NRCREP - Comments on NRC's low level radioactive waste program

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Date: 08/02/2006 2:07 PM
Subject: Comments on NRC's low level radioactive waste program
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Attached please find Kennecott Uranium Company's comments regarding the NRC's low level radioactive waste program.

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RIO TINTO

ENERGY AMERICA

1 August 2006

Chief, Rules and Directives Branch
Mail Stop T6-D59,
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Gentlemen:

Subject: Kennecott Uranium Company's Comments Regarding:
Federal Register: July 7, 2006 Volume 71, Number 130 Pages 38675-38676
Request for Comments on the Nuclear Regulatory Commission's Low Level Radioactive Waste Program

Kennecott Uranium Company is a uranium recovery licensee that operates the only remaining conventional uranium mill and operating (Subpart W) uranium mill tailings impoundment in Wyoming under Source Material License SUA-1350. The facility is located in the Great Divide Basin in Sweetwater County, Wyoming. The following are Kennecott Uranium Company's comments in response to the Commission's questions regarding the Low Level Waste Program:

Initial efforts on addressing low level waste issues

The request for comments states, "*The NRC last initiated a strategic assessment of its LLW regulatory program in August 1995.*" The Nuclear Regulatory Commission (NRC) released a document entitled *Strategic Planning Framework*, dated Sept. 16, 1996. This *Strategic Assessment and Rebaselining Initiative* (*SARI*), examined in detail all aspects of the Commission's regulatory program, and in it the Commission expressed its willingness to consider broader uses for uranium mill tailings facilities. The Commission specifically reviewed the option of expanding the use of uranium tailings impoundments to allow the disposal of waste generated during decommissioning of nuclear facilities along with 11e.(2) byproduct material.

This document states:

Because several . . . sites [currently undergoing decommissioning] have large quantities of uranium- and thorium-contaminated waste with characteristics similar to those of mill tailings, it may be cost effective to dispose of decommissioning waste at existing mill tailings sites. . . . Reclamation costs at uranium mill tailings sites average about $0.97 per ton (about $0.05 per ft3). This cost is substantially less than disposal costs at licensed low-level waste disposal sites, which charge, as a minimum, about $20 to $30 per ft3 for decommissioning-type wastes , . . .

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The Commission has been rightfully considering disposal of low activity radioactive wastes in uranium mill tailings impoundments for almost a decade, beginning in September 1996.

Key safety and cost drivers and concerns relative to LLW disposal

The issue of Low Level Waste Disposal is a complex one; however, regarding this issue the National Mining Association (NMA) has, over the previous decade, shown unique leadership. A brief history of the Association's efforts to have uranium mill tailings impoundments used as sites for the disposal of non-11e.(2) byproduct material is provided in the text that follows. On May 13, 1997, the United States uranium recovery industry, as represented by the National Mining Association (NMA), the Wyoming Mining Association (WMA) and the Uranium Producers of America (UPA), briefed the Commissioners on the state of the uranium recovery industry in the United States (*PowerPoint Presentation entitled Uranium Briefing May 13, 1997 NMA/WMA/UPA included by reference).*

In this presentation the issue of the disposal of non-11e.(2) materials in uranium mill tailings impoundments was discussed. Following this presentation, the Commissioners requested that the industry prepare and submit a white paper to the Commission regarding this and other issues.

In 1998, the National Mining Association (NMA) submitted a white paper to the Commission entitled ***Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry: A White Paper Presented By the National Mining Association.*** This document is included by reference. This document in Section IV entitled **DISPOSAL OF NON-11e.(2) BYPRODUCT MATERIAL IN TAILINGS IMPOUNDMENTS** discussed the option of disposal of certain radioactive wastes other than 11e.(2) byproduct material in tailings impoundments.

This section stated:

Considering the potentially significant public health, safety and environmental benefits of allowing non-11e.(2) byproduct material disposal in tailings piles, NRC should revise the 1995 Final Guidance to make the present policy less restrictive and more workable. For example, the Commission should examine whether the four criteria NRC applied prior to the 1995 Final Guidance were sufficient. In addition, NRC should explore allowing the disposal of NORM, mixed wastes, SNM and even 11e.(1) material if they are similar to uranium mill tailings. Moreover, in considering these options and evaluating other ways of optimizing disposal at existing uranium mill tailings disposal sites, NRC should be prepared to "think outside the box" by, for example, considering state/interagency Memorandums of Understanding (MOUs) or perhaps legislation.

It concluded by stating:

Accordingly, NMA urges the Commission to reevaluate its policy on the disposal of non-11e.(2) byproduct materials in uranium mill tailings impoundments. As discussed above, a number of compelling public policy considerations favor allowing the disposal of materials that are physically, chemically, and radiologically similar to 11 e.(2) byproduct material in such tailings impoundments. Therefore, NRC should work with its sister agencies and with relevant state authorities to develop creative and cooperative approaches (such as the use of MOUs or interagency agreements) to ensure that protection of public health, safety and the environment are optimized by facilitating the utilization of existing disposal capacity at uranium mill tailings sites.

Following the submittal of this white paper, the Commission staff prepared SECY-99-012 entitled, *"USE OF URANIUM MILL TAILINGS IMPOUNDMENTS FOR THE DISPOSAL OF WASTE OTHER THAN 11e.(2) BYPRODUCT MATERIAL AND REVIEWS OF APPLICATIONS TO PROCESS MATERIAL OTHER THAN NATURAL URANIUM ORES".*

Based upon this paper the Commission issued *STAFF REQUIREMENTS - SECY-99-0012 –" USE OF URANIUM MILL TAILINGS IMPOUNDMENTS FOR THE DISPOSAL OF WASTE OTHER THAN 11e.(2) BYPRODUCT MATERIAL AND REVIEWS OF APPLICATIONS TO PROCESS MATERIAL OTHER THAN NATURAL URANIUM ORES"* dated July 26, 2000. This Staff Requirements Memorandum (SRM) revised the pre-existing September 22, 1995 guidance by stating:

The disposal of material other than 11e.(2) byproduct material - which may include listed hazardous wastes - in mill tailings impoundments should be allowed only if: 1) there is adequate protection of the public health, safety, and the environment; 2) the long-term custodian of the site has indicated its willingness to accept responsibility for maintenance of the site prior to NRC approving the disposal; and 3) necessary approvals of other affected regulators (e.g., States, EPA) have been obtained. Regarding consent of the long-term custodian, consideration should be given to requiring written confirmation from DOE or the State that it would accept responsibility for the maintenance of the site prior to NRC approving the disposal of non-11e.(2) material.

This was a substantial step forward in that it dramatically changed the older restrictive 1995 guidance.

The now superseded 1995 Final Guidance contained a total of nine criteria for the disposal of non-11e.(2) byproduct *material* in uranium mill tailings impoundments :

1. NARM (including NORM) cannot be disposed of in an 11e.(2) byproduct material impoundment.
2. Special nuclear material (SNM) and 11e.(l) byproduct material will not be considered as eligible for disposal "without compelling reasons [i.e., immediate health and safety concerns] to the contrary.
3. The licensee must demonstrate that the material proposed for disposal is not subject to applicable RCRA or Toxic Substances Control Act (TSCA) regulations. Thus, source material physically mixed with other waste must be properly characterized in accordance with RCRA hazardous waste identification regulations set forth in 40 CFR Part 261.
4. The proposed disposal must not raise any CERCLA issues.
5. The licensee must demonstrate that there will be "no significant environmental impact" from the proposed disposal.
6. The proposed disposal must comply with the reclamation and closure criteria of Appendix A of 10 CFR Part 40.
7. Because non-11e.(2) byproduct *material* (i.e., waste containing source material) would otherwise be regulated as LLRW by states, the licensee must obtain approval for the disposal by the Regional Low-Level Waste Compact (RLLWC or the Compact) in whose jurisdiction the waste originates as well as approval by the Compact in whose jurisdiction the tailings impoundment is located,

8. DOE and the state in which the tailings impoundment is located must be informed of NRC findings and proposed approval of the disposal, with a request to concur within 120 days. A concurrence and commitment from DOE or the state to take title to the tailings impoundment after closure must be received before granting the license amendment.
9. To formally obtain NRC authorization for the disposal, the licensee must amend the mill license under 10 CFR Part 40. In addition, the licensee must obtain an exemption to the requirements of 10 CFR Part 61.6 - license for land disposal of radioactive waste.

The 1995 Final Guidance imposed so many burdensome requirements on licensees that it was extremely difficult, if not impossible, to dispose of non-11e.(2) byproduct materials in tailings piles. This was inconsistent with the goal of optimizing protection of public health, safety and the environment and generally not in keeping with sound public policy, given the many advantages that would be gained by making this a viable disposal option. Thus it was replaced by the July 26, 2000 Staff Requirements Memorandum (SRM).

Thus, the Staff Requirements Memorandum based upon SECY 99-012 is the current state of regulation regarding disposal of non-11e.(2) byproduct materials in uranium mill tailings impoundments. As described above, this current regulation evolved from the National Mining Association's (NMA's) white paper entitled, ***Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry: A White Paper Presented by the National Mining Association.***

The greatest and most fundamental concern regarding low level disposal in the United States is the failure of the compact system as discussed in the March 7, 2004 document entitled ***The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments,*** that was submitted to the Commission. This document is included by reference. This document discusses the failure of the compact system stating:

Disposal of low level radioactive waste ("LLRW"), while not quite as politically charged, nevertheless has proved to be almost as difficult to address as HLW. In the past, Congress attempted, through legislation (i.e., the Low Level Waste Policy Act ("LLWPA"), as amended)) to facilitate the development and operation of new LLRW disposal facilities based on a comprehensive system of interstate Compacts. As of this date, this so-called "Compact system" has failed to create even one new LLRW disposal site. Indeed, this nation's existing licensed LLRW disposal capacity has steadily eroded and will continue to do so in the future.

The abject failure of the compact system has led to a dismal future for the cost effective and simple disposal of low level radioactive waste in the United States. This situation must be corrected.

In addition to the failure of the compact system, the following other important concerns also surround low level waste disposal and, in fact, the disposal of most any other radioactive waste:

Protection of Human Health, Safety and the Environment (Especially Groundwater): Low level waste disposal must, first of all, consider protection of human health, safety and the environment. The disposal scheme for low-level wastes should include protections similar to, and as comprehensive as, those for 11e.(2) byproduct material. Ultimately the 10 CFR Part 40 Appendix

A requirements for the disposal of 11e.(2) byproduct material include full RCRA requirements that include a double lined impoundment incorporating leak detection between the liners as well as long term engineering controls, a stable custodian, long term monitoring and funding for long term monitoring and any future maintenance that exceed RCRA requirements.

The Introduction to 10 CFR Part 40 Appendix A states:

... a level of stabilization and containment of the sites concerned, and a level of protection for public health, safety, and the environment from radiological and non-radiological hazards associated with the sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements of this Appendix and the standards promulgated by the Environmental Protection Agency in 40 CFR Part 192, Subparts D and E.

Thus 10 CFR part 40 Appendix A references 40 CFR Part 192, Subparts D and E. These subparts in turn reference 40 CFR 264.221 which stipulate double lined impoundments stating:

(a) Standards for application during processing operations and prior to the end of the closure period. (1) Surface impoundments (except for an existing portion) subject to this subpart must be designed, constructed, and installed in such manner as to conform to the requirements of §264.221 of this chapter.

It is clear from the above discussion that many criteria critical to the disposal of radioactive materials have already been addressed in 10CFR Part 40 Appendix A for 11e.(2) byproduct material impoundments. Given the stringent nature of the present design and closure requirements for 11e.(2) byproduct material impoundments as stipulated by 10 CFR Part 40 Appendix A these impoundments would also make excellent disposal sites for many forms of low level wastes. Use of 11e.(2) byproduct material impoundments for the disposal of some types of low level wastes would help alleviate future concerns regarding availability of suitable disposal sites.

Non-proliferation of sites: Radioactive materials should not be scattered around the country in many small sites but rather located in a few large sites to simplify management and enhance security of these wastes. This issue has already been addressed in regards to 11e.(2) byproduct material in 10 CFR Part 40 Appendix A which states:

Criterion 2--*To avoid proliferation of small waste disposal sites and thereby reduce perpetual surveillance obligations, byproduct material from in situ extraction operations, such as residues from solution evaporation or contaminated control processes, and wastes from small remote above ground extraction operations must be disposed of at existing large mill tailings disposal sites; unless, considering the nature of the wastes, such as their volume and specific activity, and the costs and environmental impacts of transporting the wastes to a large disposal site, such offsite disposal is demonstrated to be impracticable or the advantages of onsite burial clearly outweigh the benefits of reducing the perpetual surveillance obligations.*

It should also be a prime consideration in the handling of low-level wastes. Current regulations for uranium mill tailings impoundments already fully address this issue.

Long Term Engineering Controls Requiring No Active Maintenance: Low level wastes should be managed in such a way so that the disposal sites once closed do not require active maintenance for a long period of time (i.e.; 1,000 years). Its issue has already been addressed in regards to the disposal of 11e.(2) byproduct material in 10 CFR part 40 Appendix A which states:

***Criterion 1**--The general goal or broad objective in siting and design decisions is permanent isolation of tailings and associated contaminants by minimizing disturbance and dispersion by natural forces, and to do so without ongoing maintenance. For practical reasons, specific siting decisions and design standards must involve finite times (e.g., the longevity design standard in Criterion 6). The following site features which will contribute to such a goal or objective must be considered in selecting among alternative tailings disposal sites or judging the adequacy of existing tailings sites: Remoteness from populated areas; Hydrologic and other natural conditions as they contribute to continued immobilization and isolation of contaminants from ground-water sources; and*

Potential for minimizing erosion, disturbance, and dispersion by natural forces over the long term.

The site selection process must be an optimization to the maximum extent reasonably achievable in terms of these features.

In the selection of disposal sites, primary emphasis must be given to isolation of tailings or wastes, a matter having long-term impacts, as opposed to consideration only of short-term convenience or benefits, such as minimization of transportation or land acquisition costs. While isolation of tailings will be a function of both site and engineering design, overriding consideration must be given to siting features given the long-term nature of the tailings hazards.

Tailings should be disposed of in a manner that no active maintenance is required to preserve conditions of the site.

and also states:

***Criterion 6**--(1) In disposing of waste byproduct material, licensees shall place an earthen cover (or approved alternative) over tailings or wastes at the end of milling operations and shall close the waste disposal area in accordance with a design which provides reasonable assurance of control of radiological hazards to (i) be effective for 1,000 years, to the extent reasonably achievable,...*

A Stable (Long-Term) Site Custodian: Low level wastes should be managed in such a manner as to assure a stable long-term custodian for the disposal site in perpetuity following closure. This issue is also addressed in the regulations (10 CFR Part 40 Appendix A) for 11e.(2) byproduct material which state:

III. Site and Byproduct Material Ownership

C. Title to the byproduct material licensed under this Part and land, including any interests therein (other than land owned by the United States or by a State) which is used for the disposal of any such byproduct material, or is essential to ensure the long term stability of

such disposal site, must be transferred to the United States or the State in which such land is located, at the option of such State. In view of the fact that physical isolation must be the primary means of long-term control, and Government land ownership is a desirable supplementary measure, ownership of certain severable subsurface interests (for example, mineral rights) may be determined to be unnecessary to protect the public health and safety and the environment. In any case, however, the applicant/operator must demonstrate a serious effort to obtain such subsurface rights, and must, in the event that certain rights cannot be obtained, provide notification in local public land records of the fact that the land is being used for the disposal of radioactive material and is subject to either an NRC general or specific license prohibiting the disruption and disturbance of the tailings. In some rare cases, such as may occur with deep burial where no ongoing site surveillance will be required, surface land ownership transfer requirements may be waived. For licenses issued before November 8, 1981, the Commission may take into account the status of the ownership of such land, and interests therein, and the ability of a licensee to transfer title and custody thereof to the United States or a State.

This criterion insures a long term and stable (governmental) entity will serve as site custodian in perpetuity, providing security for these wastes.

Long Term Monitoring (Surveillance): This is required for the management of 11e.(2) byproduct material by 10 CFR Part 40 Appendix A which states:

***Criterion 12**--The final disposition of tailings, residual radioactive material, or wastes at milling sites should be such that ongoing active maintenance is not necessary to preserve isolation. As a minimum, annual site inspections must be conducted by the government agency responsible for long-term care of the disposal site to confirm its integrity and to determine the need, if any, for maintenance and/or monitoring. Results of the inspections for all the sites under the licensee's jurisdiction will be reported to the Commission annually within 90 days of the last site inspection in that calendar year. Any site where unusual damage or disruption is discovered during the inspection, however, will require a preliminary site inspection report to be submitted within 60 days. On the basis of a site-specific evaluation, the Commission may require more frequent site inspections if necessary due to the features of a particular disposal site. In this case, a preliminary inspection report is required to be submitted within 60 days following each inspection.*

This should be required for the long term management of low level wastes as well.

Financial Assurance: Low level waste disposal sites should be required to be covered by a transfer of cash to the long term custodian of such an amount that the real rate of return from those funds will cover long term site monitoring, care and maintenance. This issue has already been addressed for 11(e).2-byproduct material in 10 CFR Part 40 Appendix A which states:

***Criterion 10**--A minimum charge of $250,000 (1978 dollars) to cover the costs of long-term surveillance must be paid by each mill operator to the general treasury of the United States or to an appropriate State agency prior to the termination of a uranium or thorium mill license.*

If site surveillance or control requirements at a particular site are determined, on the basis of a site-specific evaluation, to be significantly greater than those specified in Criterion 12 (e.g., if fencing

is determined to be necessary), variance in funding requirements may be specified by the Commission. In any case, the total charge to cover the costs of long-term surveillance must be such that, with an assumed 1- percent annual real interest rate, the collected funds will yield interest in an amount sufficient to cover the annual costs of site surveillance. The total charge will be adjusted annually prior to actual payment to recognize inflation. The inflation rate to be used is that indicated by the change in the Consumer Price Index published by the U.S. Department of Labor, Bureau of Labor Statistics.

Potential Alternative Futures/Can the Future Be Altered?

The future, as it stands now, for low level waste disposal is grim. The abject failure of the compact system as detailed above, coupled with the inexorable filling and closure of existing sites will make it increasing difficult to dispose low level waste in the future. This issue is discussed in the white paper entitled ***The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments*** which is included by reference. It states:

Disposal capacity for LLRW has slowly diminished over the last three decades. In the early 1970s, there were six operating LLRW disposal sites across the United States. Between 1975 and 1979, three (3) of those sites closed leaving only three (3) sites to receive and dispose of the nation's LLRW; (1) the Barnwell site in South Carolina, (2) the Beatty site in Nevada, and (3) the Hanford site in Washington. The Sheffield site closed when it was filled to capacity and the Maxey Flats, KY and West Valley, NY sites were closed due to a variety of problems including complex hydrogeology, surface cap collapse, and water infiltration and collection in disposal trenches.

In addition, the disposal of other forms of radioactive wastes not regulated by the Commission as part of the nuclear fuel cycle such as naturally occurring radioactive material (NORM, and technologically enhanced naturally radioactive material - TENORM) will become increasingly difficult. The disposal of Commission regulated non-low level wastes such as pre-1978 byproduct material, soils and other items contaminated with special nuclear material (SNM), low activity reactor decommissioning rubble and source material will also become more difficult. These problems will result in delays in site remediation/reclamation and closure as licensees struggle to find viable disposal options.

This grim future can be altered, specifically by adoption by the Commission of the recommendations in the March 7, 2004 document entitled ***The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments*** that was submitted to the Commission.

These recommendations include:

In addition to considering the viability of generic waste acceptance criteria for direct disposal of non-11e.(2) waste materials in licensed mill tailings impoundments, NMA/FCFF recommend that NRC actively consider the viability of performance-based license conditions for specific licensees based on the proposed generic waste acceptance criteria.

and

Where candidate materials do not fit comfortably within existing generic or site-specific assessments, NRC should evaluate whether the direct disposal of a non-11e.(2) waste stream is viable for a given site based on licensee submissions (e.g., dose assessments, etc.).

The Environmental Protection Agency (EPA) is also examining the issue of the disposal of low activity radioactive waste. On Tuesday, November 18, 2003, the Environmental Protection Agency (EPA) released an Advanced Notice of Proposed Rulemaking (ANPR) entitled ***Approaches to an Integrated Framework for Management and Disposal of Low-Activity Radioactive Waste: Request for Comment***; *Proposed Rule (Federal Register / Vol. 68, No. 222 / Tuesday, November 18, 2003 / Proposed Rules pages 65120 to 65151.* Both the National Mining Association (NMA) and Kennecott Uranium Company commented on this Advanced Notice of Proposed Rulemaking (ANPR). These two (2) sets of comments are included by reference. These comment sets also advocate the recommendations made in ***The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments.***

Disposal options for depleted uranium

The issue of the handling and management of depleted uranium is an issue that extends beyond mere disposal and touches upon the very future of the global nuclear industry. Large quantities of depleted uranium, mainly in the form of uranium hexafluoride (UF6) have been accumulated worldwide as an unused/currently unneeded end product of uranium enrichment for the production of nuclear fuel and nuclear weapons. Currently there is approximately 700,000 metric tons of depleted uranium hexafluoride stored at Paducah, Kentucky; Portsmouth, Ohio; and the East Tennessee Technology Park (ETTP) in Oak Ridge, Tennessee. The inventory at each site is as follows:

- Paducah: 39,000 Cylinders
- Portsmouth 16,000 Cylinders
- ETTP (to be relocated to Portsmouth) 5,900 Cylinders

In addition, new depleted uranium will be generated on an ongoing basis by currently operating enrichment operations and by proposed future plants (if they are in fact constructed) such as the United States Enrichment Corporation's (USEC's) American Centrifuge and Louisiana Energy Service's (LES's) proposed centrifuge in southeastern New Mexico.

Current plans for the existing stored material are for conversion of it by Uranium Disposition Services, LLC to either:

- Uranium Oxide packaged for disposal, storage or re-use
- Aqueous HF product commercially marketed

by the following reactions:

$$UF6 + 2\ H2O \Rightarrow UO2F2 + 4HF$$
$$UO2F2 + H2 + H2O \Rightarrow UOx + HF$$

Once the uranium fluoride is converted to stable uranium oxide it is now a chemically stable low specific activity product that could easily be placed for disposal in a uranium mill tailings impoundment since it is by definition source material and radiologically compatible with materials generally placed in such impoundments. This issue is discussed in ***The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments – March 2004*** when it states:

Wastes contaminated with source material in the form of depleted uranium are appropriate candidate materials for direct disposal at licensed 11e.(2) disposal facilities. 10 CFR Part 40.4 defines depleted uranium as, "the source material uranium in which the isotope uranium-235 is less than 0.711 weight percent of the total uranium present." Since depleted uranium is, by definition, source material and, since NRC's direct disposal policy currently permits the direct disposal of source material in mill tailings impoundments, materials contaminated with depleted uranium are eligible for direct disposal in mill tailings impoundments.

Wastes contaminated with depleted uranium possess less activity, by definition, than wastes contaminated with natural uranium. Depending on the level of depletion (concentration of U-235), wastes with higher concentrations of depleted uranium potentially could be placed in a mill tailings impoundment as a "buffer" to minimize radon emissions.98 For example, wastes containing only the uranium-238 isotope (100% depleted uranium) would have an in-grown activity (at a 1,000 year closure period) of 1.32E-8 curies per gram. Using the total activity of tailings from 1% uranium ore at secular equilibrium of 2.22E-8 curies per gram, a waste with a concentration of 1.68% of fully depleted uranium would remain within the "upper bound" assumption proposed by NMA/FCFF.

However, it may not be in the best interest of the United States to place this material for disposal or to in fact defluorinate (convert to uranium oxide) certain portions of it. The existing stocks of uranium hexafluoride are depleted to differing levels (different tails assays of uranium-235). It may be possible to recycle some of the depleted uranium hexafluoride containing higher concentrations of uranium-235 back through conversion plant and extract additional enriched uranium product for use as nuclear fuel. This of course would depend upon the cost of separative work units (SWU) which could conceivably drop if new gaseous diffusion enrichment plants (Enrichment Corporation's (USEC's) American Centrifuge and Louisiana Energy Service's (LES's) proposed centrifuge in southeastern New Mexico) come on line.

Depleted uranium (uranium-238), while in and of itself is unable to sustain a chain reaction (hence the need to separate from it the uranium-235 by various enrichment techniques), can be converted to fissionable material by the following nuclear reaction:

U238 +1N => Np239
Np239 => Pu239 + 1B-

Plutonium-239 is fissionable and can be used to manufacture mixed oxide fuel. At some future time, as the planet's energy needs increase, it may be necessary to convert existing stocks of uranium-238 into fissionable plutonium-239 in breeder reactors in order to generate additional nuclear energy. Rods of depleted uranium could be bombarded with neutrons in breeder reactors and the rods extracted and reprocessed to extract the fissionable plutonium-239. It may well be in the best

interests of the nation to store the depleted uranium in a highly dense/compact form for future conversion to fissionable plutonium-239.
Techniques exist to convert uranium hexafluoride to uranium metal on a continuous basis. Uranium metal is the densest form of uranium and (as long as it is not in a finely divided state) quite stable. Substantial art exists on the conversion of uranium hexafluoride to uranium metal; as evidenced by the following patents which are included by reference:

- United States Patent 4,534,792 - *Magnesium reduction of uranium oxide*
- United States Patent 4,552,588 - *Magnesium reduction of uranium fluoride in molten salts*
- United States Patent 4,564,507 - *Reductive decontamination of magnesium fluoride*
- United States Patent 4,591,382 - *Process and apparatus for recovering and purifying uranium scrap*
- United States Patent 4,636,250 - *Recovery of uranium alloy*
- United States Patent 5,104,095 - *Apparatus for separating molten salt from molten salt or molten uranium or molten uranium alloy*
- United States Patent 6,210,461 - *Continuous production of titanium, uranium, and other metals and growth of metallic needles*

In conclusion it may well be unwise to dispose of depleted uranium (in spite of the ability to safely and effectively to do so in 11(e).2 byproduct material disposal impoundments) due to its potential future value as breeder reactor feedstock to manufacture plutonium-239 for use in mixed oxide fuel. It may well be best to convert the depleted uranium (once it is clear that no additional enriched uranium product can be economically extracted from it) into uranium metal for long term storage.

References/Documents Included by Reference

The following is a list of references consisting of presentations, white papers, comment sets, United States patents and a paper prepared by either the National Mining Association (NMA) (white papers/presentations), the Fuel Cycle Facilities Forum (FCFF) (white paper/presentation) , Kennecott Uranium Company (comments), Dr. Guy R. B. Elliott (patents) or Oscar Paulson (paper) regarding the radioactive waste disposal problem as a whole, the low level waste disposal problem in particular and the processing of depleted uranium hexafluoride. The presentations were made before the Commission, the white papers were submitted to the Commission, the comments were either submitted to the Commission or to the Environmental Protection Agency (EPA), the patents were obtained between August 13, 1985 and April 3, 2001and the paper was presented at an American Nuclear Society (ANS) meeting in Denver, Colorado in August 2005. These are included by reference and include:

- *PowerPoint Presentation entitled Uranium Briefing May 13, 1997 NMA/WMA/UPA*
- *Recommendations for a Coordinated Approach to Regulating the Uranium Recovery Industry: A White Paper Presented By the National Mining Association - 1998*

- *The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments – March 2004*
- *Kennecott Uranium Company - Comments on Approaches to an Integrated Framework for Management and Disposal of Low-Activity Radioactive Waste: Request for Comment Federal Register (FR) Vol. 68, No. 222 / Tuesday, November 18, 2003 / Proposed Rules pages 65120 to 65151*
- *National Mining Association - Comments on Approaches to an Integrated Framework for Management and Disposal of Low-Activity Radioactive Waste: Request for Comment Federal Register (FR) Vol. 68, No. 222 / Tuesday, November 18, 2003 / Proposed Rules pages 65120 to 65151*
- *PowerPoint Presentation entitled The National Mining Association's White Paper Regarding the Direct Disposal of Non-11e.(2) Materials at Licensed 11e.(2) Disposal Facilities – July 22, 2004*
- *PowerPoint Presentation Non11e.(2) Disposal White Paper Where do we go from here? Katie Sweeney National Mining Association July 22, 2004*
- *PowerPoint Presentation FCFF Historical Perspective on Direct Disposal of Wastes in Mill Tailings Impoundments Presentation to the U.S. Nuclear Regulatory Commission White Flint One Rockville, MD by David Culberson, Chairman Fuel Cycle Facilities Forum – July 22, 2004*
- *Determination of the Generic Waste Acceptance Criteria Used in The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e. (2) Byproduct Materials in Uranium Mill Tailings Impoundments Oscar Paulson, P.G. Presented at the August 2005 American Nuclear Society (ANS) meeting in Denver, Colorado.*
- *Kennecott Uranium Company's Comments on NUREG-1757 Supplement I Consolidated NMSS Decommissioning Guidance Updates to Implement the License Termination Rule Analysis Draft Report for Comment*

United Sates Patents:

- *United States Patent 4,534,792 - Magnesium reduction of uranium oxide*
- *United States Patent 4,552,588 - Magnesium reduction of uranium fluoride in molten salts*
- *United States Patent 4,564,507 - Reductive decontamination of magnesium fluoride*
- *United States Patent 4,591,382 - Process and apparatus for recovering and purifying uranium scrap*
- *United States Patent 4,636,250 - Recovery of uranium alloy*
- *United States Patent 5,104,095 - Apparatus for separating molten salt from molten salt or molten uranium or molten uranium alloy*
- *United States Patent 6,210,461 - Continuous production of titanium, uranium, and other metals and growth of metallic needles*

Conclusions

1. The current situation regarding low level waste disposal in the United States is grim in light of the small number of existing disposal sites, the fact that they are filling rapidly, and the large amount of waste currently requiring disposal, the amounts that will be generated in the future and the abject failure of the compact system.

2. The National Mining Association (NMA) and the Fuel Cycle Facilities Forum (FCFF) in ***The National Mining Association's and the Fuel Cycle Facilities Forum's White Paper on Direct Disposal of Non-11e.(2) Byproduct Materials in Uranium Mill Tailings Impoundments*** dated March 2004 have presented a viable option for the safe and cost effective management of many types of radioactive wastes including some if not most types of low-level wastes. Kennecott Uranium Company requests that the Commission develop generic waste acceptance criteria based upon the ones proposed in the above referenced document for 11e.(2) byproduct material impoundments so that additional classes of wastes can be placed for disposal in uranium mill tailings impoundments. This will ease current national problems regarding low level waste disposal.

3. If the development of generic waste acceptance criteria for 11e.(2) byproduct material impoundments on a national level is not feasible, Kennecott Uranium Company requests that the Commission *actively consider the viability of performance-based license conditions for specific licensees based on the proposed generic waste acceptance criteria* as discussed in the above referenced white paper.

4. Kennecott Uranium Company requests that *...where candidate materials do not fit comfortably within existing generic or site-specific assessments, NRC should evaluate whether the direct disposal of a non-11e.(2) waste stream is viable for a given site based on licensee submissions (e.g., dose assessments, etc.)* as stated in the above referenced white paper.

5. Kennecott Uranium Company believes that while completely feasible to place depleted uranium oxide in 11e.(2) byproduct material impoundments for disposal, any permanent disposal of this material anywhere may not be in the long term interests of the United States. Consideration should be given to converting this material into its densest and most handleable form (bulk metal) and storing it for potential future use as breeder reactor feedstock. In addition, any depleted uranium hexafluoride from which additional enriched uranium product could be extracted by yet to be constructed lower cost/more efficient facilities should be kept as uranium hexafluoride for future further processing.

Kennecott Uranium Company appreciates the opportunity to provide comments on this matter. If you have any questions, please do not hesitate to contact me.

Sincerely yours,

Oscar A. Paulson

Oscar A. Paulson
Facility Supervisor

cc: Marty Stearns – Rio Tinto Energy America
Katie Sweeney – National Mining Association (NMA)