Added Protective Measures

In addition to the site and material considerations detailed above which minimize the potential for any transport of constituents from ores to groundwater, IUSA voluntarily has proposed added measures, consistent with the ALARA approach, to further reduce the potential for contaminant release in particular cases. For example, as detailed above, IUSA committed to performing the additional ALARA measures in managing the Molycorp material, which included placing the material on a concrete pad (or comparable methods) to contain moisture.

ENVIRONMENTAL MONITORING PROGRAM

As part of the environmental protection program required by the Mill's NRC license, the Mill monitors water quality data both on- and off-site. These data are published in the Mill's Semi-annual Effluent Report. Over 20 years of quarterly groundwater quality data

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[3] Paul R. Schroeder, Cheryl M. Lloyd, and Paul A Zappi. The Hydrologic Evaluation of Landfill Performance (HELP) Model. User's Guide for Version 3. Environmental Laboratory. U.S. Army Corps of Engineers. Waterways Experiment Station. Vicksburg, MI 39180-6199

[4] SoilCover, 2000. Unsaturatred Soil Group. Department of Civil Engineering, University of Saskatchewan, Saskatoon, Canada

[5] Bryan J. Travis and Kay H. Birdsell, 1988 TRACRN 1:0 A Model of Flow and Transport in Porous Media for the Yucca Mountain Project – Model Description and User's Manual. Submitted to Yucca Mountain Project Miles T421

from this program indicate that there has been no on- or off-site impact to groundwater from Mill operations.[6]

Existing monitoring program is adequate, and IUSA is voluntarily sampling for full suite in cooperation with Utah DEQ

The Mill currently has a Point of Compliance ("POC") program in place that, after more than 20 years of monitoring, indicates that there has been no contaminant migration to groundwater from Mill operations. NRC has incorporated the existing POC monitoring program as a condition of IUSA's NRC license, because the program has been demonstrated to be sufficiently protective of groundwater quality. Nevertheless, at the request of UDEQ, IUSA has voluntarily agreed with UDEQ to obtain a Utah Groundwater Discharge Permit ("GWDP") and to implement groundwater monitoring for additional parameters.

The POC program mandates quarterly sampling of the perched groundwater zone for four parameters, chloride, potassium, nickel, and uranium (the "POC Parameters"), that are key indicators of potential seepage from the tailings cells. This detection monitoring program was only approved by NRC after more than 16 years of data, using additional parameters that were collected at up to 23 wells, demonstrated no impact to the perched groundwater zone from Mill operations. The POC indicator parameters were selected based on the following criteria:

- high concentrations in tailings slimes drain water;
- low concentrations in site groundwater;
- conservative chemical characteristics: and,
- indicative representation of chemical classes; that is, a cation, an anion, a trace metal, and a radionuclide.

The metals, VOCs, and SVOCs that may be contained in alternate feed ores are typically also present in the Mill's 11e.(2) byproduct wastes but not all are either selected or appropriate as POC indicator parameters, because they do not satisfy the selection criteria listed above as well as the POC parameters do. For example, the kerosene entrained in the 11e.(2) byproduct wastes contains the SVOCs benzene and xylene, and IUSA has previously reported the presence of ppb levels of chloroform in tailings slimes. In addition, several of the metals listed in Table 3.1 of the Mill's May, 1979 Environmental Assessment were anticipated to be ultimately present in the liquid portion of the Mill tailings. This is not surprising, since mined uranium ores would contain many of the

[6]IUSA has detected some chloroform contamination at the Mill site that appears to have resulted from the operation of a temporary laboratory facility that was located at the site prior to and during construction of the Mill. The source and extent of this contamination are currently under investigation and a corrective action plan, if necessary, is yet to be devised. Although chloroform is present in perched groundwater south of the ore storage pad, there are no users of the water from this groundwater zone downgradient of the Mill site; therefore, although it is a matter of concern to IUSA that the chloroform is present, there is no danger to human health or the environment posed by the detected chloroform at this time. The chloroform was detected in a shallow perched groundwater zone approximately 100-150 feet below the surface. The regional aquifer is located approximately 1,200 feet below this perched zone, hydraulically isolated by low permeability formations.

same metals found in soils excavated at other locations in the United States. However, unlike most of the metals that could be present in 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 the other tailings constituents. Conservative constituents travel at or very near the speed of groundwater and are not significantly retarded by natural attenuation. Showing high mobility in groundwater, these constituents serve as an early warning to the potential arrival of other groundwater contaminants, such as lead. Also, these four constituents were selected as the indicator parameters because they best meet the criteria of occurrence at high concentrations in tailings slimes-drain water, while occurring at relatively lower concentrations in natural groundwater across the Mill site. For the foregoing reasons, it is not necessary to change the Mill's POC program to accommodate alternate feed ore stored temporarily prior to processing at the Mill site.

As part of the GWDP development process, IUSA has agreed with UDEQ to consider monitoring for additional parameters from a potential list of other indicators of chemical classes, such as major ions and/or other constituents, based upon criteria that would ensure that the resulting data could reasonably be used to evaluate potential leakage from the Mill's tailings cells. In a report submitted to UDEQ on October 3, 2001, IUSA provided an evaluation of additional constituents to potentially be used as additional parameters for groundwater monitoring, and the rationale for assigning compliance limits to monitoring parameters for the GWDP. The parameters that would be used to monitor the tailings cells would also be effective in monitoring groundwater that may potentially be affected by storage of mined or alternate feed ores on the ore pad. However, as noted above, the likelihood of infiltration of water, much less hazardous constituents, through the ore pad is expected to be minimal. Studies detailed above will provide further data to ensure that this assumption is correct.

Furthermore, since May of 1999, pending implementation of the GWDP, IUSA and UDEQ have been engaging in a program of collecting split samples of groundwater from all available monitoring wells at the Mill, in which essentially all of the parameters UDEQ requests are being sampled on an annual basis, or in the case of SVOCs, each year that the State has requested this analysis.

<u>Potential cumulative impacts</u>

Potential cumulative impacts from storage of alternate feed ores on water quality are expected to be no greater than those from the storage of mined ores. Impacts of the storage of mined ores are expected to be virtually nonexistent, for the following reasons:

1. Low annual precipitation and high annual evapotranspiration reduce the amount of water available to potentially infiltrate the stockpiled ores and eventually percolate to groundwater.

2. The slope of the ore pad (designed to contain runoff and drain any runoff to the tailings cells) and the compaction of the pad reduce the potential for infiltration.

4. The potential for solute transport is low.

5. The potential for organic transport is low.

In addition, even though the existing NRC licensed groundwater monitoring program is adequate to ensure that potential impacts from Mill operations, much less storage of conventional and alternate feed ores on the ore pad, are monitored, IUSA is voluntarily sampling for additional parameters in cooperation with Utah DEQ.

Maywood Material

For the reasons detailed above, there is little, if any, chance that radiological or chemical constituents in the Maywood Material could leach into the subsurface to a degree not contemplated by, and that would not be fully reclaimed under, the Mill's current reclamation plan. The composition of the Maywood Material is very similar to the composition of the materials currently present at the Mill, because the Maywood Material resulted from the processing of source material ores for the extraction of source material. The most frequently encountered compounds other than radionuclides in the Maywood Material are polynuclear aromatic hydrocarbon compounds ("PAHs"), associated with asphalt paving materials, and the natural decay of organic matter. Even in the areas of the Maywood Site with the highest PAH levels, PAHs were present at levels comparable to the levels in previously approved alternate feed ores, such as the Tonawanda Site and St. Louis Site. They are also comparable to levels already considered in the Environmental Assessment for the Mill, which anticipated the management of all the Mill's former asphalt paved areas in the tailings cells during final reclamation.

Although a few VOC compounds were detected in the Maywood Material, in all cases the concentrations were negligible, and are substantially lower than those anticipated in the Environmental Assessment for the Mill, which anticipated the management of VOC solvents and extractants from the Mill's on site laboratory in the tailings impoundments.

Therefore, the protective mechanisms detailed above which prevent infiltration of constituents contained in either mined or alternate feed ores would also apply to the Maywood Material, and there would be no incremental concerns resulting from managing the Maywood Material prior to processing.

NRC QUESTION

3. "What would be the cost of disposing of the stockpiled material should the mill be shut-down prior to another processing run? Has this cost estimate been factored into in the current surety?"

IUSA RESPONSE

The White Mesa Mill Reclamation Plan, Revision 3.0, July 2000, has conservatively assumed the removal of 18 inches of soil from over 60 acres of Mill yard and ore pad area. The reclamation plan includes analysis of 572 soil samples over the Mill yard, ore pad and surrounding area as part of the initial Scoping and Characterization Survey. An additional 300 soil samples are included in the cost estimate as a part of the Final Status Survey. Costs are also included for independent quality control during the sampling and cleanup activities.

The total estimated cost for disposing of the currently stored alternate feed material is approximately $200,000, as detailed in Attachment l. This amount includes a 15% contingency amount as well as a 10% profit allowance to account for the work being conducted by an outside contractor. Overall, this additional amount represents only 11% of the current total Mill area decommission cost and only 2% of the total projected cost for the decommissioning and reclamation of the White Mesa Mill and tailings area. The conservatively high 15% contingency amount included in the Mill's reclamation budget is more than sufficient to provide for the cost of disposing of any remaining ores not processed prior to mill shut down. It should be noted that the cost of moving any remaining mined ores from the ore pad to the tailings cell has always been considered to be included in the contingency amount. IUSA would view any remaining stockpiled alternate feed ores as a variance in quantity of material to be removed from the ore pad, and as such, would properly be covered by the contingency of approximately $1.15M included in the January 2001 Reclamation Cost Estimate. Therefore, IUSA believes that it would be reasonable to consider the cost of moving alternate feed ores to the tailings cell to be similarly included in the contingency amount.

Nevertheless, in its March 1, 2002 update to the reclamation estimate, IUSA has added the estimated cost of disposing of the currently-managed alternate feed ore into the tailings cells in the updated Mill Decommissioning Cost.

SUMMARY AND CONCLUSIONS

IUSA manages conventionally mined uranium ores, as well as alternate feed ores, by stockpiling the material on the Mill's ore pad until the next Mill run, in a manner which is subject to the Mill's ALARA Program, ensuring that any releases are not only below applicable standards, but also are further reduced to levels which are ALARA. The data provided herein provide evidence that storage of alternate feed ores produces even less impact with respect to radon or airborne particulate emissions than the storage of mined ores, which also produces emissions well below applicable standards and below the Mill's ALARA goals. Similarly, management of the Maywood Material would also fall within these limits. Furthermore, based upon site-specific considerations and monitoring programs detailed herein, it is evident that the storage of alternate feed ores or the Maywood Material would have no cumulative impact on groundwater. To provide further confirmatory data, IUSA will perform the additional analyses described above.

With respect to the adequacy of the Mill's surety to provide for the cost of disposing of stockpiled material should the Mill be shut down prior to another processing run, IUSA believes that the conservatively high contingency amount included in the Mill's reclamation budget is more than sufficient to provide for the cost of disposing of any remaining ores not processed prior to mill shut down; however, IUSA has incorporated the additional cost of disposing of the currently-managed alternate feed ore into the tailings cells in the updated Mill Decommissioning Cost.

Should the NRC have any questions regarding these responses, I can be reached at (303) 389.4131.

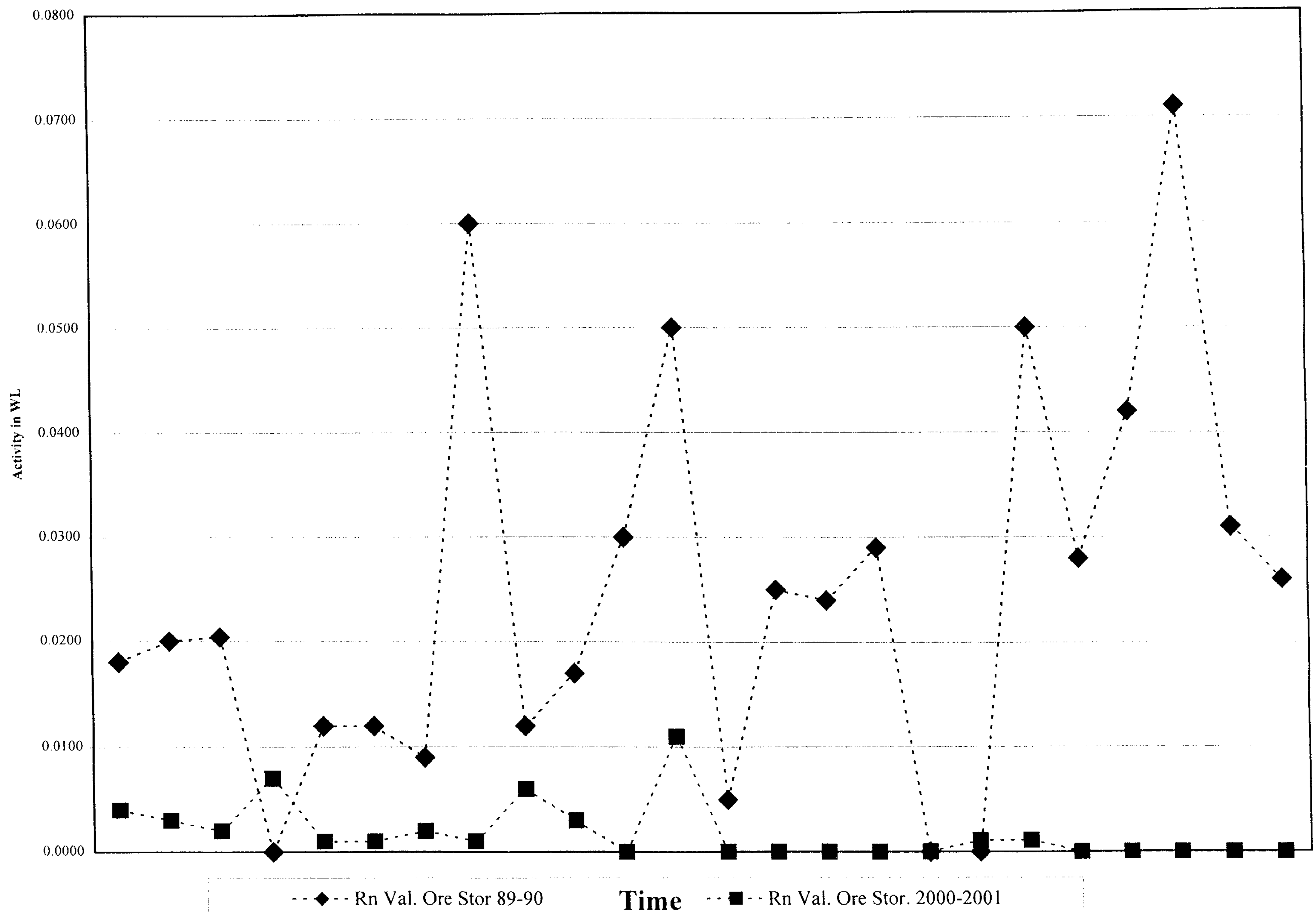
Sincerely,

Michelle R. Rehmann
Environmental Manager

MRR
Attachments

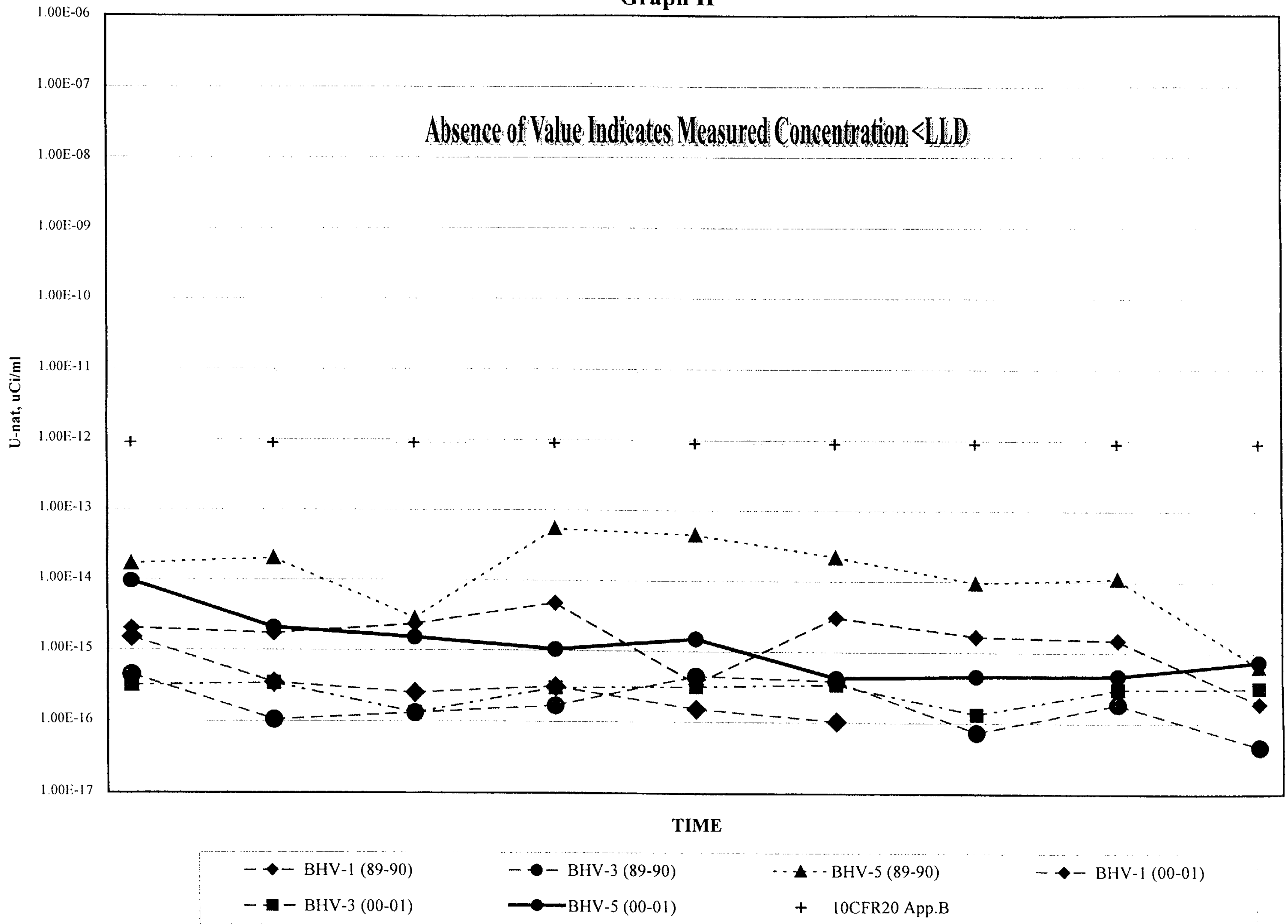
cc: Richard Bartlett/IUSA
Ronald E. Berg/IUSA
David C. Frydenlund/IUSA
Ron F. Hochstein/IUSA
Tom Rice, Ute Mountain Ute Tribe
William J. Sinclair/UDEQ
William von Till/NRC

Comparison of White Mesa Mill Ore Storage Radon Progeny Values (89-90, 00-01)
Graph I



White Mesa Mill U-nat Airborne Particulate Values of 1989-90 Compared to Values for 2000-01at BHV-1, BHV-3 (bkgd.), and BHV-5

Graph II



Attachment 1

MILL DECOMMISSIONING

Alternate Feed Disposal

Linde, Ashland & Heritage Material

Resource Description	Units	Cost/Unit	Task Units	Task Cost
Equipment Operators	hrs	$17.72	1,255	$22,237
Cat 769 Haul Truck (3)	hrs	$62.82	772	$48,488
Cat 988 Loader	hrs	$96.88	257	$24,924
Cat 651 Waterwagon	hrs	$68.97	176	$12,139
Cat 14G Motorgrader	hrs	$46.96	50	$2,348
Equipment Maintenance (Butler)	hrs	$12.08	1,255	$15,165

Total Linde, Ashland & Heritage Material **$125,301**

Total Quantity 151,274 Cubic Yards
196 Cubic Yards per Truck per hour
772 Truck Hours

Cameco Barrels

Resource Description	Units	Cost/Unit	Task Units	Task Cost
Equipment Operators	hrs	$12.74	316	$4,024
Flat Bed Trailer and Tractor*	hrs	$55.00	316	$17,372
Fork Lift (2)	hrs	$18.00	632	$11,371

Total Cameco Barrels **$32,767**

* includes operator

31,586 Barrels
40 Barrels per load
0.4 Hours per load
316 Truck Hours

Sub-Total Alternate Feed Disposal		**$158,068**
Contigency	15%	**$23,710**
Contractor O&P	10%	**$15,807**
Permits & Bonding	2%	**$474**
Total Alternate Feed Disposal		**$198,060**