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OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

May 20, 2002

BY ELECTRONIC AND U.S. REGULAR MAIL

U.S. Nuclear Regulatory Commission
Office of the Secretary
Attn: Rulemaking and Adjudications Staff
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Re: In the Matter of: International Uranium (USA) Corporation
Docket No: 40-8681-MLA-11
ASLBP No: 01-789-01-MLA

Dear Sir or Madam:

Please find attached for filing the Response of International Uranium (USA) Corporation to Written Presentations of Mr. William E. Love and the Glen Canyon Group of the Sierra Club. Copies of the enclosed have been served on the parties indicated on the enclosed certificate of service. Additionally, please return a file-stamped copy in the self-addressed, postage prepaid envelope attached herewith.

If you have any questions, please feel free to contact me at (202) 496-0780. Thank you for your time and consideration in this matter.

Sincerely,

Anthony J. Thompson
Law Offices of Anthony J. Thompson, P.C.
Counsel of Record to IUSA

Enclosures

(IUCMOLYCORPCOVERLTR.DOC)

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SECY-02

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Alan S. Rosenthal, Presiding Officer
Richard F. Cole, Special Assistant

In the Matter of International Uranium (USA) Corporation (Source Material License Amendment)	Docket No.: 40-8681-MLA-11 ASLBP No. 01-789-01-MLA Date: May 20, 2002

RESPONSE OF INTERNATIONAL URANIUM (USA) CORPORATION TO WRITTEN PRESENTATIONS OF MR. WILLIAM E. LOVE AND THE GLEN CANYON GROUP OF THE SIERRA CLUB (DOCKET NO. 40-8681-MLA-11)

International Uranium (USA) Corporation ("IUSA") submits this Response to Mr. William E. Love's ("Mr. Love's") and the Glen Canyon Group of the Sierra Club's (the "Group's") written presentations requesting the withdrawal of IUSA's license amendment allowing the receipt and processing of alternate feed material from Molycorp, Inc.'s site in Mountain Pass, California (the "Molycorp material"). IUSA respectfully requests that the Presiding Officer find that Mr. Love's and the Group's written presentations are without merit and deny their request for the revocation, suspension or alteration of IUSA's license amendment.

I. BACKGROUND AND PROCEDURAL HISTORY

On December 19, 2000, IUSA submitted to the Nuclear Regulatory Commission ("NRC" or the "Commission") a request for a license amendment to its source material license to allow IUSA to receive and process up to 17,750 tons of uranium-bearing material as alternate feed material, which resulted from the extraction of lanthanides and other rare earth materials at Molycorp, Inc.'s Mountain Pass, California site. The average uranium content of the Molycorp material is estimated to be approximately 0.15%, with portions containing higher concentrations. Notice of IUSA's application was published in the Federal Register on January 9, 2001. *See* 66 Fed. Reg. 1702 (January 9, 2001).

Sometime on or about February 7, 2001, pursuant to 10 C.F.R. Part 2, Subpart L, the Group submitted a letter requesting a hearing on IUSA's license amendment application (the "Molycorp license amendment"). On March 14, 2001, IUSA responded in opposition to the Group's hearing request. With leave of the Presiding Officer, on March 30, 2001, the Group filed a response to IUSA's opposition. The Presiding Officer conducted a telephone conference with counsel and representatives of IUSA and the Group on April 11, 2001. Following a review of the record, on April 24, 2001, the Presiding Officer entered an order denying the Group's request for a hearing due to a lack of standing.

After being granted a thirty (30) day extension, the Group filed its appeal of the denial of its hearing request on June 11, 2001. IUSA responded in opposition to the Group's appeal on June 21, 2001, and, in an order dated November 14, 2001, the Commission denied the Group's appeal and affirmed the Presiding Officer's finding that the Group lacked standing to intervene.

NRC issued IUSA's Molycorp license amendment on December 11, 2001 and, on the same day, NRC published a Federal Register notice describing NRC Staff's Finding of No *Significant* Impact ("FONSI") for IUSA's license amendment and noticed a *second* opportunity for a hearing on the license amendment.[1] Two intervenors, Mr. Love and the Group, submitted hearing requests on December 15, 2001 and January 10, 2002, respectively. IUSA submitted responses in opposition to both these hearing requests on December 31, 2001, and January 25, 2002, respectively.

In an order dated January 30, 2002, the Presiding Officer granted Petitioners standing to intervene in this matter. IUSA appealed the Presiding Officer's decision granting standing to the Commission on February 11, 2002. Then, on February 26, 2002, and February 28, 2002, respectively, the Group and Mr. Love filed motions for a stay of IUSA's Molycorp license amendment and requested a temporary stay without an opportunity for IUSA to respond. In an order dated March 13, 2002, the Presiding Officer denied both Mr. Love's and the Group's motions for a stay and requests for a temporary stay. Subsequently, on April 3, 2002, the Commission affirmed the Presiding Officer's grant of standing to Petitioners and the denial of Petitioners' requests for a stay of IUSA's license amendment,[2] thereby setting the stage for a hearing on the merits to proceed.

During a telephone conference on February 21, 2002, the Presiding Officer discussed scheduling for a hearing on the merits. *See* Memorandum and Order, (February 15, 2002). At the conclusion of the telephone conference, the Presiding

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[1] 66 Fed. Reg. 64064 (December 11, 2001).

[2] Both the Presiding Officer and the Commission found that Petitioners' requests for a stay were substantively inadequate, including the failure to demonstrate a likelihood of success on the merits of this proceeding.

Officer ordered Petitioners to submit their written presentations no later than April 1, 2002, and IUSA and NRC Staff to serve their written presentations by May 1, 2002.[3]

On March 27, 2002, the Group filed a motion requesting an additional fifteen (15) days to file a supplemental written presentation based on delays in the delivery of this proceeding's hearing file and the Group's inability to obtain relevant documents for its initial written presentation.[4] By order issued the same day, the Presiding Officer granted the Group's request.

On April 1, 2002, both Mr. Love and the Group submitted their initial written presentations. The Group incorporated by reference Mr. Love's filing and Mr. Love incorporated by reference the Group's filings, including all supplemental filings.[5] Then, on April 10, 2002, the Group submitted its *first* supplemental written presentation. On April 15, 2002, the Group filed a *second* supplemental written presentation, and, on April 16, 2002,[6] the Group filed a *third* supplemental written presentation.

In his March 27, 2002 order, the Presiding Officer noted that IUSA could seek additional time to respond to Petitioners' written presentations if, in the opinion of IUSA, there would not be sufficient time to properly respond to such presentations. IUSA and NRC Staff, on April 19, 2002, each submitted a request for a thirty (30) day extension to respond to both Mr. Love's and the Group's written presentations. The Group and Mr. Love filed responses opposing IUSA's and NRC Staff's requests on April 19, 2002, and

[3] After issuing the April 1, 2002, order, the Presiding Officer, on the same day, directed NRC Staff to become a party to this proceeding.
[4] This motion for an extension of time did not apply to Mr. Love.
[5] In his written presentation, Mr. Love states, "Petitioner [Mr. Love] incorporates by reference all of Sierra Club's arguments and supporting materials filed and scheduled for amended filing in this case..." Love Presentation at 1. The Group similarly states in its initial written presentation, "Petitioner Sierra Club incorporates by reference Petitioner William E. Love's April 1, 2002, filing in the present proceeding in this April 1, 2002, filing." Group Initial Presentation at 18.
[6] This April 16, 2002, *third* supplemental filing was technically untimely.

April 20, 2002, respectively. By order dated April 22, 2002, the Presiding Officer granted IUSA's and NRC Staff's requests for extensions of time in part, thereby making the due date for this written presentation May 20, 2002.

Pursuant to the Presiding Officer's April 22, 2002, order, IUSA submits this written presentation and respectfully requests that the Presiding Officer deny Mr. Love's and the Group's requests for the revocation, suspension or alteration of IUSA's license amendment. As both Mr. Love and the Group incorporate each other's written presentations, IUSA submits this written presentation as a unified response to Petitioners' claims and allegations.

II. STATEMENT OF THE CASE

Petitioners raise a number of procedural and substantive arguments relating to NRC's regulatory program and IUSA's White Mesa Mill (the "Mill") operating license. As will be shown below, each of Petitioners arguments relating to either NRC's regulatory program or aspects of the Mill's current and pre-existing operating license are not within the proper scope of this proceeding and are not now subject to challenge. These arguments should not be considered by the Presiding Officer as the only subject-matter properly before the Licensing Board at this time is the potential *significant, incremental* adverse impacts, if any, of IUSA's Molycorp license amendment.

This proceeding cannot be construed as an opportunity for Petitioners to challenge the regulatory regime applicable to uranium mill tailings facilities or previously licensed operations or activities at the Mill. Indeed, it is entirely unreasonable that the licensee should have to go to the time and expense to respond to an ever-expanding set of allegations which go beyond the proper scope of this proceeding—namely the proposed Molycorp license amendment's potential *significant, incremental* adverse impacts on

public health and safety and the environment. Unfortunately, since the licensee cannot afford to take the chance that these arguments will be considered by the Presiding Officer witjout an IUSA reply, they must be addressed in this Response. If such arguments are considered, they must be considered in light of the statutory regime created by Congress and the regulatory program implemented by the Environmental Protection Agency ("EPA") and NRC pursuant thereto, the Mill's license and process history, and the facts and circumstances associated with the Molycorp license amendment. When considered in this context, Petitioners' arguments are without merit and do not constitute grounds for the revocation, suspension or alteration of IUSA's license amendment. IUSA will consider each of Petitioners' allegations regarding the Molycorp license amendment in turn.

In addition, Petitioners in this proceeding have exhibited precious little discipline. Instead, they have filed and overfilled, constantly adding new issues as they go. They have sought extensions of time and opposed such requests by the licensee. In light of the above, the licensee respectfully requests that the Presiding Officer deny the Petitioners any right to reply to this Response or, at the very least, strictly define the scope of any such replies which, if exceeded, will result in such exceedances being stricken from the record and Petitioners disciplined accordingly. [7]

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[7] The preamble to 10 CFR § 2.1209 entitled *Power of Presiding Officer* explicitly states that "a presiding officer has the duty to conduct a fair and impartial hearing according to law, to take appropriate action to avoid delay, and to maintain order. The presiding officer has all the powers necessary to those ends..." *See* 10 CFR § 2.1209. "Current adjudicatory procedures and policies provide a latitude to the Commission, its licensing boards and presiding officers *to instill discipline in the hearing process* and ensure a *prompt yet fair* resolution of contested issues in adjudicatory proceedings." *See NRC Statement of Policy on Conduct of Adjudicatory Proceedings*, CLI-98-12 at 3 (emphasis added).

III. STANDARD OF REVIEW

Before turning to the statutory and regulatory framework applicable to uranium mills, including the Mill and the Molycorp license amendment, it is necessary to set forth the appropriate standard of review. The Commission's regulations require NRC Staff to make a number of findings concerning the applicant and its ability to protect public health and safety before issuing a materials license. *Philadelphia Electric Co.* (Limerick Generating Station, Units 1 and 2), ALAB-778, 20 N.R.C. 42, 48 (1984); *see* 10 C.F.R. § 70.23, 70.31; *cf. South Carolina Electric and Gas Co.* (Virgil C. Summer Nuclear Station, Unit 1), ALAB-642, 13 N.R.C. 881, 895-96 (1981), *aff'd sub nom.*; *Fairfield United Action v. NRC*, 679 F.2d 261 (D.C. Cir. 1982). Specifically, 10 C.F.R. § 40.32 states:

> "An application for a specific license will be approved if:
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> (a) The application is for a purpose authorized by the Act; and
> (b) The applicant is qualified by reason of training and experience to use the source material for the purpose requested in such a manner as to protect health and minimize danger to life or property; and
> (c) The applicant's proposed equipment, facilities and procedures are adequate to protect health and minimize danger to life or property; and
> (d) The issuance of the license will not be inimical to the common defense and security or to the health and safety of the public and;
> (e) In the case of an application...for a license to possess and use source and byproduct material for uranium milling,...the Director of Nuclear Material Safety and Safeguards or his designee...has concluded, after weighing the environmental, economic, technical and other benefits against the environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license."[8]

Thus, for the Commission to grant a materials license or license amendment, it must find that (1) the applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life or property; and (2) the applicant is qualified

[8] 10 C.F.R. § 40.32.

by training and experience to use the material for the purpose requested in such a manner as to protect public health and minimize danger to life or property and to comply with the Commission's regulations.[9] A license or license amendment is not to be denied simply on the basis of a deficiency or omission in the application.[10] NRC Staff, in its review of a license application, is not required to make specific findings of fact or to explain its approval of a license.[11] Although such findings and explanations may be helpful to a Presiding Officer or a party challenging the license in later proceedings, they are not required under NRC orders, policy statements, and regulations.[12]

When a license amendment is challenged, the licensee generally bears the ultimate burden of proof.[13] Those challenging a license, however, must provide some basis for further inquiry.[14] Where one of the parties challenging the license contends that, for a specific reason, the permit or license should be denied, that party has the burden of going forward with evidence to buttress that contention. Once the party has introduced sufficient evidence to establish a prima facie case, the burden then shifts to the applicant, which as part of its overall burden of proof, must provide a sufficient rebuttal to satisfy the Licensing Board that it should reject the contention as a basis for denial of the permit or license.[15]

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[9] *See In the Matter of the Curators of the University of Missouri*, 41 N.R.C. 71, 1995 N.R.C. LEXIS 21, *43 (1995).
[10] *Id.*
[11] *Id.* at *106.
[12] *See In the Matter of the Curators of the University of Missouri*, 41 N.R.C. 71, 1995 N.R.C. LEXIS 21, *106 (1995).
[13] 10 C.F.R. §§ 2.732, 2.1237(b); *see also Metropolitan Edison Co.*, 16 N.R.C. 1265, 1271 (1982).
[14] *See Metropolitan Edison Co.*, 16 N.R.C. 1265, 1271 (1982).
[15] *General Public Utilities Nuclear Corp.*, 17 N.R.C. 1076, 1093 (1983); *Louisiana Power and Light Co.*, 17 N.R.C. 1076, 1093 (1983), *citing, Consumers Power Co.*, 6 AEC 331, 345 (1973).

In operating license proceedings, a Licensing Board's jurisdiction is defined by the Commission's notice of hearing. *Long Island Lighting Co.* (Shoreham Nuclear Power Station, Unit 1), LBP-91-1, 33 N.R.C. 15, 20-21 (1991). Licensing Board's generally can neither enlarge nor contract the jurisdiction conferred by the Commission. *Philadelphia Electric Co.* (Limerick Generating Station, Units 1 and 2), LBP-89-19, 30 N.R.C. 55, 58, 59-60 (1989).

More specifically, in a license amendment proceeding, a Licensing Board has only limited jurisdiction. The Licensing Board may admit a party's issues for hearing *only* insofar as those issues are within the scope of matters outlined in the Commission's notice of hearing on the licensing action. *Wisconsin Electric Power Co.* (Point Beach Nuclear Plant, Units 1 and 2), ALAB-739, 18 N.R.C. 335, 339 (1983), *citing Portland General Electric Co.* (Trojan Nuclear Plant), ALAB-534, 9 N.R.C. 287, 289, n. 6 (1979). A Licensing Board *only* has jurisdiction over those matters which are within the scope of the amendment application. *Vermont Yankee Nuclear Power Corp.* (Vermont Yankee Nuclear Power Station), LBP-88-19, 28 N.R.C. 145, 152-53 (1988).

Further, with regard to Petitioners' challenges to NRC's regulatory program in general, 10 C.F.R. § 2.1239(a) entitled *Consideration of Commission rules and regulations in informal adjudications* states:

> "Except as provided in paragraph (b) of this section, any regulation of the Commission issued in its program for the licensing and regulation of Production and utilization facilities, source material, special nuclear material, or byproduct material *may not be challenged in any adjudication subject to this subpart [subpart L]."*

A petitioner may not collaterally attack Commission regulations on the grounds that they fail to protect public health and safety when such regulations have been subject to full public comment proceedings. *See id.*; *see also In the Matter of The Curators of the*

University of Missouri, 41 N.R.C. at *216.; *American Nuclear Corp.* (Revision of Orders to Modify Source Materials Licenses), CLI-86-23, 24 N.R.C. 704, 708-10 (1986).

With respect to matters that are within the proper scope of this proceeding (i.e., the Molycorp license amendment), Petitioners must "show a harm that [is] distinct and apart from that caused by the initial licensing and continued operation of the facility." *International Uranium* (USA) *Corp.* (White Mesa Mill), LBP-99-8, 49 N.R.C. 131, (February 19, 1999). The Commission has adopted the maxim that, where a facility's ongoing operations are involved, "a petitioner's challenge must show that the [proposed license] amendment will cause a 'distinct new harm or threat apart from the activities already licensed. *International Uranium* (USA) *Corp.* (Receipt of Material from Maywood, New Jersey), 2002 N.R.C. LEXIS 9, *11 (January 16, 2002), *quoting*, *International Uranium* (USA) *Corp.* (White Mesa Mill) 54 N.R.C. 27, *7-8 (July 30, 2001).

A petition to intervene in a materials licensing proceeding, regarding issues such as approval of the Mill's operating license or approval of the Mill's tailings cell design or construction would have to have been filed within thirty (30) days after the petitioner received actual notice of the pending application or the agency action granting the application; or one hundred and eighty (180) days after the agency action granting the application. *See* 10 C.F.R. § 2.1205(c)(2)(l); *see also Umetco Minerals Corp.*, LBP-94-7, 39 N.R.C. 112, 113 (1994). Actual notice does not require notice of the legal right to challenge the application or of the period of time within which a challenge must be filed. *See Nuclear Metals Inc.*, LBP-91-27, 33 N.R.C. 548, 549, 550 (1991). Any challenge filed outside this time period will be considered untimely. *See generally* 10 C.F.R. § 2.1205.

IV. GENERAL STATUTORY AND REGULATORY BACKGROUND

1. Statutory Background

To understand the import and underpinning of NRC's Alternate Feed Guidance ("AFG"), it is necessary to view it in the context of the Atomic Energy Act ("AEA"), as amended by the Uranium Mill Tailings Radiation Control Act of 1978 ("UMTRCA"), Pub. Law No. 95-604 (codified in various sections of Title 42 of the United States Code), and its amendments, pursuant to which the regulatory program developed by the EPA and NRC was promulgated.

Congress enacted UMTRCA in 1978 to address concerns regarding the potential health and environmental hazards, both radiological *and non-radiological*, presented by uranium *and* thorium mill tailings. UMTRCA was based upon a finding that mill tailings located at active and inactive mill sites may pose a potential and *significant* radiation health hazard to public health.[16] In explaining the need for UMTRCA, the House Report accompanying the legislation relied upon the description of the potential public health hazard of mill tailings in the testimony of then-NRC Chairman, Dr. Joseph M. Hendrie:

> "The NRC believes that long-term release from tailings piles may pose a radiation health hazard if the piles are not effectively stabilized to minimize radon releases and prevent unauthorized use of the tailings.

There are two basic purposes of UMTRCA: (1) to provide a remedial action program at inactive mill tailings sites and (2) to provide a program for the regulation of "mill tailings during uranium or thorium ore processing at active mill operations and after termination of such operations."[17] Title II of UMTRCA establishes a comprehensive

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[16] Pub. L. No. 95-604, at 2(a), 92 Stat. 3021-22.

[17] Title I of UMTRCA provides a specific remedial program for a number of designated inactive and abandoned tailings sites under the primary direction of the Department of Energy ("DOE"),

program for EPA and NRC regulation at active (licensed) mill tailings sites, such as the Mill, of *all* wastes including uranium or thorium mill tailings created by processing *ore* to recover its source material (i.e., uranium or thorium) content. UMTRCA defines such wastes as 11e.(2) byproduct material.[18] UMTRCA also added sections 83, 84, and 275 and amended sections 161 and 274 of the AEA to provide EPA and NRC with the broad authority to regulate all aspects of mill tailings sites.[19]

UMTRCA directed EPA to promulgate "*standards of general application*" (or "*generally applicable standards*") for both Title I and Title II programs.[20] Title II[21] charged NRC with implementing and enforcing UMTRCA regulations promulgated pursuant thereto, including EPA's *generally applicable standards* and NRC's own specific regulatory requirements.[22]

As described in the House Report, the dual EPA and NRC regulatory-setting regime contemplated that:

> "[t]he EPA standards and criteria should be developed to limit the exposure (or potential exposure) of the public and to protect the general environment from either radiological *or nonradiological* substances to acceptable levels through such means as allowable concentrations in air or water, quantities

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and is inapplicable to the White Mesa Mill. Pub. L. No. 95-604, at 2(b)(1), 92 Stat. 3022; Pub. L. No. 95-604, at 2(b)(2), 92 Stat. 3022.

[18] Under the AEA, 11e.(2) byproduct material is defined as, "the tailings or wastes produced by the extraction or concentration of uranium *or thorium* from any ore processed primarily for its source material content." *See* 42 U.S.C. § 2014(e)(2)(emphasis added).

[19] Pub. L. No. 95-604, at 201-206, 92 Stat. 3033-4.

[20] Pub. L. No. 95-604, at 206, 92 Stat. 3040. Section 206 of UMTRCA, which adds a new section 275 to the AEA, specifically requires NRC to *conform* its regulations to EPA's *generally applicable standards.*

[21] It is also worth noting that Title II of UMTRCA specifically requires that the Department of Energy ("DOE") take title to all 11e.(2) byproduct material after license termination, if the host state does not opt to take title. To the extent that either RCRA *listed or characteristic* hazardous wastes are *inappropriately* introduced into a tailings impoundment, then potential questions about post-license termination dual EPA/NRC jurisdiction may arise which could compromise transfer of title to the site to DOE, a problem which NRC and DOE wish to avoid.

[22] Pub. L. No. 95-604, at 203, 205, 92 Stat. 3036, 3039.

> of the substances released over a period of time, or by specifying maximum allowable doses or levels to individuals in the general population."[23],[24]

The NRC, on the other hand:

> "must set all standards and requirements relating to management concepts, specific technology, engineering methods, and procedures to be employed to achieve desired levels of control for limiting public exposure, and for protecting the general environment. The Commission's standards and requirements should be of such nature as to specify, for example, exclusion area restrictions on site boundaries, surveillance requirements, detailed engineering requirements, including lining of tailings ponds, depth, and types of tailings covers, population limitations or institutional arrangements such as financial surety requirements or site security measures."[25]

UMTRCA and its legislative history reflect Congress' intent that EPA and NRC regulate the potential radiological hazards associated with 11e.(2) byproduct material. This is entirely appropriate since a substantial share of the potential hazards associated with 11e.(2) byproduct material are, in fact, radiological. However, it is also clear that UMTRCA and its legislative history clearly and unequivocally address EPA's and NRC's authority and responsibility to regulate potential *non-radiological* hazards associated with 11e.(2) byproduct material.

As a result, Congress added section 275 to the AEA directing EPA to "promulgate standards of general application for the protection of the public health, safety, and the environment from radiological and *non-radiological* hazards associated with" mill tailings at active sites. *See* 42 U.S.C. § 2022(b)(1) (emphasis added). "Such generally applicable standards...for *non-radiological hazards*," must "provide for the protection of human health and the environment *consistent with* standards required under Subtitle C of

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[23] H.R. Rep. No. 1480, *supra* note 196, pt. 1, at 16-17 (emphasis added).
[24] For purposes of this written presentation, IUSA intends to add emphasis to terms, phrases or sentences within cited quotations to the extent it becomes necessary. It should be understood that the notation "emphasis added" shall be implied and will no longer be inserted from this point forward.
[25] H.R. Rep. No. 1480, *supra* note 196, pt. 1, at 16.

the Solid Waste Disposal Act [SWDA], as amended, which are applicable to such hazards." *See* 42 U.S.C. § 2022(b)(2).[26]

The House Interior and Insular Affairs Committee, in reporting on the bill that would eventually be enacted as UMTRCA, stated as follows:

> "The NRC is also responsible for implementing general standards and criteria promulgated by the Administrator of the Environmental Protection Agency [EPA]. NRC must assure that the technology, engineering methods, operational controls, surveillance requirements and institutional arrangements employed at the sites provide the necessary barriers and levels of control to limit public exposure, and protect the environment from radiological *and toxic non-radiological substances associated with uranium mill tailings materials,* as specified by EPA standards and criteria."

H.R. Rep. No. 95-1480, Part I, at 16.

Section 205 of UMTRCA requires the Commission to regulate 11e.(2) byproduct material in a manner that:

> "the Commission deems appropriate to protect the public health and safety and the environment from radiological and *non-radiological* hazards associated with the processing and with the possession and transfer of [11e.(2)] material."

42 U.S.C. § 2114(a)(1).

Congress also added section 84 to the AEA directing NRC to insure that "management" of mill tailings is carried out in such a manner as"

> "To protect public health and safety and the environment from radiological *and non-radiological* hazards associated with mill tailings...
> To conform to 'applicable general standards' promulgated by EPA; and...
> To conform to NRC 'general requirments' established 'with the concurrence' of EPA, 'which are, to the maximum extent practicable, at least comparable to requirements applicable to...disposal of *similar hazardous material* regulated' by EPA under the Solid Waste Disposal Act [SWDA]."

It is for these reasons that section 275 states that:

> "[N]o permit issued by the Administrator [of EPA] is required

[26] Subtitle C of the SWDA is the Resource Conservation and Recovery Act ("RCRA").

under this Act or the Solid Waste Disposal Act [SWDA], as amended [RCRA]…."

To explain the import of these provisions, NRC has also stated:

> "Constituents with hazardous characteristics that were in feed materials processed at a uranium mill would eventually end up in the tailings impoundment as 11e.(2)byproduct material. As such, they would be regulated under appendix A of 10 C.F.R. part 40 which provides for monitoring and control of hazardous constituents. *Thus, the ultimate fate of hazardous constituents that might be in uranium mill feed would not escape regulatory oversight.*"

57 Fed. Reg. 20525, 20533 (1992).

Thus, the statutory regime established by Congress in UMTRCA, as amended, explicitly mandates that both EPA and NRC promulgate and NRC implement regulations designed to address both the potential radiological hazards (primarily fromlong-lived radionuclides such as uranium and thorium and their decay products) and the potential *non-radiological* hazards (both naturally occurring heavy metals such as *lead* and organic process constituents) associated with uranium *or thorium* mill tailings.

2. Regulatory Background

In 1980, NRC promulgated its 10 C.F.R. Part 40, Appendix A Criteria ("Appendix A"),[27] based upon the findings in its Generic Environmental Impact Statement ("GEIS") on uranium milling operations and management of mill tailings set forth in NUREG-0706 entitled *Final Generic Environmental Impact Statement on Uranium Milling.*[28] The Criteria established a performance-oriented program for mill tailings management by setting Criteria for siting and disposal of mill tailings piles, controlling erosion and stabilizing tailings, limiting radioactive effluents from uranium

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[27] 45 Fed. Reg. 65,521 (1980).
[28] NUREG-0706, *Final Generic Environmental Impact Statement on Uranium Milling,* (September, 1980).

and thorium mills and mill tailings, controlling seepage of *non-radiological* toxic materials from tailings into groundwater, providing financial assurance for meeting disposal costs and long-term monitoring, and meeting UMTRCA's long-term custodianship requirements for tailings disposal sites.

During the development of its Appendix A Criteria, NRC's GEIS used a "model mill" to provide licensees and the general public with a generic assessment of both the *radiological and non-radiological* hazards of uranium milling and mill tailings impoundments. NRC's "model mill"[29] analysis included an assessment of *radiological and non-radiological* constituents in tailings solutions, their potential for transport through groundwater and surface water, and the proper construction of a tailings impoundment to contain both types of constituents.[30] *See* GEIS at 12-23, 12-24, 12-25. This assessment was designed to address technical problems such as:

> "isolating tailings from people for long time periods, control of persistent airborne emissions...and protection of groundwater quality...and *[n]onradiological environmental impacts* and resource use."

GEIS at 2.

NRC also explicitly stated that "[t]he UMTRCA does, however, require consistency, to the maximum extent practicable with the requirements of RCRA.." for the protection of the public health and safety from the *non-radiological hazards* associated with uranium milling and mill tailings impoundments *Id.* at 13-6.

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[29] IUSA also notes that the "model mill" analysis conducted by NRC, like the White Mesa Mill, is "based on an acid leach process which is common to the industry." GEIS at 3.

[30] NRC provides a summary of its assessment of *non-radiological* hazards associated with uranium milling and mill tailings impoundments in section 3.3 & 4.6 of the GEIS , as well as a more detailed description in sections 6.2.1 & 6.3.1. This generic assessment, which addresses typical mill tailings constituents such as heavy metals, specifically includes *lead.*

However, NRC made clear that the "model mill" analysis, and the GEIS in general, did not account for *site-specific* conditions that may potentially play a *significant* role. Indeed, NRC has stated, for example, "[t]he need for development of specific methods of tailings disposal on a *site-specific* basis is repeatedly made in the document..." *See* GEIS at §§ 1.3, 12.3.1, 12.3.5, & 12.3.10.

Recognizing that site-specific factors will dictate precise means of compliance at any particular site, Appendix A Criteria were created to be performance-oriented requirements which emphasize flexibility, rather than to be prescriptive prerequisites to licensing, to account for the unique, site-specific circumstances posed by the natural systems in which this activity takes place. These performance-oriented requirements were created with the specific intent of providing protection for the public health and safety and the environment from both the radiological and *non-radiological* hazards associated with mill tailings.

In 1983, EPA issued its general standards for inactive Title I sites,[31] and, later that year, published its *generally applicable standards* for Title II sites,[32] which among other things, established a radon emission limit for disposal areas of 20 pCi/m²/s, the so-called 5/15 pCi/g radium in soil cleanup standard, primary and secondary groundwater protection standards, and long-term design requirements for the stability of mill tailings piles or impoundments. Thus, this package of controls requires that reclaimed mill tailings facilities must assure control of potential radiological and *non-radiological*

[31] 48 Fed. Reg. 590 (1983)(codified at 40 C.F.R. §§ 192.00-.23).
[32] 48 Fed. Reg. 45,926 (1983)(codified at 40 C.F.R. §§ 192.30-.43). EPA's active site standards have been upheld against numerous challenges by industry and environmental petitioners. *See American Mining Congress v. Thomas*, 772 F.2d 640 (10th Cir. 1985), *cert denied*, 476 U.S. 1158 (1986).

hazards "for one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years."[33]

Thus, by the end of 1983, EPA had issued *generally applicable standards* for active uranium mill tailings sites (as well as for inactive sites), and Congress had amended the AEA to provide more flexibility for NRC licensees to achieve the levels of protection required under EPA and NRC regulations without necessarily being bound to the specific requirements set forth in those regulations. In addition, Congress specifically directed NRC and EPA to balance costs against risks when developing regulations and standards governing the management of uranium mill tailings and related wastes.

In 1985, the Commission amended its earlier 1980 Criteria to conform them to EPA's *generally applicable standards*,[34] although many of the Appendix A Criteria remained unchanged.[35] However, NRC's Appendix A Criteria incorporate the RCRA standards for potential *non*-radiological hazards in groundwater incorporated by EPA in its *generally applicable standards*.[36] The provisions of Appendix A, Criterion 5 expressly "incorporate the basic ground-water protection standards imposed by the EPA in 40 C.F.R. Part 192, subparts D and E[37] which apply *during operations and prior to the end of closure*."[38] Criterion 5, for example, delineates a *primary* standard focusing on the

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[33] 40 C.F.R. § 192.32(b)(1)(i).
[34] 50 Fed. Reg. 41,852 (1985).
[35] The Criteria that remained essentially identical to the Commission's 1980 regulations were Criteria 2, 3, 4, 7, 8A, and portions of each of the others. The 1985 Criteria that the Commission revised to conform to EPA's *generally applicable standards* were parts of the Introduction, Criteria 1, 5, 6, and 8.
[36] EPA's *Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing* ("FEIS") analyses, like NRC's GEIS analyses, explicitly contemplated the presence of heavy metals such as *lead* in uranium mill tailings wastes. *See* FEIS at 3-8, 3-10, 4-9, 4-10.
[37] 40 C.F.R. Part 192, Subpart D & E incorporate RCRA standards in 40 C.F.R. Part 264 *et seq.*
[38] 10 C.F.R. Part 40, Appendix A, Criterion 5.

type of liner necessary to protect groundwater during the management of uranium or thorium mill tailings and how that liner should be constructed. Additionally, a *secondary* groundwater standard is provided requiring that hazardous constituents entering groundwater must not exceed concentration limits in the "uppermost aquifer beyond the point of compliance during the compliance period."[39]

Criterion 13 contains EPA's RCRA hazardous constituents list with which the *secondary* groundwater standards discussed in Criterion 5 must comply. This list includes various types of inorganic constituents, including heavy metals like *lead* and their compounds, and demonstrates that EPA and NRC explicitly anticipated the presence of such constituents in mill tailings impoundments.[40] The list of hazardous constituents shown in Criterion 13 are not considered exhaustive and any other prospective hazardous constituents must be evaluated on a case-by-case basis independent of EPA's listing in 40 C.F.R. Part 192.

In addition to incorporating RCRA requirements, the safeguards offered by NRC's mill tailings control regime are extremely stringent and provide public health protection that is equivalent to, if not in some respects more stringent than RCRA. Mill tailings must be designed to be stabilized through use of "passive" controls (engineered barriers) to contain potential radiological and *non*-radiological hazards without the

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[39] *See* Appendix A, Criterion 5.

[40] This conclusion is further supported in NRC's recent NUREG-1620 entitled *Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act* (Draft Report for Comment), ("Mill Tailings SRP"). As shown in Table 4.1.3-1 entitled *Common Uranium Mill Chemical Constituents,* which "is based on a chemical survey performed by NRC Staff at 17 licensed mill tailings sites," heavy metals such as *lead* are constituents that are routinely present in natural uranium ores. Mill Tailings SRP at 4-8, 4-9. These constituents are *commonly* found in these ores and NRC's protective measures for proper disposal and management of 11e.(2) mill tailings were designed to specifically address such constituents.

benefit of "active maintenance" for a minimum of 200 years and, to the extent reasonably achievable, 1,000 years. By contrast, the RCRA regulatory horizon is thirty (30) years, and even under NRC's 10 C.F.R. Part 61 low-level radioactive waste ("LLRW") standards for higher activity wastes, the regulatory horizon is only 300-500 years, with no provisions similar to those in Appendix A for control of *non-radiological* (hazardous) constituents. Thus, it is indisputable that the regulatory program developed and promulgated by EPA and NRC for uranium milling and mill tailings impoundments specifically contemplates licensees processing ores for their natural uranium content regardless of the presence of potential radiological or *non-radiological* hazards and provides a flexible, site-specific framework within which licensees may continue operations without posing a *significant* threat to public health and safety or the environment.

3. Regulatory History of NRC's Alternate Feed Guidance

On August 15, 1995, NRC, in response to requests it had received, some of which the Commission had approved,[41] to mill feed material at licensed uranium mills that was not *natural uranium ore*, and after public comment, NRC promulgated its AFG entitled *Final Position and Guidance on the Use of Uranium Feed Material Other than Natural Ores*.[42] The AFG was intended to replace *ad hoc, case-by-case* review of such requests and to address two key concerns raised by alternate feed processing: (1) the possibility of

[41] For example, NRC amended the source material license held by Rio Algom's uranium mill in Lisbon, Utah several times between 1982 and 1987 to enable the mill to receive processing wastes from a uranium hexafluoride conversion facility, a niobium-tantalum recovery facility, and an yttrium-lanthanides recovery facility. *See* 57 Fed. Reg. 20525, 20531 (1992). Likewise, in 1987, NRC permitted the Quivira Mining Company to process sludge from a uranium hexafluoride conversion plant. The uranium content of these wastes typically was higher than that of the average natural ore.
[42] 60 Fed. Reg. 49296 (September 22, 1994).

dual regulation of tailings by both NRC and EPA (or States) which could lead to (2) impediments to the transfer of 11e.(2) byproduct material tailings piles to the long-term custody of DOE. It is important to note that the AFG was not and is not *primarily* focused on potential health and safety concerns of processing alternate feed. This is not to suggest that health and safety analyses associated with processing any given alternate feed are not required. Indeed, the AFG expressly states that a licensee must demonstrate that any alternate feed can be processed in compliance with NRC's 10 C.F.R. Part 40, Appendix A requirements. However, assuming that such compliance can be demonstrated, the *primary* concern is a policy concern—avoidance of the potential impacts of dual jurisdiction.

NRC's AFG imposed three key requirements for processing feed material other than *natural ores* to insure that the wastes resulting from such processing would qualify as 11e.(2) byproduct material and, thus, would be eligible for disposal in uranium mill tailings impoundments that would ultimately be transferred to the governmental custodian, DOE.

First, a proposed alternate feed material must qualify as *ore*. Under the AEA, 11e.(2) byproduct material is defined as "the tailings or wastes produced by the extraction or concentration of uranium or thorium from *any ore* processed *primarily* for its source material content." Although UMTRCA, as it amends the AEA, does not specifically define what constitutes *any ore*, the Commission has developed the following definition:

> "[A] natural or native matter that may be mined and treated for the extraction of any of its constituents or *any other matter* from which source material is extracted in a licensed uranium or thorium mill."[43]

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[43] 57 Fed. Reg. 20531 (1992).

Indeed, NRC Staff concluded that

> "The fact that the term "*any ore,*" rather than *unrefined and unprocessed ore*, is used in the definition of 11e.(2) byproduct material implies that *a broader range of feed materials could be processed in a mill*, with the wastes still being considered as 11e.(2) byproduct material.[44]

Thus, materials that already have been subject to processing, but which contain recoverable uranium, can qualify as *ore* and such materials, when processed, will yield wastes that constitute 11e.(2) byproduct material.

Second, the AFG states that feed materials containing *listed* hazardous waste subject to EPA's RCRA regulations cannot be processed as an alternate feed. This ban, however, does not apply to feed materials exhibiting only *characteristics* of hazardous waste (i.e., toxicity, ignitability, etc.), since such material is exempt from the RCRA definition of hazardous waste when reclaimed.[45]

Third, the licensee must demonstrate that the *ore* is being processed *primarily* for its source material content. This requirement is tied to the definition of 11e.(2) byproduct material and was made explicit in the AFG to address concerns about "*sham disposal*" with respect to which it had been argued that wastes which normally would have to be disposed of as LLRW or mixed waste could be milled at a uranium mill primarily to enable its disposal in a mill tailings impoundment as 11e.(2) byproduct material at less cost.

Subsequently, however, concerns about the potential for "*sham disposal*" were addressed by the Commission in *In the Matter of International Uranium* (USA) *Corp.*, wherein the State of Utah disputed alternate feed processing of material from the so-

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[44] 57 Fed. Reg. at 20532.

[45] *See* 40 C.F.R. § 261.2(c)(3).

called Ashland 2 site in Tonawanda, New York.[46] Utah claimed that, because the processing fee IUSA received was greater than the economic value of the uranium that could be extracted from the Ashland 2 material, IUSA was engaging in "*sham processing*" and was not processing the Ashland 2 material *primarily* for its source material content.

IUSA disputed Utah's contention and argued that so long as IUSA operated an NRC-licensed uranium mill and extracted, or reasonably expected to extract, uranium from the material, the processing action would be *primarily* for the material's source material content and, thus, permissible under NRC's AFG. This litigation resulted in a Commission decision which determined that a licensee may process an alternate feed material *primarily* for its source material content without inquiry into the licensee's economic motives for such processing.[47] This Commission decision, coupled with the regulatory progress achieved in the interim period, has created an AFG that is *significant*ly more flexible but which remains consistent with the objectives set forth by Congress in the AEA, as amended by UMTRCA.[48]

V. WHITE MESA MILL HISTORY AND PROCESS

1. History and Process

The Mill commenced operations in 1980, originally to process uranium and vanadium ores from the historic Colorado Plateau mining district, and later from the high-grade breccia pipe mines in northern Arizona.

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[46] CLI-00-01, 51 N.R.C. 9, (February 10, 2000).
[47] *See generally id.*
[48] SECY-99-0012, *Use of Uranium Mill Tailings Impoundments for the Disposal of Waste Other than 11e.(2) Byproduct Material and Review of Application to Process Material Other than Natural Uranium Ores* (April 8, 1999).

The milling process is based on an acid-leach followed by counter current decantation ("CCD") to wash uranium-bearing solution from the solids. During processing, the Mill's circuit can operate at leach temperatures up to ninety (90) degrees centigrade and pH levels as low as 0.5, utilizing sulfuric acid. In addition to the sulfuric acid, an oxidant such as sodium chlorate is added, as needed, to enhance uranium recovery. The Mill has eight high capacity thickeners, which are capable of being configured into groups or series of parallel stages. Three separate solvent extraction (liquid ion-exchange) circuits are capable of handling aqueous flows up to 800 gallons per minute, and the mill also has an ion-exchange ("IX") circuit. In the solvent extraction process, an organic comprised primarily of kerosene, an amine collector and isodecanol, is used to recover the uranium from the solutions. An acidified salt solution is then used to strip the uranium from the organic.[49]

The uranium is then precipitated from the concentrated solutions using anhydrous ammonia and ammonium sulfate to produce the final product of the process, U3O8 or *yellowcake*.[50] Final products are dewatered, dried or calcined at temperatures up to 650 degrees centigrade. The White Mesa Mill is operated by a seasoned professional and operations staff, some of whom have been at the facility since its startup in the spring of 1980. The metallurgical staff has the experience and background to evaluate process options for the recovery of a wide variety of minerals.

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[49] Similar chemicals and reagents are used, as well as further addition of oxidants, to recover vanadium from Colorado Plateau ores.

[50] *Yellowcake* is defined as the product of the uranium extraction process. The material is a mixture of uranium oxides that can vary in proportion and in color from yellow to orange to dark green (blackish) depending at which temperature the material was dried (level of hydration and impurities). *Yellowcake* is commonly referred to as U3O8 and is assayed as pounds U3O8 equivalent. This fine powder is packaged in drums and sent to a conversion plant that produces uranium hexafluoride (UF6) as the next step in the manufacture of nuclear fuel. *See* NRC Glossary, www.nrc.gov/reading-rm/basic-ref/glossary/yellowcake.html.

2. Tailings Management System

Waste streams that result from the ore processing are discharged from the CCD circuit in the form of a 30-40% solid/liquid slurry. The slurry is pumped to the Tailings Management System (the "tailings cells") where the solids are allowed to settle and the liquids are evaporated or recycled back to the Mill for use as wash water. Liquid tailings or raffinate from the solvent extraction or IX circuits are also pumped to the tailings cells and evaporated or recycled.

The Mill's tailings cells were designed and constructed in accordance with NRC standards, and NRC approved *both* the design and the construction of the cells. The Mill's original operating license required that the tailings cells be designed to protect groundwater from radionuclides and *non-radiological* (hazardous) wastes. As noted previously, conventional uranium ores and alternate feed materials contain heavy metals, and *organic and inorganic* chemicals are added in the milling process. As a result, the tailings cells, including tailings liners, were intentionally designed to be protective as both a radioactive waste containment system *and* a *non-radioactive* hazardous waste disposal system. The constituents present in conventional ores, including radionuclides and organic and inorganic *non-radiological* constituents such as those listed in Appendix A, Criterion 13, was considered in the design standards for the cells and the liners. Additionally, in accordance with license requirements, stability and integrity of the tailings cells has been monitored since their construction and detailed in annual reports certified by Registered Professional Engineers and have been placed on file with NRC.

3. Site Hydrogeology

The natural hydrogeologic setting at the Mill is one of the reasons the Mill was sited at its current location. It begins with a thin, *perched* groundwater zone of poor

quality[51] groundwater which rests on top of 1,000-1,100 feet of dense clays, sandstones, and shales separating the regional aquifer from this *perched* groundwater zone. Groundwater in the proximity of the Mill has been documented in three geologic strata: (1) the Dakota sandstone, (2) the Burro Canyon Formation (a low-permeability sandstone), and (3) the Entrada/Navajo Sandstones.

The groundwater occurrence in the Dakota sandstone and the Burro Canyon Formation is in the form of a single *perched* groundwater zone at depths of approximately 110 to 150 feet below the Mill site (generally approximately 70 feet below the tailings cells). The saturated thickness of the *perched* groundwater zone is, at most, 55 feet thick to the north of the Mill, approximately 20 feet thick beneath the Mill site, and thins to less than five (5) feet to the south. The Mill's tailings cells are sited within the unsaturated upper part of the Dakota sandstone. Thus, if cell leakage were to occur from the tailings cells, tailings-related constituents would have to migrate through approximately 70 feet of unsaturated material before reaching the *perched* groundwater zone, which is the zone used by the Mill for groundwater monitoring purposes.[52]

The *perched* zone of groundwater is *perched* above the Brushy Basin Member of the Morrison Formation, the first unit in a 1,000-1,100 foot sequence of low-permeability clays and shales that behave as an *aquitard*,[53] preventing downward infiltration of the

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[51] The *perched* groundwater at the Mill site is generally of low quality due to the high total dissolved solids ("TDS") in the range of 1,200 to 5,000 mg/L and is used primarily for stock watering and irrigation upgradient (north) of the Mill site.

[52] As will be shown below in greater detail, Mr. Stewart J. Smith, an expert hydrogeologist, performed an analysis of the natural geologic and hydrogeologic conditions at the White Mesa Mill and states, "[t]he permanent monitoring wells at the site are placed to monitor *perched* water conditions downgradient, upgradient, and cross-gradient of the tailings cells." Affidavit of Stewart J. Smith ("Smith Affidavit") at 2.

[53] An aquitard is defined as, "a geologic formation that may contain groundwater but is not capable of transmitting *significant* quantities of groundwater under normal hydraulic gradients.

perched groundwater. The Entrada/Navajo sandstones, below the Brushy Basin formation, form the regional aquifer, some 1,000-1,100 feet below the *perched* groundwater zone. The Entrada/Navajo Aquifer is an artesian aquifer and is used regionally for irrigation and domestic consumption and is capable of delivering from 150 to 225 gallons per minute.

The Entrada/Navajo Aquifer is naturally protected from potential contamination resulting from processing activities at the Mill in several ways. First, the Entrada/Navajo Aquifer is separated from the *perched* groundwater zone by an aquitard made up of approximately 1,000 feet of unsaturated, low-permeability formations. Second, regional aquifer water is present under artesian pressure which will cause this water to rise into the above-mentioned low permeability formations rather than allow water to move downward from these formations into the regional aquifer. Third, recharge to the Entrada/Navajo Aquifer occurs many miles from the Mill and does not occur from infiltration of precipitation falling on the surface of the Mill site. The combination of a low permeability, thick unsaturated aquitard over the Aquifer, and the artesian pressure within the Aquifer and lack of recharge from infiltration, provides a positive, natural physical and hydraulic barrier that protects the Entrada/Navajo Aquifer from being impacted by potential tailings cell leakage.

4. Tailings Cell Design and Construction

In addition to the controls offered by the natural geologic and hydrogeologic conditions at the Mill site, IUSA constructed its tailings cells in accordance with NRC guidance and best engineering practices to further take advantage of site-specific

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In some situations aquitards may function as confining beds." *See* EPA Glossary of Technical Terms, www.epa.gov/swerust1/cat/tumgloss.htm.

conditions and maximize control of radiological and *non-radiological* tailings constituents.

The tailings cells were designed to be sub-grade structures so that when full they could be covered and would blend into the surrounding areas in an environmentally-preferred fashion. The various components of the tailings cells were designed using prudent engineering practices, including good quality assurance/quality control ("QA/QC") systems and practice to mitigate the potential for errors or omissions in the design. As part of the design process, various "what-if" scenarios for the cells were considered to assure a balanced consideration of risk and engineering practice that would mitigate any potential adverse impacts.

The Mill's tailings cell liner system was designed taking into consideration the scenario of liner leakage, including the potential for both massive and small "pinhole" leaks. A synthetic liner for the tailings cells was selected which could withstand potential degradation from reaction with tailings fluids to maximize fluid retention.

A porous bedding layer was installed beneath the synthetic liner to assist in transport of massive leakage to a seepage collection system at the toe of the cell embankments. The natural calcareous materials underlying the bedding were considered to be an effective barrier for the migration of potentially hazardous constituents such as *lead* by fixing them in place as a result of chemical reactions. A drain system on top of the liner was designed to assist in reducing hydraulic pressure on the liner which is enhanced by the planned transfer of surface fluids in the tailings cells to evaporation ponds.

5. Groundwater Monitoring Program

Finally, to further assure control of tailings constituents, IUSA instituted and implemented a comprehensive groundwater monitoring program. Prior to the implementation of IUSA's groundwater monitoring program, pre-operational groundwater sampling of surface water, *perched* groundwater zone wells, and deep wells began in 1977 and continued until the Mill began operations on May 8, 1980.[54] This analysis included a 1981 study of natural background groundwater conditions that reviewed water quality data to insure that no new impacts to groundwater were introduced as a result of Mill operations.

In 1994, the Mill began using an NRC-approved Point of Compliance[55] ("POC")[56] monitoring program after reviewing groundwater monitoring results at the Mill site since 1977 which indicated:

> (1) The White Mesa Mill and its tailings system had produced no impacts to the *perched* groundwater zone or the regional aquifer; and (2) the most dependable indicators of water quality and potential cell failure would be chloride, nickel, potassium, and natural uranium

As part of the environmental protection program required by the Mill's NRC license, water quality monitoring is conducted both on and off-site.[57]

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[54] These analyses were confirmed by the Utah State Division of Environmental Health's laboratory.

[55] IUSA's POC groundwater monitoring program was approved by NRC only after studying approximately sixteen (16) years of data (fourteen (14) years at the time of application and sixteen (16) years of data at the time of approval) using parameters at up to seventy (17) wells indicated that there was no impact to the *perched* groundwater zone from the White Mesa Mill's operations.

[56] Under Appendix A, the *Point of Compliance* is defined as, "the site specific location in the uppermost aquifer where the ground-water protection standard must be met." *See* Appendix A, Introduction. The Mill's POC is at the downgradient edge of the tailings cells in the *perched* groundwater zone.

[57] Data for these reports are published in the Mill's Semi-Annual Effluent Report.

The POC monitoring program mandates quarterly sampling of the *perched* groundwater zone for four parameters; chloride, potassium, nickel, and uranium (the "POC parameters"), which are the key indicators of potential seepage from the tailings cells. The POC parameters were selected based on the following criteria:

(1) high concentrations in tailings slimes drain water;
(2) low concentrations in site groundwater;
(3) *conservative* chemical characteristics; and
(4) indicative representation of chemical classes; that is, a cation, an anion, a trace metal, and a radionuclide

These POC parameters are considered to be "*conservative*" constituents.[58] "*Conservative*" constituents travel at or very near the speed of groundwater and are not *significant*ly retarded by natural attenuation. By showing a high mobility in groundwater, these "*conservative*" constituents serve as "*early warning*" indicators for the potential arrival of other slower moving potential groundwater contaminants such as *lead*.[59] These four POC parameters were determined to be the best indicator parameters for all potential constituents in the tailings cells.

In addition, as noted above, these POC parameters were selected because they meet the criteria of occurrence at high concentrations in tailings slimes drain water while occurring at relatively lower concentrations in natural background groundwater across the Mill site. Thus, the Mill maintains a groundwater monitoring program that is extremely

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[58] The metals that may be contained in alternate feed *ores* are typically also present in conventionally mined ores and in the Mill's 11e.(2) byproduct material wastes, but not all are selected as POC parameters because they do not satisfy the four selection criteria as completely as the current POC parameters. Unlike most of the metals in the tailings, the POC parameters are chosen because they are far less affected by the geochemical processes that would attenuate the mobility of other tailings constituents.

[59] As will be shown below b y Dr. Roman Z. Pyrih, led is subject to natural attenuation, is a slow moving heavy metal, and is, therefore, not a good parameter for monitoring purposes.

"*conservative*" and that will detect any potential leakage of constituents contained in the Molycorp material from the tailings cells.

Taken together with the above-mentioned design and construction safeguards, the result is a consciously designed defense-in-depth groundwater protection plan which, with its multiple facets, provides more than adequate protection for public health and safety and the environment from the potential seepage of radiological (i.e., uranium and thorium) and *non-radiological* constituents (i.e., *lead* and other heavy metals) from the tailings cells.

Twice each year, NRC personnel inspect the Mill to insure that all aspects of the Mill's activities are in compliance with applicable NRC regulations. In over twenty years of operation and monitoring of the *perched* groundwater zone, through the licensee's comprehensive groundwater monitoring and sampling program, any additional non-routine sampling results, and the semi-annual inspections conducted by NRC, there have been no indications that Mill's tailings cells have ever released tailings liquid into the *perched* groundwater zone, much less the regional aquifer.

6. Additional Environmental Safeguards

The Mill has a routine air particulate monitoring program for uranium, thorium-230, radium-226, and lead-210 which is conducted continuously at five (5) monitoring stations located around the perimeter of the Mill and reported quarterly to NRC. The Mill has also collected thirteen years of background air quality data from an off-site monitoring station. There has not been one instance of the Mill exceeding the applicable Effluent Release Concentration standard defined in 10 C.F.R. Part 20, Appendix B, and, in fact, the monitoring stations have consistently indicated air particulate results anywhere from 10 to 100 times lower than the standard.

The Mill collects surface water samples from two nearby streams, Westwater Creek and Cottonwood Creek. Surface water (or sediment if there is no water) from Westwater Creek is analyzed annually for total and dissolved uranium, radium-226, and thorium-230. Surface water from Cottonwood Creek is analyzed semi-annually for the same parameters. Since the startup of Mill operations, there has been no detection of radionuclides in surface water or sediment above natural background for the area.

Soil samples are also collected at each of the five (5) environmental monitoring stations annually in August. The soils are analyzed for uranium and radium-226. Again, since the startup of Mill operations, there have been no statistically *significant* trends of increasing uranium or other radionuclide concentrations in area soils.

"New growth" vegetation is collected from areas northeast, northwest, and southwest of the Mill during early spring, late spring, and late fall and is analyzed for radium-226 and lead-210. There have been no statistically *significant* trends of increasing uranium or other radionuclide concentrations in area vegetation.

On a semi-annual basis, IUSA publishes a Semi-Annual Effluent Report,[60] which contains all of the recent sampling results and a history of the quarterly POC well sampling. In addition to the groundwater results, all results of all other environmental sampling programs are documented.

7. UDEQ Groundwater Discharge Permit and Split Sampling

Despite the fact that an NRC-approved POC groundwater monitoring program has been implemented at the Mill, IUSA has voluntarily agreed with the Utah Department of

[60] The Semi-Annual Effluent report is available on the NRC's ADAMS system.

Environmental Quality's ("UDEQ's") request[61] that the Mill obtain a Utah Groundwater Discharge Permit ("GWDP")[62] and implement supplementary groundwater monitoring measures which include monitoring for additional parameters. The form of the GWDP is currently being determined by IUSA in conjunction with UDEQ.

As part of this process, IUSA has agreed to include in the GWDP a requirement that the Mill will monitor for additional parameters from a list of other potential indicators of chemical classes such as major ions and/or other constituents. In a report to UDEQ submitted on October 3, 2001, while maintaining that the existing POC program provide sufficient protection of public health and the environment, IUSA provided an evaluation of additional constituents that may potentially be used as additional parameters for monitoring purposes and a rationale for assigning compliance limits to monitoring parameters for the GWDP.

Since May of 1999, pending approval and implementation of the GWDP and despite the effectiveness of the POC groundwater monitoring program, IUSA has voluntarily sampled for additional parameters in cooperation with UDEQ. This split sampling takes place on an annual basis and involves the sampling of up to seventeen (17) monitoring wells, including the POC wells and any other wells that are not dry at the time of sample collection.[63] Analytical parameters which were selected by UDEQ are; (1) major ions, (2) physical properties, (3) total metals (phosphorous and total uranium),

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[61] NRC has sole jurisdiction over radiological and *non-radiological* impacts at the Mill, but, because the Mill is located in the State of Utah, IUSA has voluntarily agreed to develop a GWDP. *See* SECY-99-0277.

[62] The Mill's tailings cells do not discharge any effluents in groundwater. *See generally* 40 C.F.R. Part 440. The GWDP is simply a standard term for a Utah groundwater protection permit.

[63] These 17 wells do not include the eleven (11) temporary wells that are currently being sampled to investigate chloroform contamination at the Mill site.

(4) dissolved metals (including *lead*), nitrogen (ammonia as nitrogen and nitrate + nitrite as nitrogen), gross alpha, and semi-volatile and volatile organic compounds ("VOCs").

8. Ore Pad Integrity and Fate and Transport Assumptions

The Molycorp material, along with other *ores,* will be stockpiled prior to the initiation of a milling campaign. Prior to processing at the Mill, the Molycorp material will be stockpiled on a *bermed concrete* ore pad to contain liquids in case of precipitation events.[64] While the *ores* are stockpiled, precipitation, whether in the form of rainfall or snow, falling on the *ore* stockpiles will evaporate, infiltrate the stockpile or, if in sufficient quantity, will be pumped to the process holding tanks. Evapotranspiration rates at the Mill are high, estimated to be as high as sixty-one (61) inches per year. Also, some infiltration into conventional alternate feed ore stockpiles is beneficial in that such moisture helps to maintain the moisture content of the stockpiles, thereby minimizing the potential for airborne contamination. IUSA, as will be discussed below, will utilize water sprays to contain any potential airborne constituents and, if necessary, add a surfactant or cover the Molycorp material with reinforced plastic.

While there is no credible mechanism through which the Molycorp material could migrate from the bermed concrete ore pad,[65] to insure that there is no loss of stockpiled ore materials from the ore pad due to precipitation, the entire Mill site, including the ore pad, is graded to drain to the tailings system. There is no mechanism for surface run-off from any precipitation that may have contacted the stockpiles to leave the site. The ore

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[64] As stated in Appendix A. Criterion 5H, "[s]teps must be taken during stockpiling of ore to minimize penetration of radionuclides into underlying soils; *suitable methods include lining and/or compaction of ore storage areas.*"*See* Appendix A, Criterion 5H.

[65] Both the Presiding Officer and the Commission have stated that there is no risk of airborne dust from the Molycorp material and, as such, there is no risk of inhalation. *International Uranium* (USA) *Corp.* (White Mesa Mill.) 2001 N.R.C. LEXIS 195, *8-10 (November 14, 2001).

pad is also underlain with crushed, compacted limestone which further enhances the immobility of any heavy metals escaping the ore pad. In order for any materials on the ore pad to reach groundwater, they must be transported from the feed stockpiles, through the surface of the ore pad, and travel downward through more than approximately 100 feet of underlying vadose zone materials to the *perched* groundwater zone.

As stated above, the Mill has several natural (i.e., aquitard) and artificial (i.e., concrete ore pad with site grading for run-off to tailings and tailings cell design) conditions and systems that are designed specifically for the purpose of preventing contamination from *significant*ly impacting groundwater and the environmental quality of the site in general. Using these conditions and systems, the Mill, in over twenty (20) years of processing both conventional and alternate feed ore materials, has never detected any defects in its operating systems (e.g., tailings cells and ore pad) or any *significant* impacts to public health and safety or the environment.

VI. PETITIONER'S ALLEGATIONS REGARDING THE MOLYCORP LICENSE AMENDMENT

1. IUSA is Permitted by NRC Regulations to Possess a Source Material License

Petitioners allege that IUSA should not be permitted to have a source material license because they assert IUSA is not a domestically owned or controlled corporation. However, while citing 10 C.F.R. § 40.38 as evidence for their contention, Petitioners fail to consider that this regulation does not apply to IUSA. Section 40.38 states:

> "A license may not be issued to *the Corporation* if the Commission determines that:
>
> (a) *The Corporation* is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government..."

10 C.F.R. § 40.4 defines *Corporation* as:

> "the United States Enrichment Corporation (USEC), or its successor, a Corporation that is authorized by statute to lease the gaseous diffusion enrichment plants in Paducah, Kentucky, and Piketon, Ohio, from the Department of Energy, or any person authorized to operate one or both of the gaseous diffusion plants, or other facilities, pursuant to a plan for the privatization of USEC that is approved by the President."

IUSA and the Mill process *ores* for their natural uranium content and *do not* engage in any procedures involving uranium enrichment or gaseous diffusion. Therefore, Petitioners' allegation is without merit and IUSA is entitled to possess a source material license.

2. The *Lead* Content of the Molycorp Material Does Not Pose A *Significant, Incremental* Threat to the Public Health and Safety Above and Beyond That of Previously Licensed Activities at the Mill

Petitioners raise several different arguments relating to the *lead* content of the Molycorp material and its alleged potential impacts on public health and safety and the environment. As will be shown below, Petitioners' arguments are without merit and do not provide any evidence of a *significant, incremental* threat to public health and safety or the environment above and beyond that of previously licensed activities at the White Mesa Mill.

a. The *Lead* Content of the Molycorp Material

According to Petitioners, the Molycorp material, which contains oxidized *lead* (*lead* sulfate) and unoxidized *lead* (*lead* sulfide), will: (1) form hazardous *lead* chemical compounds when being processed at the White Mesa Mill, (2) create hydrogen sulfide gas when exposed to the tailings cells, (3) cause chemical reactions in the tailings cells resulting in damage to IUSA's tailings cells and liners, (4) create hazardous airborne

contaminants, and (5) threaten wildlife or humans in surface water or wildlife when present in the tailings cells. These claims are mot accurate nor do they demonstrate a *significant, incremental* threat to public health and safety or the environment warranting the revocation, suspension or alteration of IUSA's license amendment.

b. The Mill's Tailings Cells Already Contain *Significant* Quantities of *Lead* and The Addition of The Molycorp Material's *Lead* Content Will Not Increase The *Lead* Content *Significantly*

Petitioners allege that because the Molycorp material contains an elevated *lead* content in the form of *lead* sulfide sludge that the material will pose a *significant, incremental* hazard to the public health and safety and the environment. However, this claim is without merit because EPA's and NRC's regulatory programs for uranium mill tailings specifically contemplate the presence of heavy metals, including, specifically *lead,* in uranium mill tailings impoundments and the Mill's tailings cells were specifically designed to safely contain *non-radiological* (hazardous) materials such as *lead.* Further, the elevated concentration of *lead* in the Molycorp material will not increase the lead content in the tailings cells or tailings solutions in any *significant, adverse* way.

First, EPA's and NRC's regulatory programs specifically contemplated that heavy metals, including, specifically *lead,* would be present in conventional natural uranium ores and that the tailings from processing such ores would be disposed of in uranium mill tailings impoundments. In its FEIS, EPA reported on tests of average concentrations of constituents found in uranium tailings impoundments at inactive sites. These tests covered nineteen (19) sites, including nine (9) sites located in the State of Colorado and

four (4) sites located in the State of Utah. EPA found that *lead* was a common constituent. *See* FEIS at 3-8, 3-10. In NRC's GEIS, *lead* was specifically listed in Table 5.3 entitled *Chemical and Radiological Properties of Tailings Wastes Generated by The Model Mill* as a component of tailings liquids to be disposed of in a tailings impoundment. *See* GEIS at 5-6. In addition, NRC's recent Mill Tailings SRP explicitly recognizes *lead* as a common constituent in uranium mill tailings impoundments. Mill Tailings SRP at 4-9, Table 4.1.3-1. Thus, Petitioners cannot claim that *lead* is a unique heavy metal which was not contemplated by EPA or NRC the development of the uranium milling regulatory program such that adequate protections do not exist to control such circumstances in uranium mill tailings impoundments such as the Mill's tailings cells.

Second, the elevated concentration of *lead* in the Molycorp material will not have a *significant, incremental* effect on the Mill's tailings cells. Ms. Jo Ann Tischler, an expert chemical and process engineer, performed an analysis of the Molycorp material's *lead* content and the effects of adding such lead content to the Mill's tailings cells. Ms Tischler states:

> "The Molycorp pond material has been estimated to contain an average *lead* content of 132,000 ppm (13.2 weight percent)....[t]he Molycorp drummed material has been estimated to contain an average of 52,600 ppm (5.3 weight percent)...[b]ased on the anticipated likely scenario...processing of the Molycorp material could introduce from 1,023 to 2,343 tons of additional *lead* into the Mill's tailings system."

Affidavit of Jo Ann Tischler ("Tischler Affidavit") at 4.

According to Ms. Tischler, ores previously processed at the Mill from both the Colorado Plateau and Arizona Strip contained *lead* in varying concentrations, as have a number of alternate feed materials.[66] *Id.* For example, Ms. Tischler states:

> "[Arizona Strip] ores have an estimated average *lead* concentration of 860 ppm (0.086 weight percent)...Ashland 1 alternate feed material is known to contain *lead* levels...with an overall average of 571ppm (0.057 weight percent). Ashland 2 alternate feed material is known to contain *lead* levels...with an overall average of 100 ppm (0.01 weight percent)."

Id. at 4-5.

Currently, the Mill's tailings cells contain "approximately 1,400 tons of lead," with an "average concentration of lead [of] 332 ppm (0.033 weight percent)," and "approximately 17 ppm (17 mg/L) is in the tailings solutions, based on a sample taken in April 2002." Tischler Affidavit at 5. By adding the Molycorp material to the tailings impoundments, Ms. Tischler states that, "[t]his would result in an increase in average lead concentration in the tailings mass from 332 ppm (0.033 weight percent) to either 576 ppm (0.058 weight percent) or 889 ppm (0.089 weight percent)," depending on the quantity of material processed. *Id.* This finding led Ms. Tischler to conclude that, "[i]n either event this [increase] represents a very small percentage of the total tailings mass," and that "[w]hile the average concentration in the entire tailings system increases...the amount of lead in solution will not increase appreciably above current levels due to solubility constraints." *Id.* at 5.

These solubility constraints are defined by the presence of elevated concentrations of iron, lead, and sulfate in the tailings cells. According to Dr. Roman Z. Pyrih, an expert

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[66] Dr. Douglas B. Chambers, Director of Risk and Radioactivity Studies for SENES Consultants Limited, whose affidavit will be discussed at greater length below supports Ms. Tischler's statement: "Colorado Plateau and Arizona strip uranium ores also contain varying concentrations of *lead* depending on the source and ore body." Affidavit of Dr. Douglas B. Chambers ("Chambers Affidavit") at 10.

geochemist, "[b]ased on a recent sample taken in April 2002, *lead* was measured at 17 mg/L," in the Mill's tailings cells. Affidavit of Roman Z. Pyrih ("Pyrih Affidavit") at 2. In addition, "[o]ther recent samples [from the tailings cells] indicated iron and sulfate measurements of up to 10,000 mg/L and up to 289,000 mg/L, respectively." *Id.* Based on these measurements, Dr. Pyrih concludes:

> "The levels of these and other constituents limit the amount of *lead* that can be in solution to approximately 20 mg/L, regardless of the total inventory of lead in the tailings."

Id.

Despite the fact that the Molycorp material contains elevated concentrations of *lead*, this *lead* content will not be a constituent that is not already contained in the Mill's tailings cells nor will the introduction of the Molycorp material increase the concentration of lead in the tailings cells or solution in any *significant* way. As such, the tailings from processing the Molycorp material can be contained safely in such tailings cells thereby posing no *significant incremental* threat to public health and safety and the environment.

c. The Molycorp Material Does Not Contain Any Constituents Not Already Present in The Mill's Tailings Cells

Petitioners make claims that the Molycorp material will introduce several new constituents into the Mill's tailings cells that have not been present in previously processed natural uranium ores and alternate feed materials. These claims are incorrect. In fact, Ms. Tischler states:

> "With the exception of lanthanum oxide, every one of the components reported by Molycorp in the radioactive Material Profile record and characterization data for the pond and drum materials have already been identified in reported analytical data for ores processed at the Mill or their resulting tailings."[67]

[67] Regarding lanthanum and lanthanum oxide, Ms. Tischler states:

This information led Ms. Tischler to conclude that, "processing of Molycorp material would introduce no new compounds to the Mill process circuit or tailings system." Tischler Affidavit at 3.

In addition, the Molycorp material will not introduce any new constituents into the Mill's tailings cells which would require additional parameters to be added to IUSA's groundwater monitoring program. As stated by Dr. Pyrih:

> "Nickel and uranium are included in NRC's list of key parameters. Nickel is not affected by the geochemical processes that attenuate the movement of heavy metals in groundwater and is much more mobile than *lead*. As such, nickel serves as an early warning of the approach of seepage that may contain *lead*."

Pyrih Affidavit at 4.

With regard to uranium as a monitoring parameter, Dr. Pyrih states:

> "Uranium is much less affected by the geochemical processes that attenuate the movement of natural radionuclides and is much more mobile than thorium. Uranium serves as an early warning of the approach of seepage that may contain thorium."

Id.

Generally, with respect to the current indicator parameters, Dr. Pyrih concludes:

> "These parameters (chloride, potassium, nickel, and uranium) are key indicators of potential leakage from the tailings cells....Because these constituents travel at the speed of groundwater, it is my opinion that monitoring these key parameters serves as an early warning to the arrival of potential groundwater contaminants such as arsenic, barium, copper, iron, *lead,* vanadium, and thorium which are attenuated in their movement."

> "[b]ecause lanthanum oxidizes so readily in ambient air, lanthanum in natural ores in reduced form would have been converted to lanthanum oxides while stored in open piles, which are exposed to air on the Mill ore pad prior to processing. That is, it would be in the same form Molycorp reported to be present in their ponds, albeit at lower levels."

Tischler Affidavit at 3; *see also* footnote 41 *supra*.

Id.

Thus, the current NRC-approved groundwater monitoring program in use at the Mill is an "early warning" system that will alert IUSA as to whether any tailings seepage containing constituents from the Molycorp material might have escaped from the tailings cells. Therefore, as the Molycorp material will not add any new constituents to the tailings cells, and the existing POC indicator parameters are sufficient for monitoring existing constituents, the Molycorp material does not require any other parameters to be added to IUSA's groundwater monitoring program.

d. Processing the Molycorp Material Will Not Create Any Hazardous *Lead* Chemical Compounds That Are Unsuitable For Disposal in The Mill's Tailings Cells

Processing the Molycorp material at the Mill will not cause the formation of any hazardous *lead* compounds during the milling process which will be different from *lead* compounds already present in the Mill's tailings cells. Prior to processing, the Molycorp material will contain both oxidized *lead* sulfide in the form of *lead* sulfate and unoxidized *lead* sulfide. As the Molycorp material is processed through the Mill, it becomes subject to the acid-leach process which, with the introduction of an oxidizing agent as necessary, oxidizes any remaining *lead* sulfide and converts such unoxidized *lead* compounds into *lead* sulfate. Additionally, the Mill's tailings cells create an "oxidizing" environment which will also convert any remaining *lead* sulfides placed in the cells to *lead* sulfate.[68]

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[68] Further support for this conclusion can be demonstrated by the Molycorp material's exposure to air while in the Molycorp ponds. Ms. Tischler states:

> "Based on my discussions with Molycorp personnel in April 2002, the materials in the Molycorp ponds are already undergoing conversion from the sulfide to sulfate form in-situ....With time, areas within the ponds have been changing...indicating conversion by reaction with air to *lead* sulfate."

Id.

In his affidavit, which will be discussed at greater length below, Dr. Pyrih states that, "[i]n short time, any residual *lead* sulfide that is discharged to the tailings cells will be oxidized to sulfate." *Id.* at 2.

Further, Ms. Tischler evaluated chemical analytical data and process history information for the Molycorp pond and drummed material in the eleven (11) month time period *prior to* the submission of IUSA's license amendment application to NRC in 2000-2001.[69] Regarding the processing of the Molycorp material, Ms. Tischler stated:

> "it is common chemical/mineral process knowledge that when a metal sulfide (such as *lead* sulfide) is "oxidized" in an aqueous environment in ambient air, it does not form an "oxide" (that is, it does not form "*lead* oxide(s))." It forms sulfates."

Tischler Affidavit at 6.

In fact, contrary to Petitioners' assertions, there are no *lead* oxide(s) in the Molycorp material:

> "In Molycorp's terminology, areas of the ponds that were exposed to air (such as the top surface material or "crust") are referred to as "oxidized." The term "oxidized" does not signify that the *lead* content, or any other metal or cation, is present as an oxide. It refers simply to the materials in the pond that were exposed to air....The Molycorp pond material to be shipped to IUSA has not contained, at any time *lead* oxides. The ponds have no *lead* oxide crust."[70]

Id. at 5.

Ms. Tischler also studied the conclusions drawn by IUSA in its license amendment application and data from conversations with Molycorp staff at its Mountain Pass, California site and concluded that:

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[69] Ms. Tischler "[a]s an independent consultant, I regularly review alternate feed materials for ...[IUSA] to determine whether such feeds are appropriate for processing at the White Mesa Mill...." Tischler Affidavit at 1.

[70] Ms. Tischler also notes that "the visible crust is primarily *lead* sulfate, which is of lower toxicity and reactivity than the *lead* sulfide strata below it." Tischler Affidavit at 6.

> "IUSA made appropriate conclusions by discounting the possibility that the pond material labeled, as "oxidized" would consist of *lead* oxide(s), and by assuming the oxidized portion was in the form of *lead* sulfate. My conversations with Molycorp site staff throughout 2001, and again in April 2002, confirmed that this "oxidized" portion was indeed *lead* sulfate..."

Id. at 6.

Based on these statements, the tailings from the Molycorp material will result in the addition of *lead* sulfate to IUSA's tailings cells, a constituent already present in such tailings cells, and not *lead* oxides as alleged by Petitioners.[71]

IUSA has processed both conventional ores and alternate feed materials that contained varying concentrations of *lead* in different chemical forms. In conventional ores, much of the *lead* is in the form of *lead* sulfide. When processed at the Mill, the *lead* constituents in these materials were converted into *lead* sulfate and deposited in the Mill's tailings cells. Over a twenty year period of processing operations and several mill processing campaigns, involving both conventional ores and alternate feed materials with varying *lead* concentrations, IUSA has never encountered an instance where any form of hazardous chemical compound resulted from the processing of *lead*-bearing materials that was not safely be disposed of and contained in IUSA's tailings cells. Thus, because processing the Molycorp material at the Mill will yield *lead* sulfate, a chemical compound previously deposited and safely contained in IUSA's tailings cells over a twenty year period, no *significant*, *incremental* threat to public health and safety or the environment will be created by IUSA's license amendment.[72]

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[71] As the Molycorp material does not contain *lead* oxides, it is not necessary for IUSA to evaluate at this time, what, if any, effect *lead* oxide may have on the Mill's operations or tailings cells.

[72] As noted above, NRC's Mill Tailings SRP and Appendix A's Criterion 13 have already anticipated that *lead* and its compounds will be present in uranium mill tailings cells, and, thus, NRC has implemented protective measures regarding *lead* and its compounds in its regulations.

e. The Processing of the Molycorp Material Will Not Create Hydrogen Sulfide Gas Which Would Threaten Public Health and Safety or The Environment

Petitioners further claim that the milling process will cause the formation of hydrogen sulfide gas (H2S) which will pose a substantial, hazardous threat to public health and safety.[73] This allegation is incorrect. First, as stated by Ms. Tischler, "[*l*]*ead* sulfide, when exposed to sulfuric acid in a *non-oxidizing* (or reducing) environment can create hydrogen sulfide gas[H2S]." Tischler Affidavit at 6. However, as Ms. Tischler notes, "[t]he Molycorp materials will...be processed in an oxidizing environment, that is, oxidants will be added, as required." *Id.* at 7. When treated with sulfuric acid during the milling process, the *lead* sulfide will be converted into "non-reactive *lead* sulfate."[74] *Id.* Thus, Ms. Tischler concludes that, "[n]o hyrodgen sulfide of any significance will be created," because "[m]etal sulfates, such as *lead* sulfate and iron sulfate, do not react with sulfuric acid and do not form hydrogen sulfide."[75] Tischler Affidavit at 7.

In addition, Ms. Tischler notes that "the materials in the Molycorp ponds are already undergoing conversion from the sulfide to sulfate form in situ...by reaction with air." *Id.* During April of 2002, in order to confirm its own previous analysis, Molycorp hired an independent RCRA-certified laboratory to confirm D003 reactivity tests on four

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[73] It is important to note that hydrogen sulfide gas (H2S), under such circumstances, would not represent a threat to the public outside the Mill's fenceline due to the distance from the Mill to that fenceline and the dilution that would take place.

[74] *See also* Pyrih Affidavit at 2.

[75] Ms. Tischler also addressed Petitioners' claim that the alleged creation of hydrogen sulfide gas from processing the Molycorp material would create an occupational hazard. Ms. Tischler states that the:

> "assertion that the [Molycorp] material poses a worker safety or environmental hazard because it will release hydrogen sulfide gas under processing conditions is inaccurate. The material will be sulfuric acid leached under oxidizing (not reducing) conditions, in which all the *lead* will be in the sulfate form, which is not reactive in acid and does not produce hydrogen sulfide."

Tischler Affidavit at 7.

samples from both the oxidized and unoxidized zones in the Molycorp material. Ms. Tischler states:

> "All of the samples passed the D003 test for both sulfur reactivity and cyanide reactivity, that is, the samples did not produce either hydrogen sulfide or hydrogen cyanide."

Id.

This data led Ms. Tischler to conclude, "it has been confirmed by independent laboratory analysis that the material to be shipped to the Mill does not generate hydrogen sulfide gas." Tischler Affidavit at 7.

f. Processing the Molycorp Material Will Not Cause Ay Adverse Chemical Reactions in The White Mesa Mill's Tailings Cells

The creation of *lead* sulfate from processing the Molycorp material also does not create the possibility, much less the probability, of chemical reactions in the tailings cells as a result of the Molycorp material's *lead* content. As stated above, IUSA has processed various types of conventional ores and alternate feed materials containing *lead* under its license during numerous mill campaigns over the past twenty years. Each of these processing campaigns has yielded various amounts of *lead* sulfate which eventually were deposited in IUSA's tailings cells and have been safely contained to date. At no time has IUSA encountered an instance where the contribution of *lead* sulfate to its tailings cells has caused any chemical reactions resulting in damage to its cell liners or the creation of any other unanticipated, potentially hazardous conditions in the tailings cells. In fact, as stated by Ms. Tischler in her analysis, *lead* sulfate "has an even lower toxicity and reactivity than the original *lead* sulfide." *Id.* at 6.

Further, Dr. Pyrih also evaluated the Mill's processing and disposal system in light of the *lead* content of the Molycorp material to determine what impact, if any, it could have on the Mill's tailings cells. Dr. Pyrih noted that the Mill process will involve acidifying the Molycorp material, including its *lead* content, so that uranium may be removed from the material. This acidification process will convert the *lead* sulfide into "*lead* and sulfate ions which are water soluble." Pyrih Affidavit at 2. Then, Dr. Pyrih states:

> "It is my opinion that reprocessing of the uranium material at the Mill will convert the bulk of the *lead*-sulfide sludge into ionic constituents that are water soluble and that are *indistinguishable* from the constituents (iron, *lead*, and sulfate) already present in the tailings solutions."

Id.

Regarding the disposal stage of the Mill processing campaign, Dr. Pyrih states:

> "After extracting the uranium, the spent leachate that contains water-soluble iron, lead, sulfate, and any residual lead sulfide will be discharged to the tailings cells. In short time, any residual sulfide that is discharged to the tailings cells will be oxidized to sulfate."

Id.

These factors led Dr. Pyrih to conclude that the spent leachate after processing the Molycorp material "will be similar to the tailings solutions presently in the cells," and that:

> "[o]ther than the oxidization of the residual sulfide to sulfate, no additional reaction between the spent leachate and the existing tailings solution is likely to occur: The dissolved constituents...will be discharged to the tailings cells in a form that is stable in the tailings environment."

Pyrih Affidavit at 2.

Thus, Petitioners' claim that processing the Molycorp material will result in a chemical reaction in IUSA's tailings cells that will create a *significant, incremental* threat to public health and safety or the environment is without merit.

g. Stockpiling and Processing the Molycorp Material Will Not Create Any Hazardous Airborne Contamination Which Threatens Public Health and Safety or The Environment

Petitioners allege, as they have in the past, that the Molycorp material will also create hazardous airborne constituents that will pose a *significant* threat to public health and safety and the environment. The Molycorp material, as Petitioners themselves have amply pointed out, is in the form of *lead* sulfide *sludge*. This, in turn, causes the Molycorp material to be moist and, thus, incapable of producing any airborne contaminants while stockpiled at the Mill site.[76]

Ms. Tischler also analyzed the potential for airborne contamination from both the pond and "drummed" Molycorp material. In her affidavit, Ms. Tischler states:

> "At the Mill site, the drummed material will remain in its containers until it is introduced directly into the Mill circuit. The pond material will be stored in bulk piles on a bermed, concrete-lined portion of the Mill's ore pad, and will have no direct contact with Mill yard soils."

Tischler Affidavit at 2.

While being stored as a *moist sludge*, the Molycorp pond material will have no exposure to any mechanism suitable for transporting such material through the air in a way that threatens the public. In addition, Ms. Tischler notes:

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[76] *International Uranium* (USA) *Corp.* (White Mesa Mill), Docket No. 40-8681-MLA-9; CLI-01-21, 2001 NRC LEXIS 195, *9-10 (November 14, 2001).

> "Prior to processing in the Mill, storage piles will be inspected and, if necessary, kept moist by water sprays, so the piles will not generate windborne dust."

Id.

Moreover, as stated by Dr. Chambers:

> "The dust control and ventilation processes which are in place in the Mill to control potential exposure to radioactive dusts will also control potential exposures to any lead that may be present in airborne dust....Since lead was present in ores such as those from the Arizona Strip which have already been processed at the Mill, the processing of the Molycorp feed materials...do not represent any new or potentially *significant incremental* hazards to workers."

Chambers Affidavit at 8.[77]

Further, IUSA has implemented a system of water sprays as part of this routine dust suppression program that will maintain a level of moisture content sufficient to prevent any airborne contaminants from being released prior to processing. IUSA has also informed NRC that, if necessary, a surfactant will be added to contain dust or the Molycorp material will be covered with reinforced plastic. After the Molycorp material is introduced into the Mill's leaching circuit, Ms. Tischler states, "an acidic solution will be added and the material will be processed as an aqueous stream, so there is no opportunity for generation of airborne *lead* dust anywhere in the Mill process." Tischler Affidavit at 2. These protective measures, combined with the limited time period the Molycorp pond material will be stored prior to processing,[78] demonstrates that there is no *significant, incremental* threat to public health and safety from airborne contamination.

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[77] As part of the Mill's occupational health and safety protection program, the Mill will be performing additional personnel monitoring for airborne lead particulates during receipt and unloading of the Molycorp pond material.

[78] In fact, the Mill will be starting up in mid-June to process Ashland and Linde material. The Mill campaign will take approximately eight (8) to ten (10) months to complete. The Molycorp material will be shipped during this mill campaign, therefore enabling the Molycorp material to be processed within a month of arriving at the site.

h. Processing the Molycorp Material Does Not Pose A *Significant, Incremental* Threat to Humans or Wildlife Above And Beyond That of Previously Licensed Activities

Finally, Petitioners allege that the *lead* content in the Molycorp material will pose a *significant, incremental* threat to humans or wildlife in the area that may drink from springs or seeps downgradient of the Mill or to wildlife that land in or drink from the tailings cells.

There is no *significant, incremental* risk of harm to wildlife or humans from *lead* in water from springs or seeps that are downgradient of the Mill site. Regarding this issue, Dr. Chambers states:

> "Upon reading the affidavits of Roman Pyrih, Jo-Ann Tischler, Stewart Smith and Michael Taylor, I am of the opinion that there is no credible way in which tailings solutions could...escape the tailings cells...and... travel, while still un-neutralized almost two miles through calcareous rocks which themselves have a large neutralization capacity, to a spring that is down gradient of the tailings cells, in concentrations posing any potentially significant hazard to public health or the environment."

Chambers Affidavit at 9.

With respect to the Mill's tailings cells, IUSA has already processed, as NRC-licensed activities, various conventional ores and alternate feed materials, each of which contained various levels of *lead* and other heavy metals (e.g., selenium, magnesium, molybdenum, etc.). This fact drives to the inevitable conclusion that there are *significant* concentrations of *lead* and other heavy metals already present in IUSA's tailings cells. The presence of *lead* and other heavy metals in the Mill's tailings cells (or any other active uranium mill's tailings cells), in addition to the highly acidic levels of such tailings solutions (i.e., pH levels of < 2.0) create an environment already unsuitable for any wildlife that could potentially find its way into the tailings cells or drink from waters

already in the cells. Adding the *lead* content from the Molycorp material will not provide any *significant, incremental* toxic effect from *lead* and other heavy metals to any wildlife.

Regarding this issue, Dr. Chambers evaluated the *incremental* threat to wildlife from the addition of the Molycorp material's *lead* content to the Mill's tailings cells, which already contain substantial quantities of *lead.* Dr. Chambers states:

> "[T]he Molycorp alternate feed materials contain *lead* at an average of about 13% by weight. However, Colorado Plateau and Arizona Strip uranium ores also contain varying concentrations of *lead* depending on the source and ore body. The NRC's generic environmental report statement... suggests a *lead* concentration of about 11 mg/L in generic tailings pond liquid, generally comparable to the 17 mg/L measured in tailings cell solutions at the Mill in April this year. The level of *lead* in solution arising from the processing of the Molycorp feed materials is not expected to exceed 20 mg/L, due to the solubility limits of lead in the tailings solutions."

Id. at 10.

Based on this analysis, Dr. Chambers concludes that, "birds or wildlife living around the Mill would not be exposed to any new or potentially *significant, incremental* hazard from *lead.*" *Id.*

Nevertheless, Dr. Chambers also analyzed the potential impact that *lead* in the Mill's tailings cells may have on birds and wildlife. Dr. Chambers conducted a conservative analysis by assuming the following factors relating to the habits of ducks and eagles at or near the Mill site:

(1) ducks (assumed to be a mallard for purpose of evaluation) are attracted to the cells where they are assumed to routinely and repeatedly consume water from the tailings cells and, subsequently, are in turn consumed by eagles....
(2) [t]he site represents about 10% of the eagle's range
(3) [t]hat the eagle is at the site 50% of the year

(4) [t]hat the mallard represents 14% of the eagles total diet (EPA 1983 for Arizona)
(5) [t]oxicity data from Sample et al 1996

Chambers Affidavit at 10.[79]

Dr. Chambers concludes that:

> "With these data, and assuming that the concentration of *lead* estimated to be in the mallard's flesh is from routine and repeated consumption of cell water when in reality the mallard might not survive any intake of cell water, I estimate that the concentration of *lead* in the tailings cell water would need to approach 600 mg/L, (*well above the level of lead anticipated in the tailings ponds about 20 mg/L),* before an eagle would experience toxicity from the intake of *lead* arising from the ingestion of mallards which drink from the tailings cells."

Id. at 11.

As stated above, the *lead* concentration in the Mill's tailings cells, as of last April, has been measured at only 17 mg/L. Therefore, the *lead* content of the tailings cells, if it ever reached an eagle through a mallard duck contaminated with *lead*, would not affect the eagle in a way that is *significantly* or *incrementally* different from the potential threat posed by the tailings cells prior to the issuance of the Molycorp license amendment.[80]

Dr. Chambers notes that the above analysis is conservative because a scenario involving an eagle consuming a mallard duck that routinely and repeatedly drinks from the tailings cells is unlikely. Dr. Chambers states:

> "It must be recognized however, that such a scenario is highly implausible since the tailings cell water is already toxic as a consequence of the low pH, and the presence of other toxic species including metals and organics which are already in the tailings cell water..."

Id.

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[79] Dr. Chambers also notes that "the effect on eagles of the consumption of mallards is an appropriate example of similar effects of other raptors and wildlife." Chambers Affidavit at 10.
[80] IUSA also notes that there have been no *significant* effects on wildlife from previous milling activities or, more specifically, from the tailings cells' *lead* content. Petitioners have not provided any evidence demonstrating that the Mill has threatened or affected wildlife in a *significant* way that has been unanticipated by NRC in its GEIS or subsequent EAs.

Dr. Chambers also notes that "it is likely, in my opinion that waterfowl and other wildlife would find this source of water unpalatable and therefore tend to avoid it." Chambers Affidavit at 11.

In response to any potential threat to wildlife from the tailings cells, IUSA has implemented additional mitigation measures to discourage wildlife from landing in the tailings cells and being harmed by the tailings solutions. These measures include the use of propane cannons and raptor decoys to scare the waterfowl away and the development of freshwater ponds which provide a more attractive habitat for wildlife to attract them away from the tailings cells during migratory seasons. Thus, the Molycorp material does not pose any *significant incremental* threat to wildlife in the area above and beyond that of previously licensed activities, and IUSA already has engaged in proper mitigation measures to further decrease the exposure of wildlife to the tailings cells.

3. The Thorium Content of the Molycorp Material

Petitioners have made several claims that the thorium content of the Molycorp material poses a *significant, incremental* threat to the public health and safety and the environment. As will be shown below, the presence of thorium in the Molycorp material does not pose such a threat, and Petitioners allegations pertaining to thorium are without merit.

a. IUSA May Process Ores Containing Concentrations of Thorium Under Its NRC License

First, as a regulatory matter, Petitioners allege that IUSA is not permitted to receive any material, alternate feed or conventional ore, that contains thorium because IUSA's source material license does not permit its receipt or processing at the White Mesa Mill. Additionally, Petitioners allege that the presence of thorium in the Molycorp

material during processing will cause a chemical reaction in the tailings cells. These arguments are without merit.

Petitioners go to great length to point out that IUSA possesses a source material license which permits processing conventional ores and, by license amendment, alternate feed materials for their natural uranium content. This, according to Petitioners, prohibits receipt and/or processing materials containing thorium, which is source material. Petitioners are, once again, incorrect.

While it is true that IUSA possesses a source material license permitting it to process ores for their natural uranium content, it defies the natural physics and physical realities of source material as it occurs in nature to prohibit the possession of these ores if they contain even a trace of thorium. Uranium and thorium are naturally occurring radionuclides which frequently occur together in nature. Indeed, thorium-230 is part of the uranium decay chain. Thorium-232, while not a part of the uranium decay chain, occurs naturally in varying concentrations with uranium, depending on the ore. Typically, most domestic uranium ores have not contained high concentrations of thorium-232, but they often do contain some thorium-232. But, even if conventional or alternate feed ores did contain higher concentrations of thorium-232, EPA states "the radiological impact of the thorium decay products would be *negligible* due to the short-half lives of the decay products, the absence of nearby aquifers, and the long transport times involved in movement through the environment."[81] Following the logic of Petitioners would result in unreasonable restrictions on the ability of licensees to process

[81] FEIS at G-12.

ores for their natural uranium content when they contain even a trace of thorium.[82] So long as IUSA processes a given ore, conventional or alternate feed, for its natural uranium content and not for its thorium content, IUSA is in compliance with its source material license.[83]

b. The Presence of Thorium in Conventional Ores and Alternate Feed Materials Has Been Contemplated and Addressed by EPA and NRC

Petitioners' line of reasoning regarding the above-mentioned argument also suggests that neither EPA, NRC nor IUSA ever anticipated that thorium would be present in ores coincidentally with natural uranium. However, the AEA defines *source material* as (1) uranium, thorium, or any other material which is determined by the Commission...to be source material; or (2) ores containing *one or more of the foregoing materials...*" 42 U.S.C. § 2014(z); *see also* 10 C.F.R. § 40.4. Thus, the AEA itself explicitly recognizes that natural source material is uranium and/or thorium or both in combination.

EPA also recognizes the presence of thorium in natural uranium ores and alternate feed materials. In its *generally applicable standards* relating to management of byproduct material, EPA has stated that "provisions applicable to the element uranium

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[82] Petitioners have claimed that IUSA does not have the authority to dispose of the waste resulting from processing the Molycorp material at the Mill. However, in addition, to possessing a source material license to process for natural uranium, IUSA's license permits the receipt, processing, *and disposal* of 11e.(2) byproduct material resulting from the processing of ores *primarily* for their natural uranium content, many of which contain thorium-232.

[83] Petitioners also levy the charge that IUSA has implicitly requested this license amendment so that it may process the Molycorp material for its thorium content. This claim is incorrect and should be disregarded. IUSA submitted its license amendment application specifically requesting permission to process the Molycorp material for its uranium content and NRC has explicitly recognized this fact. Molycorp Environmental Assessment ("EA") at 1. IUSA has no intention of processing the Molycorp material for its thorium content.

shall also apply to the element thorium." *See* 40 C.F.R. § 192.41. Thus, the application of a virtually identical regulatory regime to manage thorium byproduct material as compared to uranium byproduct material demonstrates that Petitioners' argument relating to IUSA's inability to safely possess and process uranium-bearing materials for their natural uranium content and to dispose of 11e.(2) byproduct material containing thorium is without merit.

While thorium-232 can pose a potential occupational hazard due to increased gamma radiation, EPA found that direct gamma radiation "depends on how close to the edge of a pile people live or work and how the tailings from the pile are distributed by the wind."[84] Exposure levels to members of the public will decrease as their distance to the tailings pile increases and eventually becomes a non-factor, (e.g., EPA conservatively assumed a decrease of a factor of two (2) from the center to the edge of a waste pile). In addition, EPA has concluded that, with reference to thoron gas, an exposure product of thorium-232, the dose "for the thoron decay products is about one-third that of the short-lived radon decay products." *Id.*

Finally, NRC has directly addressed concerns stemming from the presence of radionuclides associated with ingestion and inhalation, including inhalation of thorium. NRC specifically contemplated the presence of thorium in mill tailings impoundments during the development of its 10 C.F.R. Part 40 and Appendix A regulatory program stating that "the radiological parameters associated with the Th-232 [thorium] series are such that the impact of these isotopes is *relatively inconsequential*, even when they are present in amounts comparable to the natural uranium concentration in *ore*."[85] The

[84] FEIS at 10-12.
[85] GEIS at 6-21.

Molycorp material contains less than 100 pCi/g thorium-232 and approximately 500 pCi/g of uranium-238. As a result, the Molycorp material poses no *significant* threat due to its thorium content, which is lower than that of its uranium content. Thus, the potential hazards associated with processing ores containing thorium-232 and disposing of the wastes in uranium mill tailings impoundments were specifically considered by EPA and NRC in developing their uranium mill tailings regulatory regime.

c. The Thorium Content of The Molycorp Material Will Not Pose a *Significant, Incremental* Threat to The Public Health and Safety or the Environment

Dr. Chambers has addressed the potential, *incremental* radiological effects of thorium-232 and provides additional support for EPA's conclusion. When comparing the potential radiological effects of both natural uranium and thorium-232, Dr. Chambers states:

> "[W]hile the levels of hazard per unit activity can vary among the radionuclides and from decay series to decay series, the potential radiological hazards are not different in nature—in each case the pathways for exposure, and hence the types of precautions required to safely handle natural uranium (and it progeny) and natural thorium (and its progeny), are the same."

Chambers Affidavit at 5.

Dr. Chambers furthers notes:

> "Internal exposure from inhalation will require proximity to a source of airborne dust or exposure to radon gas decay products...or thoron gas decay products...which require exposure in a confined space."[86]

Id.

IUSA has previously processed, under its source material license and subsequent license amendments, numerous conventional ores and alternate feed materials containing

[86] Dr. Chambers also notes that EPA has concluded, "people need to be occupying a structure and not just standing outdoors" for radon health risks to be relevant. *See* 48 Fed. Reg. 15,076, 15,083 (April 6, 1983).

concentrations of both thorium and uranium in excess of the concentrations of those radionuclides found in the Molycorp material.[87] As stated by Dr. Chambers,

> "uranium bearing materials, including ores, which have been processed at the Mill include among others, uranium ore from the Arizona strip mines with uranium from 0.5% to 1.0% (i.e., 1650 to 3300 pCi/g of uranium-238) and the 'Cotter Concentrate' alternate feed with uranium content of up to 17% (i.e., 56,000 pCi/g of uranium-238.)"

Id. at 8.

Previously, IUSA was granted NRC-approved license amendments to process alternate feed materials from both the W.R. Grace site in Chattanooga, Tennessee, and the Heritage Minerals site in Lakehurst, New Jersey. *See* License Conditions Nos. 10.15 & 10.16. According to Dr. Chambers:

> "[t]he thorium-232 content of uranium bearing materials which have been processed or approved for processing at the Mill range from up to 8,000 pCi/g thorium-232 for materials from W.R. Grace and up to 2,000 pCi/g thorium-232 for materials from Heritage."

Chambers Affidavit at 8.

As the Molycorp material contains less than 100 pCi/g thorium-232, and approximately 500 pCi/g uranium-238, it is well below the concentration levels for other licensed activities. Based on these facts and his analysis, Dr. Chambers concludes, "the radioactivity of the Molycorp materials is well within the range of pCi/g levels for natural ores and alternate feeds that have been processed or approved for processing at the Mill." *Id.* Dr. Chambers further states:

> "There is no incremental occupational radiation exposure during processing of the Molycorp materials or as a result of the disposal of the processed Molycorp materials in the Mill's tailings cells. As the levels of natural thorium and natural uranium in the Molycorp materials are less than other previously licensed alternate feed materials and conventional ores, there are no potentially

[87] *See* License Conditions 10.15 & 10.16.

> significant incremental radiological hazards associated with their processing and disposal in the [Mill's] tailings cells."

Id.

With respect to potential inhalation exposure from airborne particulates, it must be remembered that the Molycorp material is a sludge, and IUSA has committed to additional control procedures (e.g., water sprays and/or surfactants) if the sludge dries out enough to create a potential airborne particulate problem. After processing, the wastes in the tailings cells are again moist and subject to additional controls to minimize windblown tailings. Therefore, since Petitioners do not live within close proximity to IUSA's tailings cells and, in any event, cannot be in close proximity to the cells or a potential spill, there is no *significant, incremental* threat to public health and safety and the environment from airborne particulates which contain thorium-232.[88]

Therefore, Petitioners cannot viably allege that the thorium content of the Molycorp material results in a *significant*, *incremental* threat to public health and safety or the environment.[89]

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[88] After processing previously licensed uranium-bearing materials, IUSA has deposited tailings containing various concentrations of thorium in the past and, in twenty years of operation and NRC semi-annual inspections, neither IUSA nor NRC have found IUSA in violation of its source material license or incapable of handling thorium during mill processing or after disposal into the tailings cells.

[89] In a prior IUSA license amendment proceeding regarding processing of the so-called Heritage materials, the Licensing Board addressed the legality of processing materials containing thorium for their uranium content under IUSA's source material license. The Licensing Board held that because IUSA certified that the Heritage materials were to be processed for their uranium content, as is the case with the Molycorp material, the contention that IUSA was in violation of its source material license for receiving materials containing thorium lacked "sufficient specific content to render it germane to the proceeding in any meaningful way." *In the Matter of International Uranium* (USA) *Corp.* (White Mesa Mill) LBP-01-08, Docket No. 40-8681-MLA-8, (February 28, 2001).

4. Petitioners' Claims Regarding Alleged Leakage From IUSA's Tailings Cells and Potential *Lead* Contaminations

Petitioners make several claims regarding potential groundwater contamination as a result of the Molycorp license amendment. While some of these claims pertain specifically to the license amendment itself, many of Petitioners' claims attack the construction of the tailings cells and IUSA's groundwater monitoring program. Claims relating to the license amendment include: (1) *lead* constituents will move *quickly* through the *perched* groundwater zone under the Mill site and penetrate to the regional aquifer as well as reach springs or seeps downgradient of the Mill site and (2) wildlife and humans will be threatened by the *lead* content that may reach water sources. Claims relating to matters outside the scope of the license amendment include: (1) IUSA's tailings cells are improperly constructed and (2) IUSA's tailings cells are *probably already* leaking. IUSA will address each of these claims in turn and maintains that each of these claims is without merit.

a. *Lead* Constituents from the Mill's Tailings Cells Will Not Penetrate to the Regional Aquifer

Petitioners allege that, if *lead* constituents were to escape IUSA's tailings cells, such *lead* constituents would move *quickly* through the *perched* groundwater zone and penetrate the regional aquifer as well as reach seeps or springs located downgradient of the Mill. This allegation ignores the defense in-depth protection system at the Mill which is based first on the hydrogeological conditions of the site, second, on the design and construction of the tailings cells, and, third, on the NRC POC groundwater monitoring program.

First, the natural hydrogeologic conditions at the Mill site do not promote the free movement of constituents to the *perched* groundwater zone and , from there, to the regional aquifer. Mr. Smith performed an analysis of the hydrogeologic conditions at the Mill site. Regarding the regional aquifer, Mr. Smith states:

> "The regional aquifer is located approximately 1,200 feet below land surface at the site. The regional aquifer is separated from the *perched* zone by approximately 1,000 to1,100 feet of very low permeability shales and other fine-grained materials, and sandstones with interbedded, very low permeability materials."

Smith Affidavit at 1.

The existence of these conditions above the regional aquifer leads Mr. Smith to conclude:

> "Because these interbedded very low permeability materials will dominate the vertical permeability of these sandstones, the overall vertical permeability of these intervening materials is low, which protects the regional aquifer hydraulically from the *perched* zone."[90]

Other *natural* geologic conditions exist at the Mill site further restricting the access of any potential tailings constituents into the regional aquifer. Some other natural geologic conditions, Mr. Smith states, include:

> "The regional aquifer is also under artesian pressure at the site such that water levels in wells completed in this aquifer rise above the top of the aquifer. As a result, water from the regional aquifer will tend to rise into these intervening materials rather than move downward from these materials into the regional aquifer."

Id.

The fact that water under artesian pressure cannot rise up through the aquitard suggests that, similarly, groundwater leaching from above will not be able to penetrate to the regional aquifer. With respect to this point, Mr. Smith concludes that, "artesian

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[90] Mr. Smith also stated, with regard to the actual presence of a *perched* groundwater zone at the Mill site, "[i]f the vertical permeability of this intervening zone were not low, then a *perched*water zone could not exist at the site." *Id.*

pressure could not exist in the regional aquifer without the presence of these low vertical permeability intervening materials." *Id.* Thus, the presence of low-permeability material between the *perched* groundwater zone and the regional aquifer along with the natural artesian pressure applied to waters at the Mill site demonstrates that the natural geologic conditions are ideal for preventing the flow of any potential tailings constituents into the regional aquifer.

b. Tailings Constituents from the White Mesa Mill's Tailings Cells Will Not Reach Springs or Seeps Downgradient Of The Mill Site Through the *Perched* Groundwater Zone

Petitioners' claim that the Molycorp material's *lead* content will escape the Mill's tailings cells, penetrate into the *perched* groundwater zone, which is about 70 feet below the tailings cells, and reach springs or seeps some miles downgradient of the Mill site is without merit.

First, the evidence of a chloroform plume at the Mill site presented by Petitioners to suggest that the *lead* content of the Molycorp material will behave similarly is incorrect. During his analysis of the travel time for potential constituents under the Mill site, Mr. Smith specifically addressed the travel time of the chloroform plume toward any downgradient springs or seeps. Noting that Ruin Spring, a small spring located approximately two (2) miles southwest of the chloroform plume, might be recharged by the *perched* groundwater zone, Mr. Smith states that, because the plume is moving at approximately 90 feet per year, "if the plume could reach the spring, it would take approximately 117 years." Smith Affidavit at 3. Mr. Smith further states that, as the chloroform plume slowly moves downgradient of the Mill's tailings cells, "[n]atural attenuation processes, including hydrodynamic dispersion, diffusion, and chemical

breakdown, will reduce chloroform concentrations substantially…" *Id.* These factors *lead* Mr. Smith to conclude that:

> "It is highly unlikely that chloroform concentrations *at hazardous or even detectable concentrations* would ever migrate to the spring [Ruin Spring] due to the large distance and travel time that would be required."

Id. at 3-4.

Mr. Smith has also stated that, even if tailings solutions containing "conservative" constituents escaped the tailings cells, the ability of these constituents to migrate more quickly than the slow rate of the chloroform plume is unlikely. If such tailings constituents were to escape and impact the *perched* groundwater zone, Mr. Smith states that these constituents "would be expected to be transported southwesterly once it reached the *perched* zone." Smith Affidavit at 4. *Perched* groundwater traveling in this direction will be attenuated by low permeability subsurface materials because, as Smith states:

> "Permeability estimates from hydraulic tests indicate that permeabilities in the *perched* [groundwater] zone are generally lower to the south and southwest (downgradient) of the tailings cells than they are in the vicinity of the chloroform plume (to the east-northeast of the tailings cells)."

Id.

The fact that *perched* groundwater flow traveling in a southwesterly direction is subject to a slower migration rate than that of the chloroform plume *lead*s Mr. Smith to conclude, "[p]erched [ground]water flow, and therefore contaminant transport downgradient of the tailings cells, would also be slower." *Id.* Based on this additional barrier to the expeditious migration of potential tailings constituents from IUSA's tailings cells, any potential seepage may be addressed and remediated prior to any potential off-site impacts on springs and seeps near the Mill site, much less the regional aquifer.

If any constituents less mobile than chloroform, such as *lead*, were to escape from IUSA's tailings cells, it would be even more unlikely that such constituents would reach Ruin Springs or any other springs or seeps because: (1) its mobility would be extremely limited by the natural geological conditions at the Mill site, (2) the constituent would be forced to travel great distances to reach such springs or seeps, (3) there is *significant* evidence, through the chloroform plume at the Mill site, suggesting that these constituents would not reach a spring or seep, and (4) there would be ample time to remediate any contamination if such constituents were to escape the Mill's tailings cells. Mr. Smith concludes that "[i]t is even less likely [than chloroform] that metals such as *lead*, which are subject to natural attenuation, would ever migrate to the spring." *Id.*

Further evidence exists confirming that the potential mobility of tailings constituents escaping from IUSA's tailings cells will be extremely low. As noted above, Petitioners offer evidence of the chloroform plume at the Mill site and claim that its presence is an indication that there is a *significant* threat to groundwater from the Molycorp material. On the contrary, the chloroform plume actually provides evidence that any potential tailings constituents will not travel quickly through the *perched* groundwater zone to the regional aquifer.

According to Mr. Smith, the chloroform plume at the Mill site "is moving very slowly" and has migrated at "a rate of approximately 90 feet/year." Smith Affidavit at 3. This fact causes Mr. Smith to conclude that:

> "because of the relatively slow rate of travel and large distance to the site's downgradient property boundary, there is ample time available for active mitigation of the chloroform plume using proven methodologies before there is any possibility of offsite impact."

Id. at 4.

Indeed, a recent letter to Mr. Love from William Sinclair, director of UDEQ's Division of Radiation Control,[91] confirms Mr. Smith's conclusion. Mr. Sinclair's letter, which addresses the investigation into the chloroform plume at the Mill site, notes that the Mill has three (3) characteristics that allow an extended investigation of the chloroform plume, and potential remedies as necessary, without concern about the existence of a *significant* threat to public health and safety or the environment:

> "1. The isolated location of the IUC [IUSA] facility on White Mesa that provides long distances between the contaminant plume and the facility boundaries,
>
> 2. The lack of shallow aquifer water wells in a downgradient direction, both on and off the IUC [IUSA] facility, that could become possible points of exposure to the public, and
>
> 3. *Local hydrogeologic conditions that hydraulically isolate and prevent the shallow aquifer contamination from adversely impacting the deep confined aquifer that provides drinking water to other groundwater users in the region.*"

Thus, Mr. Smith and UDEQ have found that the natural geologic and hydrogeologic conditions at the Mill site do not present a viable pathway for constituents from tailings cells to move *quickly* through the *perched* groundwater zone and reach springs or seeps downgradient of the Mill site or the regional aquifer.

c. Natural Attenuation of Lead in the Underlying Bedrock

Other natural geologic and hydrogeologic conditions serve as barriers to the free flow of constituents such as *lead* or chloroform. Natural attenuation[92] is an additional

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[91] Letter to William E. Love from William J. Sinclair, *Re: Request for Update and Status of State Groundwater Discharge Permit Application Process and Chloroform Investigation and Remediation Plan: International Uranium Corporation Uranium Mill Near Blanding, Utah*, (February 20, 2002) (emphasis added).

[92] Natural attenuation is defined as the ability of earthen materials to interact with potential groundwater contaminants and remove such constituents from seepage before the solutions enter groundwater. *See* Pyrih Affidavit at 3.

safeguard against seepage migration. The importance of approximately 70 feet of sandstone, siltstones, and claystones, which are generally calcareous in nature, was identified by Dr. Pyrih in his affidavit. Dr. Pyrih states:

> "[T]hese formations provide ample material for interacting with chemical constituents in *any* seepage that would enter the subsurface. The thickness of the formations is adequate to prevent the migration of iron, *lead*, and other potential contaminants from affecting groundwater quality."

Pyrih Affidavit at 4.

Dr. Pyrih states that, "it is true that under acidic pH conditions that are typical of the tailings solutions, the constituents are geochemcially mobile." Pyrih Affidavit at 3. However, if tailings solutions were to penetrate the Mill's tailings cells' synthetic liners and migrate into the subsurface at the site, they would encounter geochemical reactions that would prevent any further migration to the *perched* groundwater zone, much less the regional aquifer. As Dr. Pyrih states in his analysis:

> "The foundation of the cells consists of soils and bedrock that are calcareous in composition, that is, the soils and bedrock contain calcium carbonate minerals similar in composition to limestone. The carbonate minerals would immediately react with seepage, neutralizing the acidic pH of the tailings solution."

Id.

Despite Petitioners' assertions that the Mill's tailings cells contain tailings solutions that are "highly acidic," any penetration to the subsurface by these solutions will cause an immediate neutralization of their low pH levels and render heavy metals, such as *lead*, immobile prior to reaching the *perched* groundwater zone.[93] Dr. Pyrih concludes that:

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[93] According to a National Research Council study, constituents like *lead* and thorium are immobilized at pH levels between 3.5 and 8.5. *See* National Academy Press, *Scientific Basis for Risk Assessment and Management of Uranium Mill Tailings*, Uranium Mill Tailings Study Panel, Board on Radioactive Waste Management, Commission on Physical Sciences, Mathematics, and Resources, at 59 (1986).

> "[O]nce the tailings solutions make contact with naturally calcareous strata, pH conditions are established that are favorable for natural attenuation and the mobility of groundwater contaminants is greatly reduced....Similar reactions would occur with radionuclides like thorium....Most of the chemical constituents present in soluble form in the tailings solutions would be removed from solution by these natural mechanisms and would be attenuated in their migration."

Id. at 3-4.[94]

In addition, these geochemical reactions described by Dr. Pyrih not only serve to immobilize constituents such as *lead*, but also serve another valuable purpose. By reacting with the calcium carbonate minerals, any seepage pathways in the subsurface will effectively be "plugged" at the point of contact with the calcium carbonate. Dr. Pyrih states:

> "Neutralization of the tailings solutions in turn, would trigger other geochemical reactions. Calcium would be released when the calcareous soils and bedrock react with the tailings solution. This calcium would immediately react with the abundant sulfate present in the tailings solution to form insoluble calcium sulfate (gypsum) that has been demonstrated to plug seepage pathways, thus making these soils and bedrock *self-healing* and even more impermeable to seepage."

Pyrih Affidavit at 3.

Added to this, any iron that is present in the tailings solution also will act as a "plug" for potential pathways to the *perched* groundwater zone. Dr. Pyrih indicates that:

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[94] Dr. Pyrih also notes:

> "Natural attenuation of heavy metals and radionuclides is well known to NRC and is well documented by laboratory and field investigations conducted by numerous institutions at various uranium tailings sites. The studies have always indicated that potential groundwater contaminants such as arsenic, barium, copper, iron, *lead*, vanadium, and *thorium*, which are often found dissolved in acidic tailings solutions, do not migrate in the subsurface environment. From a geochemical perspective, the behavior of radioisotopes Th-230 and Th-232 is indistinguishable; their reactivity and lack of mobility are identical."

Pyrih Affidavit at 4.

> "[a]s the pH of tailings solution is partially neutralized to above pH 3, the iron would begin to precipitate as a very insoluble, iron hydrous-oxide gel that would seal-off seepage pathways."

Id.

Thus, due to these geochemical reactions, any potential seepage will create a "*self-healing*" process in the material beneath the cells to plug up groundwater migration pathways, thereby preventing seepage from reaching the *perched* groundwater zone, much less the regional aquifer.[95]

Moreover, IUSA's tailings cells were designed to limit potential groundwater contamination using the natural site-specific conditions at the Mill site. As stated by Mr. Michael J. Taylor, a Registered Professional Engineer, notes that an important part of the tailings cell design process was to, "[g]ather the data necessary for the design of the various components of the project." Taylor Affidavit at 2. Additionally, since a synthetic liner was to be installed, it was important to "understand the reaction of tailings fluids with the particular subsurface material at the site to assess the 'what-if' scenario of liner leakage." *Id.*

Despite the highly unlikely scenario of the synthetic liner leaking, the design of the tailings cells also accounted for the highly calcareous materials beneath the cell liner that would increase the natural attenuation rate of any highly acidic tailings solution and prevent such solutions from penetrating to the *perched* groundwater zone.

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[95] In addition, this "*self-healing* process" also prevents the creation of "wormhole" leaks below the tailings cells, which Petitioners assert will occur.

d. IUSA's Groundwater Monitoring Program

Additionally, IUSA has implemented an NRC-approved groundwater monitoring program designed to prevent any potential contamination from breaching the Mill's POC.[96] This monitoring program is specifically designed as an "early warning system" so that IUSA may identify constituents escaping from the tailings cells and quickly engage in corrective action, if necessary.

Mr. Smith reviewed the adequacy of the groundwater monitoring program at the Mill site and concluded that:

> "The permanent monitoring wells at the site are placed to monitor *perched* water conditions downgradient, upgradient, and cross-gradient of the tailings cells. Based on a review of tailings cell construction and hydrogeologic properties at the site, and on numerical flow and transport modeling, I consider the location and spacing of these wells currently adequate to detect any seepage from the cells that might hypothetically occur and impact *perched*water under a range of reasonable flow conditions."

Smith Affidavit at 2.[97]

As stated above, Dr. Pyrih has concluded that the current indicator parameters are adequate to detect any seepage from the tailings from the Molycorp material. Dr Pyrih states:

> "These parameters (chloride, potassium, nickel, and uranium) are key indicators of potential leakage from the tailings cells. Unlike most of the constituents present in the tailings solution, chloride, potassium, and nickel are "conservative" in their geochemical behavior, which means that these constituents are 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. Because these

[96] According to IUSA's NRC-approved groundwater monitoring program, the point of compliance for groundwater monitoring at the Mill is in the *perched* groundwater zone at the downgradient edge of the tailings cells.

[97] Mr. Smith also notes that, "[t]he adequacy of the existing monitoring wells was also the conclusion of a previous consultant at the site (Titan, 1994)." Titan. September, 1994. Points of Compliance. White Mesa Mill. Submitted to Energy Fuels Nuclear.

> constituents travel at the speed of groundwater, it is my opinion that monitoring these key parameters serves as an early warning to the arrival of potential groundwater contaminants such as arsenic, barium, copper, iron, lead, vanadium, and thorium which are attenuated in their movement."

Pyrih Affidavit at 4.

To date, after over twenty (20) years of monitoring at the White Mesa Mill and semi-annual inspections by NRC, no leakage from the tailings cells has ever been detected at the POC, much less in the regional aquifer.[98] Therefore, no *significant, incremental* threat to public health and safety or the environment will be created due to the placement of tailings from processing the Molycorp material.

e. *Lead* Constituents from the White Mesa Mill's TailingsCells Do Not Pose a Threat to Petitioners or Wildlife at Springs or Seeps Downgradient of the Mill Site

Petitioners allege that, as a result of the alleged leakage of tailings from the Molycorp material, wildlife will drink water containing tailings constituents when such water reaches a spring or seep, suffer *lead* contamination and be harmed, and that Petitioners will also be harmed from drinking such water and from eating such contaminated wildlife. As stated above and will be shown below, since tailings constituents will not reach a spring or seep downgradient from the Mill site, Petitioners' allegations are without merit.

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[98] The closest community to the Mill site that uses the Entrada/Navajo Sandstone aquifer as a potable water supply is the White Mesa Ute Community. The Ute Environmental department collects quarterly samples for gross alpha and beta analysis to determine whether uranium or other radionuclides associated with the White Mesa Mill have impacted the White Mesa Ute water supply. Cindy Crist, Director of the Ute Environmental Department, advised UDEQ in March of 1999 that, as a result of quarterly sampling in 1998:

> "The gross alpha concentrations of the samples were well below EPA's maximum concentration level ("MCL") of 15 pCi/g for drinking water and do not appear to be changing *significant*ly over time."

First and foremost, IUSA's tailings cells are not leaking. Second, it is highly unlikely that constituents from the Molycorp material will reach a spring or seep near the Mill site, given the natural (i.e., slow moving *perched* groundwater flow and low permeability calcareous materials in the subsurface) and artificial (i.e., tailings liners) barriers that exist to groundwater migration at the Mill site. The immobility of tailings constituents such as *lead* when they react with the calcium carbonate layers in the event of a leak in the cell liner, the unlikelihood that any migrating constituents would escape detection given the NRC-approved POC monitoring program, the long distances and travel times that constituents must cover to reach a spring or seep in concentrations of any significance, and the ample opportunity to undertake any necessary corrective action makes the allegation of potential harm to Petitioners and wildlife from seep or spring water little more than unsupported speculation.[99] Indeed, Dr. Chambers concludes that "[s]uch a scenario is so unlikely, that in my opinion, it is not credible. Therefore, I do not believe it is beneficial for me to further consider this issue *which would require the compounding of numerous incredible asumptions*."[100] Chambers Affidavit at 9. Thus, no *significant, incremental* threats exist to the public health and safety or the environment as a result of constituents from the Molycorp material potentially reaching a downgradient spring or seep.

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[100] NRC also found that endangered or threatened species near the Mill site would not suffer a *significant, incremental* impact. *See* Molycorp EA at 3.

f. The Mill's Tailings Cell Design

Petitioners have also argued, through their pleadings and the submission of affidavits,[101] that IUSA's tailings cells are improperly constructed and are *probably* leaking. As shown above, IUSA's tailings cells are not leaking and Petitioners can offer *no* evidence to support such a contention other than the presence of a chloroform plume which experts have found is not caused by the tailings cells. More importantly, however, the design and construction of IUSA's tailings cells is not subject to challenge in this proceeding and, in any event, Petitioners' claim that the tailings cells were defectively constructed is without merit.

The construction plan for IUSA's tailings cells was approved by NRC on October 12, 1979, after review of documentation from the White Mesa Mill's initial license application and rigorous peer reviews by NRC and its consultants, public comment, and response from other technical and non-technical parties.[102] The affidavit of Mr. Taylor, the Mill's tailings cell construction consultant who supervised the design of the Mill's tailings cells, provides a detailed description and analysis of the criteria and practices followed when the tailings cells were designed and constructed.

First, Mr Taylor states that, in addition to prudent design techniques and criteria, the design and construction of the tailings cells were based on a "consideration of the natural features of the site *in order to meet all regulatory standards and criteria*." Taylor Affidavit at 4. These natural features included:

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[101] IUSA notes that Mr. Ivan Weber, an affiant for Petitioners, is not an engineer and has had no experience in designing and building tailings facilities under the UMTRCA program.

[102] *See* Letter from Ross A Scarano, Chief, Uranium Recovery Licensing Branch, Division of Waste Management, to R.W. Adams, Chairman of the Board, Energy Fuels Nuclear, Inc. (October 12, 1979).

"(a) the natural swales in which the cells were located;
(b) the calcareous nature of the underlying soils and bedrock which would attenuate the transport of radionuclides and elements that may leak from the cells;
(c) the extensive shallow *perched* water zone which provides an ideal early warning system;
(d) the aquitard between the *perched* groundwater and the regional aquifer which minimizes the potential of any impact on the regional aquifer; and
(e) the distance the cells are from the downgradient springs and the slow moving nature of the *perched* water, which minimizes the possibilities of any potential leakage from the cells affecting surface water."

Id.

These natural features assist in the containment of *all constituents,* radiological and *non-radiological*, present in the Mill's tailings cells for the 1,000 year period as prescribed by Appendix A Criteria.[103]

According to Mr. Taylor, several different factors were considered when developing the construction designs, including the following:

(a) Cell location and layout;
(b) Embankments;
(c) Cell liners;
(d) Fluid control and handling system;
(e) Groundwater monitoring wells; and
(f) Reclamation cover

First, with respect to "cell location and layout," Mr. Taylor states:

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[103] It is important to note that uranium mill tailings piles constructed in the 1950s and 1960s were not subject to the even more stringent mill tailings control concepts that NRC began developing in the 1970s which, after the passage of UMTRCA, culminated in the Draft GEIS and the Final GEIS and Appendix A Criteria in the 1979-1980 time frame. Although these Criteria were developed primarily for prospective application, NRC Staff determined that these objectives should be satisfied "to the maximum extent practicable at existing sites." GEIS at 12-28. Thus, NRC's approval of the tailings cell design and construction followed by authorization to operate in May, 1980, can be presumed to reflect the requirements in Appendix A, which was promulgated in the fall of 1980.

> "[T]he location of the [tailings] cells in the shallow valley or swale at the site allows the tailings to be deposited and stored in areas that minimize exposure to the elements and allow reclamation below existing grade at the site."

Id.

This specific design criterion purposefully reduces the potential exposure that the tailings could have to the environment (i.e., airborne contamination, surface run-off from precipitation) and helps to negate any *significant* threats to public health and safety.

Then, the materials for the tailings cell embankments were evaluated for their suitability prior to construction of the tailings cells. These earthen embankments essentially were located across the shallow valley or swale to allow the cells to have retaining capabilities. According to Mr. Taylor:

> "Borings and test pits were advanced in the areas of the proposed embankments and in borrow areas for fill to be used in construction of the embankments....Foundation preparation was specified to assure adequate support for the embankments. Highly calcareous (naturally high pH or geochemically basic) soils and weathered rock were noted in the foundation areas and removal of unsuitable surface materials was specified where necessary."

Taylor Affidavit at 5.

The embankments for the tailings cells were also subjected to slope stability analyses using prudent engineering methods and various "what-if scenarios." According to Mr. Taylor, one such "what-if scenario" involved the "unlikely possibility of liner leakage and the potential for buildup of hydrostatic head against the embankment fill." *Id.* Though a small amount of fluid build-up against the embankment would be harmless, a large fluid build-up could cause stability problems with the embankment. To remedy this potential problem, Mr. Taylor states:

> "a drainage layer to be placed under the liner was designed for placement against the embankment slope. Any fluids entering this layer would collect

at the bottom of the slope for removal and prevent build-up of the hydrostatic head."

Id.

In addition to the primary benefit of this drainage layer (i.e., prevention of fluid build-up), the layer also provides a secondary benefit as a monitoring mechanism. Any excess fluid build-up detected in this drainage layer would provide IUSA with an "early warning" as to potential liner failure in the tailings cells and allow for prompt and effective remediation of any contamination prior to it reaching the *perched* groundwater zone, much less the regional aquifer. While it was not intended to serve as the sole groundwater monitoring mechanism, the drainage layer at the foot of the embankments serves as a leak detection system for the cell, and is yet another effective component of IUSA's "early warning system" for groundwater monitoring at the White Mesa Mill site.[104]

Cell liner construction was subject to several important considerations at the Mill site as well. Among these considerations were two crucial factors:

"(1) Select a liner that was appropriate for the fluids to be retained and appropriate for installation and operations at the Mill site
(2) Understand the reaction of tailings fluids with the particular subsurface material at the site to assess the "what-if" scenario of liner leakage."

Taylor Affidavit at 5.

While considering what type of liner would be appropriate for the White Mesa Mill's tailings cells, several possible alternatives were reviewed. The use of clay materials from the local borrow areas were considered but were deemed unacceptable because of "the potential for the clay to change physical properties when placed in

[104] These leak detection systems are maintained by IUSA on a weekly basis.

contact with the tailings fluids." *Id.* at 6. Hypalon and CPE liners were also considered, but because they "did not stand up as well as PVC to characteristics of fluids that might exist in the tailings cells," they were not selected. *Id.*

After considerable evaluation, Mr. Taylor states that "PVC was considered reliable and had a long history of successful performance."[105] *Id.* PVC liners, according to Mr. Taylor, are "good lining material for industrial applications." Taylor Affidavit at 6. Quoting a recent brochure from Field Lining Systems, Inc. of Arizona, Mr. Taylor notes:

> "Polyvinyl chloride has excellent resistance to inorganic acids and alkalis, as well as a wide range of corrosive inorganic chemicals. The combination of chemical resistance and good physical properties has led to usage in numerous industrial application[s] exposed to corrosive conditions."

Id.

However, despite the effectiveness of a PVC liner, Mr. Taylor reiterates that consideration of potential "what-if" scenarios was crucial to the proper design and construction of the tailings cells. The most important "what-if" scenario, as stated above, is the unlikely risk of liner failure. Regarding this potential scenario, Mr. Taylor states:

> "the design for the Tailings Management System assumed that if massive liner failure occurred in Cell 1, the cell would be emptied and the liner repaired before reuse. For Cells 2 and 3 that would be filled with solids, it was assumed that if massive liner failure occurred, the liner would be repaired or the cells would no longer be used, and all fluids would be removed."

Id. at 8.

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[105] Mr. Taylor notes that the only problem with PVC liners is that they deteriorate when exposed to sunlight. However, when selecting the PVC liner, Mr. Taylor states:

> "This problem could be resolved, however, by providing an earthen cover over the PVC liner, thereby preventing exposure to sunlight as well as protecting it from other casual damage." *Id.*

These design considerations led Mr. Taylor to conclude that, "[n]o further design considerations were required to mitigate the situation of massive liner failure other than to recommend repair should such an event occur." Taylor Affidavit at 8.

Another "what-if" scenario identified and considered was the potential for "pinhole leaks" in the tailings cell liners. Mr. Taylor explains:

> "Professionals working on uranium tailings during this time, including myself, regulatory agency personnel and noted scientists and engineers, had concluded, based on observation at many sites, that, depending on site-specific conditions, radionuclides and other toxic elements in tailings fluids did not move very far from even unlined tailings ponds or cells, where specific subsurface conditions existed."

Taylor Affidavit at 8.

As stated above, the Mill's subsurface area under the tailings cells contains an additional safeguard against these potential "pinhole" leaks. Due to the presence of the calcareous materials in the subsurface, Mr. Taylor finds that:

> "any small amount of leakage that potentially came through the liner in the design"what-if scenario," would immediately encounter those materials, the pH would rise rapidly and many radionuclides and other potentially toxic metals would precipitate and remain in the zone immediately under the cell."

Id. at 7.

Accordingly Mr. Taylor states that, a properly installed and covered PVC liner, the liner type that was specified for the Mill, "will prevent loss of uranium tailings fluid from the cells," and "the backup mechanism of interaction with the natural earthen materials would prevent negative impact to the environment." *Id.* This design system of barriers, Mr. Taylor concludes, "is prudent engineering design for the Tailings Management System at the White Mesa Facility and, in essence, consists of a defense-in-depth protection system." Taylor Affidavit at 7.

The fluid control and handling system is another aspect of the Mill tailings management system that incorporated a design component specifically intended to minimize threats to public health and safety and the environment from *both* the radioactive and *non*-radioactive constituents in mill tailings. This design component is centered upon the installation of a *drain* system placed on *top* of the tailings cell liner so that a slow downward flow of fluids through the deposited tailings is created. The intent of this system was to create a situation in which free liquids would be drained from the cells so that the tailings may be consolidated. After consolidation of the tailings, Mr. Taylor states:

> "As the slimes accumulate and consolidate over the drain, a tight layer of relatively impermeable materials is created. Fluids in the cells on top of this layer find it difficult to flow through this layer into direct contact with the top of the liner."

Id. at 7-8.

This consolidation of slimes and solids on and around the drain system constitutes yet another effective barrier to tailings seepage escaping the cells and proceeding to the *perched* groundwater zone beneath the Mill site. Additionally, the drains are periodically emptied as part of the operating system and, when the drain is emptied, "the hydraulic head on the liner just below the drains is *significant*ly reduced." *Id.* at 8. Based on this, Mr. Taylor concludes "[w]ith little or no hydraulic head on the liner, no tailings fluid is likely to escape. This is another aspect of the defense-in-depth protective system." Taylor Affidavit at 8.

The reduction of the hydraulic head on the liner is also accomplished by the fluid handling system, which is designed to remove free liquids from the top of the tailings

cells and transport them to the evaporation cells. This process "keeps the hydraulic head low in the solids retention cells and again limits the fluids that the liner has to retain." *Id.* In addition, Mr. Taylor states:

> "[i]t also lowers the liquids level at the upper reaches of the cells allowing consolidation of the coarser tailings that have been placed there by the beaching deposition."

Id.

These additional mitigation measures installed as part of the fluid control and handling system at the Mill further help to contain any potential tailings seepage from escaping the tailings cells.

The design of the groundwater monitoring program provides a final mitigation measure so that IUSA may have an "early warning" prior to the escape of any tailings seepage to the *perched* groundwater zone, much less the regional aquifer. As stated by Mr. Taylor, according to the Mill's design plan:

> "Wells were to be installed in both the shallow and deep groundwater zones at the site....The original monitoring wells were located along preferred flow paths that seepage from the [tailings] cells would take were it to occur. The wells were to be sampled before operation began and then periodically during operations to assess changes, if any."

Taylor at 8.

These monitoring wells, as stated by Mr. Taylor, were designed "to detect impacts to the groundwater and not to detect small amounts of leakage from pinholes in the liner." *Id.* The risk that groundwater would be impacted from these "pinhole" leaks is, according to

Mr. Taylor, "small" and not *significant* according to the intended design and construction plan of the White Mesa Mill's tailings cells.[106]

g. The White Mesa Mill's Tailings Cell Construction

As stated above, after the design of the tailings cells construction plan was complete, NRC authorized the first stage of construction on October 12, 1979. In his affidavit, Mr. Taylor provides a detailed assessment of the construction phase and his observations during such activities. Using the NRC-approved design plans, on-site personnel then began construction in accordance with the design specifications in the plans, incorporating modifications if necessary, and recording all results of progress so that proper QA/QC could be maintained.[107]

During the construction phase, factors similar to those enumerated for the design specifications were evaluated. Regarding the embankment construction, Mr. Taylor notes:

> "The construction of the embankments involved preparation of the foundations and placement of the earth fill. The foundations for the embankments were excavated to bedrock, because of geotechnical variability of material and concern for uniform support of the embankment loads."

Taylor Affidavit at 9.

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[106] Mr. Smith has stated that, in his opinion, "[b]ased on the overall site hydrogeology and the monitoring controls in place, I consider the tailings cells to be well-situated and designed to be protective of the environment." Smith Affidavit at 3.

[107] Mr. Taylor states regarding this iterative process, "[t]his was done during the construction of the cells and other elements of the Tailings Management System at the White Mesa Facility." Taylor Affidavit at 9.

Through these procedures, on-site personnel were able to create a suitable foundation on which the embankments could be constructed in order to remain stable for a 1,000 year regulatory horizon.

Construction of the embankments also required appropriate fill material. While being observed by a properly authorized engineering representative, this material was removed from the borrows, spread in lifts, and compacted with a self-propelled roller at the construction site. Mr. Taylor states:

> "Density testing was conducted on every 600 to 1,000 cubic yards placed to assure that the compaction was achieving required and specified results. Density test results were compared to the Proctor Tests conducted on the borrow materials in the laboratory."[108]

After the density tests were performed on the borrow material, Mr. Taylor finds:

> "Observation during construction and test results indicated that the embankments were constructed in accordance with the plans and specifications."

Id.

Thus, the embankments were constructed in accordance with design specifications approved by NRC and, therefore, provide sufficient protection of public health and safety and the environment.

Regarding the construction of the tailings cell liners, PVC liners were installed, tested, and inspected by the manufacturer's representatives. Prior to installation of the liner itself, a bedding layer was placed in the liner areas. Bedding layer materials were:

> "obtained by crushing the weathered rock and soils at the site…to obtain materials with the grain size distribution of coarse sand. Grain size distribution tests on the placed material…verified the coarse sand nature of the material."

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[108] Mr. Taylor also indicates that QA/QC was performed to insure the tests were conducted properly. Taylor Affidavit at 9.

Id. at 10.

While a concern associated with the installation of bedding layer materials[109] is the creation of particles with sharp edges that may penetrate the liner after final construction, Mr. Taylor states:

> "Knowing the characteristics of the soft weather rock at the site and the capabilities of a [Caterpillar 825] compactor to crush such materials, it was relatively assured that creation of any particles with sharp edges that would penetrate the liner was virtually impossible."

Taylor Affidavit at 10.

Despite the fact that the installation of bedding layer materials yielded a minute level of risk that particles could penetrate the liner, an additional safeguard was implemented. According to Mr. Taylor, "[t]he placed bedding material was compacted with a smooth drum vibratory roller." *Id.* at 10. This process insured that all potentially sharp-edged particles that may have remained after installation of the bedding material would be flattened with *significant* force to eliminate the threat to the liners integrity would be present.[110] Based on these procedures, Mr. Taylor states, "[t]he likelihood of any particles remaining with sharp edges after these operations is small." *Id.*

The liner material itself was subject to rigorous testing and QA/QC procedures. Before reaching the Mill site for installation, the PVC liner material was sampled to

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[109] Mr. Taylor also notes that, while some reviewer may state that the bedding layer materials are not low permeability materials, these materials need not be of such a nature because, "[t]his layer was never designed to be a low permeability barrier….it was intended to be a more permeable layer zone between the PVC liner and the underlying much less permeable natural rocks." Taylor Affidavit at 10. This permeable bedding layer was designed to provide a pathway for any significant leakage to reach the tailings cells leak detection system.

[110] As part of the QA/QC for the construction phase, on-site engineering personnel inspected the surface where the bedding layer material was installed to insure that no sharp particles remained. If any did remain, they were removed by hand or the same area was recompacted. According to Mr. Taylor, "[t]he visual inspection of the surface…verified the acceptance of the bedding layer for receipt of the PVC liner." *Id.*

determine whether it would be suitable for placement in the environmental setting at the mill. According to Mr. Taylor, "[t]he test results verify that the liner met all specifications and requirements." Taylor Affidavit at 10.

The installation of the liner was observed and inspected by representatives of the manufacturer, D'Appolonia, and the then-licensee Energy Fuels Nuclear, Inc. A cover constructed of prepared coarse sand materials which was "advanced in lifts of sufficient thickness (12 to 24 inches) to prevent damage by the small dozer used to spread the cover material" was installed to protect the liner material from any impacts. *Id.* After completion of the liner installation procedures and testing, Mr. Taylor states that "[f]rom all indications, they followed instructions and placed the cover in a proper manner."[111]

Finally, the fluid control and handling systems were constructed of acid-resistant piping and material as delineated in the design specifications. All construction and installation work was done with care to avoid disturbing the liner and to prevent any damage to the tailings system. Based on this, Mr. Taylor concluded, "[t]hese systems were installed to operate as designed for the life of the facility." *Id.* at 11.

Moreover, as stated above, NRC is required to approve the construction design plan for tailings cell construction and to verify that construction has been completed in accordance with the design plan. NRC approved the design plan for the cells, and, by authorizing operations, approved the cell construction as completed in accordance with the approved design. NRC authorized the initial stages of the embankment and liner

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[111] According to Mr. Taylor, "[t]his activity was closely observed to make sure that no damage to the liner occurred. Equipment operators performing this work were instructed not to make hard turns or otherwise dig in the tracks on their equipment to prevent such damage." Taylor Affidavit at 10-11.

system construction on October 12, 1979,[112] and, after completion of tailings cell construction licensed the commencement of operations in May, 1980. Since that time, NRC has conducted at least semi-annual inspections of the Mill's tailings cells and, at no time, has NRC determined that the tailings cells are leaking.[113] Therefore, the totality of the design specifications for the Mill's tailings cells and the subsequent construction of the cells pursuant to the NRC-approved design specifications demonstrate that Petitioners' allegations on this matter are without merit.

h. The Mill's Tailings Cells Are Not Leaking

Any allegation by Petitioners that IUSA's tailings cells *might* be leaking is mere unsupported speculation. Nowhere do Petitioners identify where there is leakage from the tailings cells, which are leaking, and the concentrations of such constituents. The only evidence Petitioners offer is the aforementioned chloroform plume at the Mill site. Both Mr. Smith and Dr. Pyrih analyzed whether the chloroform plume could be coming from the Mill's tailings cells or some other source at the Mill site. With regard to the chloroform plume itself, Mr. Smith states that "the chloroform plume is located cross-gradient to up-gradient of the tailings cells with respect to *perched* water flow." Smith Affidavit at 3. Comparing the location and flow of the chloroform plume to the location

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[112] *See* Letter from Ross A Scarano, Chief, Uranium Recovery Licensing Branch, Division of Waste Management, to R.W. Adams, Chairman of the Board, Energy Fuels Nuclear, Inc. (October 12, 1979). It should be noted that Mr. Scarano supervised NRC Staff that prepared the Draft GEIS, the Final GEIS, and Appendix A Criteria based thereon.

[113] *See* Letter from Charles L. Cain, Chief, Nuclear Materials Licensing Branch, to David C. Frydenlund, Vice-President and General Counsel, IUSA, *Re: NRC Inspection Report 40-8681/02-01* (April 19, 2002); Letter from W.C. Seidle, Chief, Engineering Inspection Branch, to R.W. Adams, Chairman of the Board, Energy Fuels Nuclear, Inc., *Re: License No. SUA-1358* (August 21, 1981).; *see also* Letter from G.D. Brown, Chief, Fuel Facility and Material Safety Branch, to R.W. Adams, Chairman of the Board, Energy Fuels Nuclear, Inc., *Re: RIV, Docket No. 40-8681/Rpt. 80-01* (June 11, 1980);

of the tailings cells, Mr. Smith finds that "[t]he hydraulic location of the tailings cells...indicate that the tailings cells are not the source of the detected chloroform..." *Id.* This conclusion, according to Mr. Smith and Dr. Pyrih, are supported by several factors.

First, Mr. Smith states that "constituents present in the tailings cells could not follow the same pathway as the detected chloroform." *Id.* If tailings solution were to escape the tailings, Mr. Smith states that they "would be expected to be detected in monitoring wells downgradient of the tailings cells should they ever seep from the cells and impact *perched* water." Smith Affidavit at 3. The fact that no tailings constituents were detected in IUSA's monitoring wells is supported by Dr. Pyrih's conclusions:

> "Neither the quarterly NRC compliance monitoring of key parameters nor diagnostic fingerprinting of water "types" indicated that seepage from the tailings cells had migrated to the monitoring well."

Pyrih Affidavit at 5.

Tailings solutions, according to Dr. Pyrih:

> "have a characteristic and unique major-ion fingerprint in which magnesium and sodium are the predominant cations, and sulfate and chloride are the predominant anions."

Id.

If any tailings solution were to escape the tailings cells, there would be some indication of elevated concentrations of these constituents in IUSA's monitoring wells. However, as Dr. Pyrih states, "[n]one of the monitoring wells at the Mill site...showed the groundwater with the major-ion fingerprint that would be indicative of tailings solutions."[114] *Id.* On this basis, Dr. Pyrih concludes that "the tailings cells are not

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[114] Dr. Pyrih also states that:

> "[i]f tailings solutions were not flowing into monitoring well MW-4 (which is located cross-gradient of the tailings cells), then tailings seepage could not be carrying chloroform into the monitoring well." Pyrih Affidavit at 5.

leaking and tailings solutions are not making their way into the monitoring wells." Pyrih Affidavit at 5.

Second, Mr. Smith's and Dr. Pyrih's analyses have led them to agree on the likely source of the chloroform contamination. According to both Mr. Smith and Dr. Pyrih, the likely source of the chloroform contamination is an abandoned scale house leach field, which is situated east to northeast of the tailings cells and was used prior to operation of the Mill. Whereas the tailings cells could not have been leaking since no tailings constituents were detected in monitoring wells, the leach field "received laboratory wastes containing chloroform more than 20 years ago, prior to the White Mesa Mill's operation" and was capable of discharging chloroform to the subsurface. Smith Affidavit at 3. The likelihood of the leach field being the source of the chloroform plume is supported by three factors:

> "(1) the general distribution of chloroform detected in existing perched monitoring wells;
> (2) the location of the abandoned scale house leach field upgradient of the detected chloroform; and
> (3) the correlation between elevated nitrate concentrations and elevated chloroform concentrations in the monitoring wells that have been identified to have elevated chloroform concentrations."

Id.

In addition, Mr. Smith notes "I have seen no evidence that a continuing source of chloroform exists." *Id.* These factors also support Mr. Smith and Dr. Pyrih's conclusions that the Mill's tailings cells are not leaking and pose no *significant* threat to the public health and safety or the environment.[115]

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[115] The fact that the Mill's tailings cells are not leaking is further evidenced by the fact that the tailings cell is inspected annually and have been approvedby EPA under its Offsite Rule for receipt of CERCLA materials.

Further, Petitioners do not offer any credible evidence of elevated concentrations of any other parameters, including the above-mentioned POC parameters, nor can they show that the constituent of concern here (i.e., *lead*) has been detected in IUSA's monitoring wells or, for that matter, anywhere else at the site. Therefore, based on the above-mentioned facts and Petitioners' inability to present credible evidence demonstrating that IUSA's tailings cells are leaking, Petitioners claim that the *perched* groundwater zone beneath the Mill site is being contaminated by Mill operations is without merit.[116]

5. Transportation of the Molycorp Material to the White Mesa Mill Does Not Pose a *Significant, Incremental* Threat to Public Health or Safety Above and Beyond That of Previously Licensed Activities

Petitioners allege that transportation of the Molycorp material will pose a *significant* threat to themselves and the City of Moab prior to being received at the White Mesa Mill. Further, Petitioners allege that they will be harmed by the City of Moab's lack of an "emergency response plan" that may adequately respond to a potential spill of the Molycorp material. These allegations are without merit.

a. The Transportation of Radioactive Materials Poses No *Significant, Incremental* Threat

116 Petitioners also allege that constituents from the Molcyrop material will penetrate to the *perched* groundwater zone through the same pathway as the chloroform plume because the source of the plume has not yet *definitively* been determined. This allegation is without merit for several reasons. First, as noted above, the Molycorp material will be placed on a bermed concrete ore pad and will not interact with soils at the Mill. Second, as demonstrated above, IUSA's tailings cells are not leaking. Third, there is ample evidence to show that the chloroform plume originated from the abandoned scale house leach field, which received laboratory wastes containing chloroform over twenty years ago, prior to Mill operations, which the Molycorp material will not come tinto contact with prior to, during, or after processing.

First, as a general proposition, the transportation of materials with various levels of radioactivity has already been assessed and evaluated by NRC and the Department of Transportation ("DOT"). The preamble to 10 C.F.R. Part 51 explicitly states that the transportation of radioactive materials does not pose any *significant radiological* threat to public health and safety. DOT found in an EA on the transport of radioactive materials that "the risks of highway transport are so low that the regulations authorizing such transport will have no *significant* environmental impact." The Commission, in NUREG-0170, considered the environmental impacts of the transportation of *all* types of radioactive materials. This NUREG set forth the Commission's conclusion that:

> "the environmental impacts, radiological *as well as non-radiological*, of both the normal transportation of radioactive materials and of the risk and consequent environmental impacts attendant an accidents involving radioactive material shipments were sufficiently small that shipments by *all* modes of transport should be allowed to continue and no immediate changes to NRC regulations were needed."[117]

These regulations dealt with the transport of *high-level radioactive waste or materials* while the Molycorp material consists of low-specific activity ("LSA") material, and the transport of such material, in and of itself, does not pose a *significant, incremental radiological or non-radiological* threat to public health and safety or the environment.

b. Transportation of the Molycorp Material to the White Mesa Mill Conforms With All Applicable DOT Regulations and Poses No *Significant, Incremental* Threat

The transportation of alternate feed materials from a generator site to the Mill involves the use of a transportation contractor. This transportation contractor is responsible for utilizing appropriate transport containers, in accordance with applicable

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[117] 49 Fed. Reg. 9352, 9374 (March 12, 1984).

DOT and state regulatory requirements and for the safe and effective remediation of any potential spills that may occur as a result of an accident during transport.

The Molycorp materials will be transported to the Mill in *exclusive-use* trucks with *lined, covered* aluminum end-dump trailers as "strong, tight packages" as required by DOT regulations. Each transport trailer will be lined with a pre-fitted, durable, 6-millimeter *liner* to contain potential liquid and dust, and all "free liquid" will be decanted from the Molycorp material before loading at the Molycorp site. *See* Molycorp EA at 4. The Molycorp material will be enclosed and sealed within these liners in a "*burrito-wrap*" configuration fully containing all materials, and an 18-ounce vinyl tarpaulin will protect the "burrito-wrapped" materials from precipitation. *Id.* Preventative maintenance will be performed on each of the transport trailers and an inspection checklist will be followed, including visual inspection of all transport equipment in accordance with DOT regulations and a preliminary check for DOT compliance before any loading takes place. *Id.* These preventative measures led Dr. Chambers to conclude that:

> "there is no *significant* risk of exposure to the public from inhalation or ingestion....Therefore, there is virtually no potential for fugitive dust, and any radon or thoron gas that may escape from the containers would be *insignificant* compared to background for the area..."[118]

Chambers Affidavit at 6.

By following all applicable DOT regulations, IUSA and NRC Staff have properly evaluated the requirements for the safe and effective transport of the Molycorp material to the White Mesa Mill, and such transportation will not pose any *significant, incremental* threat to public health and safety or the environment from noise, increased

[118] Regarding the threat from radon or thoron gas during transport, Dr. Chambers also notes that "as discussed earlier, radon and thoron gas are only a potentially *significant* concern in confined areas." Chambers Affidavit at 6.

highway danger from collision or exposure or reduced community aesthetics.[119] Dr. Chambers also analyzed the potential for exposure to the Molycorp material while in transport and states, "[t]he material in the trucks will be shielded from persons on the street and there will be essentially no duration of exposure to external radiation..." *Id.* at 5-6. Thus, Dr. Chambers finds that, "there is no credible opportunity for significant or acute exposure to the public." *Id.* at 6.

In addition, both the Molycorp EA and Technical Evaluation Report ("TER") accompanying the Molycorp EA address the transportation of the Molycorp material through the City of Moab and to the White Mesa Mill, and these reports indicate that a FONSI was warranted.[120] This finding signifies that NRC Staff found that the transportation of the Molycorp material to the White Mesa Mill posed no *significant, incremental* threat to public health and safety and the environment.

c. Any Potential Spill of The Molycorp Material Poses No *Significant, Incremental* Threat

Regarding Petitioners' allegations of the potential radiological or *non*-radiological impacts that might be caused by an accidental spill of the Molycorp material during transport, Ms. Tischler performed an analysis of the potential effects from such a

[119] Regarding Petitioners' claims that airborne contamination in the form of dust will occur from the Molycorp material, Ms. Tischler has stated that "[i]t [Molycorp material] contains no particulate fines and will produce no dusts in transport." Tischler Affidavit at 2. In fact, the Presiding Officer, in the prior proceeding regarding IUSA's license amendment, addressed any concerns of exposure to dust by stating that truck traffic causing any of these effects were similar to previously licensed activities and no such transport of the Molycorp material would cause a *significant, incremental* threat of creating dust emissions. *See In the Matter of International Uranium* (USA) *Corp.* (White Mesa Mill), 53 N.R.C. 344, *15 (2001). In addition, as stated above, the Molycorp material is a moist sludge and poses less risk of airborne dust emissions than other previously licensed activities.

[120] *See* Molycorp EA at 4.

potential spill and the transportation plan implemented by Molycorp and its transportation contractor. Ms. Tischler states:

> "The worst-case spill scenario would involve the overturning and loss of the contents of one full truckload, or 23 tons, on the highway in or near Moab."

Tischler Affidavit at 10.

If such an accident were to occur involving the Molycorp material, Ms. Tischler states:

> "Because the Molycorp material is a moist solid with no free liquid, in the event of a truck spill, there would be a) no windborne dust, b) no emitted gases, and c) no free flow of liquid from the spill site. The worst-case scenario, the cleanup of 23 tons of soil-like solid, could be accomplished within several hours."

Id.

Based on this, Ms. Tischler concludes:

> "The potential spill of Molycorp material would not present any significantly different potential for closure of the highway than any other licensed alternate feed material. For that matter, the potential for closure may be less than a spill of any chemicals or other goods that are transported along the Highway 191 corridor."

Id.

In addition, even if a spill were to occur, Dr. Chambers notes that any potential radiological exposure pathway to Petitioners from the Molycorp material would pose no significant risks. Dr. Chambers notes that the potential for exposure to gamma radiation from the Molycorp material "would be largely limited to the immediate area of the spill itself and would result in *insignificant* irradiation of bystanders." Chambers Affidavit at 6. According to Dr. Chambers, "[t]he gamma dose falls off rapidly with increasing distance from the spill," such that the "dose to a person standing at the edge of any such spill would be about ½ of that to a person standing at the center of the spill." *Id.* Moreover, as NRC has noted, "long and sustained exposure to radioactivity in the [entire

uranium] tailings pile would be required to produce any *significant* chance of adverse effect."[121] Thus, Dr. Chambers concludes:

> "Overall, the potential hazard to the public arising from the transportation of the Molycorp feed materials is *negligible* and in any event no different in nature or severity than for a spill of uranium-bearing materials which have been processed, or are approved for processing, *and which have already been transported to the Mill....*"[122]

Id. at 7.

Therefore, based on the relatively simple cleanup procedures[123] required to remediate a spill of the Molycorp pond material and the lack of an exposure pathway that would affect Petitioners in any significant way, no *significant*, *incremental* threat to public health and safety or the environment will occur as a result of transportation of the Molycorp material, including an accidental spill.[124]

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[121] Chambers Affidavit at 6, *quoting* GEIS at 1231.

[122] In fact, the "drummed" Molycorp material has already been shipped to the Mill without incident.

[123] Dr. Chambers notes that:

> "In the case of a spill or traffic accident, the clean-up procedures and precautions taken for the Molycorp materials would be virtually identical to the clean-up procedures for any other uranium-bearing feed ores of alternate feed materials authorized to be processed at the Mill."

Chambers Affidavit at 6.

[124] Further support for this conclusion is demonstrated by the facts and circumstances of the spill of alternate feed material being transported to the Mill which occurred on September 29, 1999 at the Cisco, Utah railhead site, approximately sixty (60) miles from Moab. MHF Logistical Solutions, Inc., the transportation contractor at the time, and the hazardous materials clean-up specialist, Wastren Remediation, Inc., cleaned the entire area of all residual material and containerized such material within eight-and-one-half (8 1/2) hours of the spill. Wastren Remediation, Inc. conducted radiological surveys after clean-up was completed and IUSA conducted further post-clean-up verification surveys to assure that no residual material remained. IUSA's surveys yielded results demonstrating that no residual material remained.

d. The City of Moab is Properly Equipped to Respond to a Potential Spill of the Molycorp Material

Petitioner's allegations that the City of Moab is ill-equipped to adequately respond to a potential spill of the Molycorp material because it lacks an "emergency response plan" is without merit and incorrect. First, as stated above, the transportation contractor is primarily responsible for the ultimate remediation of a spill of alternate feed material that occurs during transport. These transportation contractors are equipped with fully trained emergency response personnel capable of remediating a spill of radioactive or hazardous material within a short period of time and without leaving residual radioactive or hazardous material at a spill site.

Second, contrary to the specific assertions of Mr. Love, the City of Moab is well-prepared to respond to an accidental spill of the Molycorp material or, for that matter, any other alternate feed material that passes through the city. According to Mr. Doug Squire, Chief Deputy of the Office of the Grand County Sheriff and the Grand County Emergency Manager, Grand County is prepared to address a potential spill of the Molycorp material for the following reasons:

> "1. The Grand County Emergency Response personnel are familiar with the characteristics of the Molycorp material and all other alternate feed that have been sent to the White Mesa Mill;
> 2. The Grand County Emergency Response personnel are comfortable with the emergency response plans of the transportation sub-contractors; in particular the spill response contingency plans;
> 3. The Grand County Emergency Response personnel are satisfied that the Emergency Response Plans of the transportation sub-contractors combined with our own emergency response capabilities are sufficient to respond to any emergency that may occur that involves a shipment of alternate feed to the White Mesa Mill;
> 4. Alternate feed materials are less dangerous than many other materials shipped along Hwy 191 and through Grand County."

See Letter to Ron Hochstein, President IUSA, from Doug Squire, Grand County Emergency Manager (May 20, 2002).

Thus, the transportation contractor, with assistance of the Office of the Grand County Sheriff if necessary, is adequately prepared to protect Petitioners from any potential effects from an accidental spill of the Molycorp material within the City of Moab's or Grand County's boundaries.[125]

VII. PETITIONER'S CLAIMS REGARDING THE NATIONAL ENVIRONMENTAL POLICY ACT AND 10 C.F.R. PART 51

Since Petitioners also raise general claims based on the requirements of the National Environmental Policy Act of 1969[126] ("NEPA" or the "Act"), a brief review of NEPA and NRC's implementing regulations is necessary to properly analyze these claims, which are without merit.

1. NEPA Overview

The Council on Environmental Quality's ("CEQ's") regulations state, "[NEPA] is our basic national charter for protection of the environment."[127] Section 101 of NEPA "declares a broad national commitment to protecting and promoting environmental quality,"[128] and sets forth the Act's basic "substantive goals for the Nation,"[129] that the federal government should "use all practicable means and measures" to protect environmental values."[130] Section 101(b) of the Act provides that "it is the continuing responsibility of the federal government to use all practicable means, consistent with

[125] Even if Petitioners could show that the City of Moab is ill-equipped to address a potential spill of the Molycorp material, as noted above, the remediation measures that must be initiated when a spill occurs are relatively simple, are no different than for other previously licensed feed materials transported through Moab, and can be initiated and fully completed with a brief period of time.
[126] 42 U.S.C. §§ 4321 *et seq.*
[127] 40 C.F.R. § 1500.1.
[128] *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 519, 558 (1978).
[129] *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519, 558 (1978).
[130] 42 U.S.C. § 4331(a).

other essential considerations of national policy" to, *inter alia*, avoid environmental degradation, "attain the widest range of beneficial uses of the environment without degradation...or other undesirable and unintended consequences," and "preserve important historic, cultural, and natural aspects of our national heritage."[131]

To meet the goals set forth in section 101, section 102 of the Act includes "action-forcing" procedures.[132] Section 102 mandates that "to the fullest extent possible" all federal agencies shall "utilize a systematic, interdisciplinary approach...in planning and in decision making which may have an impact on man's environment."[133] Section 102 requires that environmental considerations are a part of agency decision making by instructing agencies to "identify and develop methods and procedures...which will ensure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations."[134]

Pursuant to section 102(2)(C) of NEPA and the NRC regulations implementing the Act, NRC Staff must prepare an environmental impact statement ("EIS") addressing any major action taken by the Commission that may *significant*ly affect the quality of the human environment.[135] The Commission's regulations in 10 C.F.R. Part 51 implement NEPA "in connection with the Commission's licensing and regulatory activities."[136]

The regulations state that the "principal objective of [NEPA] is to build into the agency decision-making process an appropriate and careful consideration of

[131] 42 U.S.C. § 4331(b).
[132] *See Calvert Cliffs' Coordinating Committee v. AEC*, 449 F.2d 1109, 1113 & n. 7 (D.C. Cir. 1971).
[133] 42 U.S.C. § 4332(2)(A).
[134] 42 U.S.C. § 4332(2)(B).
[135] 42 U.S.C. § 4332(2)(C); 10 C.F.R. Part 51.
[136] 10 C.F.R. § 51.1(b).

environmental aspects of proposed actions."[137] Moreover, the regulations specify "types of actions that require either an environmental impact statement, a negative declaration supported by an environmental impact appraisal, or no environmental analysis at all."[138] Neither NEPA nor the NRC regulations require NRC Staff to prepare an EIS if the federal action's effect on the environment is not "*significant*."[139] If, however, the proposed action has a *significant* effect, then there must be a "detailed statement by the responsible party on—

> (i) the environmental impact of the proposed action,
> (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
> (iii) alternatives to the proposed action,
> (iv) the relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity, and
> (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."[140]

If a "detailed statement" setting forth this information is required, NRC's regulations provide that the NRC Staff must prepare and circulate a draft environmental impact statement ("DEIS"), followed by the publication of a final environmental impact statement ("FEIS").[141]

When issuing a source material license pursuant to the Commission's regulations set forth at 10 C.F.R. Part 40, Part 51 and NEPA requirements must be satisfied.[142] Part 51 has been incorporated into 10 C.F.R. § 40.32 of the Commission's regulations which states that an "application for a specific license will be granted if…:

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[137] 10 C.F.R. § 51.1(a).
[138] *See In the Matters of Duke Power Co.*, 12 N.R.C. 459, 1980 N.R.C. LEXIS 24, *21 (1980), *citing*, 10 C.F.R. § 51.5.
[139] *Id.*
[140] *Id.* at *23-24.
[141] *See* 10 C.F.R. §§ 51.70-51.73, 51.80-51.81 (incorporating 51.74), & 51.97; *see also In the Matter of Duke Power Co.*, 1980 N.R.C. LEXIS at *22.
[142] *See* 10 C.F.R. § 51.21(b)(8).

> "(e) In the case of an application ...for a license to possess and use source and byproduct material for uranium milling...the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to subpart A of part 51 of this chapter, has concluded, after weighing the environmental, economic, technical and other benefits against the environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values."[143]

Thus, in order to issue a source material license, NRC Staff must weigh the environmental, economic, technical and other benefits of issuing the license against the environmental costs and consider available alternatives based on information and evaluations made pursuant to subpart A of Part 51. NRC Staff may issue the license "with any appropriate conditions to protect environmental values."[144] The Staff's determinations with respect to environmental concerns are based in part upon an environmental report ("ER") which must be prepared by applicants for a materials license. However, as stated in NRC's NUREG-1748 entitled *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, "[i]nformation may also be submitted as part of the license application or amendment request, without an ER. NUREG-1748 at 16.

2. The Influence of NEPA on NRC Regulations

In the NEPA context, it is well-settled that NRC, as an independent regulatory agency, is not bound by the CEQ's NEPA regulations to the same extent as other federal administrative agencies. Indeed, the Commission has stated:

> "as a matter of law, the NRC as an independent regulatory agency can be bound by CEQ's [Council on Environmental Quality's] regulations only so far as those regulations are procedural or ministerial in nature.

[143] 10 C.F.R. § 40.32.
[144] *Id.*

> NRC *is not bound* by those portions of CEQ's regulations which have a substantive impact on the way in which the Commission performs its regulatory functions."

49 Fed. Reg. 9352 (March 12, 1984) (emphasis added).

Regarding the NEPA analysis required for NRC licensing activities, "the Commission's general approach to the consideration of alternatives from the standpoint of NEPA is closely tailored to the nature and scope of the Commission's licensing and related regulatory functions…" *See* 49 Fed. Reg. at 9356 (March 12, 1984). With this in mind, courts have frequently agreed that "the nature and form of environmental analysis required in any given case are matters left to the discretion of the agency involved." *Id.* The given complexities involved in conducting the types of environmental analysis used by agencies like NRC…, the judgment of the NRC as the agency with the requisite technical expertise should govern." *Id.* The Commission, therefore, has made it clear that NRC will determine the proper approach to NEPA evaluations for NRC regulatory actions such as granting the Molycorp license amendment.

In the broadest sense, NRC began its NEPA analysis of uranium mills and mill tailings impoundments in 1980 with the GEIS. As noted above, the GEIS provided a generic assessment of potential environmental and public health issues involving potential radiological and *non-radiological* hazards associated with uranium mills during operations, mill decommissioning, and after site closure. The GEIS, however, specifically indicated that evaluations for activities at any given mill site could require site-specific analysis.

As a result, NRC Staff has conducted several NEPA analyses for the White Mesa Mill including the 1979 Environmental Statement, subsequent EAs in 1985 and 1997,[145] and the current EA specifically addressing the receipt, processing, and disposal of the Molycorp material. NRC Staff's EA for the Molycorp license amendment yielded a FONSI, thus demonstrating that *no significant impacts* to public health and safety and the environment would occur as a result of the Molycorp license amendment. Therefore, NRC Staff, generally and specifically, has conducted the required NEPA analysis to support the Molycorp license amendment. Indeed, by issuing a FONSI, NRC Staff has also found that there are no *disparate impact* issues associated with the Molycorp license amendment.[146]

3. NEPA and NRC Materials License Amendment Proceedings

NEPA requirements apply to license application proceedings as well as license amendment proceedings. In the case of a license amendment to an already-existing source material license, NEPA imposes procedural rather than substantive constraints upon an agency's decision-making process. The statute only requires that an agency undertake an appropriate assessment of the environmental impacts of its action without mandating that the agency reach any particular result concerning that action. *See, e.g., Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989); *Babcock & Wilcox* (Apollo, Pennsylvania Fuel Fabrication Facility), LBP-93-4, 37 N.R.C. 72, 93

[145] It is important to note that at the time NRC performed its EA in 1997 for renewal of the Mill's operating license, the Mill had processed and received license amendments for a number of alternate feed materials. Therefore, when evaluating the Mill's license renewal in 1997, NRC was fully aware of the Mill's alternate feed program.

[146] Under most circumstances, no environmental justice review should be conducted where an EA is prepared. If it is determined that particular action will have no *significant* environmental impact, then there is no need to consider whether the action will have disproportionately high and adverse impacts on certain populations. *See* NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*.

(1993). NEPA does not establish minimal environmental standards; the environmental review mandated entails a balancing of costs and benefits rather than a measuring against absolute environmental standards. *See Public Service Co. of New Hampshire* (Seabrook Station, Units 1 and 2), ALAB-422, 6 N.R.C. 33, 43 (1977).

In license amendment proceedings, a Licensing Board should not embark broadly upon a fresh assessment of the environmental issues which have already been thoroughly considered and which were decided in the initial licensing decision. Rather, the Licensing Board's role, with respect to EAs for license amendments, is limited to assuring itself that the ultimate NEPA conclusions reached in the initial licensing decision are not *significant*ly affected by the proposed new developments. *Detroit Edison Co.* (Enrico Fermi Atomic Power Plant, Unit 2), LBP-78-11, 7 N.R.C. 381, 393 (1978), *citing Georgia Power Co.* (Alvin W. Vogtle Nuclear Plant, Units 1 & 2), ALAB-291, 2 N.R.C. 404, 415 (1975).

Regarding the requirement for preparation of an EIS, Federal agencies are required to prepare an EIS for every *major* Federal Action significantly affecting the quality of the human environment. *See* 42 U.S.C. § 4332(2)(c) (emphasis added). NRC Staff is not required to prepare an EIS if, after performing an initial environmental assessment, it determines that the proposed action will have no *significant* environmental impact. *Virginia Electric and Power Co.* (North Anna Power Station, Units 1 & 2), ALAB-790, 20 N.R.C. 1450, 1452, n. 5 (1984). No study of alternatives is needed under NEPA unless the action *significant*ly affects the environment or involves an unresolved conflict in the use of resources. Where an action will have little environmental effect, an alternative could not be materially advantageous. *Virginia Electric and Power Co.* (North Anna Power Station, Units 1 & 2), LBP-85-34, 22 N.R.C. 481, 491 (1985).

In NRC's NUREG-1748 addressing licensing actions, an EA is conducted to provide sufficient information so that NRC Staff may determine whether to perform an EIS or issue a FONSI.[147] If NRC Staff determines that the proposed licensing action will not cause any *significant* impacts, then a draft or final FONSI is prepared and no EIS is required *See* 10 C.F.R. § 51.32-51.35; *see also* NUREG-1748 at 17, 20. In this proceeding, NRC Staff performed an EA for IUSA's license amendment and a final FONSI was issued.[148] The issuance of a FONSI demonstrates that NRC Staff found no need to conduct an EIS to assess the environmental impacts of the receipt and processing of the Molycorp material at the Mill.

4. NRC Staff's Decision Not to Perform an EIS Was Proper and a Finding of No *Significant* Impact Was Warranted

Petitioners' allege that NRC Staff did not have adequate information to conclude that no EIS was needed and a FONSI was warranted. This allegation is without merit because IUSA and NRC Staff correctly followed all regulations applicable to NRC license amendments and environmental reviews.

Prior to submitting its Molycorp license amendment application, IUSA personnel performed detailed analysis of *all* parameters necessary to present adequate information to NRC Staff for evaluation. It is standard practice for IUSA to perform an analysis of the chemical and radiological components of a proposed alternate feed material and such analyses were performed for IUSA on the Molycorp material.[149]

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[147] NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, Draft Report for Interim Use and Comment, at 17, 20 (September 2001).
[148] 66 Fed. Reg. 64064 (December 11, 2001).
[149] As noted by Ms. Tischler, "I regularly review alternate feed materials for International Uranium (USA) Corporation…to determine whether such feeds are appropriate for processing…" Tischler Affidavit at 1.

When IUSA submitted its Molycorp license amendment application to NRC, NRC Staff became the "action" group responsible for evaluation of IUSA's submission. NRC Staff has engaged in the practice of evaluating countless materials license and license amendment applications since NRC's inception and has the necessary expertise to exercise its professional judgment in this context.[150]

Obtaining a license amendment from NRC is an "iterative" process beginning with a determination by NRC Staff that an application is substantially complete. In order to make this determination, within 30 days NRC Staff performs an "acceptance review" to satisfy itself that, given its knowledge about the site and the issues associated with the proposed license amendment, sufficient information has been provided for NRC Staff to *commence* its full-scale review. It is not necessary for a licensee to provide NRC Staff with information which NRC Staff already possesses and, more specifically, there is no need to provide NRC Staff with all the information a lay person would require to understand the license amendment application.[151]

Frequently, NRC Staff will request further information from the licensee. This is accomplished through a Request for Further Information ("RFI") or a Request for Additional Information ("RAI") to the extent such additional information from the licensee is necessary.[152] In addition to evaluating the data submitted by the licensee, it is NRC Staff's responsibility to insure that any alternate feed proposal meets NRC's AFG,

[150] As discussed above, any NEPA action performed by NRC Staff must be considered as having been performed in the context of the generic assessments performed by EPA (FEIS) and NRC (GEIS) in the 1980s.

[151] Under NRC regulations, NRC Staff may incorporate information contained in previous applications by reference. *See* 10 C.F.R. § 40.31(a).

[152] The licensee is also free to submit additional material to NRC Staff on its own initiative if it sees fit. In the case of the Molycorp material, IUSA submitted additional information to NRC Staff regarding the drummed Molycorp material including chemical analyses. *See* 10 C.F.R. § 2.102(a).

which has been the subject of public comment proceedings, Commission Staff Requirements Memorandum ("SRM"), and a Commission decision in the IUSA/Utah litigation.[153] As detailed in NRC Staff's EA and TER, IUSA's proposed Molycorp license amendment fulfilled each requirement under the AFG and, as such, was determined to be an appropriate alternate feed.

Regarding the potential environmental impacts of IUSA's proposed Molycorp license amendment, NRC Staff performed the necessary EA and found that no *significant* impacts would be caused by granting the license amendment. Under 10 C.F.R. Part 50, an EA "shall identify the proposed action and include:

> (1) A brief discussion of:
> (i) The need for the proposed action;
> (ii) Alternatives as required by section 102(2)(E) of NEPA;
> (iii) The environmental impacts of the proposed action and alternatives as appropriate: and
> (2) A list of agencies and persons consulted, and identification of sources used.

10 C.F.R. § 51.30.

In addition to these requirements, the Commission may issue a FONSI with the EA.

When the Commission issues a FONSI, the notice must:

> (1) Identify the proposed action;
> (2) State that the Commission has determined not to prepare an environmental impact statement for the proposed action;
> (3) Briefly present the reasons why the proposed action will not have a *significant* effect on the quality of the human environment;
> (4) Include the environmental assessment or a summary of the environmental assessment...
> (5) Note any other related environmental documents; and

[153] Petitioners have levied allegations that NRC's AFG is inconsistent with the provisions of the AEA, as amended by UMTRCA. As stated in Section III, NRC's Guidance and its subsequent revisions have been subject to public comment proceedings, published as Commission policy and, implicitly, if not explicitly, reaffirmed in the Commission's IUSA/Utah decision noted above, including the definition of ore. As such, Petitioners' challenges are not within the scope of this proceeding.

(6) State that the finding and any related environmental documents are available for public inspection and where the documents may be inspected.

10 C.F.R. § 51.32

Each of these requirements were fulfilled by NRC Staff in its EA and TER and, as such, NRC Staff considered the potential environmental effects of IUSA's proposed Molycorp license amendment and properly issued a FONSI.

NRC Staff provided the public with notice that the EA and TER for IUSA's proposed Molycorp license amendment had been prepared and would be available for inspection on December 11, 2001.[154],[155] The EA itself is composed of several sections of discussion providing insight into NRC Staff's decision-making process regarding IUSA's license amendment. More specifically, these discussion sections comply directly with the regulatory provisions of 10 C.F.R. § 51.30 in the following manner. EA section 1.1 entitled *Background and Need for the Proposed Action* directly complies with section 51.30(a)(1)(i) of the regulations requiring a brief discussion of the need for the proposed action. *Compare* 10 C.F.R. § 51.30(a)(1)(i). EA section 5.0 entitled *Alternatives* directly complies with section 51.30(a)(1)(ii) of the regulations requiring a brief discussion of alternatives to the proposed action as required by NEPA. *Compare* 10 C.F.R. § 51.30(a)(1)(ii). Finally, EA sections 4.0 and 7.0 entitled *Environmental Effects* and *State Consultation* respectively directly address the requirement in sections 51.30(a)(1)(iii) & (a)(2) of the regulations requiring a brief discussion of environmental impacts and a list

[154] *See* 66 Fed. Reg. 64064 (December 11, 2001).

[155] As stated in 10 C.F.R. § 51.33, "the appropriate NRC Staff director *may* make a determination to prepare and issue a draft finding of no significant impact [FONSI] for public review and comment before making a final determination whether to prepare an environmental impact statement [EIS] or a final finding of no significant impact [FONSI]." *See generally* 10 C.F.R. § 51.33. In the case of the Molycorp license amendment, NRC Staff chose to issue a *final* FONSI and not a *draft* FONSI.

of agencies that were consulted during the EA process. *Compare* 10 C.F.R. §§ 51.30(a)(1)(iii) & (a)(2).

When issuing its FONSI for IUSA's license amendment, NRC Staff also complied with 10 C.F.R. § 51.32. EA section 1.3 entitled *Proposed Action* complies with section 51.32(a)(1) which requires a statement of the proposed action. *Compare* 10 C.F.R. § 51.32(a)(1). NRC Staff's decision not to prepare an EIS is detailed in its decision to issue a FONSI, which, by its very nature, implies that an EIS is not warranted. *Compare* 10 C.F.R. § 51.32(a)(2). Section 51.32(a)(3)'s requirement that a brief discussion of the reasons for the lack of any *significant* environmental impacts is met by section 4.0 of the EA entitled *Environmental Effects*. Finally, each of these regulatory provisions is fulfilled by the December 11, 2001 Federal Register notice, including notice to the public of the location of relevant documents for public inspection. *See* 10 C.F.R. §§ 51.32(a)(4) & (5). Therefore, as shown above, NRC Staff fulfilled each of the regulatory requirements for performance of an EA and, contrary to Petitioners' assertions, was not in error when it issued a FONSI and granted IUSA's license amendment.[156]

Furthermore, NRC Staff did not require additional information to properly conduct its review of IUSA's license amendment. For example, regarding Petitioners' claim that more information on the "drummed" Molycrop material was required, Ms. Tischler states:

> "Although Molycorp is a controlled site where the source of every single drum is known, their sampling program met and exceeded

[156] In fact, even if NRC Staff did make a procedural mistake in its evaluation of IUSA's license amendment application, as stated above, a license amendment is not to be denied simply on the basis of a deficiency or omission in the application. *See In the Matter of the Curators of the University of Missouri*, 41 N.R.C. 71, 1995 N.R.C. LEXIS 21, *43 (1995).

USEPA's acceptable sample frequency from unknown drum contents. Sampling and analysis of only four drums would have been acceptable; Molycorp's sampling and analysis of six drums was more conservative than standard environmental practice."

Tischler Affidavit at 12.

In addition, with respect to Petitioners' claim that more information on the potential for *lead* airborne dust should have been provided, Ms. Tischler states:

> "Specifically, the Sierra Club's assertion that IUSA's amendment application was incomplete...is incorrect....there is no mechanism for the generation of airborne *lead* dust...during material shipping, ore pad storage, processing, or disposal in the tailings cells."

Id. at 2.

Thus, the information presented to NRC Staff by IUSA was sufficient and Petitioners' claim that the information was inadequate is without merit.

5. The Drummed Molycorp Material is Similar to the Molycorp Pond Material and Did Not Require a Separate Environmental Assessment

Petitioners allege that NRC Staff and IUSA did not provide the proper information necessary for an assessment of the physical, chemical, and radiological properties of the drummed Molycorp material. In essence, Petitioners claim, contrary to the findings of NRC Staff, that the drummed Molycorp material is not similar to the Molycorp pond material and, therefore, required a separate EA. This allegation is without merit because NRC Staff's conclusion that the drummed and the Molycorp pond material are similar was correct

According to the chemical analysis conducted by Ms. Tischler, prior to the submission of IUSA's license amendment application to NRC:

"The Molycorp drummed material originated from the same process source as the pond material, and had generally the *same* levels of thirteen metals as the pond material..."

Tischler Affidavit at 11.

Both the pond and the drummed Molycorp material contain the same levels of thirteen metals and, when describing any differences between the two sets of material, Ms. Tischler states:

"The drummed material is a) lower in radionuclide content, b) is lower in barium and *lead* content, and c) consists of a substantially lower volume of material. The drums had somewhat higher levels of ...copper and zinc, which are known to be present in uranium ores *(at levels greater than in the Molycorp drums)* and in uranium mill tailings."

Id.

Though there are some differences between the "ponded" and "drummed" Molycorp material, these differences are insignificant. As Ms. Tischler states, "[f]rom the environmental standpoint, the drummed material characteristics represent a *lower* potential environmental and/or safety impact than the pond contents." *Id.* Thus, the conclusions by IUSA in its license amendment application and NRC Staff in its EA and TER that the "drummed" Molycorp material was *similar* to the "ponded" Molycorp material and, therefore, required no separate environmental assessment, were correct and in the best interests of protecting public health and safety and the environment.[157]

[157] Ms. Tischler also notes that, "IUSA's letter to NRC of October 17, 2001, by treating the drummed material as "similar" to the pond contents, was, therefore, conservative. Tischler Affidavit at 11.

VIII. CONCLUSION

Petitioners have, by their constant attempts to expand the focus of this proceeding, forced IUSA into an expensive and time-consuming effort to defend a license amendment to process an alternate feed material which is unremarkable in all respects except that it contains only elevated concentrations of lead, which do not pose any significant, incremental hazards. As indicated above, the *generic* assessments of uranium *and* thorium milling prepared by EPA and NRC explicitly contemplated that uranium mill tailings impoundments would contain, along with naturally occurring long-lived radionuclides, naturally occurring *non*-radiological (hazardous) constituents, primarily in the form of heavy metals such as lead, as well as *potentially* toxic and corrosive chemicals (*e.g.*, sulfuric acid). UMTRCA mandated, and EPA and NRC promulgated, regulatory programs specifically designed to provide adequate controls to protect public health, safety and the environment against *any* potentially *significant* hazards associated with processing such materials and managing the wastes generated thereby.

IUSA's Molycorp license amendment satisfies all of the requirements in NRC's AFG, including the Criteria set forth in 10 C.F.R. Part 40, Appendix A. The Mill has over twenty years of operating experience and operating history with processing conventional ores and alternate feeds. During this time-frame, there has never been any indication of any potentially adverse off-site impacts from Mill operations. Nevertheless, IUSA has been forced to defend NRC's Appendix A regulatory program, its pre-existing licensed facilities at the Mill and its justification for the proposed Molycorp amendment in response to allegations which amount to little more than baseless speculation. Petitioners' assault on the Mill, EPA's and NRC's regulatory program is improper and

unsupported. The overwhelming weight of the evidence in this proceeding mandates a dismissal of Petitioners' challenge of IUSA's Molycorp license amendment.

For the aforementioned reasons, IUSA respectfully requests that the Presiding Officer deny Petitioners' request for the suspension, revocation or alteration of IUSA's license amendment.

Respectfully submitted,

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COUNSEL TO INTERNATIONAL
URANIUM (USA) CORPORATION

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

Alan S. Rosenthal, Presiding Officer
Dr. Richard F. Cole, Special Assistant

IN THE MATTER OF:	)
	) Docket No: 40-8681-MLA-11
INTERNATIONAL URANIUM (USA)	)
CORPORATION	) ASLBP No. 01-789-01-MLA
	)
(Source Material License Amendment)	) DATE: MAY 20, 2002
	)

CERTIFICATE OF SERVICE

I hereby certify that true and complete copies of the foregoing Response of International Uranium (USA) Corporation's Written Presentation of Mr. William E. Love and the Glen Canyon Group of the Sierra Club in the above-captioned matter has been served upon the following by electronic mail (as indicated by an asterisk (*)) and by first class mail, postage prepaid, on this 20th day of May, 2002.

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AFFIDAVIT OF JO ANN S. TISCHLER

I, Jo Ann S. Tischler am a chemical engineer who has performed process engineering design, hazardous waste status evaluations, and waste management planning under the regulatory frameworks of 28 states and six foreign countries. A copy of my current curriculum vitae is attached as Attachment 1 hereto.

I received a Bachelor of Science degree in chemical engineering from New Jersey Institute of Technology in 1977. I completed the coursework towards a Master's Degree in chemical engineering at Louisiana State University. I have more than 25 years of experience in synthetic organic chemical, petrochemical, and petroleum refinery operations. I have served for 10 years as Senior Process and Environmental Engineer for BASF Corporation Chemicals Division, during which I was responsible for management of waste emission to all environmental media including solid waste disposal, surface water discharges, air emissions, and deep well injection operations for the Polymers Division and Colors Division. I have also served for over 14 years as environmental and hazardous waste consultant to major organizations within the chemical industry, including Du Pont de Nemours, Dow Chemical USA, Petroquimica Argentina, Imperial Chemical Industries Ltd., and Norinco Chemicals of China; and the mineral processing industry, including Diamond Shamrock Inc., Stauffer Chemical/Rhone Poulenc, and Schuylkill Metals, Inc.

I have been selected as project manager and RCRA regulatory expert for major projects for the U.S. Department of Energy, the U.S. Department of Defense, the U.S. Department of the Interior, and the U.S. Environmental Protection Agency ("USEPA") (Region 8).

I have also been responsible for assessment of environmental impacts from processing radioactive materials or wastes at a number of waste management and remediation sites including the Rocky Flats Environmental Technology Site in USEPA Region 8, and the Richland, Washington Hanford Nuclear Reserve in USEPA Region 9.

I have served as process engineer responsible for assessing and managing the potential air, soil, and groundwater environmental impacts of surface impoundments containing mixtures of organic and inorganic wastes at numerous facilities including the Rocky Mountain Arsenal in Colorado, the Denver Metro Wastewater Reclamation District, the former Stauffer Wyoming Soda Ash mine and mill, the BASF Corporation Electrolytics (Inorganics) Division, the Champion Libby Montana Superfund Site, and several Southern Pacific Railroad California yards.

As an independent consultant, I regularly review alternate feed materials for International Uranium (USA) Corporation ("IUSA") to determine whether such feeds are appropriate for processing at the White Mesa Mill (the "Mill") at Blanding, Utah. In performing these analyses, I routinely evaluate the chemical composition and radiological properties of the proposed alternate feed material, its source, production, and storage history, its similarity to or differences from other alternate feeds, its compatibility with Mill process

chemistry and tailings chemistry, the regulatory history of the material and the facility where it was generated.

1. Description of Molycorp Materials and Reviews Completed

During the period from January 2000 to December 2001, I was retained by IUSA as an independent consultant to evaluate chemical analytical data and process history information for pond materials and drum contents at the Molycorp Mountain Pass Facility ("Molycorp"), which Molycorp proposed to ship to the Mill. In addition to analytical data and process history, this evaluation included review of Molycorp waste material characterization reports, and site remediation documents associated with the ponds and drums; telephone contacts and interviews with Molycorp site personnel to discuss source and nature of the material, and excavation and handling plans; and telephone contacts with personnel at the Mill to discuss the Mill's proposed handling, processing and disposal procedures for this material, and compatibility of the proposed material with the Mill's processing chemicals, operating conditions, and tailings components.

The Molycorp pond and drummed material contains no volatile or unstable chemical components; that is, it will generate no hazardous vapors in shipment. It contains no particulate fines and will produce no dusts in transport. The material, as shipped, will contain no free liquids and, therefore, cannot leak or flow out of its transport containers. Both the truck shipments of pond material and the single shipment of drums will use closed, sealed containers, and will produce neither noxious nor nuisance odors.

At the Mill site, the drummed material will remain in its containers until it is introduced directly into the Mill circuit. The pond material will be stored in bulk piles on a bermed, concrete-lined portion of the Mill's ore pad, and will have no direct contact with Mill yard soils. Prior to processing in the Mill, storage piles will be inspected and, if necessary, kept moist by water sprays, so the piles will not generate windborne dust. Once introduced into the Mill's leaching circuit, an acidic solution will be added and the material will be processed as an aqueous stream, so there is no opportunity for generation of airborne lead dust anywhere in the Mill process. The tailings solutions consist of an aqueous acidic liquid phase above a sub-layer of aqueous tailings solids (or wet sands). There is similarly no opportunity for generation of dry lead dust in the tailings impoundments.

As described in Item 6, below, standing liquid phases in the Molycorp ponds, and free liquid drained from the excavated solid phase material will not be shipped to IUSA.

Specifically, the Sierra Club's assertion that IUSA's amendment application was incomplete because it "failed to provide accurate information with respect to hazards related to exposure to lead airborne dust" is incorrect. As explained above, there is no mechanism for the generation of airborne lead dust (and hence no lead respiratory hazard) during material shipping, ore pad storage, processing, or disposal in the tailings cells.

2. <u>The Molycorp Material Would Introduce No New Compounds to the Mill Circuit or Tailings</u>

The Mill's tailings cells are already known to consist of a broad range of organic and inorganic constituents from two primary sources: 1) tailings from the natural uranium ores processed to date – primarily Colorado Plateau and Arizona Strip ores, and 2) tailings from the alternate feed materials processed to date.

As indicated in the literature (See Attachment 2, Columns 1 through 3, and 5), it is commonly known that Colorado Plateau and Arizona Strip uranium ores contain, in varying concentrations depending on the source and ore body, all of the following metals, ions, or compounds: antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, iron hydroxides, lanthanum, lead, lead sulfide, mercury, molybdenum, selenium, silver, thorium-230, and vanadium.

Commercially- and federally-sponsored analytical studies of mill tailings from processing of Colorado Plateau and Arizona Strip ores (Attachment 2, Columns 4, 5, 8, and 9), as well as IUSA analyses of tailings cell solutions at the Mill (Attachment 2, Columns 6 and 7), indicate that in addition to tailings constituents deriving from the ore feedstocks, uranium tailings are also known to contain carbon disulfide, chloride, fluoride, phosphorus, lead sulfate, and substantial levels of other sulfates.

With the exception of lanthanum oxide, every one of the components reported by Molycorp in the Radioactive Material Profile Record and characterization data for the pond and drummed materials have already been identified in reported analytical data for ores processed at the Mill or their resulting tailings. Although lanthanum oxide has not been explicitly analyzed in regional ores or tailings, lanthanum was analyzed and reported to be present in ores (Attachment 2, Column 2). Because lanthanum oxidizes so readily in ambient air, lanthanum in natural ores in reduced form would have been converted to lanthanum oxides while stored in open piles, which are exposed to air on the Mill ore pad prior to processing. That is, it would be in the same form Molycorp reported to be present in their ponds, albeit at lower levels.

Based on the known information for regional uranium ores, uranium mill tailings, and the Molycorp material analysis, processing of Molycorp material would introduce no new compounds to the Mill process circuit or tailings system.

Specifically, Mr. William Love's assertion that the nine alternate feed materials listed on IUSA's website, which have been previously processed at the Mill, are completely different from the Molycorp material, and that the Molycorp material is unique in containing lead sulfides, lead oxides, copper, barium, and thorium is incorrect. First, as explained below, the Molycorp material has not at any time contained lead oxides. Mr. Love's inclusion of Material Safety Data Sheets ("MSDSs") for lead oxides is inappropriate. The oxidized layer(s) of pond contents contain lead sulfate, and not lead oxides.

Second, Mr. Love apparently misunderstood the nature of the information located on the website. The information provided therein is a description of each alternate feed materials project, but does not represent the actual chemical composition of any of the alternate feeds. Data on the chemical composition of each alternate feed is available in IUSA's Nuclear Regulatory Commission ("NRC") license amendment application for each respective alternate feed, which documents are public record. A review of those documents would demonstrate that lead compounds, copper, barium and thorium are present in one or more of these alternate feeds, and have already been processed at the Mill with no significant incremental environmental, worker safety, or process impacts.

Mr. Love's assertion that the Molycorp material contains new constituents whose compatibility with the Mill process and the Mill tailings has not been evaluated or understood is incorrect. As discussed above, every constituent in the Molycorp material has been demonstrated to be present in natural ores or IUSA's previous alternate feeds, and is already present in the Mill's tailings from either or both of those sources.

Mr. Love's further assertion that Molycorp processed the bastnasite ores by the "addition of concentrated hydrochloric acid and lead" is inaccurate. Lead was not added to the ore in the Molycorp process. Lead was naturally present in the bastnasite ores (as it is in uranium ores) as lead sulfide (the galena mineral form) and was precipitated and removed as an impurity from the lanthanide product, resulting in its concentration in the lead sulfide ponds.

3. <u>The Concentration of Lead in the Molycorp Material</u>

The Molycorp pond material has been estimated to contain an average lead content of 132,000 ppm (13.2 weight percent) with a range of lead concentrations in the characterization samples from a minimum of 2,213 ppm (0.2 weight percent) to a maximum of 262,410 ppm (26.2 weight percent) of lead. The Molycorp drummed material has been estimated to contain an average of 52,600 ppm (5.3 weight percent) of lead with a range of lead concentrations from a minimum of 15,800 ppm (1.5 weight percent) to a maximum of 73,400 ppm (7.3 weight percent). Based on the anticipated likely scenario (7,750 tons) and maximum scenario (17,750 tons) of pond material to be shipped to the Mill, processing of the Molycorp material could introduce from 1,023 to 2,343 tons of additional lead into the Mill's tailings system.

However, as discussed above, natural ores and other alternate feeds processed at the Mill, and the tailings resulting from them are also known to contain significant levels of lead. Attachment 3 summarizes the quantity of lead introduced into the tailings from the total mass of natural ores and alternate feeds processed to date. The most significant source of lead introduced into the tailings system is from processing of natural ores from mines in the Arizona Strip. These ores have an estimated average lead concentration of 860 ppm (0.086 weight percent). Alternate feeds already processed at the Mill also contain elevated levels of lead. Ashland 1 alternate feed material is known to contain lead levels from 24 ppm (0.002 weight percent) to 7,500 ppm (0.75 weight percent) with an overall average of 571 ppm (0.057 weight percent). Ashland 2 alternate feed material is known

to contain lead levels from 20 ppm (0.002 weight percent) to 354 ppm (0.03 weight percent) with an overall average of 100 ppm (0.01 weight percent). Attachment 2 shows that the tailings system already contains approximately 1,400 tons of lead, based on the average lead concentrations identified in conventional ores and alternate feeds. Based on a total existing tailings mass of approximately 4.2 million tons, the average concentration of lead is 332 ppm (0.033 weight percent). Of the average 332 ppm in the tailings system, approximately 17 ppm (17 mg/L) is in the tailings solutions, based on a sample taken in April 2002.

As stated earlier, Attachment 2 shows that the mass of lead that will be introduced with the Molycorp material varies from 1,023 to 2,343 tons, depending on the quantity of material shipped. This would result in an increase in average lead concentration in the tailings mass from 332 ppm (0.033 weight percent) to either 576 ppm (0.058 weight percent) or 889 ppm (0.089 weight percent) depending on the volume shipped. In either event this represents a very small percentage of the total tailings mass. While the average concentration in the entire tailings system increases, I agree with Roman Pyrih's conclusion that the amount of lead in solution will not increase appreciably above current levels due to solubility constraints.

4. <u>The Molycorp Materials Do Not Contain Lead Oxide</u>

The Molycorp pond material consists of precipitated, thickened, wet process solids that contain a variety of metal impurities including, originally, lead sulfide, which were removed from Molycorp's lanthanide products. The ponds, which were considered part of the processing system, were used for evaporation of water content and concentration of the solids for possible further recovery of lanthanides. In Molycorp's terminology, areas of the ponds that were exposed to air (such as the top surface material or "crust") are referred to as "oxidized." The term "oxidized", as used by Molycorp, does not signify that the lead content, or any other metal or cation, is present as an oxide. It refers simply to the materials in the pond that were exposed to air. These materials can be identified because they turned from black lead sulfide to orange lead sulfate. "Unoxidized" refers to materials below the pond surface, which were not continually exposed to air, and appear to be black. The Molycorp pond material to be shipped to IUSA has not contained at any time lead oxide(s). The ponds have no lead oxide crust. The visible crust is primarily lead sulfate, which is of lower toxicity and reactivity than the lead sulfide strata below it.

It is typical of an experienced mineral or chemical processing facility, such as Molycorp and/or IUSA, to analyze potential feeds based on total content of each metal, or cation, and to make assumptions about the compound or complex form the metal or cation is in (reduced, oxidized, hydrated, etc.) based on the physical and chemical properties of the feed. For example, and as discussed further above, it is well known that the lanthanum in ores, when exposed to air is not present as metallic lanthanum, but as lanthanum oxide. That is, it is neither necessary, nor practical, from a chemical process standpoint, to analyze for every possible compound of every known ion in each ore or alternate feed. Both IUSA and Molycorp followed standard practices when describing the pond and

drummed materials' lead content in terms of total lead, total iron, or total of any other metal.

As a further example, it is common chemical/mineral process knowledge that when a metal sulfide (such as lead sulfide) is "oxidized" in an aqueous environment in ambient air, it does not form an "oxide" (that is, it does not form "lead oxide(s)"). It forms sulfates. In evaluating Molycorp analytical data entries entitled "Oxidized and Unoxidized Concentration" or "Oxidized Lead/Iron Residue," IUSA made appropriate conclusions by discounting the possibility that the pond material labeled, as "oxidized" would consist of lead oxide(s), and by assuming the oxidized portion was in the form of lead sulfate. My conversations with Molycorp site staff throughout 2001, and again in April 2002, confirmed that this "oxidized" portion was indeed lead sulfate, which has an even lower toxicity and reactivity than the original lead sulfide. The ponds do not contain Pb_2O (lead suboxide), PbO (lead monoxide or litharge or yellow lead), PbO_2 (lead dioxide or brown lead), Pb_2O_3 (lead trioxide), Pb_3O_4 (lead tetroxide or red lead), $Pb(OH)_2$ (lead hydroxide). The ponds do not contain $PbSO_3$ (lead sulfite), nor is the oxidation process in the Mill's leaching step sufficiently aggressive to produce it.

Specifically, Mr. Love's assertion that Molycorp Pond 11 contains a 4.5-foot layer, and that Pond 24 contains a one-foot layer, of lead oxide is inaccurate. As explained above, these "oxidized" layers consist of lead sulfate (the oxidized form of lead sulfide). They do not contain any lead oxides. His assertion that these layers are not known, documented or analyzed is incorrect. These layers were included in every sample analyzed by Molycorp for remediation characterization and for preparation of the IUSA Radioactive Material Profile Record; every sample sent to IUSA for amenability testing; and every sample tested by Molycorp for response to sulfuric acid.

Additionally, Mr. Love's assertion that the reaction of lead oxide with chlorine to form halides will pose a processing hazard is irrelevant. First, as explained above, there is no lead oxide in the Molycorp material. Second, no chlorine or fluorine is used in the Mill process, so there is no mechanism for any alternate feed to be in contact with either chemical.

Further, the Sierra Club's statement that the toxicity difference between lead sulfide and lead oxides is "like night and day" is irrelevant with respect to the Molycorp material. As explained above, the lead compounds in the Molycorp material are present as lead sulfide and/or lead sulfate and not in the oxide forms.

5. <u>Processing the Molycorp Materials at the Mill Will Not Create Hydrogen Sulfide Gas</u>

Lead sulfide, when exposed to sulfuric acid in a non-oxidizing (or reducing) environment can create hydrogen sulfide gas (H_2S). However, sulfuric acid leaching of uranium is generally performed in an oxidizing environment. Reduced forms of uranium have generally poor solubilities in aqueous acids. Oxidizing the uranium-bearing stream improves the solubility of the uranium, and therefore it's leach efficiency. In the sulfuric acid leach process at the Mill, oxidants are typically added to the leach solution in

conjunction with the sulfuric acid to create an oxidizing environment and maximize uranium recovery.

In this oxidizing environment, metals present as sulfides, such as lead sulfide or iron sulfide, are oxidized to their sulfate forms. Metal sulfates, such as lead sulfate and iron sulfate, do not react with sulfuric acid and do not form hydrogen sulfide. This is why the processing of natural ores, which are known to contain lead as the mineral galena, or lead sulfide, does not create hydrogen sulfide at any significant level. Metal sulfates have also been demonstrated to have lower toxicities than their corresponding sulfides.

The Molycorp materials will also be processed in an oxidizing environment, that is, oxidants will be added, as required. Any lead present in the sulfide form will be converted to non-reactive lead sulfate. Therefore no hydrogen sulfide of any significance will be created. Additionally, the oxidation step in the Mill's leaching process will help to convert the lead to a less toxic and less environmentally hazardous form -- lead sulfate -- and it will remain in the sulfate form when it is eventually discharged to the tailings system. In any event, the tailings solutions are themselves an oxidizing environment, and any lead sulfides that are exposed to the tailings solutions will be oxidized into lead sulfate.

Based on my discussions with Molycorp personnel in April 2002, the materials in the Molycorp ponds are already undergoing conversion from the sulfide to sulfate form in-situ. Lead sulfide is a dull black compound. The material originally transferred from the Molycorp process to the ponds was black lead sulfide. Lead sulfate is a distinctive orange color. With time, areas within the ponds have been changing to orange, indicating conversion by reaction with air to lead sulfate.

In any event, it has been confirmed by independent laboratory analysis that the material to be shipped to the Mill does not generate hydrogen sulfide gas. As a follow-up to previous test work, in April 2002, Molycorp contracted an independent RCRA-certified laboratory to perform D003 reactivity tests, according to USEPA standard methods, on four samples that contained material from both oxidized and unoxided zones in the Molycorp ponds (Ponds P-8, P-11, and P-24, plus one duplicate). All of the samples passed the D003 test for both sulfur reactivity and cyanide reactivity; that is, the samples did not produce either hydrogen sulfide or hydrogen cyanide. Hence, the material cannot be characterized as "RCRA characteristic hazardous waste D003," because RCRA characteristic numbers may not be applied to materials that pass the appropriate RCRA characteristic-specific test.

Specifically, Mr. Love's assertion that the material poses a worker safety or environmental hazard because it will release hydrogen sulfide gas under processing conditions is inaccurate. The material will be sulfuric acid leached under oxidizing (not reducing) conditions, in which all the lead will be in the sulfate form, which is not reactive in acid and does not produce hydrogen sulfide.

Mr. Love's assertion that the material should carry the RCRA hazard characteristic D003, for "sulfide reactivity" or the release of hydrogen sulfide is incorrect. As explained above, independent laboratory testing demonstrated that the samples from each of the Molycorp ponds passed the sulfide reactivity test and do not generate hydrogen sulfide or hydrogen cyanide under USEPA test conditions for measuring D003 reactivity.

6. Manner of Excavation of Molycorp Materials – No free Liquid; Inclusion of Some Surrounding Soils

During my discussions with Molycorp site personnel in 2001, Molycorp described a detailed engineering plan for excavation, separation, and preparation of pond materials for shipment to IUSA. Molycorp's contractor will be required to excavate the pond material in trenched rows. The top six feet (approximately) of each trench – dried material – will be loaded for shipment to IUSA. The material below six feet will be removed, stockpiled on a drainage surface and drained of all free water. The drained water will be collected for treatment on site at Molycorp. In no case will a liquid phase or free water be shipped to IUSA. IUSA was correct in not seeking analysis of the free liquid described in Molycorp's pond description documents, because Molycorp had committed as early as 2000, that no free liquids would be shipped to IUSA.

Molycorp anticipates that during remedial excavation of the ponds, a small amount of subsurface or perimeter soils may be excavated with the pond contents. The only materials processed at the Molycorp site were bastnasite ores. The only bulk wastes stored at the Molycorp site were tailings and lead sulfide solids from processing of those ores. Neither the pond nor soils have a history of contamination by industrial chemicals. That is, the only contaminants that are present in the pond perimeter soils or sub-soils would be lower levels of the same components known to be in the ponds. Molycorp anticipates shipping those soils (if any) to IUSA. IUSA already determined that acceptance of the pond materials would pose no unusual human health or environmental risks. Acceptance of a small amount of soil would represent even lower potential risks than pond contents.

Mr. Love's assertion that the Molycorp material contains a liquid phase that has not been analyzed and that "testing must be done to completely determine the liquid phase" is incorrect. First, as explained above, the aqueous fraction in the ponds consists only of the same lead and iron sulfides, and lead and iron as the sludge fraction. There are no unknown organic liquid phases or unknown inorganic solution phases, because no material other than the lead sulfide sludge has ever been placed in the ponds. Second, regardless of the composition of the liquid phase, no liquids will be shipped to IUSA. Molycorp will drain or decant all liquids before loading the solids into transport containers for shipment to IUSA. Decanted liquids will be treated onsite at Molycorp or shipped offsite to another treatment facility, but not to IUSA.

7. Flotation Tailings Will Not Be Included in the Material Shipped to IUSA

The Molycorp pond material is currently stored in three impoundments at the Molycorp site, Ponds P-8, P-11, and P-24. Pond P-8 also contains approximately 39,000 feet (1,444 cubic yards) of "flotation tailings." Where it is present in this pond, it exists as a distinct layer above the lead sludge layer. Ponds P-11 and P-24 do not contain any flotation tailings. As stated in IUSA's December 19, 2000 amendment application, the flotation tailings will be separated from the lead sludges and will not be shipped to IUSA.

Flotation tailings were produced in the flotation step of the Molycorp lanthanide recovery process. Aeration of the digested bastnasite ore converts some of the mineral impurities in the ore to their phosphate and carbonate forms, which are lighter than the lanthanide product stream and are removed from the process stream as a float. The float contains oxidized iron and phosphorous, as well as carbonates of barium, calcium, and lead. The float also contains strontium carbonate, and oxides of lanthanum and thorium. Based on the known process history, the flotation tailings are not a RCRA listed waste. Based on Molycorp's characterization data, they do not appear to be a RCRA characteristic waste.

In a later step in the Molycorp process, the lanthanide product stream (which has already had the float removed) is treated to precipitate lead and iron sulfides, which are heavier than the lanthanide product stream, and are removed, from the bottom of the process as a precipitated sludge. The uranium that originated with the bastnasite ore is precipitated in this step with the lead and iron.

Flotation tailings are fine light brown-colored sands, of lower density (lighter) than lead sludge. Lead sludges are a moist, dense solid ranging from black to gray to orange depending on whether they are primarily in the lead sulfide form (black), partly oxidized (gray) or fully oxidized to lead sulfate (orange). Upon excavation of Pond P-8, Molycorp will visually segregate and mechanically separate all flotation tailings/brown sands, and any interface material where flotation tailings may have been mixed with lead sludge, for management on site at Molycorp. The remaining black/gray/orange lead sulfide sludge, containing uranium but no flotation tailings, will be shipped to IUSA.

Specifically, the Sierra Club's contention that IUSA's amendment application was incomplete because it did not contain "a determination of whether the flotation tailings contain hazardous waste" and that the "flotation tailings are not properly characterized" is inappropriate. Neither the tailings sands, nor interfacial material from the ponds containing tailings sands will be included in the material shipped to IUSA.

8. MSDS for Lead Oxide Not Appropriate for the Molycorp Materials

Mr. Love's concern that the material poses a special hazard because it is toxic if ingested, is misplaced. First, the MSDS that carried the warning of "poisonous by ingestion" referred to lead oxide. As demonstrated in Item 4, above, there is no lead oxide in the Molycorp material.

Second, all uranium-bearing materials (such as natural ores and previous alternate feeds), and a number of common process chemicals employed at the Mill, are toxic if ingested. IUSA and Molycorp's shipper will control or minimize the off-site health risk from the ingestion pathway by shipping the material in closed, sealed containers, so that no airborne dusts will reach the environment, and none will be available for accidental inhalation or ingestion by humans or animals. The Mill will continue to prevent airborne dusting to eliminate the inhalation or ingestion pathway after the material is unloaded on the ore pad. IUSA has already committed to monitor the Molycorp material and keep it moist with water sprays, if necessary, to control airborne dust. IUSA minimizes the worker safety impacts from all its ores, alternate feeds and process chemicals by on site air monitoring, requiring and supplying appropriate personnel protective equipment, and by personnel safety procedures (such as not allowing smoking or eating in controlled areas of the Mill site) to prevent accidental worker ingestion of toxic or hazardous materials.

Mr. Love's concern that IUSA's proposal to store the material on open concrete pads will not protect the public because it does not comply with the material storage requirements in the MSDS (in Attachment E of Mr. Love's petition) is misdirected. The MSDS refers to lead oxide. As stated several times in this affidavit, there is no lead oxide in the Molycorp material. Moreover, packaging requirements in supplier MSDS forms for lead compounds apply to pure or blended dry products in the concentration and form supplied by the manufacturer or packager. They do not apply to the Molycorp materials. Specifically, it is not meaningful, or even possible, to take a material with entrained moisture, which has been partially evaporated by exposure to ambient sunlight, and require it be stored "in a cool, dry place."

9. Worst Case Transportation Spill Scenario Not a Significant Issue

Molycorp's plan for transporting pond contents to the Mill is based on use of lined, covered, aluminum end-dump truck trailers. The worst-case spill scenario would involve the overturning and loss of the contents of one full truckload, or 23 tons, on the highway in or near Moab. Because the Molycorp material is a moist solid with no free liquid, in the event of a truck spill, there would be: a) no windborne dust, b) no emitted gases, and c) no free liquid flow from the spill site. The worst-case scenario, the cleanup of 23 tons of soil-like solid, could be accomplished within several hours. The potential spill of Molycorp material would not present any significantly different potential for closure of the highway than for a spill of any other licensed alternate feed material. For that matter, the potential for closure may be lower than for a spill of many of the chemicals or other goods that are transported along the Highway 191 corridor. No citizen in the Moab area would be cut off from food shopping stores or other commercial access to the town for any appreciable length of time.

10. RCRA Analysis

Mr. Love's assertion that neither the NRC nor IUSA has any verification that the Molycorp material does not contain any maintenance waste, processing waste or mixed

waste, and that NRC must require an impartial RCRA analysis of the waste is inappropriate. He claims that Molycorp's statement that there is no listed waste is inadequate because neither Utah nor California has performed sampling and analysis of the ponds to confirm it. He further states that any RCRA analysis not performed by an USEPA-authorized state is suspect. All his claims are unfounded. IUSA and Utah Department of Environmental Quality ("UDEQ") have jointly developed a Protocol for Determining Whether Alternate Feed Materials Contain RCRA Listed Waste (the "Protocol"). For known process wastes that have been under the control of the generator (such as the Molycorp Ponds), the Protocol considers an affidavit from the generator an appropriate confirmation that material is not a RCRA listed waste. This provision of the Protocol is consistent with the RCRA requirements for "Identification and Listing of Hazardous Waste" as defined in 40 CFR 261 et. seq. RCRA requires that the determination of whether a waste is or contains a RCRA-listed waste (which is based on knowledge of its source, not a chemical analysis) be performed by the *generator*, specifically by a *"generator's knowledge of the process."* IUSA's use of a generator affidavit was appropriate and sufficient under both RCRA and the IUSA/UDEQ Protocol. Furthermore, neither RCRA nor the IUSA/UDEQ Protocol requires that a RCRA source analysis must be performed by the state, nor do they require that the state must independently sample every waste to confirm that a generator's determination is correct. I interviewed Molycorp personnel both prior to December 2000 and as a follow-up in April 2002, to confirm the basis for the statements in their affidavit that the Ponds contain no RCRA listed waste (See Attachment 4). Molycorp confirmed that because the pond contents contained lanthanides that had potential product recovery value, Molycorp management has always considered the ponds part of the lanthanide process system and have never allowed site personnel to dispose of any waste into the ponds.

11. The Molycorp Drummed Material Raises No Additional Issues

The Molycorp drummed material originated from the same process source as the pond material, and had generally the same levels of thirteen metals as the pond material, but the drum contents are, in fact, not *identical* to the pond contents. The drummed material is: a) lower in radionuclide content, b) lower in barium and lead content; and, c) consists of a substantially lower volume of material. The drums had somewhat higher levels of two metals of commercial value, copper and zinc, which are known to be present in uranium ores (at levels greater than in the Molycorp drums) and in uranium mill tailings. From the environmental standpoint, the drummed material characteristics represent a lower potential environmental and/or safety concern than the pond contents. IUSA's letter to NRC of October 17, 2001, by treating the drummed material as "similar" to the pond contents, was therefore conservative.

Molycorp is known to have accumulated 36 drums of lead sulfide material at their site. For the characterization of unknown drummed contents on an uncontrolled waste site, USEPA typically recommends a sampling frequency of one in ten drums (or in some cases less). That is, even on a waste site where nothing is known of the source or content of any of the drums, sampling and analysis of one out every ten drums is considered representative of all the drums. Although Molycorp is a controlled site where the source

of every single drum is known, their sampling program met and exceeded USEPA's acceptable sample frequency for unknown drum contents. Sampling and analysis of only four drums would have been acceptable; Molycorp's sampling and analysis of six drums was more conservative than standard environmental practice.

Specifically, the Sierra Club's claim that data is missing for the drummed material is false. According to standard environmental practice, all 36 drums have been appropriately characterized by the sampling and analysis of six of the drums.

12. The Mill Has Experience Processing Materials That Contain Thorium-232

The Mill's experience with thorium-bearing materials includes materials with both the thorium-230 and thorium-232 isotopes. Analysis of the Mill tailings solutions in 2002 indicates that the tailings currently contain both thorium-230 and thorium-232, from processing conventional ores and other alternate feeds.

Specifically, Mr. Love's assertion that IUSA has not alleged or demonstrated any prior experience with processing of materials containing thorium is incorrect. As explained above, both natural ores and alternate feeds already processed at the Mill or currently being received at the Mill for processing contains elevated levels of thorium.

Further, the Sierra Club's assertion that thorium-232 in Molycorp materials presents an unanticipated new hazard is incorrect. As stated above, the Mill has already safely processed a number of alternate feed materials that contained levels of both thorium-230 and thorium-232 isotopes higher than those in the Molycorp material.

13. Conclusions

Based on my review of the IUSA amendment request and all existing technical documentation on the Molycorp material, and from direct discussions with Mill and Molycorp technical personnel, I have concluded that:

1. The Molycorp pond and drummed materials will not introduce any new compounds into the Mill process or the Mill tailings system. Additionally, the material contains no lead oxides or lead sulfites and will introduce no associated ingestion toxicity hazards.

2. The higher concentration of lead in the Molycorp materials will not have any significant incremental effect on the Mill's process or tailings management system, and in fact will add little to the concentration of the solubilized lead in the tailings solution.

3. The Molycorp pond and drummed materials will not introduce any new radionuclides into the Mill process or the Mill tailings system. All known radionuclides in the material have already been managed at the Mill in natural ores or alternate feeds.

4. The Molycorp drummed material is generally less hazardous than the Molycorp pond material, and it was appropriate for the amendment request to describe them as chemically and radiologically "similar."

5. The transport, storage, processing and disposal of the Molycorp material will not produce a lead inhalation hazard. In addition, the worst-case potential transportation spill will neither endanger Moab or Mill area residents, nor cause any long-term inconvenience during spill response.

6. The RCRA analysis performed for the application was performed in accordance with Utah's protocol for RCRA listed hazardous waste, and consistent with USEPA and RCRA guidelines for evaluating characteristic and listed wastes.

Jo Ann Tischler

Jo Ann Tischler

Subscribed and Sworn to before me this 17th day of May, 2002.

My Commission Expires: My Commission Expires 02/05/2005

Crystal Marquez

Notary Public

Wells Fargo Bank West, N.A
1050 17th St. STE 100
Denver, CO. 80265

JO ANN TISCHLER
Resume and Experience

process engineering
hazardous waste remediation
pollution prevention
regulatory compliance and planning
permitting and licensing

EDUCATION

Louisiana State University, Completed coursework for Non-Thesis M.S., Chemical Engineering, 1981
New Jersey Institute of Technology, B.S. Chemical Engineering, 1977

PROFESSIONAL HISTORY

Tischler Consulting, President, 1998 to present
Dames & Moore, Inc. Senior Associate, 1997 to 1998
URS Consultants, Program Director, Environmental Services, 1994 to 1997
Woodward-Clyde Consultants, Vice President, Senior Associate, 1992 to 1993
Woodward-Clyde Consultants, Associate, 1990-1992
Woodward-Clyde Consultants, Senior Project Engineer, 1987-1989
BASF Corp., Chemicals Division, Senior Process Engineer, 1977-1987
New Jersey Department of Environmental Protection, Hackensack Meadowlands Development Commission, Water Quality Analyst, 1976-1977

REPRESENTATIVE EXPERIENCE

Ms. Tischler has over 25 years of experience in management and execution of remediation and environmental compliance projects. She has proven success in performance of remedial design, compliance, environmental permitting, and strategic planning for industrial, commercial, and military facilities. She has proven success in RCRA, CERCLA, and state remedial action projects; waste minimization programs; and regulatory compliance projects addressing Clean Air Act, Clean Water Act, Oil Pollution Act, Atomic Energy Act, UMTRCA, NRC Licensing, and other regulatory requirements. Ms. Tischler has also served as process engineer and environmental compliance engineer for BASF Corporation's Chemicals Division, where she had direct operations responsibility for waste and energy reduction and compliance with applicable air, water, and waste regulations.

Regulatory Compliance and Permitting Experience

Protocol for Determining Presence of Listed Hazardous Waste International Uranium Corporation, Denver CO and Utah Department of Environmental Quality: Worked with Corporate Counsel, outside counsel, and State solid waste division to develop rigorous decision flow chart and decision logic governing historic, forensic, and analytical procedures for determining whether process waste materials or environmental media contain RCRA listed hazardous waste. Protocol serves as basis for state acceptance of uranium mill alternate feed recycling, and land disposal of residues in tailings cells after processing.

Color Blending Facility Regulatory Compliance Audit, Bennett, CO: Performed environmental regulatory compliance audit to determine applicability and compliance status with respect to RCRA, CERCLA/SARA, Clean Air Act, UST, NPDES and other regulatory requirements, at synthetic color blending facility. Recommended modifications to plant record keeping procedures, storage tank containment area.

FIFRA Compliance Support, Color Blending Facility, Bennett, CO: Assisted facility owners following USEPA facility inspection and receipt of FIFRA Notice of Intent associated with organic salts used as floral preservatives and additives. Serve as technical liaison with legal counsel in response to allegations and negotiation of compliance settlement.

Floral Coloring Facility Wastewater Treatment, Southern CA: Assisted facility operator and color supplier with treatment of wastewater from rhodamine batch dyeing of floral products and organic fibers. Evaluated color removal efficiency and cost effectiveness of granular activated carbon versus emerging technology (fly-ash based flow-through fixation). Project is ongoing.

Uranium Mill Tailings Inventory, International Uranium Corporation, Blanding, UT: Developed radionuclide, inorganic, and organic chemical material balance and contaminant inventory for uranium mill tailings impoundments, based on historic feed composition data. Inventory addressed impacts historic mill runs of natural ores, uranium bearing alternate feeds from other facilities, and FUSRAP contaminated soil alternate feeds on levels of radium-226 and other radionuclides regulated under Mill license, as well as hazardous chemical constituents regulated under state water quality requirements. Inventory will serve as basis for evaluating acceptability future alternate feeds to mill.

Uranium Mill Regulatory Compliance Audit, International Uranium Corporation, Blanding, UT: Performed environmental regulatory compliance audit to determine applicability and compliance status with respect to RCRA, UST, NPDES and other regulatory requirements, at uranium mill. Recommended and implemented improvements to Mill Emergency Response Plan, laboratory spill management procedures, used oil disposal record-keeping procedures, and laboratory waste disposal record-keeping procedures.

Response to NRC Allegations, International Uranium Corporation, Blanding, UT: Performed records review in response to USNRC allegations regarding operation, transportation, and health and safety performance of uranium mill. Interviewed personnel and reviewed air pollution equipment operating records, air pollution control design parameters, NRC License conditions, transportation records, and shift safety reports. Prepared letter report in response to allegations for corporate counsel. All allegations dropped as a result of responses.

NRC License Amendment Requests for FUSRAP Alternate Feeds, International Uranium Corporation, Denver, CO: Prepared and published amendment request packages for three NRC license amendments to allow acceptance of alternate feeds from Ashland 1 and Linde FUSRAP sites under USACE Buffalo District, and St. Louis FUSRAP site under USACE Kansas City District. Addressed chemical, nuclear, RCRA, transportation, worker safety, and environmental impacts of each alternate feed; provided response to NRC comments. Securing approvals generally within 3 months of submittal. Approved amendments represent 2 million tons of potential new feed to White Mesa uranium mill.

NRC License Amendment Requests for Recycling Rare Earth Pond Sludges, International Uranium Corporation, Denver, CO: In progress. Prepared amendment request package for NRC license amendment to allow recycling of tailings pond sludge from Molycorp rare earth plant in Mountain Pass, California for uranium recovery.

Waste Minimization Plan, Petrox National Refinery, Talcahuano, Chile: Performed waste inventory, waste reduction, and liability management study for Chilean National Refinery. Project included two-day on-site inspection and interviews with refinery staff to prepare material balance and unit-by-unit inventory of solid waste, hazardous waste, and loss of hazardous constituents to environmental media (air and water). Evaluation included inventory of existing units and material balance and estimation of anticipated waste volumes from new units under construction, including coking, continuous reforming, and sulfur unit. The project also required identification of U.S. and international recycling/ reclaiming facilities for streams currently land disposed.

Leak Detection System Data Interpretation, International Uranium Corporation, Blanding, Utah: Managed project to develop data interpretation report for leak detection system historic data associated with tailings cells at uranium mill facility, in response to Nuclear Regulatory Commission requirement. Managed a follow-on project requiring the use of control chart software (CC:Control) to analyze and present historical data from groundwater point of compliance (POC) monitoring wells and to select the optimum data set to use as the basis for future reporting. Provide continuing semi-annual support in presentation of data and interpretation of CC:Control results in semi-annual effluent report to NRC, to demonstrate that POC parameters have remained control.

Facility Response Plan, Malmstrom AFB, Great Falls, MT: Senior Consultant for preparation of Facility Response Plan addressing POC and hazardous materials spills from aboveground and underground storage tanks at Air Force Missile Support facility.

Compliance and Pollution Prevention Audits of DOT Regional Operations, Casper, WY: Project Manager for compliance and waste reduction audit of Wyoming Department of Transportation Region 2 Casper Yard. Project included compliance inspection, recycling study, water use reduction evaluation, development of pollution prevention plan and training of DOT Region 2 operations foremen.

Wastewater Pretreatment Study, FE Warren Air Force Base, Cheyenne, WY: Task Manager for inspection, maintenance plan and compliance plan for 31 oil water separators and grease traps upstream of Base outfall to POTW. The project involves inspection, engineering evaluation of design versus current service, development of O&M manuals, upgrade of CADD as-built drawings, and Basewide compliance status report.

Waste Management Planning, US Air Force Academy, Colorado Springs, CO: Project Manager for multiple hazardous waste regulatory compliance tasks for the US Air Force Academy. Projects included script writing, video production and preparation of test questions for modular hazardous waste awareness training film; development of Academy-wide waste stream characterization and Hazardous Material Management Plan; production of a Pocket Generator Guide for waste managers; and upgrading the waste database for compatibility with RCRA generator biennial report requirements.

ECAMP Audit, US Air Force Academy, Colorado Springs, CO: Served as Project Manager for 1996 Environmental Compliance Assessment and Management Plan Audit of Basewide operations at the Academy. Led a four-person team that supported the Environmental Flight in-house staff on inspections and reporting of compliance with hazardous materials, hazardous waste, air quality, water quality, toxic materials, and pesticide regulatory protocols.

RCRA LandBan Impacts Study, Total Petroleum, Inc., Denver, CO: Project Manager of regulatory study addressing impacts of RCRA "Land Ban" provisions on refinery and terminal operations, and short and long term compliance considerations . Project included briefing session for Corporate environmental managers and development of instructional white papers for training of refinery environmental staff.

Title V Air Permit, Metro Wastewater Reclamation District, Denver, CO: Served as Technical Oversight for development of Colorado Clean Air Act Title V Permit Application for central sewage treatment plant of largest sanitary district in Colorado. Provided planning, oversight and document quality review for emissions inventory, operating flexibility needs assessment and permit application development for 150 MGD facility in metropolitan Denver that included waste gas flares, boilers and cogeneration engines.

Total Petroleum Refinery Closure Alternatives Study, Denver, CO: Project manager for evaluation of regulatory compliance and remediation cost/benefits for three future-use scenarios at petroleum refinery including: shutdown, sale, and conversion to terminal. Study addressed strategies and costs associated with production waste management, RCRA closure and waste management, air permitting, groundwater quality and liability management issues associated with each scenario.

Total Petroleum Crisis Management Plan, Denver, CO: Project Manager for development of a Corporate Crisis Management Plan for Oil Refiner. Characterized all potential physical incidents according to required response levels, and established roles and responsibilities for both corporate and on-site participants in crisis response. The plan integrated existing plans developed for compliance with OPA and other emergency authorities, at gas stations, pipelines, terminals, and refineries.

Total Petroleum Pollution Prevention Plan, Denver, CO: Served as project manager for a corporate Pollution Prevention Plan addressing hazardous and solid waste reduction for four refineries and eleven terminals in six states. The program provided reduction targets, a technology database, and incentive funding for a continuing firm-wide program.

U.S. Military Overseas Environmental Policy, Milan, Italy: Task Manager for wastewater regulations study for U.S. Army, Navy and Air Force. Project included review of Italian language national, regional and municipal wastewater regulations, and comparison to U.S. military overseas operations environmental standards (OEBGD). Recommended policies and standards to be adopted in U.S. Military Final Governing Standards document for European operations.

Apple Computer Permit Support, Fountain, CO: Project manager for a fast-tracked startup services program for the Apple Computer Fountain, Colorado Facility including air permit, NPDES compliance, POTW permit, SARA Title III compliance, Emergency Response Plan and staff training.

Union Pacific Railroad Site, Cheyenne, Wyoming: Site Manager for review of proposed remediation presented in Closure Plan Portion of RCRA Part B permit application. Project included review of containment, groundwater monitoring, and remedial design for management of DNAPLs in complex hydrogeology and hydrostratigraphy in four aquifers. Managed hydrogeological, geostatistical, health and safety, engineering feasibility, legal, and cost review of RCRA application package.

Hazardous and Solid Waste Remediation Experience

Conoco/Total Petroleum Commerce City Refinery Remediation: Program Director for site characterization studies associated with RCRA Facility Investigation and Corrective Measures Study for groundwater and surface channel contamination adjacent to refinery tank farm. Project team served as joint consultant for studies managed under dual responsibility of Total Petroleum Colorado Refining Company (CRC) and Conoco Inc. Managed interaction with joint clients, development of investigation cost proposals, treatability test plans, and corrective measures study plans.

Installation Restoration Program, Falcon Air Force Base, Colorado Springs, CO: Currently serves as Technical Manager for field investigation and Corrective Action Plan for UST diesel spill to be remediated under Colorado State Inspector of Oils authority.

Installation Restoration Program, FE Warren Air Force Base, Cheyenne, WY: Technical Manager for contractor support to the CERCLA IRP at FE Warren AFB. Provides scoping, budgeting, scheduling, and technical review of risk assessments, feasibility studies, interim action plans, investigation derived waste management for landfills, contaminated soils, and groundwater operable units at Space Command Missile Wing Base. Project addresses remediation of lead soils at firing ranges, sanitary and hazardous debris in abandoned landfills, chlorinated solvents, petroleum hydrocarbons and secondary contaminants such as nitrates in groundwater at seven Operable Units.

Bureau of Indian Affairs, Navajo Toxaphene Sites, Arizona: Project Manager of review study supporting BIA attorneys with cost settlement negotiations with USEPA. Evaluating technical adequacy and cost of EPA contractor's site characterization and remediation of 22 toxaphene and lindane contaminated sites on Navajo Nation land in northeastern Arizona. Evaluating effectiveness and cost of alternatives to the long-term biotreatment already underway.

Paradise Ranch Properties, Woodland Park, CO: Project Manager of site investigation and cleanup of abandoned oil drums at former ranch property under negotiation for sale and redevelopment.

Nez Perce Hanford Nuclear Facility Oversight, Lapwai, ID: Served as Technical Advisor to Nez Perce Tribe of Idaho Environmental restoration and Waste Management Office. Supervised and assisted Native American staff in their oversight role in the Environmental Restoration Program at Hanford Nuclear Facility. Provided technical and policy review and comments on program documentation including air emissions and exposure studies, groundwater characterization and remediation, radionuclide dosimetry and screening, and remedy selection for transuranic and chemical hazardous waste.

ICI Chemicals Remediation Study, Botany Bay, Australia: Task manager for preliminary feasibility study addressing remediation of industrial solvents, metals and pesticides in soil, groundwater and sediments at chemical complex at Sydney Harbor, Australia. Phase I study involved evaluation of standard and developmental technologies for all media, identification of data gaps, and development of data quality objectives for Phase II investigation and preparation of alternatives analysis.

Passiac River Sediments Remediation, NJ: Task Leader of technology study to establish existing and emerging technologies database for remediation of heavy metals, dioxin, and chlorinated aromatic compounds in sediments. Served as technology and policy advisor to chemical manufacturer addressing contaminated river sediments at former defoliant and pesticide plant under EPA Region II CERCLA consent order. Project involved development of database on agency policy and status of technologies; interaction with key forums for sediment technology (USACE Waterways Experiment Station, Great Lakes Program Manager's Office, etc.); and development and negotiation of Feasibility Study Statement of Work for River Sediments.

Basin F Interim Response Action, Rocky Mountain Arsenal, CO: Project Manager of CERCLA interim response action for selection and design of an on-site treatment of petrochemical and agent waste stored in Basin F surface impoundment at the Rocky Mountain Arsenal. Ms. Tischler managed a $5 million program involving waste characterization, process selection, human health risk assessment, wildlife endangerment assessment, pilot testing, and engineering design of a $45 million submerged quench incinerator plant. Her responsibilities included technical team management, interaction with Army operations personnel; negotiations with EPA, state and local regulatory agencies; and leading community workshops, hearings, and briefings. This program achieved regulatory approval and public consensus for the siting of the first CERCLA waste incinerator in EPA Region VIII.

Basin F Storage Tanks Closure, Rocky Mountain Arsenal, CO: Managed preparation of detailed plans and specifications for in-place dissolution of precipitates in three 1.3 million gallon hazardous liquid storage tanks in the Basin F tank farm at RMA. She managed a risk assessment study evaluating on-site and off-site potential exposure and risk from operational spills of untreated Basin F liquids under several tank failure scenarios.

Sitewide Treatability Study Program, Rocky Flats Plant, CO: Project manager for production of a master plan and guidance document for the selection and development of all treatability studies for the Rocky Flats Weapons Plant. The project resulted in the development of a master database of technologies for metals, transuranic metals, volatile and semi-volatile organics, and suspended and soluble inorganics from surface water, groundwater, soils, and all other media at the site.

OU2 Treatability Study, Rocky Flats Plant, CO: Project manager of a RCRA/CERCLA treatability study program addressing contaminated surface water at the Rocky Flats Plant. Managed field and laboratory staff in developing performance data for treatment of radionuclides and volatile solvents in contaminated seeps near plutonium production plant areas.

Surface Impoundment Mercury Remediation: Provided technical oversight and senior review of technology assessment and pilot test for remediation of mercury and heavy metals in lime settling basins at a former agent plant in the South Plants complex at Rocky Mountain Arsenal, Colorado.

Herbicide Facility Remediation, NJ: Task leader for groundwater treatment selection and testing at pesticide and herbicide manufacturing site. The project addressed removal of 2,3,7,8 tetrachlorodibenzo-p-dioxin, pesticides, phenols, VOCs, and aromatic solvents. The treatability tests addressed conventional technologies (macro- and micro-filtration), and innovative approaches (photochemical oxidation).

Sacramento Station Expedited FS, Sacramento California: Served as task leader for a fast-tracked condensed feasibility study for Southern Pacific Transportation Company. Prepared decision document for remediation of heavy metals and diesel fuel in soil, and vinyl chloride in groundwater in support of property transfer of a railroad passenger station.

Libby Superfund Site, MT: Task manager of CERCLA Feasibility Study for remediation of wood-treating waste, soils and groundwater containing PAH, pentachlorophenol, trace dioxins and other dense non-aqueous phase liquids (DNAPLs). Managed process engineering, civil, and hydrogeology team in selection and design of in-situ and ex-situ biotreatment alternatives, FS document, and installation/startup of a demonstration scale treatment system.

Rooney Pit Closure, Dickenson, ND: Managed alternative assessment study project for closure of oil field reserve pit in North Dakota containing DNAPLs, hydrocarbons and drilling muds. This work included site investigation, treatability testing, alternatives evaluation and closure plan.

Hewlett Packard Groundwater VOC Remediation, Loveland, CO: Technical responsibility for selection study, work plans, and pilot test design for remediation of chlorinated volatile solvents (TCE and other DNAPLs) in soil and groundwater at a semiconductor facility.

Waverly Superfund Expedited Response Action: Technical responsibility and technical review of air stripper and vapor extraction plant design for remediation of TCE, Carbon Tetrachloride and other DNAPLs in soil and groundwater at a grain storage facility.

Schuylkill Metals FS, Plant City, FL: Management of a CERCLA feasibility study for remediation of heavy metals in soil and groundwater, and closure of a former battery lead reclamation site. The project involved investigation and conceptual design of innovative technologies including solution mining, smelter recovery of metals in soils, and electrochemical recovery of lead from groundwater.

Pond and Ditch Site, Sacramento, CA: Performed feasibility study for remediation of volatile solvents, BTEX compounds, DNAPLs, and lead at a major railroad yard in California. The project included pilot/bench scale testing and conceptual design of chemical fixation for soil remediation, a groundwater transfer system, and negotiation of a Remedial Action Plan.

UNOCAL Groundwater Remediation, Yuma, AZ: Process selection and design for removal of BTEX and petroleum from groundwater at a product distribution terminal. The design included specifications for the entire plant including gravity separator, air stripper, and carbon adsorption system.

Expert Witness Experience

Defense of Ashland 2, International Uranium Corporation, Denver, CO: Provided expert testimony for Corporate Counsel negotiations with Utah Department of Environmental Quality. Demonstrated via process source forensic chart that chemical contaminants from refinery wastes commingled with radioactive soil at captive landfill did not contain RCRA listed hazardous waste.

State of Utah Proceeding Before Nuclear Regulatory Commission Presiding Judge, Regarding Ashland 2 Alternate Feed Project: Provided expert testimony via affidavit for IUSA response to State of Utah filing. Addressed arguments regarding recoverable uranium content, RCRA status and environmental impacts.

State of Utah Proceeding Before Nuclear Regulatory Commission Presiding Judge, Regarding Ashland 1 Alternate Feed Project: Provided expert testimony via affidavit for IUSA response to State of Utah filing. Addressed arguments regarding recoverable uranium content, RCRA status and environmental impacts.

Senior Engineering Support, Featherstone and Shea, Refinery Waste Management Alternatives: Supported litigating attorneys defending major U.S. refining company against remediation technology firm. Provided senior technical review of plaintiff's exhibits and basis for compensation demand. Identified and screened expert witnesses, assisted in preparing respondent's exhibits and refutation of technical and economic basis for claims.

Chemical Operations Experience

Colors Division Wastewater Treatability Studies: Performed wastewater treatment bench and pilot treatability tests to assess feasibility and cost effectiveness of modernizing dyestuffs wastewater treatment plant from powdered activated carbon and precipitation/clarification to regenerable granular carbon columns. Designed pilot column tests from bench scale adsorption isotherm data and assessed scale up costs and economics.

Colors Division Waste Discharge Allocation Study: Performed water use and material balances to allocate wastewater treatment costs between Palanil (synthetic fiber) and Basacryl (water soluble acrylic) dyestuffs units. Collected water flow rate data and wastewater quality samples from equipment and process drains associated with synthesis reactors, color quench, filter press, ribbon blenders and pan dryers in synthesis and finishing areas of both plants, and produced water distribution, TOC, and color load distribution for charge allocation.

Colors Division NPDES Water Balance: Performed surface water runoff flow and quality study of soluble dyestuff, insoluble dyestuff and phthallic acid/di-octyl phthalate plant site to develop parameters for surface water discharge permit.

Polymers Division Incinerator Closure: Supervised site remediation and closure of a RCRA hazardous waste facility. This project required a closure plan, project design, and groundwater

monitoring for the shutdown and demolition of a waste incinerator that had processed carcinogenic liquid by-products.

Polymers Division Wastewater Treatment and Diversion: Managed response team for RCRA compliance order. Proposed pilot-tested, designed and started-up a fixed bed granular carbon adsorption system to remove low-level aromatic amines from process wastewater for diversion to NPDES outfall.

Geismar Works Incinerator Feasibility Evaluation and Design: Led hazardous waste incinerator conceptual design team on waste characterization, pilot test burns and permit acquisition, and process design for a multiple burner unit. This facility will handle high chloride content solids, high nitrogen content liquids, high glass-transition temperature oligomers, and polymers.

Geismar Works NPDES Outfall Design: Performed wastewater outfall commingling point design including permit review, design of hydraulics, pump, piping, outfall flume and feedback and shutdown controls for an NPDES outfall sample point. The outfall commingled biotreatment plant and RCRA wastewater treatment plant discharges to the Mississippi River from herbicide, glycol and isocyanate manufacturing units.

Polymers Division Spent Catalyst Waste Minimization: Managed waste minimization project to eliminate metal catalyst waste. This project required pilot testing, design, and startup of a microfiltration system for recovery of suspended submicron nickel catalyst from a crude organic product solution. The installed system resulted in both improved product purity and downstream reduction of nickel and tar waste.

Electrolytics Division Subsurface and Plant Building Mercury Remediation: Served as process engineer for closure of mercury cell house in former chlorine manufacturing plant at BASF. Assisted with data collection, alternatives evaluation and remediation design, consisting of concrete cap on mercury contaminated soils.

Urethanes Plant Dryer Residue Waste Minimization: Provided chemical waste handling design. This installation conveyed, ground, cooled, deactivated and transported a chemically active, hot granular organic waste, converting it to a stable, inactive, transportable product to be sold for its fuel value.

Polymers Division VOC Emissions Survey: Provided VOC and fugitive emissions surveys for batch and continuous processes. This work resulted in management of follow-on projects including upgrade of vacuum jet fume collection systems, modification of control instrumentation on acid gas scrubbing towers, and dust and fume control improvements on solids handling operations.

AWARDS

American Consulting Engineers Council, Engineering Excellence Awards, 1992
Consulting Engineers Council of Colorado, Grand Award Winner, 1992
Engineering News-Record, Construction Engineering Man of the Year Citation, 1991

AFFILIATIONS

American Institute of Chemical Engineers
Society of Women Engineers
Society of American Military Engineers
Tau Beta Pi Society

CONTINUING EDUCATION

Essentials of Colorado Environmental Law for Non-Lawyers, University of Colorado, Denver, 1995
Environmental Regulation Course, Executive Enterprises, 1995
Women in Management, Center for Professional Advancement, 1991
Microbial Processes in Hazardous Waste Cleanup, National Water Well Association, 1988
Industrial Wastewater Pretreatment, University of Toledo, 1987
Ion Exchange, Water Softening, and Demineralization, Center for Professional Advancement, 1984
Industrial Energy Management, State of Louisiana Department of Natural Resources, 1983
Boiler Efficiency Improvement, Louisiana State University, 1980
Industrial Energy Management, Louisiana State University, 1980
Compressor and Steam Turbine Technology, Center for Professional Advancement, 1979

PUBLICATIONS AND PRESENTATIONS

<u>The Hidden Scope of Work in Environmental Projects</u>, Seminar presented at University of Denver, 1994

<u>HazMat and HazWaste Training Requirements</u>, Seminar presented at Ohio Business Conference, 1994

<u>Waste Minimization: The Roll-Up Method</u>, Seminar presented to ASCE, El Paso, 1993

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for
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WordPerfect, MS Word, Wordstar, MS Powerpoint,
MS Excel, QuattroPro, Lotus 1,2,3 and other spreadsheets
Filemaker Pro, Dbase, and database management tools
Adobe Pagemaker and composition and graphics tools
Corel Draw, Corel Photoshop, Adobe Photoshop

ATTACHMENT 2

Components of Uranium Mill Tailings: Summary of Sources

Tailings Constituent	(1) Wenrich Arizona Strip Brecchia Pipe Ore Data	(2) USGS Hacks (Az Strip) Ore Data	(3) Hacks (Az Strip) Ore Data	(4) NRC UMTRCA Recl Plan	(5) Moab (CO Plateau) Tail Recl Report	(6) Hazen Tailings Data	(7) Titan IUSA Mill Tailings Eval	(8) NRC Generic EIS	(9) EPA Final EIS Model Tailings
antimony	Y				24 ppm				
arsenic	14,000 ppm	200 ppm	Y	Y	1.8 ppm	700 ppm	0.26 ppm	3.4 ppm	0.2 ppm
barium	NA	700 ppm			0.25 ppm				
beryllium	14 ppm	2 ppm		Y	0.14 ppm				
cadmium	180 ppm	NA		Y	0.49 ppm		4.2 ppm	5 ppm	0.2 ppm
chromium	NA	100 ppm		Y	310 ppm				
cobalt	266 ppm	20 ppm	Y		1.3 ppm		14ppm		
copper	150,000 ppm	7,000 ppm	Y		11 ppm		177 ppm	8.6 ppm	50 ppm
iron	47%	20,000 ppm	Y		650 ppm	10,000 ppm		3,000 ppm	1,000 ppm
iron hydroxide	Y as FeO(OH).nH2O	NA	Y as FeO(OH).nH2O						
lanthanum	NA	20 ppm							
lanthanum oxide	NA	NA							
lead	6,300 ppm	70 ppm		Y	<2.0 ppm		0.21 ppm	2 ppm	7 ppm
lead sulfate	NA	NA			<2.0 ppm				
lead sulfide	Y	NA	Y						
lead oxides	NA	NA							
mercury	3.5 ppm	NA		Y	0.5 ppb				0.07 ppm
molybdenum	2,000 ppm	500 ppm	Y	Y	0.52 ppm	136 ppm	0.44 ppm	16 ppm	100 ppm
selenium	905 ppm	NA		Y	< 2.0 ppm		0.64 ppm		20 ppm
silver	170 ppm	7 ppm		Y	< 0.5 ppm				
thallium	NA	NA							
thorium 230	NA	NA		Y		39 ppm	3650 pCi/L		90,000 pCi/L
vanadium	40,000 ppm	383 ppm			53 ppm	3.39 ppm	165 ppm	120 ppm	0.10 ppm
zinc	7,000 ppm		Y		6 ppm				80 ppm
carbon disulfide	NA	NA		Y					
chloride	NA	NA			370 ppm	30,600 ppm	3,191 ppm		300 ppm
fluoride	NA	NA			<100 ppm	76 ppm		2.1 ppm	5 ppm
phosphorous (PO4)					5.1 ppm	4790 ppm	8.2 ppm		
sulfate (SO4)					30,000 ppm	289,000 ppm	38,404 ppm		30,000 ppm

SOURCES

1. Karen J. Weinrich U.S. Geological Survey Mineralization of Breccia Pipes in Northern Arizona 1970
2. William L. Chenowth, U.S. Geological Survey The Production History and Geology of the Hacks, Ridenour, Riverview and Chapel Breccia Pipes May 1988
3. Energy Fuels Nuclear Internal Reports 1981 and 1984
4. U.S. NRC Standard Review Plan for the Review of a reclamation Plan for Mill Tailings SitesUnder Title II of UMTRCA NUREG-1620
5. Moab Mill Reclamation Trust Dewatering Design Plan June 15, 2000
6. Hazen Research, Inc. Report of Analysis on White Mesa Mill Tailings Cells December 2001
7. Titan Environmental Hydrogeologic Evaluation of White Mesa Uranium Mill July 1994
8. U.S. NRC Final Generic EIS on Uranium Milling NUREG-0706 September 1980 from Jackson, Coleman, Murray and Scints EPA Study Data
9. U.S. EPA Final EIS for Standards for Control of Byproduct Material from Uranium Ore Processing September 1983

"Y" indicates constituent was identifed as present, but not quantified. "NA" indicates the study did not analyze for this constituent.

Mill Tailings Inventory 5/3/02 Lead Content Average Case

Tailings Source	Description	Tons	Feed Pb (ppm)	Feed Pb (lbs)	Fed Pb (tons)
Arizona Strip Ores(1)	15 year actual	1,471,942	863	2,540,572	1,270
Colorado Plateau Ores (1)	15 year actual	2,374,725	< 2.0 ppm	950	0.5
Allied Signal (2)	Calcium Fluoride	5,734	84	963	0.5
Allied Signal (2)	KOH solution recovery	3,500	*No data. Analysis for the six major ions did not include these metals.*		
Cabot (3)	Tantalum residues	16,000	*No data available in Cabot amendment request file.*		
Ashland 1 (4)	Soil	131,141	571	149,763	75
Ashland 2 (5)	Soil	43,981	100	8,796	4
Linde (5)	Soil	123,000	288	70,848	35
Cameco (6)	KF product	1,966	0	0	0
Cameco (6)	UF4 with filter ash	10	0	0	0
Cameco (6)	calcined product	2,197	0	0	0
Cameco (6)	Phosph. Regen. product	557	*No data available in Cameco amendment request file.*		
Nevada Test Site (7)	Cotter Concentrate	363	0	0	0
Rhone-Poulenc (8)	Uranyl nitrate hexahydrate	17	*No data available in amendment request file.*		
CURRENT ESTIMATED TAILINGS TOTAL		**4,175,133**		**2,771,892**	**1,386**

Molycorp Ponds (9)	Likely Case	7,750	131,977	2,045,644	1023
Molycorp Drums (9)	Likely Case	11	52,600	1,157	1
Molycorp Total	Likely Case	**7,761**		**2,046,801**	**1,023**

Notes:

(1) Ore and alternate feed tonnages based on IUSA operating data current as of 2002. Lead based on Wenrich USGS average.
(2) Based on maximum TCLP values in attachments to UMETCO letter to NRC, 6/15/93. Totals were estimated from the TCLPs and the EPA 20 X rule.
(3) Based on IUSA amendment request 4/3/97 and Cabot affidavit 8/6/97
(4) Based on higher of DOE RI data max and IT initial characterization data max.
(5) Based on higher of DOE RI data, initial profile data, and post-excavation results max. Estimated from TCLP value x 20.
(6) Based on maximum end of ranges in Cameco MSDS
(7) Based on attachments to letter from Runore Wycoff, USDOE to Paul Liebendorfer, 12/20/96
(8) Based on IUSA Amendment Request
(9) Lead based on Maximum concentration in data from Molycorp. Tons based on average of Molycorp estimate and Molycorp max.

Mill Tailings Inventory 5/3/02 Lead Content Maximum Case

Tailings Source	Description	Tons	Feed Pb (ppm)	Feed Pb (lbs)	Fed Pb (tons)
Arizona Strip Ores(1)	15 year actual	1,471,942	863	2,540,572	1,270
Colorado Plateau Ores (	15 year actual	2,374,725	< 2.0 ppm	950	0.5
Allied Signal (2)	Calcium Fluoride	5,734	84	963	0.5
Allied Signal (2)	KOH solution recovery	3,500	*No data. Analysis for the six major ions did not inlcude these metals.*		
Cabot (3)	Tantalum residues	16,000	*No data available in Cabot amendment request file.*		
Ashland 1 (4)	Soil	131,141	571	149,763	75
Ashland 2 (5)	Soil	43,981	100	8,796	4
Linde (5)	Soil	123,000	288	70,848	35
Cameco (6)	KF product	1,966	0	0	0
Cameco (6)	UF4 with filter ash	10	0	0	0
Cameco (6)	calcined product	2,197	0	0	0
Cameco (6)	Phosph. Regen. product	557	*No data available in Cameco amendment request file.*		
Nevada Test Site (7)	Cotter Concentrate	363	0	0	0
Rhone-Poulenc (8)	Uranyl nitrate hexahydrate	17	*No data available in amendment request file.*		
CURRENT ESTIMATED TAILINGS TOTAL		**4,175,133**		**2,771,892**	**1,386**

Molycorp Ponds (9)	Maximum Case	17,750	131,977	4,685,184	2,343
Molycorp Drums (9)	Maximum Case	14	52600	1,473	1
Molycorp Total	Maximum Case	**17,764**		**4,686,656**	**2,343**

Notes:

(1) Ore and alternate feed tonnages based on IUSA operating data current as of 2002. Lead based on Wenrich USGS average.

(2) Based on maximum TCLP values in attachments to UMETCO letter to NRC, 6/15/93. Totals were estimated from the TCLPs and the EPA 20 X rule.

(3) Based on IUSA amendment request 4/3/97 and Cabot affidavit 8/6/97

(4) Based on higher of DOE RI data max and IT initial characterization data max.

(5) Based on higher of DOE RI data, initial profile data, and post-excavation results max. Estimated from TCLP value x 20.

(6) Based on maximum end of ranges in Cameco MSDS

(7) Based on attachments to letter from Runore Wycoff, USDOE to Paul Liebendorfer, 12/20/96

(8) Based on IUSA Amendment Request

(9) Lead based on Maximum concentration in data from Molycorp. Tons based on average of Molycorp estimate and Molycorp max.

MEMORANDUM

To: Michelle R. Rehmann

Copies: David C. Frydenlund

From: Jo Ann Tischler JAT

Date: May 3, 2002

Subject: Discussion with Molycorp on Management of Maintenance Wastes

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I contacted Molycorp Project Manager John Espinoza at the Molycorp Mountain Pass Facility ("the facility") on April 22, 2002 to discuss how the facility manages and disposes of maintenance wastes and other waste materials generated from day to day operations. I asked specifically whether any lubricants, solvents, or operations and maintenance waste of any other type has been disposed in the lead sulfide ponds from which IUSA anticipates receiving lead sulfide solids as alternate feed material.

Mr. Espinoza stated that maintenance wastes, including spent lubricants, spent solvents, paints, cleaners, and materials contaminated with these substances, as well as other maintenance wastes have been managed, for the history of the facility, by off-site shipment and disposal as California Hazardous Wastes, or solid wastes. These materials are segregated as hazardous or solid wastes, containerized, and shipped off site to recovery or treatment/disposal facilities permitted to accept them under California environmental code. There is no history of these materials ever being added to any of the lead sulfide ponds, or any of the lead sulfide recovery drums.

Additionally, the interim storage area for containers of hazardous and solid operations and maintenance wastes is not adjacent to the lead sulfide ponds, so there is no opportunity for spills or runoff from hazardous and solid waste storage to enter the ponds.

Mr. Espinoza explained that the facility has always viewed the ponds as an extension of the process plant (the mill) and not as waste disposal units. The pond contents were considered to be a potentially recoverable lanthanide byproduct stream, and for some periods in the facility's history, a portion of the pond material was actually returned to the plant for further lanthanide recovery. As a result, throughout the facility's history, Molycorp management has not allowed the practice of disposing anything from any other source or activity in the ponds.

This is consistent with the Affidavit provided by Molycorp's Public and environmental Affairs Manager, William Sharrer, on August 8, 2001, in which he states that:

> "Based on my knowledge of waste management at the facility, the proposed alternate feed materials have not been mixed with wastes from

any other source, which may have been defined as or may have contained listed wastes enumerated in U.S. Code of Federal Regulations, Title 40 Section 261, Subpart D as amended by the U.S. Federal Register August 6, 1998."

2

Affidavit of Douglas Chambers

I, Douglas B. Chambers, do attest and declare as follows:

1. My name is Douglas B. Chambers. I am the Director, Risk and Radioactivity Studies, for SENES Consultants Limited, Ontario, Canada. I have held this position since 1980 when SENES was formed. Prior to my current position, I was employed by James F. McLaren Limited as a Senior Radioactivity Specialist. I received my B.Sc. (Physics) from the University of Waterloo in 1968 and my Ph.D. (Physics) from McMaster University in 1973. I have attached a current version of my curriculum vitae as Attachment 1 hereto.

2. I have been working in the area of environmental radioactivity and risk assessment for more than 25 years and have studied both radioactive and non-radioactive substances. I have worked on projects across Canada, throughout the United States, and overseas.

   In 1980, my colleagues and I founded SENES Consultants Limited, in which I hold the position of Vice-President and Director of Radioactivity and Risk Studies. In 1990, we created the SENES Oak Ridge Center for Risk Analysis. My current interests include the methods and applications of risk assessment for both radioactive and non-radioactive substances, the development and application of methods of uncertainty analysis, risk management, and risk communication.

   Among my other activities, I have been instrumental in the development of probabilistic tools for pathways analysis and risk assessment for uranium mill tailings. I have directed or carried out environmental and radiological evaluations of all stages of the nuclear fuel cycle, including uranium mill tailings, uranium refining and conversion facilities, and nuclear power reactors. I have also carried out numerous studies on radioactive wastes including: uranium mining wastes, low level fuel cycle wastes and "historic" wastes in Port Hope Ontario, Chicago Illinois, Saxony and Thueringea in eastern Germany and elsewhere.

   I have carried out numerous risk assessment studies, among them, evaluation of risks from exposure to radon, investigations into harmonization of cancer and non-cancer risks, integrating quality of life issues in cost-benefit analyses, studies of the effect of uncertainty in exposure (dose) on the feasibility of epidemiological investigations,

pharmacokinetic modeling and toxicological assessments of uranium, arsenic and other toxins, and evaluations of the risks associated with nickel, lead, chromium, and other metals at mining sites and in soils at contaminated industrial sites. I have also studied the risks of various metals and organisms in drinking water, incineration of municipal wastes, and exposure to fugitive dust emissions from mining, municipal, radioactive, and hazardous waste management activities. My company has carried out remedial actions for lead contaminated homes and advised the U.S. Environmental Protection Agency ("EPA") in this regard.

I have played a key role in the development of ecological risk assessment methodologies for mining regions in Canada and overseas, in support of remedial actions for industrial contaminated sites, and for application to nuclear activities. In the course of these studies, I have assessed potential risks to various biota including, for example birds, fish, deer and other species arising from exposure to various metals such as nickel, lead, and copper among others, organic contaminants and radioactive constituents.

I am a member of numerous professional societies. I was a founding member of the Canadian Radiation Protection Association. I became a member of the Canadian Standards Association ("CSA") Committee on Environmental Radiation Protection in 1978, and subsequently was chairman to 1989. During this time, my Committee developed national guidelines for exposure pathways analysis. I have also been a member of other CSA committees on Risk Analysis. I was a member of Scientific Committee No. 85 of the National Council on Radiological Protection and Measurements ("NCRP"), which has prepared a report on the risk of lung cancer from radon. I have also participated on a committee of the Science Advisory Board of the EPA concerning radon research initiatives. I am a member of the Canadian delegation to the United Nations Scientific Committee on the Effects of Atomic Radiation ("UNSCEAR") and I am currently consultant to UNSCEAR on radon health effects.

3. International Uranium (USA) Corporation ("IUSA") has asked me to review several matters relating to the thorium-232 and lead content of the Molycorp materials that are the subject of a recent license amendment (the "License Amendment") to the White Mesa Mill's (the "Mill's") Nuclear Regulatory Commission ("NRC") source material license

No. SUA-1358. The License Amendment has been challenged by Mr. William Love and the Glen Canyon Group of the Sierra Club (together the "Petitoners") (Docket No. 40-8681-MLA-11).

I understand that, the Molycorp materials are estimated to contain thorium-232 at less than 100 pCi/g and on average, uranium-238 at about 500 pCi/g (i.e. about 0.15% natural uranium by weight) and lead at an average of about 13% by weight. Moreover, I understand that the Molycorp materials will be processed at the Mill using typical acid dissolution, ion exchange, and solvent extraction primarily for the recovery of uranium. The purpose of the milling process is to segregate the uranium product from the other constituents in the feed material. Thus, the tailings which result from this process will contain any thorium-232 or lead which is present in the Molycorp feed and will be permanently disposed of in the Mill's existing tailings cells.

In response to the questions asked of me, I have had the benefit of reviewing affidavits prepared by Jo Ann S. Tischler, Roman Z. Pyrih, Stewart J. Smith, and Michael J. Taylor, which I understand have also been submitted as part of IUSA's response to the Petitioners in this proceeding.

4. When we refer to uranium, we are normally referring to "natural" uranium – that is, uranium as it occurs in nature. Natural uranium consists of uranium-238 and uranium-234 from the uranium-238 series, and uranium-235 from the uranium-235 series. On a mass basis, almost all of the natural uranium is uranium-238. On an activity basis, the activities of each member of a decay series are the same as that of the parent. For example, uranium-234 would be present at the same activity as its uranium-238 parent. Uranium-235, which is the parent of its own decay series, is present in nature at its own isotopic abundance, where its activity would be about 1/22 of the activity of uranium-238 or uranium-234.

Similarly, almost all of the mass of natural thorium ("thorium") is from thorium-232, even though natural thorium contains thorium-228 at the same activity as its parent thorium-232. Unless otherwise stated, when reference is made to natural thorium, it is understood that this is intended to refer to the thorium isotopes in the thorium-232 decay series, and reference to natural uranium is intended to refer to uranium-238, uranium-235

and their respective decay series (including thorium-230 from the uranium-238 decay series).

It is important to understand that both uranium and thorium series radionuclides are naturally occurring and that every person on earth is exposed to some radiation from these radionuclides. The 1997 Report No. 94 of the National Council on Radiation Protection and Measurements (NCRP No. 94) provides a succinct discussion of the ways in which people in the United States and Canada can be exposed to naturally occurring background radiation including the uranium and thorium series radionuclides. The ways in which people are exposed to natural radiation include: cosmic radiation from outer space, external gamma radiation from uranium and thorium radionuclides in the soil, inhalation of naturally occurring airborne radioactive particles, inhalation of radon and thoron decay products and ingestion of radionuclides in food and in water.

The exposure from natural radioactivity varies from place to place. For example, the external gamma exposures from terrestrial radionuclides such as thorium and uranium will vary with the amount of thorium or uranium which is present in the earth's crust at a particular location; notably, exposures from radionuclides in the soil in the Colorado Plateau (a wide area including the Mill site and Moab) average approximately 90 mrad per year as compared to the national average of approximately 40 mrad per year and less (about 23 mrad per year) in coastal areas (NCRP No. 94, p. 78, 89). Thus, anyone living on the Colorado Plateau will be exposed to natural gamma radiation levels well above the national average. This natural incremental gamma exposure is much larger than any potential incremental exposure (from all potential incremental pathways of exposure) to a hypothetical receptor who lives at the edge of the Mill property, which can be attributed to sources at the Mill.

The nature of the potential radiological hazards from uranium and thorium are the same – namely, the hazard associated with the external gamma radiation from the uranium and thorium series radionuclides or from internal exposure to the uranium and thorium series radionuclides which may have been taken into the body through ingestion or inhalation. Although the types of hazard are the same for the uranium and thorium decay series radionuclides, the actual hazard will depend on the potential exposure scenario. The

extent of any external gamma exposure will depend upon the strength of the source, proximity to the source, and duration of exposure. Internal exposure through the ingestion pathway requires ingestion of food and/or water containing the radionuclides. Internal exposure from inhalation will require proximity to a source of airborne dust or exposure to radon gas decay products (from the uranium-238 decay series) or thoron gas decay products (from the thorium-232 decay series) which require exposure in a confined space. ["As EPA has noted, people need to be occupying a structure and not just standing outdoors" for radon health risks to be relevant. 48 Fed. Reg. 15, 076 15, 083 (April 6, 1983). Moreover, the EPA has concluded that the dose "...for the thoron decay products is about one-third that of the short-lived radon decay products." (Final Environmental Impact Statement for Standards for the control of Byproduct Materials from Uranium Ore Processing (40 CFR 192), Appendix G, EPA 1983.) Finally, the NRC has concluded that when the thorium-232 levels in ores are comparable to the levels of natural uranium, that "...the impact of these isotopes [isotopes of the thorium-232 decay chain] is relatively inconsequential..."].

The level of hazard per unit activity (i.e. Pico curies per gram or "pCi/g") can vary among the radionuclides and from decay series to decay series (e.g. per pCi/g, the gamma fields from thorium-232 (and progeny) are about 50% larger than those from uranium-238 (and progeny), all other factors being equal). Thus for example, an alternate feed material containing 100 pCi/g of natural thorium would emit gamma radiation equivalent to that emitted from an alternate feed material containing about 150 pCi/g of natural uranium.

In conclusion, while the levels of hazard per unit activity can vary among the radionuclides and from decay series to decay series, the potential radiological hazards are not different in nature—in each case the pathways for exposure, and hence the types of precautions required to safely handle natural uranium (and its progeny) and natural thorium (and its progeny), are the same.

5. The Transportation of the Molycorp materials does not represent an unusual hazard.

Under the typical transportation scenario there will be no significant radiological exposure pathway. The material in the trucks will be shielded from persons on the street

and there will be essentially no duration of exposure to external radiation as the truck travels on the highway or passes through towns such as Moab. Furthermore, there is no credible pathway for internal exposure under such circumstances. As the Molycorp materials will be transported in covered containers, there is no significant risk of exposure to the public from inhalation or ingestion. The material will be transported as a "strong tight package" under Department of Transportation regulations. Therefore, there is virtually no potential for fugitive dust, and any radon or thoron gas that may escape from the containers would be insignificant compared to background for the area (as discussed earlier, radon and thoron gas are only a potentially significant concern in confined areas).

In the case of a spill or traffic accident, the clean-up procedures and precautions taken for the Molycorp materials would be virtually identical to the clean-up procedures for any other uranium-bearing ores or alternate feed materials authorized to be processed at the Mill. The danger of exposure to the public during any such cleanup would be negligible, and in any event, would be no different in nature or severity than for a spill of conventional ore or alternate feed material, with comparable levels of radioactivity, already transported to the Mill in accordance with IUSA's license and the licenses of other NRC licensees.

Even in the event of a worst-case scenario where a spill occurred in town, there is no potentially significant hazard. First, such a spill would be cleaned up in a short period of time using well-established and approved clean-up procedures. In the worst-case event, a spill of an entire truckload, about 23 tons, could be cleaned up in a few hours. Second, the gamma radiation arising from such a spill would be largely limited to the immediate area of the spill itself and would result in insignificant irradiation of bystanders. For example, the gamma radiation dose to a person standing at the edge of any such spill would be about ½ of that to a person standing at the center of the spill. The gamma dose falls off rapidly with increasing distance from the spill. Moreover, the NRC has stated "long and sustained exposure to radioactivity in the [entire uranium] tailings pile would be required to produce any significant chance of adverse effect". [NUREG-0706, vol. 1 at 1231 (1980).] Thus, there is no credible opportunity for significant or acute exposure to the public.

Similarly, there is no credible way for the public to be exposed to lead from the transportation of the Molycorp materials on the highway or through towns such as Moab. As discussed earlier, the Molycorp materials will be transported in covered containers, and hence there is no significant risk of exposure to the public from inhalation or ingestion. The Molycorp feed materials are in the form of sludges and therefore not amenable to dusting. In any event, in the event of a spill, the same clean-up procedures that are in place and have been approved for implementation in the event of a spill of any other uranium-bearing materials which have been processed, or are approved for processing, at the Mill would ensure that there is no significant potential for the public to be exposed to lead by ingestion.

Overall, the potential hazard to the public arising from the transportation of the Molycorp feed materials is negligible and in any event no different in nature or severity than for a spill of uranium-bearing materials which have been processed, or are approved for processing, and which have already been transported to the Mill in accordance with IUSA's license and the licenses of other NRC licensees.

6. Molycorp Materials do not represent an Incremental Radioactivity Hazard.

Petitioners are apparently concerned that radiological hazards from the thorium-232 chain are different from the hazards from the uranium-238 chain isotopes. As noted previously, the nature of the radiological hazards is the same, the potential hazards are not different in type; the pathways for exposure are the same – either through exposure to gamma radiation, based on proximity to the materials and duration of exposure, or through internal exposure, either through inhalation or ingestion.

As I indicated above, there is no credible method for incremental exposure by inhalation or ingestion. Potential gamma exposures vary with the radioactivity content of the feed in addition to the factors described above. I have specifically evaluated whether the radiological makeup of the Molycorp materials is significantly different from that of other materials which have been processed at the Mill, that is, would the Molycorp materials pose any increased risk of exposure to members of the public. In analyzing this issue, I considered the information provided to me by IUSA, which shows an expected

concentration of natural uranium and natural thorium of 500 pCi/g (uranium-238) and less than 100 pCi/g (thorium-232) respectively in the Molycorp feed materials.

These levels are less than the pCi/g levels for uranium and thorium of many of the natural uranium ores and alternate feeds which have been processed or approved for processing at the Mill. Based on information provided by IUSA, uranium-bearing materials, including ores, which have been processed at the Mill include among others, uranium ore from the Arizona Strip mines with uranium from 0.5% to 1.0% (i.e. 1,650 to 3,300 pCi/g of uranium-238) and the "Cotter Concentrate" alternate feed with uranium content of up to 17% (i.e. 56,000 pCi/g of uranium-238). The thorium-232 content of uranium-bearing materials which have been processed or approved for processing at the Mill range up to 8,000 pCi/g thorium-232 for materials from W.R. Grace and up to 2,000 pCi/g thorium-232 for materials from Heritage. Thus, the radioactivity of the Molycorp materials is well within the range of pCi/g levels for natural ores and alternate feeds that have been processed or approved for processing at the Mill.

7. The Molycorp Materials do not require any special precautions while being processed or as a component of the Mills Tailings

There is no incremental occupational radiation exposure during processing of the Molycorp materials or as a result of the disposal of the processed Molycorp materials in the Mill's tailings cells. As the levels of natural thorium and natural uranium in the Molycorp materials are less than other previously licensed alternate feed materials and conventional ores, there are no potentially significant incremental radiological hazards associated with their processing and disposal in the tailings cells.

The dust control and ventilation processes which are in place in the Mill to control potential exposure to radioactive dusts will also control potential exposures to any lead that may be present in airborne dust. In addition, the Molycorp feed material is in the form of a sludge, which is not prone to dusting. Since lead was present in ores such as those from the Arizona Strip which have already been processed at the Mill, the processing of Molycorp feed materials, which also contain lead, do not represent any new or potentially significant incremental hazards to workers.

It should be noted that in situations where the natural uranium or natural thorium (thorium-232) content of the ore or alternate feed material are significantly elevated, then some special precautions may be required to be taken by the Mill to ensure that doses to workers are maintained well within regulatory limits. These protections would only be required to protect workers and would not be required for members of the public who do not get close enough to these materials to experience any gamma radiation. The levels of natural uranium and thorium in the Molycorp feed materials are well below the levels that would require the implementation of any such precautions.

8. The License Amendment Contained Sufficient Information Relating to Thorium-232

As discussed above many conventional ores and alternate feed materials contain levels of thorium-232 as well as uranium (often reported as uranium-238). The pathways for exposure from thorium-232 are the same as for natural uranium. Therefore, the precautions taken by the Mill with respect to uranium are satisfactory for processing the Molycorp feed materials. Moreover, as already noted, the thorium content of ores and alternate feeds already processed at the Mill or licensed for processing at the Mill have had larger thorium concentrations than those associated with the Molycorp feed material. Consequently, there was no need for IUSA to make any specific mention of the thorium-232 content of the Molycorp materials in their submission to the NRC.

9. There is no significant incremental risk of harm to wildlife or humans from Lead poisoning resulting from drinking water from springs that are down gradient of the Mill site

Upon reading the affidavits of Roman Pyrih, Jo Ann Tischler, Stewart Smith and Michael Taylor, I am of the opinion that there is no credible way in which tailings solution could a) escape from the tailings cells, and b) remain un-neutralized as it passes through the calcareous soils underlying the tailings cells, and c) remain mobile in order to reach the perched water about 70 feet below the tailings cells, and d) go undetected by the groundwater monitoring network, and e) travel, while still un-neutralized almost two miles through calcareous rocks which themselves have a large neutralization capacity, to a spring that is down gradient of the tailings cells, in concentrations posing any potentially significant hazard to public health or the environment. Such a scenario is so

unlikely, that in my opinion, it is not credible. Therefore, I do not believe it is beneficial for me to further consider this issue which would require the compounding of numerous incredible assumptions.

10. Any increase in the Concentration of Lead in the Tailings Cells will not add any incremental hazard to Wildlife.

According to information provided by IUSA, the Molycorp alternate feed materials contain lead at an average of about 13% by weight. However, Colorado Plateau and Arizona Strip uranium ores also contain varying concentrations of lead depending on the source and ore body. The NRC's generic environmental report statement (NUREG-0706 Vol. II, App E, pE-16, Sept. 1980) suggests a lead concentration of about 11 mg/L in generic tailings cell liquid, generally comparable to the 17 mg/L measured in tailings cell solutions at the Mill in April this year. The level of lead in solution arising from the processing of the Molycorp feed materials is not expected to increase the level of lead in the tailings cell solutions above 20 mg/L, due to the solubility limits of lead in the tailings solutions. Thus, birds or wildlife living around the Mill would not be exposed to any new or potentially significant incremental hazard from lead.

Nevertheless, I have investigated the potential impact that lead in tailings cell water might have on birds and wildlife. In order to carry out this evaluation, I have assumed that ducks (assumed to be mallard for purpose of evaluation) are attracted to the tailings cells where they are assumed to routinely and repeatedly consume water from the tailings cells and, subsequently, are in turn consumed by eagles. The effect on eagles of the consumption of mallards is an appropriate example of similar effects of other raptors and wildlife. In brief, I have assumed

- The site represents about 10% of the eagle's range
- That the eagle is at the site 50% of the year
- That the mallard represents 14% of the eagle's total diet (EPA 1983 for Arizona)
- Toxicity data from Sample et al 1996

With these data, and assuming that the concentration of lead estimated to be in the mallard's flesh is from routine and repeated consumption of tailings cell water when in reality the mallard might not survive any intake of tailings cell water, I estimate that the concentration of lead in the tailings cell water would need to approach 600 mg/L (well above the level of lead anticipated in the tailings cells of about 20 mg/L) before an eagle would experience toxicity from the intake of lead arising from the ingestion of mallards which drink from the tailings cells.

It must be recognized however, that such a scenario is highly implausible since the tailings cell water is already toxic as a consequence of the low pH, and the presence of other toxic species including metals and organics which are already in the tailings cell water. Therefore, any mallard which consumes water from the cells is likely to die from other or combined toxic effects before the lead content in its flesh could approach equilibrium with the lead in the water. In addition, it is likely, in my opinion, that waterfowl and other wildlife would find this source of water unpalatable and therefore tend to avoid it. Finally, IUSA has implemented several measures to minimize the potential use of the tailings cells by waterfowl. These measures include the use of propane cannons and raptor decoys to scare the waterfowl away and the development of freshwater ponds, which provide a more attractive habitat for waterfowl, and which will attract them away from the tailings cells during migratory seasons.

11. Potential Risks to People

I am very familiar with the potential pathways of exposure for workers and members of the public associated with the milling of uranium ores. In my opinion, having studied the processing of ores with a wide range of uranium and thorium contents and with high and variable metal content, I am of the opinion that the workplace and environmental practices which have been used to protect workers and the public in the past will provide ample protection from potential exposure to either radioactivity or lead arising from the transportation, on-site management, and processing of the Molycorp alternate feed and its subsequent disposal in the tailings cells.

12. Opinion

For the reasons given above, it is my opinion that the transportation of the Molycorp materials, the management of the Molycorp materials on ore storage pads, and processing at the Mill does not represent any new or unusual hazards and that the potential radiological and non-radiological hazards from transporting, management of on-site storage, processing and disposing of the Molycorp alternate feed material in the tailings cells are no different in type from the potential hazards represented by other alternate feed materials which have been or are licensed for processing in the While Mesa Mill.

Further Affiant sayeth not.

SENES Consultants Limited, Ontario, Canada

By: Douglas B. Chambers

Dr. Douglas B. Chambers

Director, Risk and Radioactivity Studies

Subscribed and Sworn to before me this 17th day of May, 2002.

My Commission
Expires: JAN 02, 2004

Zlata Michunovich

Notary Public

OFFICIAL SEAL
ZLATA MICHUNOVICH
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm Expires Jan. 2, 2004

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Sample, B.E., D.M. Opresko, G.W. Suter II 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision.* June 1996

United States Environmental Protection Agency (U.S. EPA) 1993. *Wildlife Exposure Factors Handbook.* EPA/600/R-93/187.

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United States National Council on Radiation protection and measurements (NCRP) 1987. *Exposure of the Population in the United States and Canada from Natural Background Radiation. 30 December.* NCRP Report No.94.

U.S. Nuclear Regulatory Commission *'Final Environmental Impact Statement on Uranium Milling"* Sept. 1980. NUREG-0706.

DOUGLAS B. CHAMBERS

Vice-President, Director of Radioactivity and Risk Studies

EDUCATION

B.Sc. (Honours), Physics, 1968, University of Waterloo (University of Waterloo Tuition Scholarship)
Ph.D., Physics, 1973, McMaster University (National Research Council Science Scholarship)
Two Sessions at the Advanced School for Statistical Mechanics and Thermodynamics, University of Texas, Austin, 1970 and 1971
Air Pollution Diffusion, U.S. EPA, Research Triangle Park, 1974
Annual Health Physics Course, Chalk River Nuclear Laboratories, 1974
Observations on Human Populations, School of Hygiene, University of Toronto, 1979

PROFESSIONAL AFFILIATIONS

Advisory Committee on Radiation Protection (1993 to 2002 - committee advises the Canadian Nuclear Safety Commission on matters concerning radiation protection)
American Nuclear Society
Canadian Standards Association, Member of Technical Committee on Environmental Radiation Protection (1978 to 1994, Chairman 1987 to 1994)
Canadian Standards Association, Member of Technical Committee on Risk Analysis (1989 to present)
Canadian Radiation Protection Association
Health Physics Society (U.S.)
Society for Risk Analysis (U.S.)
U.S. National Council on Radiation Protection and Measurements, Scientific Committee 85 on Risk of Lung Cancer from Radon (1991 to date)
United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), Member 1998 to date, Canadian delegation
Consultant to UNSCEAR for preparation of "Sources-to-Effect Assessment of Radon in Homes and Workplaces".

AWARDS

1997 W.B. Lewis Award (Canadian Nuclear Association) for achievements in environmental radioactivity.

2002 Health Physics Society Morgan Lecturer
"Perspectives on Radioactive Waste Management in Canada. Joint Midyear Meeting. Orlando, February 2002.

EXPERIENCE

1980 to date - SENES Consultants Limited
Vice-President and Director of Risk and Radioactivity Studies. Technical responsibilities include management and technical direction of multi-disciplinary studies including: human health risk assessments; radioactivity exposure evaluations; environment impact assessments; environmental pathways and dose assessments; air dispersion modelling studies of radon and dense/reactive gases; ecological risk assessments; mine waste management; geochemical modelling assessments; low-level radioactive waste management; and risk (cost) - benefit analyses.

Dr. Chambers has contributed to the development of, and made extensive use of the methods of uncertainty analysis for: exposure pathways analysis; dose reconstruction and epidemiological investigations; risk assessments; and application of environmental statistics. While at SENES, Dr. Chambers has directed or contributed to more than 300 projects, examples of which are given below.

Human Health Risk Assessment - Numerous studies including: risks from exposure to radon; investigations into harmonization of cancer and non-cancer risk; integrating quality of life issues in cost-benefit analyses; studies of the effect of uncertainty in exposure (dose) on the feasibility of epidemiological investigations, pharmacokinetic modelling and toxicological assessments of uranium, arsenic and other toxins; and evaluation of the risks associated with nickel in soils at contaminated sites proximate to nickel production facilities.

Risk assessments performed under Dr. Chambers' direction include evaluation of risks from: naturally occurring radioactivity in phosphogypsum arising from use in agriculture and road construction; radioactivity, and various metals in drinking water; reuse of industrial contaminated sites; incineration of municipal wastes and accidental release of chlorine from waste water treatment facilities. Other projects include: LNG storage facility; blood mercury levels and water level regulation in respect to low-head hydro projects; release of volatile organics from waste water treatment plant; risks for alternative uses of sewage sludge; and exposure to fugitive dust emissions from mining, municipal, radioactive and hazardous waste management activities.

Ecological Risk Assessment - Dr. Chambers has played a key role in the development of ecological risk assessment methodologies for mining regions in northern Saskatchewan and northern Ontario, and in

support of decontamination planning for contaminated industrial sites. Dr. Chambers also completed an ecological risk assessment for the use of slag from refining operations as construction fill. He has directed numerous risk assessments for industrial contaminated sites.

Environmental Assessment – Numerous, assessments including: the preparation of an environmental impact statement for the decommissioning of uranium tailings facilities in Ontario and northern Saskatchewan, the United States and elsewhere; and a risk (cost) - benefit analysis for the reclamation of an *in situ* leach property in Texas. Dr. Chambers has also contributed to environmental assessments of nuclear power plants, thermal power plants and other industrial and mining facilities.

Facility Risk Assessment – Dr. Chambers has been involved in numerous facility risk assessments involving petrochemicals, ammonia, uranium hexafluroide, and chlorine amongst others. He has supervised a number of transportation risk studies involving petrochemicals, acids, radioactive waste, sludge and ore slurry. He has also been involved in a health and safety risk analysis for oxygen and nitrogen pipelines. These projects have been conducted in Ontario, British Columbia, Saskatchewan, South Africa and Trinidad.

Geochemical Modelling and Assessment - Dr. Chambers is active in the development and application of geochemical models for evaluation of management options for mine waste rock and tailings. He was a senior scientist in a multi-disciplinary study team assisting the Federal German Environment Ministry with the decommissioning of uranium mining and processing sites in Saxonia and Thüringia, where geochemical modelling was employed to perform a comparative evaluation of rehabilitation options for multiple surface waste rock heaps, including evaluation of specific criteria for relocation of waste rock to a large open pit mine, and geochemical simulation of the backfilled pit as well as the flooding of the entire mining area. Other geochemical assessments include evaluation of alternatives for reducing acid generation of mine waste heaps in South Africa.

Radioactivity - Director or senior health physics advisor for numerous studies pertaining to radiation protection including: dose reconstruction and epidemiologic analyses of persons exposed to elevated radon progeny concentrations including residents of Port Hope Ontario and uranium miners of Beaverlodge, Port Radium and Colorado Plateau; reconstruction of environmental exposures and doses from radioactive contaminated sites, decommissioning of uranium and thorium facilities; review of thorium metabolism data; and uranium biokinetic models; development of decommissioning criteria and guidelines; assessment of the potential risks from naturally occurring radioactivity (NORM);dose assessment and the development of health and safety practices for uranium mine workers; and the application of the ALARA optimization principal.

Remedial Actions and Decommissioning - Directed and participated in numerous decommissioning and remedial action programs for NORM (naturally occurring radioactive material) wastes and low-level radioactive waste (LLRW) management sites, uranium mining facilities in Canada, United States and overseas. Dr. Chambers directed conceptual design studies for disposal of LLRW in near-surface facilities and engineered underground caverns. He also directed a study to investigate the technical and economic feasibility of a commercial LLRW facility in Canada.

Air Quality Assessment - Provided technical direction to atmospheric dispersion studies involving dense/reactive gases such as ammonia, chlorine, anhydrous hydrogen fluoride and N_2/O_2 and uranium hexafluoride releases. Dr. Chambers developed a detailed physical/chemical model for the release, atmospheric transport and deposition of uranium hexafluoride for an accident at a uranium hexafluoride facility in Gore Oklahoma. He has carried out numerous site-specific modelling studies of thermal power stations, numerical air quality modelling for complex terrain, calibration/verification studies, and development of long-range transport models.

1973-1980 - James F. MacLaren Limited

General Manager, Nuclear Projects Division from 1977 to 1980. Responsible for the development of the firm's capabilities in environmental radioactivity and radiation protection. Project Manager for the Air Environment Division from 1973 to 1977.

Environmental specialist on matters pertaining to the air environment and/or radioactivity on numerous environmental impact assessments across Canada and internationally.

Specialist input to the development, implementation and interpretation of results from air quality and meteorological surveys, air dispersion analyses and noise assessments at several types of industrial projects at locations across Canada. Developed a meteorological control system for large oil fired power plant in New Brunswick.

TECHNICAL PAPERS AND PRESENTATIONS

More than 100 technical papers, reports publications and presentations (list available upon request). He has also presented seminars and workshops on a variety of topics, in Canada, the United States, Europe, South America and Africa.

ACRP-22, Protection of Non-Human Biota from Ionizing Radiation Former Advisory Committee on Radiological Protection for the CNSC, INFO 0703 CNSC April 2002. (Chairman of Working Group).

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Environmental Issues in the 21st Century. Invited keynote address at International Symposium on the Uranium Production Cycle and the environment, International Atomic Energy Agency, Vienna, Austria, 2-6 October 2000.

Remediation During Changing Regulatory Requirements for Characterization Surveys. Uranium 2000, September. (R.H. Stager).

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Perspectives on Molecular Epidemiology. Presented to the 2000 Canadian Radiation Protection Association Annual Conference, Montreal, Quebec, May 2000. (N.E. Gentner).

Environmental Risk Assessment – A Practitioner's Perspective. Canadian Nuclear Society, 21st Annual Conference, 11-14 June 2000, Toronto, ON. (M.W. Davis).

Risk – What It is, and How to Manage it. Invited presentation Mining Millenium 2000, CIMM Annual Meeting March 2000. (G.M. Wiatzka).

Screening Level Dose Assessment of Aquatic Biota Downstream of the Marcoule Nuclear Complex in Southern France. Health Physics 77(3): 313-321, September 1999 (with S. St-Pierre, L.M. Lowe and J.G. Bontoux).

Radiation (Protection) in the 21st Century. Invited Presentation Canadian Radiation Protection Association, June 1999, Saskatoon, SK.

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Practical Issues in the Risk Management of Low Dose Radiation. Presented at The Nineteenth Annual Conference of the Canadian Nuclear Society, Toronto, ON, 18-21 October 1998 (with M.W. Davis, N.C. Garisto and L.M. Lowe).

Long Term Population Dose Due to Radon from Uranium Mill Tailings. Presented at The Uranium Institute Twenty-Third Annual Symposium, London, U.K., 10-11 September 1998. (Available at www.uilondon.org) (with L.M. Lowe and R.H. Stager).

Steps Towards Harmonization of Risk From Chemical and Radioactive Contaminants Spectrum '98 – International Conference on Nuclear and Hazardous Waste Management, 13-17 September 1998 (with N.C. Garisto, S.L. Fernandes, H.A. Phillips and G.W. Wiatzka).

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Assessment of Radiation Effects on Biota in Proximity to Uranium Mining and Milling Sites in Canada: Field Observations and Model Predictions. In: Symposium on Radiological Impacts from Nuclear Facilities on Non-Human Species, Ottawa, 2-3 December 1996 (with N.C. Garisto, M.W. Davis, J.M. Takala, D. Krochak, R.G. Barsi and S.M. Bartell).

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Investigations Into the Effect of Uncertainty in the Exposure Variable on the Feasibility of Epidemiological Investigations. Prepared for Centers for Disease Control (Atlanta), April 1996 (with M. Tai, R.H. Stager and P. Reilly).

Development of Cleanup Criteria for Historic Low-Level Radioactive Waste Sites in Canada. In: Proceedings of The Fifth International Conference on Radioactive Waste Management and Environmental Remediation (ICEM '95) Vol. 2 Management of Low-Level Waste and Remediation of Contaminated Sites and Facilities, pp. 1433-1437 (ASME), Berlin, Germany 3-8 September 1995 (with R.W. Pollock and L.M. Lowe).

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Ecological Risk Analysis of Uranium Mining in Northern Saskatchewan. Presented at Sudbury '95, Mining and the Environment, 28 May - 1 June 1995, Sudbury, Ontario (with D.K. Krochak, S.M. Bartell and M.B. Wittrup).

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Radiological Significance of ^{227}Ac and ^{231}Pa in Inhaled Natural Uranium. Health Physics 61(6): 918, December 1991 (with L.M. Lowe and M.W. Davis).

Preparing Environmental Impact Statements. Presented at the 1991 Conference on Environmental Management in Mining, Saskatoon, Saskatchewan, November 1991 (with C.M. Pettit and B.E. Halbert).

Effects of Exposure Uncertainty on Estimation of Radon Risks. In: " Twenty-Ninth Hanford Symposium on Health and the Environment, Indoor Radon and Lung Cancer: Reality or Myth? – Part 2" (ed. F.T. Cross) Battelle Press, pp. 987-1012, 15-19 October 1990 (with P. Reilly, R.H. Stager, L.M. Lowe and P. Duport).

Communicating Risks to the Community: A Tale of Two Incinerators. Presented to the 1990 Annual Meeting of the Society for Risk Analyses (with J.F. Peters and J.M. Southwood).

Environmental Assessment Modelling. Published as Section 8.1 of the IAEA Monograph "Environmental Behaviour of Radium." Technical Report Series No. 310, 1990 (with B.E. Halbert, V.J. Cassaday and F.O. Hoffman).

Examples of Dose Assessment: Mining and Milling in Canada. In: "The Environmental Behaviour of Radium – Vol.2". IAEA Technical Report Series No. 310, pp. 419-439, 1990 (with L.M. Lowe and R. John).

Assessing Risks From Incineration of Municipal Solid Wastes. Published in proceedings of EPA/ORNL Workshop on Risk Assessment for Municipal Waste Combustion, Deposition, Food Chain Impact, Uncertainty and Research Needs. 1989 (with B. Ibbotson and B. Powers).

Risk Assessment as an Environmental Tool. Presented at the American Mining Congress Convention, San Francisco, CA September 1989.

Radon in the Uranium Mine Environment: Exposure Estimation and Risk Prediction. Presented at Workshop/ Symposium on: Radiation Protection: Past and Future ("Marko" Conference), Chalk River, ON, 20-22 March 1989. Published as AECL-9959, June 1989 (with L.M. Lowe).

Exposures from Mining and Mine Tailings. Invited paper in special issue on "Radionuclides In The Environment", Radiation Physics and Chemistry 34(2): 295-307, 1989 (with L.M. Lowe and V.J. Cassaday).

The Assessment of Incineration Risks (A.I.R.) Model. Presented at the 1988 Annual Conference, Society for Risk Analysis, Washington, DC. (with J.D. Phyper, B. Powers, M. Rawlings and R. Willes)

A Primer on Radon and Potential Health Risks from Exposure to Radon Daughters. Prepared for International Symposium on Uranium and Electricity -

Teachers' Program. Saskatoon, SK, September 1988 (with L. M. Lowe).

Canadian Perspectives on the Management of Low-Level Radioactive Wastes. Keynote Address, International Symposium on Uranium and Electricity, Toronto, September 1988 (with R.A. Knapp and G.G. Case).

The Potential Radiological Impacts of Phosphogypsum Stacks. Presented at the Ninth Annual Conference of the Canadian Radiation Protection Association, Montebello, Quebec, 11-13 May 1988 (Abstract in Health Physics 56(4): 581, April, 1989.) (with L.M. Lowe and M.W. Davis).

Development of Clean-up Criteria For The Port Hope Remedial Program. In: Proceedings of the Annual Meeting of the Society for Risk Analysis, 1-4 November, 1987 Houston, Texas. Published as "Risk Assessment in Setting National Priorities" (eds. J.J. Bonin and D. E. Stevenson), Plenum Press, New York, pp. 25-41, 1989 (with L.M. Lowe, G.G. Case and R.W. Pollock).

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Risks and Consequences of Occupational Exposure to Radon Daughters. Presented at the Eighth Annual Conference of the Canadian Radiation Protection Association, Saskatoon, SK, 27-29 May 1987 (abstract in conference proceedings) (with L.M. Lowe).

An Assessment of the Potential Health Risks From Exposure to Radon Daughters. Prepared for the Health Protection Branch, Department of National Health and Welfare, May 1987 (with L.M. Lowe).

Assessment of Risk from Uranium Mining in Virginia. In: "Environmental Health Risks: Assessment and Management." (ed. R.S. McColl) Waterloo, University of Waterloo Press, 1987, pp. 237-258 (Proceedings of symposium held on 29 May 1985) (with L.M. Lowe and V.J. Cassaday).

An Approach to Risk Assessment for Canadian Uranium Mill Tailings. Presented at the Second International Conference on Radioactive Waste Management, Winnipeg, Manitoba, September 1986 (with M.L. Murray, R.A. Knapp, and R.W. Holmes).

Probabilistic Assessment of the Long-Term Effects of Uranium Mill Tailings. Presented at the Second International Conference on Radioactive Waste Management, Winnipeg, Manitoba, September 1986 (with B.E. Halbert, M.L. Murray and D.I. Beals).

Probabilistic Analysis of the Environmental Behaviour of Uranium Mill Tailings. Presented to the Society for Computer Simulation, San Diego, January 1986 (with B.E. Halbert, M.L. Murray and D.I. Beals).

Health Effects of Radon. Presented at Workshop on Information Needs for Risk Assessment in Canada, Toronto, ON, September 1985. In: "Information Needs For Risk Management" (eds. C.D. Fowle, A.P. Grima and R.E. Munn), Environmental Monograph No. 8, Institute for Environmental Studies, University of Toronto, pp. 177-192, November 1988 (with L.M. Lowe).

Probabilistic Analysis of Radon Released from Uranium Mill Tailings. Presented at the Sixth Annual Meeting of the Canadian Radiation Protection Association, Saint John, NB, 11-13 June 1985 (with L.M. Lowe and M.L. Murray).

Safety Assessment of Uranium Mill Tailings: The National Uranium Tailings Program. Presented at the annual meeting of the Canadian Nuclear Society, Ottawa, ON, June 1985 (with W.C. Harrison and B.E. Halbert).

Conceptual Design Study of a Low-Level Radioactive Disposal Facility. Presented at the Health Physics Society annual meeting, Chicago, IL, May 1985 (with G.G. Case and R.A. Knapp).

Pilot ALARA Analysis Applied to Dose Reduction in an Underground Uranium Mine. In: Occupational Radiation Safety in Mining, Proceedings of the International Conference, Toronto, ON, 14-18 October 1984, Vol. 1, pp. 45-51. (Published by the Canadian Nuclear Association 1985) (with L.M. Lowe, J.L. Chakravatti, D. Lahoux,K. Black and K. Culver).

Beta Radiation Considerations in the Mining and Milling of High Grade Uranium Ore. To be presented at the International Conference on Occupational Radiation Safety in Mining. Toronto, ON, October 1984 (with J.R. Mernagh).

Potential Co Carcinogens in the Uranium Mine Environment. Presented at the International Conference on Occupational Radiation Safety in Mining, Toronto, ON, October 1984 (with R. Marchant).

Conceptual Design for Disposal of Uranium Refinery Wastes in Mined Limestone Caverns. Presented at Health Physics Society Annual Meeting, New Orleans, LA, June 1984 (with G. Case, J. Davis, D. Moffet).

ALARA Analysis for the Decommissioning of the Beaverlodge Uranium Mine and Mill Site. Presented at the Twenty-Ninth Annual Meeting of the Health Physics Society, New Orleans, LA, 3-8 June 1984 (with V.J. Cassaday, R.A. Knapp, L.M. Lowe, M.P. Filion).

Critical Receptor Pathways Analysis for the Decommissioning of the Beaverlodge Uranium Mine and Mill. Presented at the Fifth Annual Conference of the Canadian Radiation Protection Association, Banff, AB, 30 April – 3 May 1984 (with V.J. Cassaday, L.M. Lowe and M.P. Filion).

Design for Radiation Protection in a High Grade Underground Uranium Mine. Presented at Fifth Annual Conference, Canadian Radiation Protection Association, Banff, AB, May 1984.

TLV's for Non-Standard Work Schedules. Pollution Engineering, November 1983 (with L.M. Lowe).

Long Term Dose Implications of Accidental Releases from Nuclear Facilities. Presented at the Fall Meeting of the Ontario Section of the APCA on "Accidental Atmospheric Releases of Radionuclides and Toxic Chemicals", Minette, ON, 11-13 September 1983 (with D.W. Hopper and L.M. Lowe).

Air Quality Model Validation Study. Presented at the Seventy-Sixth Annual Meeting of the Air Pollution Control Association, Atlanta, GA, June 1983 (with D.W. Hopper and J.P. Jarrell).

A Model for the Regional Transport and Environmental Cycling of Carbon-14. Presented at the Twenty-Eighth Annual Meeting of the Health Physics Society, Baltimore, MA, 19-23 June 1983 (Abstract in Health Physics 45(1): 209, July 1983) (with J.M. Scharer and L.M. Lowe).

Accident Dispersion Modelling - A Simplified Approach. Presented at the Seventy-Sixth Annual Meeting of the Air Pollution Control Association, Atlanta, GA, June 1983 (with D.W. Hopper).

Calculation of Radiation Exposure in a Case-Control Study of Lung Cancers in Port Hope, Ontario. Presented at the Fourth Annual Conference of the Canadian Radiation Protection Association, Toronto, ON, 3-5 May 1983 (with G. Case and L.M. Lowe).

Environmental Issues Related to Uranium Mining. Presented at the Canadian Nuclear Association Seminar on Uranium and Nuclear Issues, Toronto, ON, November 1983 (with D.M. Gorber).

Design for Radiation Protection in the Mining of High Grade Uranium Ore. Chapter 70 of "Radiation Hazards in Mining - Control, Measurements and Medical Aspects", the Proceedings of the First International Conference, Colorado School of Mines, Golden, CO, October 1982 (with J. Mernagh and R.T. Torrie).

Overview of Uranium Tailings Management Practice. Presented at the International Conference on Radioactive Waste Management, Winnipeg, Man., September 1982 (with L.M. Lowe, R.A. Knapp and B.G. Ibbotson).

Assessment of Hypothetical Disposal Facilities for Canada's Low-Level Radioactive Waste. Presented at the Third International Conference on Radioactive Waste Management, Winnipeg, MB, September 1982 (with L.M. Lowe, A. Buchnea, L. Cabeza and E.J. Chart).

Environmental Considerations Related to Uranium Exploration. Presented at the Third Annual Conference of the Canadian Nuclear Society, Toronto, ON, June 1982 (with B.G. Ibbotson and V.J. Cassaday).

Public Health Effects of Radon from Uranium Mining and Milling. Presented at the Twenty-Sixth Annual Meeting of the Health Physics Society, Louisville, KY, 21-26 June 1981. (Abstract (slightly different title) in Health Physics 41(6): 874, December 1981) (with L.M. Lowe and R.B. Sutherland).

Fuel Cycle Risks - The Front End. Presented to the Canadian Nuclear Association Seminar on Nuclear Power Risks in Perspective, Toronto, ON, May 1981 (with S.E. Frost and V.J. Cassaday).

Potential Health Impacts of Enhanced Radiation Levels in Port Hope. Presented at the Second Annual Meeting of the Canadian Radiation Protection Association, Ottawa, ON, May 1981 (with L.M. Lowe, R.B. Sutherland and E.J. Chart).

The Canadian Experience - A Review of Environmental Considerations Associated with Uranium Mining Operations in Elliot Lake. Presented at the operation Action UP Conference on Uranium Mining and Radiation Safety at Michigan Tech University,

Houghton, MI, September 1980 (with D.M. Gorber and B.G. Ibbotson).

Development and Use of Radon Source Terms in Environmental Impact Assessments. Presented at the Twenty-Fifth Annual Meeting of the Health Physics Society, Seattle, WA, 20-25 July 1980 (Abstract in Health Physics 39(6): 1030, December 1980) (with L.M. Lowe, V.J. Cassaday, J. Nantel and J. Archibald).

Radium in Water, Sources, Levels and Effects. Presented at the Annual Conference of the Ontario Section, American Waterworks Association, Toronto, ON, April 1980 (with D.M. Gorber and B.G. Ibbotson).

Radiological Evaluation of a Uranium Mines Expansion: A Case Study. Presented at the Twenty-Fifth Winter Meeting of the American Nuclear Society, San Francisco, CA, 11-15 November 1979 (with L.M. Lowe).

Environmental Assessments - A Consultant's Viewpoint. Presented at the Canadian Nuclear Association International Conference, Toronto, ON, June 1979.

Radiological Monitoring of Uranium Fuel Processing Facilities. Seminar at Environment Canada, March 1979.

Environmental Factors Related to the Development of a New Uranium Refinery. Presented at the Eighth Annual Hydrometallurgical Meeting, Montreal, PQ, August 1978 (with J.P. Jarrell).

Radium Removal - Perspectives for the Future. Presented to the Canadian Uranium Producers' Metallurgical Committee Workshop on Radium-226 Control, Ottawa, ON, October 1977 (with R.A. Knapp).

Industrial Hygiene Survey of Uranium Mining and Milling Industry in Canada. Seminar at Canada Centre for Mineral and Energy Technology, Ottawa, ON, July 1977.

Taught Course in Air Pollution Control Engineering at University of Toronto (Spring 1976, Spring 1977). Offered by Department of Civil Engineering to fourth year and graduate students.

The Role of Noise in Environmental Impact Statements. Presented to a joint meeting of the PCAO and Ontario APCA, Toronto, ON, November 1976.

Comparison of Environmental Factors Relating to Alternative Sites for a Nuclear Generating Station in New Brunswick. Presented at Environment II, Association of Consulting Engineers of Canada, Montreal, PQ, September 1976 (with R.D. Gillespie and E. Koczkur).

Noise Pollution. Seminar #4 - Man and the Environment, Conservation Council of Ontario, February 1976.

Sources and Emissions of Atmospheric Mercury. Presented at the International Conference on Heavy Metals in the Environment, Toronto, ON, October 1975 (with D.M. Gorber and E. Koczkur).

Air Environment Review of Asbestos, Mercury and Lead. Presented at the Industrial Waste Conference, Toronto, ON, June 1975 (with D.M. Gorber and E. Koczkur).

Role of Consulting Engineer in Air Pollution Control. Seminar at Centre for Air Measurements Studies at Pennsylvania State University, 1974.

Review of Noise in Canada - Attitudes and Levels. Presented at the Ontario - Quebec APCA Joint Fall Meeting, Ottawa, ON, 1974 (with E. Koczkur).

Stack Testing, Odour Measurement and In-plant Measurements. Joint seminar of the MOE and PCAO, Toronto, ON, 1974 (with E. Koczkur).

Review of Industrial and Environmental Noise Concerns. Presented at the AIME Fall Meeting, Hamilton, ON, 1973 (with E. Koczkur).

3

Affidavit of Stewart J. Smith
Senior Hydrogeologist
Hydro Geo Chem, Inc.
51 West Wetmore
Tucson, AZ 85705

My name is Stewart J. Smith and I am a Senior Hydrogeologist with Hydro Geo Chem, Inc. ('HGC"). A copy of my curriculum vitae is attached to this affidavit.

I have been asked my opinion regarding the hydrogeology and potential for contaminant transport at the White Mesa Uranium Mill Site (the "site") located near Blanding, Utah. I am basing my opinion on a review of past consultant's reports describing the hydrogeology of the site (primarily on Titan, 1994[1]) and on my own involvement as a consultant to International Uranium (USA) Corporation ("IUSA") with an ongoing investigation into the occurrence of chloroform in a perched water zone underlying the site. The ongoing investigation is summarized, as of November 2001, in IUSA and HGC, 2001[2]. This opinion is based only on information available to me at the present time.

The site hydrogeology has been extensively studied by a number of past investigators and this study continues to the present day. The site is underlain by low permeability sandstone that hosts a perched water zone, which is about 70 feet below the tailings cells. The water quality of this perched zone is naturally poor and is of very limited usable quantity due to generally low permeability and low saturated thickness at the site, resulting in low yields to wells completed in this zone.

The regional aquifer is located approximately 1,200 feet below land surface at the site. The regional aquifer is separated from the perched zone by approximately 1,000 to 1,100 feet of very low permeability shales and other fine-grained materials, and sandstones with interbedded, very low permeability materials. Because these interbedded very low permeability materials will dominate the vertical permeability of these sandstones, the overall vertical permeability of these intervening materials is low, which protects the regional aquifer hydraulically from the perched zone. If the vertical permeability of this intervening zone were not low, then a perched water zone could not exist at the site. The regional aquifer is also under artesian pressure at the site such that water levels in wells completed in this aquifer rise above the top of the aquifer. As a result, water from the regional aquifer will tend to rise into these intervening materials rather than move downward from these materials into the regional aquifer. Furthermore, artesian pressure could not exist in the regional aquifer without the presence of these low vertical permeability intervening materials.

The direction of groundwater flow in the perched zone at the site is generally south to southwest, and varies from generally southerly on the eastern side of the site to generally

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[1]Titan, July 1994. Hydrogeological Evaluation of White Mesa Uranium Mill. Prepared for Energy Fuels Nuclear.

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

southwesterly on the western side of the site. The perched water is monitored by a number of permanent and temporary monitoring wells. The temporary wells were constructed beginning in 1999 to study a chloroform plume first detected in one of the permanent monitoring wells (MW-4) in 1999. The chloroform investigation is ongoing with successive stages of the investigation based upon the results of previous stages. With respect to perched water flow, the chloroform plume is located cross-gradient to up-gradient of the tailings cells at the site. Some of the permanent monitoring wells at the site that are located downgradient of the tailings cells are also located downgradient of the chloroform plume. Chloroform has not been detected in these wells except for a low concentration of 3.8 parts per billion (ppb) in one well that was demonstrated to be due to cross-contamination during sampling. Chloroform was not detected in a re-sampling of this well. The location of the detected chloroform relative to the tailings cells indicates that the detected chloroform could not have originated from the tailings cells.

The permanent monitoring wells at the site are placed to monitor perched water conditions downgradient, upgradient, and cross-gradient of the tailings cells. Based on a review of tailings cell construction and hydrogeologic properties at the site, and on numerical flow and transport modeling, I consider the location and spacing of these wells currently adequate to detect any seepage from the cells that might hypothetically occur and impact perched water under a range of reasonable flow conditions. This analysis is summarized in HGC, 2001[3]. The adequacy of the existing monitoring well network is enhanced by features of the tailings cells which would tend to make any seepage that might occur diffuse, that is, spread over a large areal extent. The larger the area over which potential seepage is spread, the fewer the wells needed to detect it should it ever impact perched water. For example, the drain layer located beneath the liner in Cell #3, which has a high permeability relative to bedrock, would tend to spread any seepage passing through the liner laterally. Also, any seepage that occurred via small manufacturing defects in the liner which would tend to be spaced relatively uniformly over the liner, would be spread out over a large areal extent to begin with, and be detectable with the existing monitoring wells should it ever impact perched water. The adequacy of the existing monitoring wells was also the conclusion of a previous consultant at the site (Titan, 1994[4]).

Dissolved constituents monitored in the permanent wells include species that are present in tailings cells at concentrations that are elevated with respect to their concentrations in the perched water. The monitored constituents fall into two broad categories: 1) those that are expected to migrate with the perched water (a conservative solute such as chloride) and 2) those that are expected to migrate more slowly than the perched water due to interaction with the matrix materials. Monitoring of the perched zone for elevated concentrations of conservative constituents provides an "early warning" for potential impact from the tailings cells. The monitored perched zone can be considered in this regard as an "early warning" system to detect potential leaks from the cells.

[3]Hydro Geo Chem, Inc. 2001. Assessment of the Effectiveness of Using Existing Monitoring Wells for GWDP Detection Monitoring at the White Mesa Uranium Mill, Blanding, Utah. Submitted to International Uranium (USA) Corporation

[4] Titan. September, 1994. Points of Compliance. White Mesa Uranium Mill. Submitted to Energy Fuels Nuclear.

Based on the overall site hydrogeology and the monitoring controls in place, I consider the tailings cells to be well-situated and designed to be protective of the environment. The site relies on natural features such as the perched water and underlying low permeability materials to protect regional groundwater as well as engineered controls. Even in the hypothetical event of a release from the tailings cells, the regional aquifer is additionally protected from impacts by the dilution that would occur in the perched zone and the low permeability strata between the perched zone and the regional aquifer. Furthermore, I have seen no evidence from monitoring results that would indicate any impact to the perched zone from the tailings cells. That the tailings cells have not impacted perched water is the conclusion of Roman Z. Pyrih and Associates.

As stated previously, the chloroform plume is located cross-gradient to up-gradient of the tailings cells with respect to perched water flow. The hydraulic location of the tailings cells and a number of other factors detailed in IUSA and HGC, 2000[5], indicate that the tailings cells are not the source of the detected chloroform, and that constituents present in the tailings cells could not follow the same pathway as the detected chloroform. Constituents present in the tailings cells would be expected to be detected in monitoring wells downgradient of the tailings cells should they ever seep from the cells and impact perched water. The source of the detected chloroform is most likely the abandoned scale house leach field, located east to northeast of the tailings cells. This leach field received laboratory wastes containing chloroform more than 20 years ago, prior to the White Mesa Mill's operation. The leach field origin is supported by: 1) the general distribution of chloroform detected in existing perched monitoring wells, 2) the location of the abandoned scale house leach field upgradient of the detected chloroform, and 3) the correlation between elevated nitrate concentrations and elevated chloroform concentrations in the monitoring wells that have been identified to have elevated chloroform concentrations. Furthermore, I have seen no evidence that a continuing source of chloroform exists. The absence of a continuing chloroform source is supported by data collected from the temporary monitoring wells and a soil gas survey conducted at the site in 1999.

The chloroform plume is moving slowly and has migrated approximately 1,800 feet south of the abandoned scale house leach field in more than 20 years, a rate of approximately 90 feet/year. The direction of migration of the plume is to the south and southwest. This apparent velocity represents the rate of movement of detectable chloroform concentrations and may be faster than the average groundwater velocity.

A small spring (Ruin Spring) located approximately 2 miles southwest of the chloroform plume may be recharged by the perched water zone. At a rate of approximately 90 feet/year, even if the plume could reach the spring, it would take approximately 117 years. Natural attenuation processes, including hydrodynamic dispersion, diffusion, and chemical breakdown, will reduce chloroform concentrations substantially if it continues to migrate downgradient. It is highly unlikely that chloroform concentrations at hazardous or even detectable concentrations would ever migrate to

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[5] IUSA and HGC, 2000. Investigation of Elevated Chloroform Concentrations in Perched Groundwater at the White Mesa Uranium Mill near Blanding, Utah.

the spring due to the large distance and travel time that would be required. It is even less likely that metals such as lead, which are subject to natural attenuation, would ever migrate to the spring.

Furthermore, because of the relatively slow rate of travel and large distance to the site's downgradient property boundary, there is ample time available for active mitigation of the chloroform plume using proven methodologies before there is any possibility of offsite impact. The isolation of the chloroform plume from the regional aquifer, and the long distances between the plume and the site boundaries, are points that were also recently stated in a February 20, 2002 letter from Mr. William J. Sinclair, Director, State of Utah Department of Environmental Quality, Division of Radiation Control, to Mr. Bill Love, 2871 East Bench Road, Moab, Utah.

Although I have seen no evidence for seepage from tailings cells at the site, potential seepage from the cells, should it ever occur to an extent that would impact perched water, would be expected to be transported southwesterly once it reached the perched zone. It is highly unlikely, however, that even conservative constituents originating from tailings cells that hypothetically impacted perched water would migrate as fast as the chloroform originating from the abandoned scale house leach field has. Permeability estimates from hydraulic tests indicate that permeabilities in the perched zone are generally lower to the south and southwest (downgradient) of the tailings cells than they are in the vicinity of the chloroform plume (to the east-northeast of the tailings cells). Perched water flow, and therefore contaminant transport downgradient of the tailings cells, would also be slower. Although the tailings cells are located slightly closer to Ruin Spring than the detected chloroform (approximately 1.8 miles from the spring), travel times even for conservative constituents originating from the tailings cells would be expected to be longer than travel times estimated based on past chloroform migration. Should perched zone monitoring ever indicate an impact from the tailings cells, ample time would be available to mitigate the problem before there was any possibility of off-site impact.

Stewart J. Smith

Subscribed and Sworn to before me this 17th day of May, 2002.

My Commission
Expires: July 17-2004

Notary Public

GREAT SEAL OF THE STATE OF ARIZONA 1912
TANYA BENTLEY
Notary Public - Arizona
Pima County
My Commission Expires
July 17, 2004

RESUME OF STEWART J. SMITH

EDUCATION:

B.S. (Geosciences), University of Arizona, Tucson, Arizona, 1980.
M.S. (Hydrology), University of Arizona, Tucson, Arizona, 1989.

EXPERIENCE:

Hydro Geo Chem, Inc.

Mr. Smith joined Hydro Geo Chem in 1989 as a Hydrogeologist. His responsibilities include management of site characterization and remediation activities, design of soil and groundwater remediation systems, collection and interpretation of chemical and hydrogeologic data, use of numerical models for remedial design and as predictive and interpretive tools, and preparation of interpretive reports. Project management duties have included representation of clients to and negotiation with controlling regulatory agencies.

Project involvement includes:

- Management of a groundwater remediation project at an Albuquerque, NM landfill site. Project elements include estimation of landfill gas generation rates, design of a soil vapor extraction (SVE) system to remove VOC from soils underlying the landfill that act as a continuing source to groundwater, and design of a groundwater pump and treat system. Includes field measurement of soil and aquifer properties to support the design of the SVE and groundwater treatment system, and evaluation of other remedial alternatives.

- Numerical modeling of the decomposition of municipal solid waste under both aerobic and anaerobic conditions. Model results were used to support the design of an in-situ pilot aerobic treatment system for a closed City of Tucson landfill and to predict long term methane generation rates for untreated landfills.

- Numerical modeling of a baro-pneumatic landfill gas generation rate measurement technique to support a patent application. Patent is pending. Use of the technique to estimate landfill gas generation rates in landfills located in Tucson, AZ, Albuquerque, NM, and Livermore, CA.

- Design of deep soil vapor extraction (SVE) systems for protection of groundwater beneath three Tucson, AZ landfills. Systems were configured to maximize removal of deep vadose zone volatile organic compounds (VOC) that have acted as a source to groundwater while minimizing air intrusion into the overlying landfill. The design process included the use of three-dimensional numerical gas flow and transport models that utilized estimates of soil properties derived from field air permeability tests.

- Management of an investigation at a uranium mill site in Utah to support the award of a groundwater discharge permit. Elements of the project include measurement of soil and bedrock hydraulic properties, numerical modeling to select appropriate monitoring well densities, investigation of a localized groundwater VOC plume, and presentation of results to and negotiation with controlling regulatory agencies.

- Development of a three-dimensional numerical model of groundwater flow through a fanglomerate drinking water aquifer located in central Arizona. The modeling was part of an ongoing remedial effort at an Arizona mine site. The model was used to predict the hydraulic interaction between the fanglomerate and an overlying alluvial aquifer impacted by acid mine drainage under pre-remedial conditions and under conditions of future remedial pumping of the alluvial aquifer.

- Management of an SVE design study at a U.S. Environmental Protection Agency Superfund site located near Gary, Indiana. Work included performance of a pilot test, design of an SVE remedial system for the site using numerical models, and preparation of a design report. The effects of biodegradation resulting from SVE operation were included in the evaluation. The system is currently operating within design parameters.

- Numerical modeling of unsaturated flow and transport within mine tailings impoundments at a copper mine in Arizona and a Trona mine in Wyoming. Three-dimensional numerical models have been used to: 1) predict the impact of past and current wet tailings disposal on regional groundwater, 2) assess remedial options, 3) direct further data collection activities, and 4) provide data for slope-stability studies.

- Development of a three-dimensional numerical flow and transport model to predict the effectiveness of various remedial pumping strategies on acid mine drainage at a site in Arizona.

- Hydrogeologic assessment of a mountainous terrane for a Native American tribe in Nevada. Work included estimation of sustainable water supply and water quality, and recommendation of areas most favorable for water development.

- Analysis of multi-depth soil gas data collected at a municipal landfill in Tucson, Arizona. Work included supervision of field activities and development of numerical flow and transport models that incorporate groundwater and soil gas data as an aid to understanding past history and current and potential future impacts of VOCs on groundwater.

- Supervision of an SVE /air sparging pilot test at the site of a gasoline release in Phoenix, Arizona. Work included preparation of site-specific work plans, quality assurance project plans, health and safety plans, and analysis and interpretation of field data using numerical models.

- Management of a remedial investigation at a U.S. Environmental Protection Agency Non-Time Critical Emergency Response site located in Fort Wayne, Indiana. Work has included investigation of on- and off-site subsurface VOC contamination and preliminary design of a soil and groundwater remedial system.

- Supervision of the design of an SVE system to remediate a VOC-contaminated Superfund site located in Kalamazoo, Michigan. Work included preliminary system design using numerical models.

- Assessment of the long-term impact of vadose zone VOCs on groundwater at a site located within the North Indian Bend Wash Superfund site. Work included use of numerical models and preparation of an interpretive report.

- Supervision of the design and installation of an SVE/Enhanced Bioremediation System for clean-up of a fuel oil spill in Phoenix, Arizona. Work included predictive numerical modeling of vapor extraction and biodegradation efficiency for the purpose of pilot test design, performance of a pilot test, interpretation of pilot test results, and preparation of interpretive reports.

- Supervision of an investigation of subsurface contamination by organic compounds at a Superfund site in the Livermore Valley, California. Duties included planning and direction of soil gas, soils, and groundwater work.

- Supervision of the investigation and remediation of tetrachloroethylene soil contamination at a site located within the San Gabriel Basin Superfund site, southern California. Duties included planning and direction of field activities, design of remedial alternatives, and preparation of interpretive reports.

- Biostimulation soil venting pilot tests. Duties included preparation of site-specific work plans, supervision of field operations, performance of venting efficiency and tracer tests, interpretation of results using numerical models, and preparation of interpretive reports.

- SVE pre-design investigations. Duties included supervision of soil gas sampling and soil air permeability tests, and interpretation of results using numerical models.

- Environmental audits. Duties included research and investigation into all aspects of past and present property use which may have an impact on potential site contamination and owner liability, as well as investigation into the possibility of contamination from off-site sources. Preparation of interpretive reports based on the results of research and on-site investigations.

- Acid mine water contamination study. Duties included sampling and on-site analysis of groundwater to delineate the extent and type of contamination, supervision of monitor and production well installation, performance and interpretation of aquifer tests, and preparation of interpretive reports.

Prior Experience

Geologist/Geologic Engineer for Newmont Exploration Ltd., Tucson, Arizona, 1984 to 1989. Major duties included:

- Analysis of the hydrogeology of the area surrounding a developing mine site in Nevada through interpretation of geologic maps. Recommendation of areas favorable for development of production wells to serve mining operations.

- Interpretation of geophysical data with respect to lithology and structure. Co-author of in-house report relating major gold districts to basin and range structure (as defined by regional gravity and aeromagnetic data). Development of a statistical model to quantify the spatial association of mineralization to aeromagnetic features.

- Geostatistical ore deposit modeling. Transformation of drill-hole data into engineering models used for mine design and planning, corporate financial planning, and published corporate ore reserve statements. Process required detailed analysis of the geologic environment, and analysis of the statistics and geostatistics of element distribution within an ore deposit, to ensure accurate estimation by kriging or inverse-distance techniques.

- Field acquisition, transcription, reduction, and presentation of data. Use of existing software to load, edit, grid, contour, and image process data on Burroughs mainframe, IBM PC, and COMPAC portables.

- Development of computer software to improve data processing procedures and design of routines to process new types of data sets.

- Research and field examination of areas with potential for bulk-minable gold mineralization. Using satellite imagery, located prospects with potential significant enough to warrant property acquisition.

Mineral Exploration Geologist for AMAX Exploration, Inc., and St. Joe American Corporation (now Bond Gold), 1980 to 1984. Responsibilities included research and field evaluation of properties with potential for bulk-minable gold, silver, tin, tungsten, and molybdenum mineralization; preparation of geologic reports and recommendations; supervision of drilling operations; and collection and analysis of geophysical data.

PROFESSIONAL AFFILIATIONS:

Member, National Groundwater Association

AWARDS/HONORS:

Member, Phi Kappa Phi (Honorary Society).

SHORT COURSES:

General Physics Corporation Short Course, "Bioremediation Engineering" November 1992.

Air and Waste Management Association Seminar, "Bioventing and Vapor Extraction: Uses and Application in Remediation Operations", April 1992.

OSHA 40-Hr Health and Safety Training for Hazardous Waste Site Activities, September 1989. 8-Hr Refreshers, Annually.

PROFESSIONAL PUBLICATIONS:

Bentley, H.W. and S.J. Smith. 1998. Soil Vapor Extraction of Chlorinated VOCs in the Vicinity of a Landfill Equipped with a Landfill Gas Control System. Presentation at the 1998 Arizona Hydrological Society Eleventh Annual Symposium. September 23 to 26, 1998. Abstract with Proceedings.

Bentley, H.W., J. Tang, S.J. Smith, D. Samorano, R.G. Arnold. 1998. Analysis of Remedial Options for Chlorinated VOCs at Harrison Landfill. In: Bioremediation and Phytoremediation, Chlorinated and Recalcitrant Compounds. The First International Conference on Remediation of Chlorinated and Recalcitrant Compounds. Monterey, California, May 18 to 21, 1998. pp. 21-26

Ward, J.J. and S.J. Smith. 1998. Arid Zone Landfills: What Do Investigation and Modeling of Containment Migration Reveal About Transport Mechanisms? Presentation at the 1998 Arizona Hydrological Society Eleventh Annual Symposium. September 23 to 26, 1998. Abstract with Proceedings.

Smith, S.J., J. Pepe, and G.R. Walter. 1995. The Effect of Variable Injection Rates on Air Sparging Patterns in Heterogeneous, Porous Media. Presented at the First International Symposium on In-Situ Air Sparging for Site Remediation. Las Vegas, Nevada.

Smith, S. and G. Walter. 1993. Numerical Modeling of "Raining" Soil Vapor Extraction Wells for a Hypothetical Alluvial Aquifer. Presented at Rocky Mountain Ground Water Conference - Ground Water Technology and Tasks in the 90's, Albuquerque, New Mexico, 1993.

Walter, G.R., R.D. Philip, and S.J. Smith. 1993. Chicken/Egg Arguments in the Establishment of Soil Cleanup Standards. Presented at Hazmacon '93, San Jose, California.

4

AFFIDAVIT OF MICHAEL J. TAYLOR, P.E.

1. I, Michael J. Taylor am a Registered Professional Engineer. I obtained my registration by written examination in Pennsylvania. I am registered in several other states including Colorado, and maintain active status in at least one of the states at any given time. A copy of my current curriculum vitae is attached hereto.
2. I received a Bachelor of Science and Master of Science degree in civil engineering in 1963 and 1965 respectively from Carnegie Institute of Technology (now Carnegie Mellon University). I have spent much of my engineering career working on environmental and waste management problems and solutions including work on mine waste, mill tailings, and chemical remediation and waste management at industrial sites, including Superfund Sites. I have also been actively involved in dam safety, foundation engineering, technology development and other aspects of the civil engineering profession.
3. I am currently employed as General Manager and Vice President of ERM EnviroClean Rocky Mountain, LLC in Greenwood Village, Colorado near Denver. ERM EnviroClean Rocky Mountain, LLC is a wholly owned construction/design/build services company of Environmental Management Resources (ERM), a large multinational consulting, engineering and design/build environmental firm.
4. My involvement with the White Mesa Milling Facility, near Blanding Utah dates back to 1979 when I was employed by D'Appolonia Consulting Engineers (D'Appolonia) as a Project Manager in Denver, Colorado. I was Project Manager for the conceptual design of the Tailings Management System for the White Mesa facility and also Project Manager for the detailed design and construction monitoring of various portions of this Tailings Management System. These duties and responsibilities extended into the 1980's. Several designs, reports and documents related to this facility were prepared by me or under my direction and supervision.
5. During the period of the late 1970's into the 1980's, I was also a Project Manager and actively engaged in assessments, designs and construction of various aspects of many other uranium tailings disposal facilities throughout the Western United States. Based on this experience, I authored or co-authored several published papers on this subject (See References List). During this period, I was also actively involved in the preparation of comments and participation in public meetings associated with the Nuclear Regulatory Commission's (NRC's) development of regulations governing the handling and disposal of uranium tailings.
6. This cumulative knowledge and experience was applied to the design and construction monitoring of various portions of the White Mesa Facility Tailings Management System. Referenced documents and other information were submitted to the NRC as part of the initial license and application. NRC and its consultants performed rigorous peer reviews of these designs, solicited public comment, responded to reviews and comments by other outside technical and non technical parties, and found the designs to be acceptable. This acceptance was documented in NRC's written permission to proceed with construction.

7. Likewise, various parties including NRC representatives monitored the construction of the initial phase of the facility. I was the Project Manager at D'Appolonia for monitoring of the construction of Cell 2 and for compilation of information for the construction of Cell 1-I. A D'Appolonia representative, reporting to me as Project Manager, was on-site during construction activity from September 1979 through May 1980 for Cell 2 construction. The results of the D'Appolonia construction monitoring and information from the construction of Cell 1-I (as provided by others) were contained in a Construction Report (Reference 4) that was submitted to the NRC for review and approval prior to the start of operations. NRC reviewed this information along with the information gained by having its own representatives visit the site during construction, and, as noted above, granted permission to start operations.
8. The detailed design of Cell 3 occurred in 1981 and was set forth in an Engineer's Report (Reference 1) which contained construction plans and specifications. As referenced above, I was the Project Manager for this detailed design. This report and the construction plans and specifications along with other relevant information were submitted to the NRC for review before the start of construction. Review of these plans and specifications was conducted by the NRC and its consultants, and the design was judged to be acceptable. Although D'Appolonia did not have an on-site representative during construction of Cell 3, I, or members of the design team were available for consultation on a periodic basis regarding design and construction issues during the construction period. Construction monitoring data and information similar to that collected for Cell 2 was collected and presented in a report for review by the NRC prior to the use of Cell 3. The NRC subsequently gave permission to use Cell 3.
9. In approaching the engineering task of creating an effective Tailings Management System for the White Mesa Facility, the design team under my supervision and with my active input, considered the following precepts of prudent engineering practice;

   Precept I - Layout and Design
   Conceptualize and layout the structure based on engineering experience, the needs and economics of the project and other factors. For the Tailings Management System at the White Mesa Facility, key input factors were the requirements of the Draft Environmental Statement for this facility. This document required, among other things, that the tailing disposal facilities be generally established as subgrade structures, so that when full they could be covered and would blend into the surrounding areas in an environmentally preferred fashion.

   Gather the data necessary for the design of the various components of the project. For the Tailings Management System at the White Mesa Facility, this included collection of geotechnical, geochemical, environmental, hydrologic and geologic data.

   Design the various components using prudent engineering practice and environmental considerations including good quality assurance/quality control (QA/QC) systems and practice to mitigate the potential for errors or omissions in the design. As part of any design, a prudent engineer considers various "what-if" scenarios for the facility or structure being designed. As an example of a "what-if" scenario, if an engineer were designing a bridge, the bridge would be designed for normal traffic loading and weather

conditions, then "what-if" scenarios involving excessive wind or earth quake loading, vibrations from unusual traffic, impact by boat traffic under the bridge, etc. would be considered. The prudent engineer then attempts to combine risk assessment with engineering design to mitigate these impacts if economically feasible. For some scenarios (e.g. a magnitude 10 earthquake), failure will occur and replacement or repair is the only option. Designing for such conditions is neither practical nor prudent.

For design of the Tailings Management System at the White Mesa Facility, consideration in the design had to be given to the "what-if" scenario of liner leakage, and this was done as discussed below. Massive liner failure for some unknown reason was considered a condition where replacement or repair was the only option. However, the potential for small leaks was a "what-if" scenario that was given consideration in the design.

Precept II-Construction
Monitor and/or collect data during construction to assure that the facility as constructed is consistent with the construction plans and specifications and the intent of the design. Various entities and individuals including NRC, the design engineer, representatives of the liner manufacturer, representatives of the facility owner and others monitored the construction of all aspects of the Tailings Management System at the White Mesa Facility. A vast amount of data and written observations were collected and reviewed by NRC and others. The conclusion by all parties involved was that the various components of the facility were constructed as designed or within the intent of the design.

Precept III – Performance Observation
Perhaps most important of all is the monitoring and observation of performance of the facilities under actual operating conditions. For example, a bridge after years of traffic and occasional extreme loading that performs well, validates the design and construction. Speculative assessments and "what-if" scenarios during design and prior to construction are theoretical at best. Speculation of negative "what-if" scenarios, as some may have done concerning the White Mesa Facility's Tailings Management System after construction and operation of the system for nearly 20 years are certainly less theoretical and can be shown to be essentially invalid. The system has been tested for those scenarios and proven adequate.

10. Using these prudent engineering approaches or precepts, the designs, construction and subsequent operations performance monitoring of the Tailings Management System at the White Mesa Facility have proceeded. The main components of this system as originally contemplated and used through the design of Cells 1, 2 and 3 are as follows:

    a) Originally, five cells were planned with four cells (Cells 2, 3, 4,and 5) planned for retention of solid wastes or tailings and one cell planned for evaporation of liquids that would be removed from the solid waste or tailings storage cells. The cells were located essentially below grade in a shallow valley or swale at the site.

b) Earthen embankments located essentially across the shallow valley or swale to create the retaining capabilities of the cells. A drain system under the liner along the face and toe of the embankments to (1) prevent hydrostatic head build up on the upstream face of the embankment and (2) detect major leakage from the cells.

c) A PVC liner in the cells to mitigate or eliminate seepage of tailings liquid out of the cells. The PVC liner was to be bedded on specially prepared materials and covered by similar materials to protect it from exposure to the sun's ultraviolet rays and accidental contact and damage by equipment or vandalism.

d) A fluids control and handling system in the solids retention cells consisting of:

- A drain system on top of the liner in the slimes accumulation area of the solids storage cells to (1) assist in tailings consolidation by drawing tailings fluids down through the tailings, (2) create a low permeability area of tight fine particles over the liner in this area and (3) minimize the hydraulic head directly on top of the liner.

- A pumping system to remove fluids from the solids storage cells and transport these fluids to the evaporation cell (Cell 1).

e) A system of groundwater monitoring wells to detect any impact to the groundwater.

f) A reclamation cover for those solids retention cells or portions of those cells that are full and require final reclamation for permanent storage of the solids in the cells.

11. A brief discussion of the layout, design, construction considerations and performance monitoring observations for each of these components is provided in order to demonstrate the degree of care and consideration that went into the design and construction of this facility. In summary, the design of the system was based on prudent engineering design principles for the constructed portions of the site as well as consideration of the natural features of the site in order to meet all regulatory standards and criteria. As will be discussed below, the natural features considered in the design included: (a) the natural swales in which the cells were located; (b) the calcareous nature of the underlying soils and bedrock which would attenuate the transport of radionuclides and elements that may leak from the cells; (c) the extensive shallow perched water zone which provides an ideal early warning system; (d) the aquitard between the perched groundwater and the regional aquifer which minimizes the potential of any impact on the regional aquifer; and, (e) the distance the cells are from the downgradient springs and the slow moving nature of the perched water, which minimizes the possibilities of any potential leakage from the cells affecting surface water.

12. Layout and Design Considerations

(a) Cell Location and Layout: the location of the cells in the shallow valley or swale at the site allows the tailings to be deposited and stored in areas that minimize exposure to the elements and allow reclamation below existing grade at the site.

This requirement and location concept was set forth in the Draft Environmental Statement (and eventually in the Final Environmental Statement) for the site. A detailed assessment of the environmental benefits of these locations and layout concepts can be found in those documents, along with inputs by wildlife and other experts participating in the licensing process at that time.

(b) Embankments: Borings and test pits were advanced in the areas of the proposed embankments and in borrow areas for fill to be used in construction of the embankments. Samples were taken and tested. Foundation preparation was specified to assure adequate support for the embankments. Highly calcareous (naturally high pH or geochemically basic) soils and weathered rock were noted in the foundation areas and removal of unsuitable surface materials was specified where necessary. Slope stability analyses were conducted using prudent engineering methods and various "what-if" scenarios.

One such scenario was the unlikely possibility of liner leakage and the potential for buildup of hydrostatic head against the embankment fill. Although a small amount of fluids against the embankment would not cause problems, a full hydraulic head of fluids could begin to create a saturated condition in the embankment and cause stability issues. To prevent this occurrence, a drainage layer to be placed under the liner was designed for placement against the embankment slope. Any fluids entering this layer would collect at the bottom of the slope for removal and prevent build up of the hydrostatic head.

A secondary benefit of this layer was as a monitoring mechanism. If significant amount of tailings fluids were ever found in this drainage system, it could indicate that a major leak had occurred in the liner. Monitoring of this system was then specified as part of the facility operation. This drainage system was not, however, meant to be the sole leakage detection system for the cells. As discussed below, an extensive system of groundwater monitoring wells was also a part of the monitoring system for the facility in order to detect any impacts of the facility on the surrounding groundwater environment.

(c) Cell Liners: Various considerations went into the selection and design of the cell liners for the Tailings Management System at the White Mesa Facility. These are set forth in the Engineer's Report for the Initial Phase Design (Reference 1) as well as in published papers prepared by myself and others. The factors that were considered were extensive and detailed and beyond the scope of this Affidavit. In summary, however, the following two key considerations went into this design;

- Select a liner that was appropriate for the fluids to be retained and appropriate for installation and operations at the site
- Understand the reaction of tailings fluids with the particular subsurface material at the site to assess the "what-if" scenario of liner leakage. This was key since in the late 1970's and early 1980's it was well known that depending upon-site specific conditions uranium tailings solutions interacted with soils and soft rock in certain Western uranium tailings sites to

significantly mitigate impact of uranium tailings fluids on the environment even at unlined disposal sites. (References 6,7,8,11)

Various types of liners were considered in the design including earthen materials from the local area, PVC, Hypalon and CPE. The clays from local borrow areas were not selected, primarily because of the potential for the clay to change physical properties when placed in contact with the tailings fluids. Hypalon and CPE liners could have been selected, but they were very expensive at that time and did not standup as well as PVC to characteristics of fluids that might exist in the tailings cells. PVC was considered reliable and had a long history of successful performance. Its biggest drawback was that it deteriorated under sunlight. This problem could be resolved, however, by providing an earthen cover over the PVC liner, thereby preventing exposure to sunlight as well as protecting it from other casual damage. The PVC liner was therefore selected and a cover of earthen materials was specified after installation.

Even today, PVC liners and materials are considered a good lining material for industrial applications. For example as quoted from a recent brochure from Field Lining Systems, Inc of Arizona, which I agree with "Polyvinyl chloride has excellent resistance to inorganic acids and alkalis, as well as a wide range of corrosive inorganic chemicals. The combination of chemical resistance and good physical properties has led to usage in numerous industrial applications exposed to corrosive conditions...."

Although the PVC liner would theoretically eliminate leakage from the cells unless massive failure occurred, prudent engineering design required us to look at the "what-if" scenario of small amounts of liner leakage, just as a bridge designer may look at excessive wind loads from a hurricane. The likelihood that such a situation will occur is small over the life of the structure, but if it does occur the engineer wants to know what the consequences are and try to design against adverse consequences if economically feasible.

In that regard, the design for the Tailings Management System assumed that if massive liner failure occurred in Cell 1, the cell would be emptied and the liner repaired before reuse. For Cells 2 and 3 that would be filled with solids, it was assumed that if massive liner failure occurred, the liner would be repaired or the cells would no longer be used, and all fluids would be removed. No further design considerations were required to mitigate the situation of massive liner failure other than to recommend repair should such an event occur. However, the potential for small minor leaks from pinholes were a "what-if" scenario that were reviewed in the design since emptying or cessation of the cell use in that case would not be practical.

Professionals working on uranium tailings during this time, including myself, regulatory agency personnel and noted scientists and engineers, had concluded, based on observation at many sites, that, depending on-site specific conditions,

radionuclides and other toxic elements in tailings fluids did not move very far from even unlined tailings ponds or cells where specific subsurface conditions existed.

The reasons for this action are complex and can be better understood by reading the many papers written on the subject. In simple terms, however, the reason this occurs is as follows;

- Radionuclides and other potentially toxic metals and chemicals in uranium tailing fluids are in solution because the pH of the fluids is very low (1 to 2). If the pH of the fluids remains low, these elements move freely with the fluids.
- When the pH increases (above 4 or 5), these elements no longer remain in solution and precipitate out. Consequently, fluids at higher pH moving through soils cannot carry these elements with them.
- At many Western uranium tailings sites, the subsurface natural earth is chemically basic with high pH. Whether at unlined sites or at lined sites, the uranium tailings fluids encounter these basic earthen materials, the pH of the fluids increases very rapidly near the pond or cell bottom. The radionuclides or toxic elements then no longer remain in solution and they precipitate into the natural earthen materials in this zone near the pond cell bottom.

At the White Mesa Facility, the subsurface materials are very basic as evidenced by the calcareous materials found throughout. Consequently, any small amount of leakage that potentially came through the liner in the design "what-if" scenario, would immediately encounter those materials, the pH would rise rapidly and many radionuclides and other potentially toxic metals would precipitate and remain in the zone immediately under the cell.

From a design standpoint, a properly installed and covered PVC liner was specified for this site. This will prevent loss of uranium tailings fluids from the cells. However, in the unlikely event that small amounts of tailings fluid were to escape, the backup mechanism of interaction with the natural earthen materials would prevent negative impact to the environment. This system of primary barriers with a backup mechanism is prudent engineering design for the Tailings Management System at the White Mesa Facility and, in essence, consists of a defense-in-depth protection system.

This type of fluids/earthen interaction and liner consideration is not necessarily applicable to tailings ponds at copper, gold or other types of mine/mill operations nor at retention systems at industrial chemical sites because the tailings fluids may not be low pH or may not contain metals and/or will not react with the subsurface environment in the same manner as does the uranium tailings fluid. For example at gold mines, the tailings fluids may contain cyanide which will not act the same as radionuclides when in contact with the underlying soils and rocks. At those sites, extra care has to be taken to prevent even small leakage. Such may be the experience of some reviewers of the White Mesa Facility design.

(d) Fluids Control and Handling System: The drain system placed on top of the liner was designed to create a downward flow or slow movement of fluids through the deposited tailings. The intent of the drain system was to consolidate the tailings in the cell. As the slimes accumulate and consolidate over the drains, a tight layer of relatively impermeable materials is created. Fluids in the cells on top of this layer find it difficult to flow through this layer into direct contact with the top of the liner. This provides another barrier to the escape of tailings fluid from the solids retention cells.

Finally, when the drains are periodically emptied as part of the operations of the system, the hydraulic head on the liner just below the drains is significantly reduced. With little or no hydraulic head on the liner, no tailings fluid is likely to escape. This is another aspect of the defense-in-depth protection system.

The fluid handling system designed for installation in the solids retention cells removes free liquids from the top of the cells and transports them to the evaporation cells. This keeps the hydraulic head low in the solids retention cells and again limits the fluids that the liner has to retain. It also lowers the liquids level at the upper reaches of the cells allowing consolidation of the coarser tailings that have been placed there by the beaching deposition.

(e) Groundwater Monitoring Wells: Although the various barriers to loss of tailings fluids to the environment significantly mitigated against any negative impacts, prudent engineering requires monitoring to assure that these barriers and systems are working properly. NRC also requires monitoring to detect impacts for this and all uranium tailings disposal facilities. Therefore as an integral part of the design, a groundwater monitoring system was designed and specified as part of the Tailings Management System at the White Mesa Facility.

Details of the design of this monitoring system can be found in the Engineer's Report on the Initial Phase Design and in the Letter Report, Leak Detection System Evaluation (Reference 3). Wells were to be installed in both the shallow and deep groundwater zones at the site. Subsequently, it is my understanding that the NRC determined that it was no longer necessary to monitor the deep groundwater zone, i.e. the regional aquifer. The original monitoring wells were located along preferred flow paths that seepage from the cells would take were it to occur. The wells were to be sampled before operation began and then periodically during operations to assess changes if any. Their purpose was to detect impacts to the groundwater and not to detect small amounts of leakage from pinholes in the liner. As discussed above, the probability that such small leakage could ever impact the groundwater is very small and detection of that leakage at the point of leakage is not important. It is the impact of massive leakage, were it to occur, on the groundwater that is important to regulatory agencies and is the basis of the monitoring system designed for this system.

(f) Reclamation Cover: Although the reclamation cover is not at issue here, it's design can also be considered another aspect of the defense-in-depth protection system that mitigates against loss of fluids or negative impacts to the environment.

The original reclamation cover design consisted of 13 feet of earthen materials. Two feet of that cover was to be a clay layer that will limit radon emissions and infiltration of moisture. It is my understanding that subsequent evaluations, designs and agency approvals resulted in some changes to the cover design, but still one that retains these basic components and restricts infiltration. Ultimately, this cover will prevent additional fluids accumulation in the cells and resultant hydraulic head on the liner. With lower head on the liner, the potential for escape of fluids is further reduced.

13. Construction Considerations

Proper construction begins with the preparation of well designed plans and specifications. This was done during the detailed designs for Cells 1, 2 and 3. The detailed plans and specifications are presented in the Engineer's Reports for these designs (References 1 and 2).

During field construction then, it becomes the responsibility of those on-site to assure that construction is conducted in accordance with those plans and specifications; or agreed upon modifications thereto based on field conditions as they are revealed during construction. Proper testing and recording of those test results is an integral part of the QA/QC for such work. This was done during the construction of the cells and other elements of the Tailings Management System at the White Mesa Facility. The results of the construction monitoring, testing and observations that was done in part under my supervision and direction are presented in the Construction Report (Reference 4). A few key points regarding this construction are presented below for the pertinent elements of the system that have come under discussion.

(a) Embankments: The construction of the embankments involved preparation of the foundations and placement of the earth fill. The foundations for the embankments were excavated to bedrock because of geotechnical variability of material and concern for uniform support of the embankment loads.

The fill material for embankment construction was removed from the borrow, taken to the embankment construction-site, spread in lifts and compacted with a self-propelled roller. Placement and compaction operations were observed by a D'Appolonia representative (Cell 2) or other authorized engineering representative. Density testing was conducted on every 600 to 1,000 cubic yards placed to assure that the compaction was achieving required and specified results. Density test results were compared to the Proctor Tests conducted on the borrow materials in the laboratory. QA/QC testing was done to assure that the density testing was being properly conducted. Observation during construction and test results indicated that the embankments were constructed in accordance with the plans and specifications.

(b) Liners: The PVC liners as manufactured by B.F. Goodrich were installed, tested and inspected by the manufacturer's representatives. First a bedding layer was placed in the areas to be lined. The bedding layer materials were obtained by crushing the weathered rock and soils at the site with a self-propelled Caterpillar 825 sheeps-foot compactor to obtain materials with the grain size distribution of coarse sand. Grain size distribution tests on the placed material, as presented in the Construction Report (Reference 4) verified the coarse sand nature of the material. Knowing the characteristics of the soft weather rock at the site and the capabilities of a Cat 825 compactor to crush such materials, it was relatively assured that creation of any particles with sharp edges that would penetrate the liner was virtually impossible. Regardless, an additional step was taken to assure a good bedding layer. The placed bedding material was compacted with a smooth drum vibratory roller. The surface was inspected by on-site engineering personnel to see if any large particles still existed and if they did, these particles were removed by hand or the area recompacted. The likelihood of any particles remaining with sharp edges after these operations is small. The visual inspection of the surface by representatives of D'Appolonia, BF Goodrich and the owner Energy Fuels verified the acceptance of the bedding layer for receipt of the PVC liner.

Testing of this layer to assess whether it had low permeability was not required as suggested by some reviewers. This layer was never designed to be a low permeability barrier. In fact, it was intended to be a more permeable layer zone between the PVC liner and the underlying much less permeable natural rock. This characteristic would allow any leakage to be directed to the toe of the embankments of the cells where the fluid drain/leak detection system is located. In addition, the layer was a geochemical barrier to the movement of radionuclides and metals for any leakage that might enter the layer.

Samples of the PVC materials from the actual rolls of material to be placed in the field and samples of field seams were taken and tested in the laboratory by BF Goodrich to verify compliance with ASTM standards and liner manufacturer requirements. These test results are contained in the Construction Report (Reference 4). The test results verify that the liner met all specifications and requirements.

The actual installation of the liner was inspected and observed by representatives of BF Goodrich, D'Appolonia and Energy Fuels. Supervision and inspection of the liner installation was performed by B.F. Goodrich. As indicated in the Construction Report (Reference 4), "From our observation, the liner in Cell 2 appears to have been installed in accordance with the guideline specifications."

The cover on the PVC liner was constructed of prepared coarse sand materials. The cover was advanced in lifts of sufficient thickness (12 to 24 inches) to prevent damage by the small dozer used to spread the cover material. This activity was closely observed to make sure that no damage to the liner occurred. Equipment operators performing this work were instructed not to make hard turns or otherwise

dig in the tracks on their equipment to prevent such damage. This was standard practice for the installation of such liners. From all indications, they followed instructions and placed the cover in a proper manner.

(c) Fluid Control and Handling Systems: As per the specifications, these systems were constructed of acid resistant piping and materials. Where work occurred around the liner, care was taken to not disturb the liner. These systems were installed to operate as designed for the life of the facility.

14. Performance Observations

Based on information supplied by the owner and operator of the Tailings Management System at the White Mesa Facility, the system as constructed and operated has performed for nearly 20 years as designed. This conclusion is based on the following pertinent factors:

- Cell 2 has been used to safely store solids tailings, and has been successfully covered as it reached capacity.
- Cell 1 has been used for nearly 20 years with no evidence of leakage.
- No tailings fluids have been observed in the groundwater monitoring systems. The liner and/or the backup systems seem to be performing as designed.
- The drains on the back of the embankments have kept fluids from accumulating against the back of the embankment, and no tailings fluids have been noted in these drains. The drains and the liner have performed as designed.
- The embankments have remained stable with no signs of sloughing, failure or distress. The embankments have performed as designed.
- Tailing fluids are periodically pumped from the drain system in the slimes area of the cells and consolidation of the tailings in these areas has occurred. The drains in the slimes have performed and provided the benefits as designed.

It is certainly possible to speculate on future performance problems, but unless there is a significant change in the operation of the facility, the probability of changes in the performance of the system and its demonstrated capability to protect the environment is slight. The designs have been made, the system constructed and the performance monitored for nearly 20 years, and found to be as designed. This then is considered a successfully engineered and operated facility by any applied engineering standards.

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6. Taylor, M.J. and PE. Antommaria, 1978, "Immobilization of Radionuclides at Uranium Tailings Disposal Sites," presented at the Symposium on Uranium Mill Tailings Disposal, Colorado State University, Fort Collins, Colorado.

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11. Champlin, 1979, Interactions of Uranium Mill Tailings Liquor with Natural Materials, presented at the Symposium on Uranium Tailings Disposal, Colorado State University, Fort Collins, Colorado.

12. Draft Environmental Statement for White Mesa Uranium Project, 1978.

13. Final Environmental Statement for White Mesa Uranium Project, 1979.

14. NRC Operations License for White Mesa Uranium Project, 1979 (giving permission to construct and operate the Tailings Management System)

Michael J. Taylor

Subscribed and Sworn to before me this 17th day of May, 2002.

My Commission
Expires: November 28, 2002

Notary Public

SHARON L. PIERSON
NOTARY PUBLIC
STATE OF COLORADO

Biographical Information and Professional Experience

Michael J. Taylor, P.E.

Fields of Competence

- Design/ Build and Construction
- Remediation
- Remedial technologies
- Mine and Mine Waste/Tailings Reclamation
- Dams and Water Resources
- Infrastructure Systems (Roads, Water, Sewer, Power, etc.)
- Brownfields Redevelopment
- Building Foundations and Geotechnical Engineering

Experience Summary

Mr. Taylor has over 30 years of experience in consulting, engineering, and construction in civil, redevelopment, mining and waste management projects; managing and solving problems on often complex integrated multidisciplinary endeavors.

After two years active duty as a Corps of Engineers Officer, he spent sixteen years with D'Appolonia Consulting Engineers as a consultant, engineer and design/builder. Projects included solving slope stability problems, building foundations, earth and concrete dams, active mine tailings systems and reclamation/closure, land development infrastructure systems and hazardous waste sites investigation and remediation.

For eleven years with Canonie Environmental Services, he served as construction/project manger and executive in this environmental design/build/construction company primarily involved with hazardous waste remediation and mine tailings reclamation projects.

For the next five years with CH2M Hill, he assisted and developed design/build and construction capabilities in this then primarily consulting organization.

He currently is the General Manger of ERM EnviroClean Rocky Mountain, an integrated construction /design/build organization working closely with ERM's Rocky Mountain consulting business.

Credentials

B.S. Civil Engineering Carnegie- Mellon University 1963
M.S Civil Engineering, Carnegie -Mellon University 1965
Registered Professional Engineer, Colorado, Pennsylvania and 13 other states

Professional Affiliation

Member ASCE

Publications

Over 23 published papers and articles on design/build, consulting, engineering and construction in areas of expertise and experience.

Professional Publications

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5

AFFIDAVIT

I, Roman Z. Pyrih, being duly sworn according to law, depose and state as follows:

1. I am presently employed as President and Consulting Geochemist of Roman Z. Pyrih & Associates, Inc. A copy of my curriculum vitae is attached to this affidavit. I have been asked my opinion regarding the reprocessing of certain uranium-bearing material by International Uranium (USA) Corporation ("IUSA") at the White Mesa Uranium Mill (the "Site"). The uranium material is described as "lead-sulfide sludge" from Molycorp's facility in Mountain Pass, CA. My opinion relates to the properties of the uranium material, to the solubility characteristics and geochemical mobility of certain constituents contained in the material, to the ability of the tailings cells to manage the constituents that would be introduced, and to the adequacy of existing groundwater monitoring. I am basing my opinion on a review of past consultants' reports describing the hydrogeology of the Site, and on my own involvement as a geochemical consultant to IUSA with an ongoing investigation into the occurrence of chloroform in the perched groundwater at the Site. I was asked to look at the geochemical mobility of lead in the tailings environment well before the issuance of License Amendment 20.

2. It is my understanding that Molycorp processed ores for rare-earth recovery and that these ores contained uranium. The host rocks for such ores were metamorphic gneisses that were intruded by pegmatites and carbonatites. The carbonatites contained the mineral bastnasite that contained the lanthanum series of elements. Associated with the lanthanum series were impurities including uranium, iron, and lead.

3. Metamorphic rocks such as gneisses can be uranium-bearing and can be a source of uranium ores. It is my understanding that in the past, the Mill has processed ores that were mined from sedimentary rock (sandstones) and from metamorphic rock (breccia). Breccia is a rock that is altered or metamorphosed in the earth by hydrothermal solutions.

4. It is my understanding that the uranium material was produced during the milling of the metamorphic gneisses that were the host rock for the rare earth. Milling the metamorphic gneisses consisted of crushing and grinding the rock and then floating the bastnasite ores to separate and concentrate the material that contained the rare earths from the tailings. This flotation concentrate was roasted to drive off carbonate and to oxidize the rare earth product. The roasted product was leached with acid to solubilize the constituents and the resultant leachate was purified by removing the uranium, iron, and lead impurities before recovering the rare earths using solvent extraction / ion exchange.

5. It is also my understanding that the uranium material was formed during this purification step when the acidic pH of the leachate was neutralized with ammonia to precipitate iron impurities as iron hydroxide, and a chemical reducing agent, sodium hydrosulfide, was added to precipitate lead impurities as lead sulfide. Uranium impurities in the leach liquor followed the iron and the lead in precipitating as an insoluble uranium product.

6. It is my understanding that the uranium material that will be processed at the White Mesa Mill (the "Mill") consists of uranium-bearing lead-sulfide sludge that was separated from the leachate during the purification step in the Molycorp process. This lead-sulfide sludge is elevated in iron.

7. It is my understanding that reprocessing the uranium material at the Mill will necessitate acidifying the lead-sulfide sludge mixture, and if needed, oxidizing the contained uranium so as to put the uranium product back into solution. In the process of oxidizing the uranium, the residual lead sulfide will be oxidized also. The oxidation process will convert the lead-sulfide sludge into lead and sulfate ions, which are water soluble.

8. It is my opinion that reprocessing of the uranium material at the Mill will convert the bulk of the lead-sulfide sludge into ionic constituents that are water-soluble and that are indistinguishable from the constituents (iron, lead, and sulfate) already present in the tailings solutions. After extracting the uranium, the spent leachate that contains water-soluble iron, lead, sulfate, and any residual lead sulfide will be discharged to the tailings cells. In short time, any residual sulfide that is discharged to the tailings cells will be oxidized to sulfate.

9. The iron, lead, sulfate, and any residues of lead sulfide remaining from reprocessing the Molycorp uranium material will be discharged to the tailings cells as an acidic, spent-leachate solution. The chemical composition of this spent leachate will be similar to the tailings solutions presently in the cells. Under the acidic pH conditions typical of the tailings solutions, much of the lead and iron will remain dissolved as water-soluble cations, and the sulfate will remain dissolved as a water-soluble anion. Other than the oxidation of the residual sulfide to sulfate, no additional reaction between the spent leachate and the existing tailings solution is likely to occur. The dissolved constituents of the spent leachate will be discharged to the tailings cells in a form that is stable in the tailings environment.

10. The acidic tailings solutions already contain elevated concentrations of iron, lead, and sulfate. Based on a recent sample taken in April 2002, lead was measured at 17 mg/L. Other recent samples indicated iron and sulfate measurements of up to 10,000 mg/L and up to 289,000 mg/L, respectively. The levels of these and other constituents limit the amount of lead that can be in solution to approximately 20 mg/L, regardless of the total inventory of lead in the tailings.

11. The iron, lead, and sulfate that will be introduced into the tailings cells from reprocessing the uranium material could remain soluble in the tailings solution for some time. While it is true that under the acidic pH conditions that are typical of the tailings solutions, the constituents are geochemically mobile and it is my opinion that given the geochemical conditions existing at the Site, the constituents dissolved in the tailings solution are physically isolated and geochemically contained. If seepage from the tailings cells were ever to penetrate the synthetic liner and migrate into the subsurface, geochemical reactions would instantly occur between the tailings solution and the cell's foundation materials. The foundation of the cells consist of soils and bedrock that are calcareous in composition, that is, the soils and bedrock contain calcium carbonate minerals similar in composition to limestone. The carbonate minerals would immediately react with seepage, neutralizing the acidic pH of the tailings solution. Neutralization of the tailings solutions in turn, would trigger other geochemical reactions. Calcium would be released when the calcareous soils and bedrock react with the tailings solution. This calcium would immediately react with the abundant sulfate present in the tailings solution to form insoluble calcium sulfate (gypsum) that has been demonstrated to plug seepage pathways, thus making these soils and bedrock *self-healing* and even more impermeable to seepage. Similarly, any iron that may be present in tailings solution would also act to plug solution pathways in the soils and bedrock beneath the tailings cells. As the pH of tailings solution is partially neutralized to above pH 3, the iron would begin to precipitate as a very insoluble, iron hydrous-oxide gel that would seal-off seepage pathways. These reactions, that are typical of acidic uranium tailings solutions, preclude the formation of preferential flow pathways that could eat "wormholes" through the underlying rock. In fact, numerous studies conducted for NRC and industry have demonstrated the opposite to occur. Namely, the percolation of acidic uranium tailings solutions through naturally calcareous strata makes the strata more impermeable to seepage.

12. Secondly, it is my opinion that neutralization of the tailings solutions' acidity by the calcareous soils and bedrock creates geochemical conditions that are optimal for natural attenuation. Natural attenuation is the ability of earthen materials to interact with potential groundwater contaminants and remove such constituents from seepage before the solutions enter groundwater. Natural attenuation occurs through geochemical mechanisms that lead to precipitation and co-precipitation, to sorption, and to cation and anion exchange of the contaminants. Again while it is true that under the acidic pH conditions that are typical of the tailings solutions and potential groundwater contaminants are geochemically mobile, once the tailings solutions make contact with naturally calcareous strata, pH conditions are established that are favorable for natural attenuation and the mobility of potential groundwater contaminants is greatly reduced. At the point of contact, low pH solutions will attack the calcareous strata and will consume the calcium carbonate until acidity is neutralized. Some thickness of strata will be sacrificed before the penetration would *self-heal* and conditions favorable for natural attenuation are established. In my experience, this transition occurs within inches in naturally calcareous strata.

13. It is my understanding that the tailings cells were designed and engineered to incorporate natural attenuation as an additional safeguard against seepage migration. About 70 feet of sandstone, siltstones, and claystones separate the tailings cells from the perched groundwater zone. It is my opinion that these formations provide ample material for interacting with chemical constituents in any seepage that would enter the subsurface. The thickness of the formations is adequate to prevent the migration of iron, lead, and other potential contaminants from affecting groundwater quality. For example, heavy metals such as copper, lead, and zinc would be adsorbed on the clay minerals of the siltstone and claystone bedrock through the process of cation exchange. Similar reactions would occur with radionuclides like thorium. Other soluble tailings constituents such as arsenic, for example, co-precipitate with hydrous iron oxides to form an insoluble ferric arsenate analogous to the mineral Scorodite. The same hydrous-oxides of iron and of manganese would act as geochemical scavengers and adsorb potential groundwater contaminants. Most of the chemical constituents present in soluble form in the tailings solutions would be removed from solution by these natural mechanisms and would be attenuated in their migration.

14. The role that geochemical reactions play in attenuating the percolation of seepage and the migration of potential groundwater contaminants has been studied extensively over 30 years of investigation and observation. Natural attenuation of heavy metals and radionuclides is well know to NRC and is well documented by laboratory and field investigations conducted by numerous institutions at various uranium tailings sites. The studies have always indicated that potential groundwater contaminants such as arsenic, barium, copper, iron, lead, vanadium, and thorium, which are often found dissolved in acidic tailings solutions, do not migrate in the subsurface environment. From a geochemical perspective, the behavior of radioisotopes Th-230 and Th-232 is indistinguishable; their reactivity and lack of mobility are identical.

15. Groundwater has been monitored at the Site even prior to the initiation of milling operations. Background has been developed over the years for the key parameters under the Mill's NRC compliance monitoring program. These parameters (chloride, potassium, nickel, and uranium) are key indicators of potential leakage from the tailings cells. Unlike most of the constituents present in the tailings solution, chloride, potassium, and nickel are "conservative" in their geochemical behavior, which means that these constituents are 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. Because these constituents travel at the speed of groundwater, it is my opinion that monitoring these key parameters serves as an early warning to the arrival of potential groundwater contaminants such as arsenic, barium, copper, iron, lead, vanadium, and thorium which are attenuated in their movement.

16. Nickel and uranium are included in NRC's list of key parameters. Nickel is not affected by the geochemical processes that attenuate the movement of heavy metals in groundwater and is much more mobile than lead. As such, nickel serves as an early warning of the approach of seepage that may contain lead. Uranium is much less affected

by the geochemical processes that attenuate the movement of natural radionuclides and is much more mobile than thorium. Uranium serves as an early warning of the approach of seepage that may contain thorium.

17. It is my understanding that in addition to the key parameters already being monitored, an expanded list of parameters that includes iron, lead and other inorganic and organic constituents, as well radionuclides including thorium are monitored in groundwater at the Site on an annual basis under a split sampling program with the State of Utah Department of Environmental Quality.

18. It is my opinion that the chloroform plume first identified in monitoring well MW-4 did not emanate from the tailings cells. Neither the quarterly NRC compliance monitoring of key parameters nor diagnostic fingerprinting of water "types" indicated that seepage from the tailings cells had migrated to the monitoring well. The diagnostic fingerprint technique is used by geochemists to "type" groundwater based on its chemical composition or major-ion chemistry. For example, groundwater can be characterized by the relative concentrations of sodium, potassium, calcium, magnesium cations and the relative concentration of sulfate, chloride, and bicarbonate anions that are dissolved in the water. Relative concentrations of these major ions can be plotted in diagnostic diagrams that fingerprint the water. Tailings solutions have a characteristic and unique major-ion fingerprint in which magnesium and sodium are the predominant cations, and sulfate and chloride are the predominant anions. None of the monitoring wells at the Site (including MW-4) showed the groundwater with the major-ion fingerprint that would be indicative of tailings solutions. As a result, I have concluded that the tailings cells are not leaking and tailings solutions are not making their way into monitoring wells.

19. If tailings solutions were not flowing into monitoring well MW-4 (which is located cross-gradient of the tailings cells), then tailings seepage could not be carrying chloroform into the monitoring well. Some other source area had to account for the presence of high concentrations of chloroform in the monitoring well. In my opinion, the most-likely source of the chloroform reported in monitoring well MW-4 was an abandoned leach field that received laboratory effluents containing chloroform between 1979 and mid-1980, prior to the operation of the Mill. The abandoned leach field has been under extensive investigation by Hydro Geo Chem, Inc., which confirms the leach field to be the most-likely source of the chloroform reported in monitoring well MW-4.

Roman Z. Pyrih

Subscribed and Sworn to before me this 17th day of MAY, 2002.

My Commission
Expires: ____________

My Commission Expires 07/19/2005

Notary Public

ELAINE K. ILGENFRITZ
NOTARY PUBLIC
STATE OF COLORADO

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Senior Project Manager

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Citizenship: United States of America

Education:

Ph.D. Geochemistry, Colorado School of Mines, Golden, Colorado, 1974
M.S. Chemistry, Colorado School of Mines, Golden, Colorado, 1970
B.S. Chemistry, Fordham University, New York, 1967

US Army Chemical Center and School, Fort McClellan, Alabama, 1973

Professional Summary:

Dr. Roman Z. Pyrih has more than 25 years of industry experience in managing mining and industrial waste, and in dealing with soils and groundwater contaminated by heavy metals and radionuclides. Dr. Pyrih is internationally recognized as an expert on the geochemical behavior of heavy metals and radionuclides in the environment. He has managed and consulted on numerous domestic and international projects, while integrating geochemical technology into resource recovery, and soil and groundwater cleanup strategies.

Dr. Pyrih has directed environmental services in geochemistry and geohydrology that included: definition of background, geochemical pathway and fate analysis, contaminant attenuation studies, and *in situ* remediation using microbial degradation, adjustments of Eh and pH, and geochemical fixation of contaminants. His specialty is *in situ* cleanup of soils and groundwater utilizing naturally occurring geochemical and microbial processes to immobilize or eliminate potential groundwater contaminants.

Experience:

1988 to Present

President and Consulting Geochemist
Roman Z. Pyrih & Associates, Inc.
Geochem Ventures International
Golden, Colorado

Dr. Pyrih has been pursuing "bankable" environmental projects, both domestically and internationally. These opportunities recover and recycle valuable resources such as spilled fuels, precious metals, or industrial chemicals and minerals, with revenues from the recovery being utilized to pay for cleanup operations.

Concurrently, Dr. Pyrih has been providing consulting services in geochemistry to the mining and metals industries by overseeing the preparation of site characterization reports, engineering evaluations and cost analyses, and risk assessments. He has managed soils and groundwater cleanup projects for major US clients and multinational lending institutions, and has implemented *in situ* remedies at sites contaminated with arsenic, boron, hexavalent chromium, copper, cyanide, lead, mercury, molybdenum, selenium, and uranium.

1996 to 1998

Principal Geochemist
Fluor Daniel GTI, Inc.
Golden, Colorado

Directed remediation of groundwater and soils at gas plant sites and CCA wood-treating facilities. Utilized chemical reduction technology to effect *in situ* conversion of hexavalent chromium to the trivalent state, followed by *in situ* precipitation and geochemical fixation of the chromium in the groundwater regime.

Directed laboratory studies that quantified natural attenuation of CCA chemicals, including arsenic, copper and hexavalent chromium, by soils and aquifer materials and confirmed natural attenuation of hexavalent chromium in field demonstrations.

Demonstrated *in situ* cleanup of arsenic in groundwater. Natural attenuation of arsenic was enhanced by introducing iron into groundwater and was effected by air sparging of the subsurface, so as to promote the precipitation and removal of insoluble iron-arsenate compounds.

Managed the remediation phase of the Lincoln Park superfund site at the Cañon City Uranium Mill in Colorado. Proposed and successfully negotiated an in-place remedy to treat soils and restore water quality in the former uranium tailings disposal area, contaminated with uranium and molybdenum. The remedy was a cost-effective alternative to excavating and removing soils from the footprint of the former unlined tailings ponds, and was implemented at the site in the fall of 1996, with the consent and approval of regulatory agencies including US EPA. An objective of the remedy was to minimize long-term groundwater pumping and treatment costs.

Pursued resource recovery opportunities to include: ozone treatment of sulfide ores; electrokinetic treatment of zinc-bearing waste; vacuum-enhanced recovery of spilled fuels; microbial degradation and chemical oxidation of organic contaminants.

1992 to 1995

Director of Ukrainian Operations and Principal Geochemist
GEOCHEM, a Division of TerraVac
Lakewood, Colorado

Evaluated opportunities to recover jet fuel and solvents spilled at fuel storage facilities at the Uzyn military base in Ukraine. The spilled hydrocarbons seeped into the ground, contaminated groundwater, and hindered the conversion of airport facilities for commercial, non-military use. The full-scale project could be self-funding, with revenues being generated by the recovery and recycling of valuable fuel products. Negotiated with potential partners on projects in Ukraine, with Ukrainian officials in the Ministry of Defense, the Ministry for Environmental Protection, and the Embassy of Ukraine in Washington, D.C. Initiated a faculty/student exchange program between the Colorado School of Mines and the Ivano-Frankivske University for Oil and Gas in Ukraine.

Responsible for identifying "bankable" environmental projects in Ukraine and Eastern Europe. Managed a feasibility study for one of the first environmental cleanup projects in Ukraine, at an oil refinery site in Drohobych, Lviv Region, and obtained funding for this feasibility study from the Overseas Private Investment Corporation.

1986 to 1992

President and Director of Geochemistry
GEOCHEM, Inc.
Lakewood, Colorado

Directed technology group that supported design of waste-disposal facilities at numerous customer sites. Integrated geochemical concepts into the design of waste-disposal facilities which incorporated additional environmental safeguards to protect groundwater from potential contamination.

Developed chemical reduction technology to convert hexavalent chromium in soils and groundwater to the less mobile, trivalent state. Incorporated chemical reduction into remediation strategies to affect *in situ* precipitation and geochemical fixation of chromium.

Introduced passive in-place treatment to abate the generation and effects of acidic rock drainage, as an alternative to conventional water treatment for heavy metals and arsenic. Demonstrated the ability of soils and earth materials to attenuate the movement of free cyanide and metal cyanide complexes in the subsurface for numerous customer sites. Implemented biogeochemical remedies to degrade cyanide in groundwater using indigenous microorganisms.

1979 to 1986

President and Consulting Geochemist
Roman Z. Pyrih & Associates, Inc.
Golden, Colorado

Conducted contaminant attenuation studies at numerous locations in support of permitting, closure, and land application activities. Studies included quantifying the ability of clay liners, soil, and bedrock material to attenuate the movement of various chemical and radiochemical constituents as potential groundwater contaminants.

1974 to 1979

Project Manager
Earth Sciences, Inc.
Golden, Colorado

Designed, engineered and operated a five-acre, heap-leaching pilot facility to recover gold using sodium cyanide and activated carbon. Developed and patented pyrometallurgical and hydrometallurgical processes to recover vanadium from metal-bearing shale, and uranium from commercial phosphate fertilizer.

Membership in Professional Societies:

Mining and Metallurgical Society of America
Society for Mining, Metallurgy, and Exploration
Ukrainian Academy of Sciences for Oil and Gas (Honorary)

Language Proficiencies:

English - Excellent (Speaking, Reading, Writing, Understanding)
Ukrainian - Excellent (Speaking, Reading, Writing, Understanding)
Russian and Polish - Fair (Reading, Understanding)
Italian, Spanish, and German - Fair (Speaking, Understanding)

Publications:

Dr. Roman Z. Pyrih has authored more than 30 technical publications dealing with the movement of contaminants such as cyanide, heavy metals, and radionuclides in the environment. His papers have also addressed *in situ* approaches to treating soils and restoring water quality in groundwater aquifers. He has been issued four US patents for hydrometallurgical processes to recover vanadium and uranium. A partial list is provided below.

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Pyrih, R. and R. Brown, 1998. "Enhancing the Natural Attenuation of Metals." Fourth Annual Conference on Natural Attenuation '98, Pasadena, CA, December, 1998.

Pyrih, R. 1998. "Overview of Metals Remediation Technologies Used in the Private Sector; Geochemical Fixation of Uranium and Molybdenum." Presented before Committee on Technologies for Cleanup of Subsurface Contaminants in the DOE Weapons Complex, National Research Council, Hanford Reservation, Richland, WA, May, 1998.

Pyrih, R. and R. Brown, et al. 1998. "In situ Remediation of Metals Comes of Age." Remediation / Summer 1998, p. 81 - 96.

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Pyrih, R. 1997. "Geochemical Fixation as a Remedy for Restoring Groundwater Quality." Presented before Hazardous Materials and Waste Management Division, Colorado Department of Health, Denver, Colorado.

Pyrih, R. 1996. "In-Place Cleanup of Soils and Groundwater Containing Cyanide and Metals." Presented at meeting of Alaska Miners Association, Anchorage, Alaska.

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Pyrih, R. 1996. "Laboratory Testwork and Field Demonstration of Flushing with Geochemical Fixation of Uranium and Molybdenum in the Old Ponds Area." Prepared for Cotter Corporation in support of remedy activities at the Cañon City Mill.

Pyrih, R. and J. Rouse. 1994. "In-Place Cleanup of Copper, Chromium, and Arsenic in Soil and Groundwater at Wood Preserving Sites." Second International Symposium and Exhibition on Environmental Contamination in Central and Eastern Europe, Budapest, Hungary.

Pyrih, R. 1993. "Remediation, Rehabilitation and Natural Resource Development in Eastern Europe - Environmental Opportunities and Needs." National Western Mining Conference & Exhibition, Denver, Colorado.

Pyrih, R. and J. Rouse. 1993. "Geochemistry." Geotechnical Practice for Waste Disposal. Edited by David E. Daniel; Chapman & Hall, London.

Pyrih, R. 1992. "Resource Recovery in Ukraine; Size and Scope of Environmental Projects." Environmental Group of ASCE Colorado Section.

Pyrih, R. 1992. "Opportunities and Needs in Natural Resources Development in Ukraine." Presented at TWG Leadership Conference, Developing a New Democracy - The Role of U.S. - Ukraine Relations, Washington, D.C.

Pyrih, R. 1992. "Environmental Regulation and Their Application to Mineral Development in the United States." Ukrainian State Committee on Geology and Utilization of Mineral Resources, in Kiev and Krivij Rih, Ukraine.

Pyrih, R. 1992. "Supplemental Trip Report, World Bank Environmental Mission to Ukraine, July 8 to 11, 1992." Prepared under Terms of Reference for The World Bank.

Pyrih, R. 1992. "Environmental Rules and Regulations in the United States - an Industry Perspective." Ministry for Environmental Protection of Ukraine, in Kiev, Ukraine.

Pyrih, R. 1992. "Final Report, World Bank Environmental Mission to Ukraine, April 9 to April 29, 1992." Prepared under Terms of Reference for The World Bank.

Pyrih, R. 1992. "Environmental Degradation and Environmental Health in Ukraine - Panel Discussion." Health and the Environment Conference held at the United Nations, New York City.

Pyrih, R. 1991. "Evolution of the Environmental Protection Agency in the United States." Ministry for Environmental Protection of Ukraine, in Kiev, Ukraine.

Pyrih, R. 1991. "Use of Lysimeters to Monitor the Effects of Tailings Dewatering on Pore-Water Chemistry." Proceedings, Randol Gold Forum, Cairns '91, Australia.

Pyrih, R. and D. Hall, Hall Southwest Water Consultants. 1991. "Naturally Occurring Radionuclides and Their Distribution in Texas." Prepared for Texas Utilities Mining Company in support of permitting.

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Pyrih, R. and V. Straskraba, et. al. 1988. "A Study of the Potential for Surface and Groundwater Contamination by Arsenic at the Sunbeam Gold Mine." Third International Mine Water Congress in Melbourne, Australia.

Pyrih, R. and J. Rouse. 1988. "Natural Geochemical Attenuation of Trace Elements in Migrating Precious-Metal Process Solutions." Proceedings, Randol International Gold Conference, Perth, Australia.

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Pyrih, R. and J. Rouse. 1985. "Natural Geochemical Attenuation of Contaminants Contained in Acidic Seepage." Proceedings, International Conference on New Frontiers of Hazardous Waste Management, EPA .

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6

SHERIFF
James D. Nyland, Sr.
435-259-8115

CHIEF DEPUTY
Doug Squire
435-259-8115

OFFICE OF THE GRAND COUNTY SHERIFF

May 20, 2002

Via Facsimile

Mr.Ron Hochstein
President and Chief Executive Officer
International Uranium (USA) Corporation
1050 17th Street, Suite 950
Denver, CO 80265

Re: Grand County Emergency Response

Dear Ron:

In response to our discussions in the past and your request to clarify a few issues with respect to the transportation of alternate feed materials to International Uranium (USA) Corporation's White Mesa Mill, I would like to make the following statements;

1. The Grand County Emergency Response personnel are familiar with the characteristics of the Molycorp material and all other alternate feeds that have been sent to the White Mesa Mill.

2. The Grand County Emergency Response personnel are comfortable with the emergency response plans of the transportation sub-contractors, in particular the spill response contingency plans.

3. The Grand County Emergency Response personnel are satisfied that the Emergency Response Plans of the transportation sub-contractors combined with our own emergency response capabilities are sufficient to respond to any emergency that may occur that involves a shipment of alternate feed to the White Mesa Mill.

4. Alternate feed materials are less dangerous than many other materials shipped along Hwy 191 and through Grand County.

We look forward to working with International Uranium on future projects and as we discussed looking at some "tabletop" exercises with your transport companies.

Sincerely,

Doug Squire
Grand County Emergency Manager
LEPC Co-chairman

MRR
Cf: Mill Utah / Groundwater

State of Utah

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF RADIATION CONTROL

Michael O. Leavitt
Governor
Dianne R. Nielson, Ph.D.
Executive Director
William J. Sinclair
Director

168 North 1950 West
P.O. Box 144850
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www.deq.state.ut.us Web

February 20, 2002

Mr. Bill Love
2871 East Bench Road
Moab, UT 84532

Re: Request For Update and Status of State Groundwater Discharge Permit Application Process and Chloroform Investigation and Remediation Plan: International Uranium Corporation Uranium Mill Near Blanding, Utah.

Dear Mr. Love:

This letter is in response to your telephone inquiry regarding an update and status report of State progress towards: 1) issuance of a Groundwater Discharge Permit for the International Uranium Corporation (IUC) uranium mill near Blanding, Utah, and 2) completion of the on-going chloroform groundwater contamination investigation and remediation plan. A summary of the status of both projects is provided below.

1. State Groundwater Discharge Permit Application – we are working with IUC to complete this application. Several technical studies have been prepared and are in process of review by Utah Division of Radiation Control (DRC) staff. In general, these studies are needed to:

    1) Describe and characterize local groundwater conditions at White Mesa,
    2) Determine the number and location of monitoring wells needed for adequate groundwater monitoring of the facility,
    3) Determine best management practices to prevent groundwater contamination at the facility.

    Currently, we are awaiting IUC's resolution of several groundwater hydrology issues to move forward with this process. The need to investigate the chloroform contamination at the facility at the same time we are reviewing the GWD Permit application is impacting the GWD Permit schedule. It is important to coordinate these two efforts to ensure separate and distinct monitoring of the tailings facility from the chloroform plume. IUC also has several issues of their own that they would like resolved before permit issuance.

    In the meantime, the State has conducted independent split-sampling of the existing IUC monitoring wells on 3 different occasions to confirm past groundwater quality data and better understand the dynamics of the IUC monitoring system (May, 1999, November, 2000, and November, 2001). During this split-sampling the State expanded the list of groundwater monitoring parameters used previously by IUC for their NRC license.

FEB 27 2002

Our goal is to obtain a GWD Permit that provides adequate groundwater monitoring for the facility, and prevents groundwater pollution, to the degree possible thru reasonable improvements to engineering containment and operational processes. Accomplishing this goal is time consuming, and requires negotiation with the mill operator.

At this time, a firm date cannot be provided regarding the issuance of the State GWD Permit. However, we can continue to provide you periodic updates of our progress. As always, the State permitting process requires notification of the public of when the comment period opens, and when a hearing will be scheduled.

2. <u>Chloroform Investigation</u> - as you might recall in August, 1999 we issued a Groundwater Corrective Action (GWCA) Order to IUC regarding chloroform contamination discovered in IUC monitoring well MW-4 during the May, 1999 split-sampling event. The GWCA Order required IUC to submit for approval both: 1) an investigation report to determine the extent and cause of the groundwater pollution, and 2) a subsequent groundwater remediation plan.

   Since issuance of the GWCA Order, IUC has provided several reports related to the groundwater contamination investigation. The latest of which was dated November 9, 2001 and is currently under review. To date, this investigation has been completed in stages and is currently on-going. With each stage of the investigation, we have found additional information that needs to be provided before the contaminant investigation phase can be considered complete. To date, we have twice asked for additional information regarding this investigation, see DRC letters of July 3, 2000 and June 7, 2001. Currently, the investigation is not yet complete, and no DRC approval has been issued to data for either the investigation report or any proposed groundwater remediation plan.

   During the investigation so far, IUC has installed 9 additional groundwater monitoring wells near existing well MW-4. From these new wells it appears that the southern-most boundary of the chloroform plume has been identified. However, additional work is needed to identify and quantify the groundwater pollution along the western, eastern, and northern boundaries of the contaminant plume. Because we have yet to establish the physical extent and concentrations of this groundwater plume, the cause(s) or source(s) of the plume are as of yet not substantiated.

   In December, 2001 IUC installed two (2) more monitoring wells Northwest of existing well MW-4 in an attempt to better define the extent of the contaminant plume. We are currently awaiting an IUC report to document the geologic logs, well completion details and diagrams, and contaminant concentrations for these two (2) new wells.

Currently, the groundwater contamination investigation required by the August, 1999 GWCA Order continues at the facility. To the casual observer, it may appear that an excessive amount of time has transpired to identify the source and extent of the groundwater pollution. However, several factors combine that allow us additional time to investigate and remediate the groundwater pollution at the IUC facility, including:

1. The isolated location of the IUC facility on White Mesa that provides long distances between the contaminant plume and the facility boundaries,

2. The lack of shallow aquifer water wells in a downgradient direction, both on and off the IUC facility, that could become possible points of exposure to the public, and

3. Local hydrogeologic conditions that hydraulically isolate and prevent the shallow aquifer contamination from adversely impacting the deep confined aquifer that provides drinking water to other groundwater users in the region.

As mentioned above, the chloroform groundwater investigation is a complicated, on-going, and evolving project. Consequently, it is difficult today to predict when the investigation will be complete and when any remediation plan will be ready for State approval. In the meantime, we would be happy to inform you of progress made by IUC on the groundwater investigation and remediation plan in question.

In addition, the Utah Ground Water Quality Rules require all groundwater remediation plans to be made available for public review and comment before they are approved by the State (see Utah Administrative Code [UAC], R317-6.15.E). These rules also mandate several factors and criteria that must be met as a part of any State approval. When the time for this approval arrives, we will provide formal notice of the public comment period and a formal statement of basis to explain the State's findings regarding both the IUC contaminant investigation and the final groundwater remediation plan. At this time, the public may request a hearing regarding the proposed action (UAC R317-6-.20.A).

If you have further questions, or would like a periodic update regarding either the State GWD Permit or Groundwater Contaminant Investigation or Remediation Plan in progress for the IUC facility, please contact Loren Morton of my staff at (801) 536-4262. Thank you for your interest in this matter.

Sincerely,

William J. Sinclair
Director

WJS/LBM:lm

cc: Harold Roberts, IUC

F:\...\SierraClubUpdate2.doc
File: IUC Groundwater Permit Application

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 12 1979

WMUR:EAT
Docket No. 40-8681
SUA-1358, Amendment No. 1

Energy Fuels Nuclear, Inc.
ATTN: Mr. R. W. Adams
Chairman of the Board
Three Park Central, Suite 900
1515 Arapahoe
Denver, Colorado 80202

Gentlemen:

Pursuant to Title 10, Code of Federal Regulations, Part 40, Source Material License SUA-1358 is hereby amended to authorize the first stage of construction of the embankments and liner system of the tailings retention system by revising Conditions 25 and 26 as follows:

25. The licensee shall construct, operate, and maintain the embankments and liner system for the Initial Construction Phase illustrated on Sheet 4 of 16 of the "Engineers Report, Tailings Management System, White Mesa Project, Blanding, Utah," (Evaporation Cell 1 - Initial, Tailings Cell 2, and the Cell 2 "Safety Dike") in accordance with the following documents, including all consultant recommendations, submitted in connection with the tailings retention system proposal:

   a. June 19, 1979 letter forwarding "Engineers Report, Tailings Management System, White Mesa Project, Blanding, Utah" (prepared by D'Appolonia Consulting Engineers, Inc.).

   b. September 11, 1979 letter forwarding "Guideline Specifications for Earthwork, Liner Material, Liner Installation, Inspection and Maintenance, Tailings Management System, White Mesa Project, Blanding, Utah."

   c. September 14, 1979 letter forwarding "Addendum to Guideline Specifications, Initial Phase Construction, Tailings Management System, White Mesa Project, Blanding, Utah" (addendum to "Engineers Report, Tailings Management System, White Mesa Project, Blanding, Utah").

   d. September 28, 1979 letter forwarding "Response to Dam Safety Questions, NRC Consultants Review. White Mesa Project, Blanding, Utah."

e. October 10, 1979 letter forwarding "Addendum 2 to Guideline Specifications, Initial Phase Construction, Tailings Management System, White Mesa Project, Blanding, Utah."

Gravel material that is used in the lining underdrain system shall consist of clean gravel free of organic material containing less than 2 percent which passes a #100 sieve. After placement the gravel material shall have a permeability greater than 1000 times the permeability of the underlying material. Filter criteria shall be met between all materials in adjacent zones of the liner underdrain system.

In addition, the licensee shall not make any changes in the Initial Construction Phase portion of the tailings retention system without specific prior approval of the NRC obtained through application for amendment to this license. Also, construction of any of the embankments and/or the liner system for portions of the tailings retention system other than the Initial Construction Phase shall not begin until the system design has been reviewed and approved by the NRC, and NRC approval has been incorporated into this license by amendment.

Note: When requirements apply to cell embankments, it is intended that the requirements apply to all of the embankments in the Initial Construction Phase illustrated on Sheet 4 of 16 of the "Engineers Report, Tailings Management System, White Mesa Project, Blanding, Utah," i.e., embankments on the downstream sides of Cell 1 - Initial and Cell 2 and the Cell 2 "Safety Dike" (the Cell 2 "Safety Dike" will become the embankment on the downstream side of Cell 3 during a future phase of construction). Requirements concerning the liner system apply to cells lined during Initial Construction Phase, i.e., Cell 1 - Initial and Cell 2. Only Cell 1 - Initial and Cell 2 must be completely constructed prior to generation of tailings.

26. The licensee shall comply with the following regarding construction, operation, and maintenance of the tailings retention system:

Note: See Condition 25 "Note" for applicability of requirements concerning cell embankments and cell liners.

a. Notify Region IV, USNRC, Office of Inspection and Enforcement, Arlington, Texas and the Uranium Recovery Licensing Branch, USNRC, Washington, D. C., at least three weeks prior to the following construction features to provide adequate time for on-site inspections by the NRC:

i. When foundation excavation is near completion and prior to placement of embankment fill, except for Initial Construction Phase embankment foundations for which an on-site inspection by the NRC has already been conducted.

ii. During embankment fill placement at approximately 10 percent and 70 percent stages of completion.

iii. When cell excavation is near completion and prior to placement of the liner system.

iv. At intermediate stages during the liner construction to allow time for inspection of the compacted bed material underneath the liner, construction of joints in the liner and placement of cover over the liner.

b. Submit to the Uranium Recovery Licensing Branch, USNRC, Washington, D.C., within six months after completion of each substage of construction, as-built drawings showing construction details of the foundations of embankments and liner system and subsoil profile (including topography and a mapping of soil types) prior to embankment construction and liner installation and a construction report summarizing the following:

i. Compaction control test results.

ii. Classification of all soils used in the embankment.

iii. Construction equipment and procedures.

iv. Unexpected conditions and problems encountered in construction, and methods employed to resolve these problems.

c. Maintain a minimum freeboard of 5 feet in the Tailings Cell 2 and a minimum freeboard of 6 feet in Evaporation Cell 1 - Initial.

d. Conduct and document a daily inspection of the embankments and the exposed protective soil cover over the liner and make repairs if any erosion occurs.

e. Insure that programs for inspection and monitoring of dam safety and water quality are conducted and evaluated by an experienced professional engineer. The responsible engineer should insure that all field inspectors are able to recognize signs of possible distress or abnormalities. A summary report of the results of the regular scheduled surveillance and inspections shall be submitted annually to the Uranium Recovery Licensing Branch, USNRC, Washington, D.C., in a report bearing the seal of the professional engineer.

All other conditions of this license shall remain the same.

In addition, at the time of submittal of the construction report for the final substage of construction of the Initial Construction Phase, please provide specific plans for meeting the guidelines of Regulatory Guide 3.11.1 entitled "Operational Inspection and Surveillance of Embankment Retention Systems for Uranium Mill Tailings."

The above conditions were discussed and agreed to in a October 10, 1979 telephone conversation between your Mr. M. Vincelette and Mr. E. Trager of my staff.

FOR THE NUCLEAR REGULATORY COMMISSION

Ross A. Scarano, Chief
Uranium Recovery Licensing Branch
Division of Waste Management

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TEXAS 76011

Amend #1

August 21, 1981

License No. SUA-1358

Energy Fuels Nuclear, Inc.
ATTN: Mr. R. W. Adams
Chairman of the Board
Three Park Central, Suite 900
1515 Arapahoe
Denver, Colorado 80202

File White Mesa Mill License

Gentlemen:

This refers to the inspection conducted by Mr. Claude E. Johnson of this office on August 6, 1981, of activities authorized by NRC Source Material License No. SUA-1358, and to the discussion of our findings with Mr. D. K. Sparling, Mr. Ed Baker and other members of your staff at the conclusion of the inspection.

Areas examined during the inspection and our findings are discussed in the enclosed inspection report.

Within the scope of the inspection, no violations or deviations were identified.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosed inspection report will be placed in the NRC's Public Document Room. If this report contains any information that you believe to be exempt from disclosure under 10 CFR 9.5(a)(4), it is necessary that you (a) notify this office by telephone within 10 days from the date of this letter of your intention to file a request for withholding; and (b) submit within 25 days from the date of this letter a written application to this office to withhold such information. If your receipt of this letter has been delayed such that less than seven days are available for your review, please notify this office promptly so that a new due date may be established. Consistent with Section 2.790(b)(1), any such application must be accompanied by an affidavit executed by the owner of the information which identifies the document or part sought to be withheld, and which contains a full statement of the reasons on the basis which it is claimed that the information should be withheld from public disclosure. This section further requires the statement to address with specificity the considerations listed in 10 CFR 2.790(b)(4). The information sought to be withheld shall be incorporated as far as possible into a separate part of the affidavit. If we do not hear from you in this regard within the specified periods noted above, the report will be placed in the Public Document Room.

Should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

W. C. Seidle, Chief
Engineering Inspection Branch

Enclosure:
Appendix - IE Inspection Report 40-8681/81-01

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TEXAS 76011-8064

April 19, 2002

APR 2 1 REC'D

David C. Frydenland, Vice-President and
General Counsel
International Uranium (USA) Corporation
Independence Plaza, Suite 950
1050 Seventeenth Street
Denver, Colorado 80265

SUBJECT: NRC INSPECTION REPORT 40-8681/02-01

Dear Mr. Frydenland:

On April 3, 2002, the NRC completed an inspection at your White Mesa Mill near Blanding, Utah. This inspection consisted of a review of site status, management organization and controls, radiation protection, site operations, radioactive waste management, and environmental protection. The inspection results were provided to members of your staff at the conclusion of the inspection. The enclosed report presents the results of that inspection.

No violations or deviations were identified during this inspection; therefore, no response to this letter is required.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, its enclosure(s), and your response (if any) will be made available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Mr. Louis C. Carson II at (817) 860-8221 or the undersigned at (817) 860-8186.

Sincerely,

Charles L. Cain

Charles L. Cain, Chief
Nuclear Materials Licensing Branch

Docket No.: 40-8681
License No.: SUA-1358

Enclosure:
NRC Inspection Report
40-8681/02-01

Rider 20-A See p. 1 of This Rider

ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Docket No.	40-8681
License No.	SUA-1358
Report No.	40-8681/02-01
Licensee:	International Uranium (USA) Corp.
Facility:	White Mesa Mill
Location:	San Juan County, Utah
Dates:	April 2-3, 2002
Inspector:	Louis C. Carson II, Health Physicist Nuclear Materials Licensing Branch
Accompanied By:	Charles L. Cain, Chief Nuclear Materials Licensing Branch
Approved By:	Charles L. Cain, Chief Nuclear Materials Licensing Branch
Attachment:	Supplementary Information

Report Details

1 **Site Status**

The NRC issued Source Material License SUA-1358 to Energy Fuels Nuclear during August 1979. International Uranium Corporation (IUC) assumed ownership of the White Mesa Mill on May 10,1997, with NRC's approval of License Amendment 2.

The licensee had not received and processed natural ore for uranium or vanadium since December 1999. As authorized by License Condition 10.5, the licensee was disposing of 11e.(2) byproduct material waste on site. The mill was in a preoperational state during this inspection with an anticipated restart of operations in June 2002.

The mill was actively receiving alternate feed material during this inspection. Alternate feed material is ore other than natural uranium ore. The licensee is authorized to receive and process alternate feed materials from certain out-of-state entities by License Conditions 10.6 through 10.17. In December 2001, the licensee was granted permission by the NRC to receive and process approximately 17,750 tons of alternate feed materials from Molycorp of Mountain Pass, California. This alternate feed material from Molycorp resulted from the extraction of lanthanides and other rare earth metals that were processed from bastnasite ore. The residuals of the processed ore were stored in ponds as lead sulfide sludge with an estimated uranium content of 0.15 percent or more.

2 **Management Organization and Controls (88005)**

2.1 Inspection Scope

The organization structure was reviewed to ensure that the licensee had maintained effective organization and management controls to maintain compliance with NRC requirements. Also reviewed was the utilization and implementation of the licensee's performance-based license (PBL) and selected procedures.

2.2 Observations and Findings

a. Management Organization

The organization structure requirements are provided in License Condition 9.3 as described in the NRC-approved license renewal application dated January 30, 1997. No changes had been made to the organization structure since the previous inspection. However, the licensee had hired a process engineer to fill the position of mill manager. There were 23 workers employed at the mill at the time of this inspection. The licensee's organization structure was found to be in agreement with the intent of License Condition 9.3.

3.2 Observations and Findings

a. Site Tour

The inspector toured the facility to observe activities in progress. The inspector measured radiation levels using an NRC microRoentgen (μR) meter (Serial Number 15525, calibration due date December 10, 2002). Radiation surveys taken by the inspector at various locations throughout the mill, around the ore pad, and radioactive material storage areas were consistent with radiation levels from previous inspections. The inspector's radiation measurements were found to be consistent with the licensee's routine survey results. No "radiation areas" as defined by 10 CFR 20.1003 were identified within the process facility. Site perimeter postings required by License Condition 9.9 were in place at the appropriate entrances to the mill. No health or safety concern was identified during the tour.

b. As low As Is Reasonably Achievable Program

In accordance with License Condition 11.6, an annual ALARA audit of the radiation safety program is required to be performed in accordance with Regulatory Guide 8.31. This ALARA audit was also required by Section 3.6 of the license application. The most current ALARA audit was conducted December 5-6, 2001, and was found to have been adequate. The report provided useful information pertaining to the implementation of the radiological program. No significant health or safety issue was identified.

Since the last inspection, the licensee had conducted several routine ALARA committee meetings. The inspector reviewed the third quarter ALARA committee meeting minutes and the ALARA Action Items Tracking List. The tracking list contained 47 action items that the ALARA committee had prioritized for improving the White Mesa radiation protection program. The inspector determined that the ALARA program was adequate.

c. Internal and External Radiation Exposures and Bioassay Results

The inspector reviewed the deep dose equivalent (DDE) radiation exposures from year 2001. According to dosimeter results, 12 workers had DDEs that measured 100-260 millirems. The inspector noted that the RSO had monitored radiation exposures of all radiation workers.

The highest worker total effective dose equivalent (TEDE) recorded was 290 millirems of which 200s millirem was background radiation. All workers TEDE were less than 10 percent of the 5,000 millirem annual limit specified in 10 CFR 20.1201.

The inspector reviewed the licensee's bioassay results for year 2001. The licensee had implemented the bioassay program as specified by NRC Regulatory Guide 8.22, "Bioassay at Uranium Mills." Employee urinalysis results were required to be investigated if bioassay samples exceeded the action level of 15 micrograms per liter uranium. No bioassay results had exceeded the action level during year 2001. The licensee's bioassay program was found to be adequate.

During this inspection, the license was preparing for receiving bulk alternate feed materials from Molycorp in May 2002, and for commencing operations in June 2002, processing alternate feed material. License Condition 10.17 and related correspondence for Molycorp alternate feed material required the licensee to implement several protective measures prior to receiving bulk shipments of Molycorp feed material. The licensee was required to certify the concentration of hazardous and radioactive waste constituents in the Molycorp material. White Mesa was required to determine if their tailings impoundments had adequate capacity to store the waste generated from the Molycorp material. Additionally, the licensee was required to assure that the Molycorp material would be stored on a concrete pad that was bermed to prevent liquid runoff from the material. The licensee was also required to utilize a water spray process for dust suppression.

The inspector verified that the licensee had conducted a tailings capacity evaluation on December 19, 2001, for tailings Cells 1, 2, and 3. The evaluation included projecting waste generated from 11(e).2 material from Texas and Wyoming and alternate feed material waste from Ashland I, Linde, Heritage, and Molycorp. The licensee had also received an alternate feed material report from the Molycorp site which certified that hazardous waste constituents met specifications. The inspector observed that the licensee had prepared a concrete storage area for the receipt of Molycorp material that was bermed using plastic liner material and stacked barrels around the perimeter. The inspector observed the licensee's dust suppression in operation. The inspector determined that the licensee had met the protective requirements of License Condition 10.17.

b. Environmental and Effluent Monitoring Programs

The environmental monitoring program requirements are identified in License Condition 11.2. The licensee must implement the effluent and environmental monitoring programs specified in Section 5.5 of the renewal application. The inspector reviewed the semi-annual effluent report for the second half of calendar year 2001.

The licensee's environmental monitoring program consisted of continuous air, groundwater, surface water, and vegetation, as well as ambient gamma exposure rate measurements. The licensee had collected and analyzed the required samples at the sampling stations, including one at the nearest resident and at a background location. The inspector observed the operation of two environmental monitoring stations.

(1) Environmental Air Sampling

Particulate air sampling was performed at the sampling stations using continuous high volume samplers. The sample filters were exchanged weekly and analyzed quarterly for natural uranium, radium-226, thorium-230, and lead-210 concentrations. All sample results were less than 2 percent of the concentrations specified in 10 CFR Part 20, Appendix B. No adverse trends were identified.

4.3 Conclusions

Operational activities were being conducted safely and in accordance with the license and NRC regulations. Observations of the licensee's alternate feed material receipt operations revealed that the material was handled in an orderly and controlled fashion. The licensee was noted to have collected environmental monitoring samples as required by the license and as reported in the July - December 2001 semi-annual effluent report. Sample results were less than the associated effluent release limits specified in 10 CFR Part 20. No adverse trends were identified.

5 Exit Meeting Summary

The inspector presented the inspection results to representatives of the licensee at the conclusion of the inspection on April 3, 2002. The licensee did not identify any information reviewed by the inspector as propriety information.

Law Offices of Anthony J. Thompson, P.C.

1225 19th Street, NW., Suite 200
Washington, DC 20036
202-496-0780
Fax 202-496-0783
(e-mail): ajthompson@athompsonlaw.com

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USNRC

2002 MAY 22 PM 3:01

OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

May 20, 2002

BY ELECTRONIC AND U.S. REGULAR MAIL

U.S. Nuclear Regulatory Commission
Office of the Secretary
Attn: Rulemaking and Adjudications Staff
One White Flint North
11555 Rockville Pike
Rockville, MD 20852

Re: In the Matter of: International Uranium (USA) Corporation
Docket No: 40-8681-MLA-11
ASLBP No: 01-789-01-MLA

Dear Sir or Madam:

Please find attached for filing the Response of International Uranium (USA) Corporation to Written Presentations of Mr. William E. Love and the Glen Canyon Group of the Sierra Club. Copies of the enclosed have been served on the parties indicated on the enclosed certificate of service. Additionally, please return a file-stamped copy in the self-addressed, postage prepaid envelope attached herewith.

If you have any questions, please feel free to contact me at (202) 496-0780. Thank you for your time and consideration in this matter.

Sincerely,

Anthony J. Thompson
Law Offices of Anthony J. Thompson, P.C.
Counsel of Record to IUSA

Enclosures

(IUCMOLYCORPCOVERLTR.DOC)