December 5, 1996

Ms. Barbara Dankmyer
Resident Manager
Molycorp, Inc.
300 Caldwell Avenue
Washington, Pennsylvania 15301

Dear Ms. Dankmyer:

This letter is to inform you that the U.S. Nuclear Regulatory Commission staff has completed an acceptance review of your report entitled, "Final Design Report: Temporary Thorium Storage Structure," dated October 29, 1996. We have determined that the information provided in this document is sufficient to begin the technical review.

In addition, we have initiated our technical review. This review has focused on your revised final design, which changes the design material from vertical concrete block to concrete filled fabric forms, and radiological health and safety. The comments resulting from this review are enclosed. Please respond to these comments within 15 days of the date of this letter.

If you have any questions regarding our review, please do not hesitate to call me at (301) 415-6701.

Sincerely,

[Original signed by]

LeRoy S. Person, Project Manager
Low-Level Waste and Decommissioning
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Docket No.: 040-8778
License No.: SMB-1393

Enclosure: As stated

cc: G. Dawes, Molycorp
J. Yusko, PA-DEP

NL17

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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U.S. NUCLEAR REGULATORY COMMISSION STAFF
REQUEST FOR ADDITIONAL INFORMATION
FINAL DESIGN REPORT: TEMPORARY THORIUM STORAGE STRUCTURE

A. STATUS OF NRC STAFF COMMENTS FORWARDED ON OCTOBER 29, 1996

Comment 1 - Requested material submitted in the Final Design.
Status - CLOSED

Comment 2 - Requested material not submitted in the Final Design. Draft applicant response dated November 19, 1996 states that an addendum to the Final Design will be submitted.
Status - OPEN

Comment 3 - Groundwater monitoring. Addressed in November 19, 1996 response.
Status- CLOSED

Comment 4 - Requested justification provided in November 19, 1996 response.
Status - CLOSED

Comment 5 - Same as comment 2. The addendum should include calculations for the elastic and consolidation settlement for the various layers which will result from the proposed construction.
Status - OPEN

Comment 6 - Requested analyses submitted in the Final Design.
Status - CLOSED

B. ADDITIONAL COMMENTS

1. The Design Basis document assumed a soil bearing value of 2000 psf. The soil bearing value of almost 3000 psf is used in the Final Design. The applicant should provide a technical basis for the adequacy of the design soil bearing value including a discussion of estimated total and differential settlements and their potential impacts.

2. In Appendix D, the boring logs show "OH" and "OL" classification symbols for the natural clay layer. This appears inconsistent with the information shown on the previous boring logs. The applicant should either provide an additional description regarding the OH and OL material or submit revised boring logs.

3. In Appendix B, Section 8.2.1 states that the Field Engineer will classify excavated and imported material as either Fill or Unsuitable. The applicant should include the criteria which will be used by the Field Engineer in this determination. The criteria should include acceptable unified soil classification system (USCS) classifications, maximum particle size, extent and types of deleterious material (if any), maximum percent fines or other limited factors which were considered in the design.

Enclosure

4. Several aspects of the slope stability analyses presented in Appendix G appear questionable. First, the applicant's analysis of the cut slope includes the concrete fabriform layer. Independent analysis by staff, indicates a much lower factor of safety (FS=1.01), if the concrete layer is not included. Second, the analysis does not consider perched water zones within the slag fill. Based on the high moisture contents reported (50 to 70 percent), perched water zones within the slag fill are considered highly likely. Perched water zones will reduce the slope stability. Third, considering the relatively low and variable N-values, and the low reported unit weights, the selected shear strength values for the slag fill appear to be unconservative. Fourth, different unit weights are used in the exterior wall stability (spread sheet) and the global stability (STABL5). Also, the Ka and Kp values used are not consistent with the friction angle. The applicant should provide additional calculations or justifications in response to the above four comments.

5. The information requested below is especially pertinent to concerns and issues related to internal and external exposures from thorium and its progeny as it relates to the applicable requirements in 10 CFR Part 20. The operations of concern that could potentially release radionuclides and result in exposure to workers or members of the public include those that occur during excavation of the bunker site, transport of slag/soil to the bunker, unloading of slag/soil at the temporary bunker storage site. For each of these types of operations, the applicant should provide the following:

   a. The time frame or duration of the activity;

   b. The bases and assumptions used to determine the emission rates of radionuclides from each operation (e.g., picocuries/year of each gaseous and particulate radionuclide released to the atmosphere);

   c. The duration of the release of the emitted radionuclides;

   d. Hard copies of the input/outputs of any computer codes that were used to estimate the transport of radionuclides along any pertinent exposure pathway to a receptor; and

   e. The dose conversion factors used in the analyses (or their source if they are commonly available to the NRC).

6. Paragraph 4 of Section 5.1.1 indicates that, "The radionuclide of concern is Th-232 in equilibrium with its decay products." However, the RESRAD dose assessments for workers described in Appendices H-1 and H-2 do not take into account the concentrations of progeny that will be present in the slag/soil at the time of delivery from York, PA into the storage bunker at Washington, PA. Because the analyses in the subject report consider only those progeny that are generated during the storage or loading/unloading intervals, they will likely underestimate the dose to the worker. The analysis should be revised to include the contributions of the progeny of Th-232 to the assessments of doses to

the workers as required by Subpart C, Occupational Dose Limits, of 10 CFR Part 20.

7. The applicant should provide calculations, and their bases, that were used to estimate if the airborne concentrations of radionuclides and/or the external doses will be sufficiently large to warrant monitoring of workers as required by Subpart F, Surveys and Monitoring, of 10 CFR Part 20. Further clarification of this potential requirement is provided in NRC Information Notice 96-18, "Compliance with 10 CFR Part 20 for Airborne Thorium" (a copy is attached to this memorandum) and Regulatory Guide 8.25, "Air Sampling In The Workplace."

8. As required by Subpart D of 10 CFR Part 20, the applicant should provide calculations, and their bases, to demonstrate compliance with the limits on concentrations in air and water at the boundary of the unrestricted area, and with the annual limits (in terms of the Total Effective Dose Equivalent) for the individual member of the public likely to receive the highest doses from each operation that can potentially release radionuclides or produce external exposure.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS
WASHINGTON D.C. 20555

March 25, 1996

NRC INFORMATION NOTICE 96-18: COMPLIANCE WITH 10 CFR PART 20 FOR AIRBORNE THORIUM

Addressees

All material licensees authorized to possess and use thorium in unsealed form.

Purpose

This notice is provided to alert recipients to radiological problems that may be encountered in using thorium in unsealed form. These problems were identified by U.S. Nuclear Regulatory Commission (NRC) inspectors, during inspections of the approximately 120 licensees authorized to use unsealed thorium, some of which are engaged in processing and manufacturing activities that pose a potential for generating significant airborne radioactive contamination. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

NRC inspections at facilities using thorium in unsealed form revealed a number of programmatic weaknesses in the control and monitoring of airborne thorium hazards at an unexpectedly high proportion of these facilities. One of the areas of weakness frequently encountered was worker intake monitoring programs that did not appear capable of adequately quantifying intakes for purposes of demonstrating compliance with the requirements of 10 CFR Part 20, particularly the annual limits on intake (ALI). A second area of concern was the frequent lack of adequate licensee efforts to maintain exposures as low as reasonably achievable (ALARA), as required by 10 CFR 20.1101(c). NRC inspectors repeatedly observed intakes and resulting organ doses that appeared to be unnecessary, or avoidable, in view of the potential to reduce them by implementation of relatively simple ALARA measures. Some of the intakes in these cases were evaluated and produced organ doses in the 0.2 to 0.3 Sv (20 - 30 rem) range in a year. Such high doses, representing a substantial fraction of the maximum permissible organ doses, cannot be viewed as acceptable unless justified by a thorough ALARA analysis. In most of the observed cases, however, an adequate ALARA assessment had not been performed.

Demonstration of compliance with dose limits to members of the public, from airborne thorium, was also found, in some cases, to have been less than adequate. In some cases, the licensees were found to have no adequate monitoring systems for their airborne effluents, and in others the methods used to quantify these effluents did not possess sufficient sensitivity to enable demonstration of compliance.

In response to the regulatory violations noted above, NRC issued Confirmatory Action Letters (CALs) to a number of licensees, confirming commitments to taking specific actions to correct these deficiencies. Notices of Violation and other enforcement actions were also taken by NRC, in some cases. These actions, as well as extensive discussions with licensees, to alert them to the problems, have resulted in substantial improvements in most licensees' programs.

Discussion

The programs that licensees should develop for control of airborne hazards arising from the use of unsealed thorium do not differ in any basic respect from those needed in the case of programs to control the hazards from any airborne radioactive material. Facilities using thorium, however, must make allowances for certain constraints imposed by the nature of the thorium decay chain. The major constraint is the difficulty of measuring thorium-232 (Th-232) in the body after an intake using bioassay methods, either in vivo, such as whole body counting, or in vitro, such as urine analysis. This is caused, in part, by the relatively low ALI for Th-232, which is 37 Bq (1 nCi) for class W, and 111 Bq (3 nCi) for class Y aerosols, as well as the type of radiation emissions from the thorium decay chain, which are mostly alpha and beta radiations, with only relatively low-intensity gamma radiations.

The difficulties regarding the use of bioassay methods were increased after implementation of the revised 10 CFR Part 20, which became mandatory for all licensees on January 1, 1994. Intakes of Th-232 by inhalation before the Part 20 revisions were limited to 520 MPC-hours per quarter, where MPC was the maximum permissible concentration tabulated in the old Appendix B to 10 CFR Part 20. This was equivalent to an intake of about 700 Bq (19 nCi) per quarter for both the soluble and insoluble forms of thorium, or about 2800 Bq (75 nCi) per year. The revised Part 20 lowered that limit to ALIs of about 40 Bq (1 nCi) and 100 Bq (3 nCi) for classes W and Y aerosols, respectively. Therefore, bioassay methods that may have been capable of detecting intakes that were a small fraction of the allowable limits in the old Part 20 were no longer capable of the same performance under the revised Part 20 limits, and could therefore not serve the same monitoring functions in a routine airborne radioactivity control program as they did previously.

Although bioassay techniques are still useful in assessing relatively large intakes, they are not capable of providing routine monitoring for intakes substantially below the ALI. The air monitoring program therefore usually must assume a much greater importance at facilities using unsealed thorium than for other radionuclides. Facilities using thorium need to rely on accurate air sampling to estimate intakes that cannot be detected by bioassay techniques, which, in effect includes all intakes other than those that approach or exceed the ALI. Because of this reliance on air sampling to show compliance and assess internal doses, the air sampling program must be carefully designed to provide accurate intake estimates for all occupationally exposed workers, as well as members of the public who may be exposed to airborne thorium as a result of licensed operations. However, appropriate bioassay procedures should be established and available for use in assessing accidental or suspected high exposures, and for use in cases where adequate air sampling was inadvertently not provided. In this latter case, bioassay would provide an upper limit on the magnitude of any intake that may have occurred, even though it may not be capable of quantifying intakes below an ALI.

Air Sampling

The major deficiencies noted in air sampling programs at some of the inspected facilities included programs that did not provide samples that are representative of the intake by each exposed worker, monitoring frequencies that were far too low to be capable of detecting changes in air concentrations over time, and counting techniques that did not possess adequate sensitivity for their intended purpose.

One of the factors that led to non-representative samples was the excessive reliance on general area air sampling to monitor worker intakes in that area. Studies have repeatedly shown that air concentrations in a work area can vary by several orders of magnitude over distances of only a few feet, and a general area sample is most likely to grossly underestimate the intake of a worker involved in activities that generate aerosols. With rare exception, the most reliable method of assessing worker intakes is by use of personal air samplers. In the case of effluent sampling, the method chosen should be capable of obtaining a representative sample from the exhaust duct or other outlet. For aerosols, this usually means use of isokinetic sampling methods, and licensees should determine, for their particular case, whether such sampling methods are needed.

The choice of method of analysis should also be given careful consideration. This includes choice of the filter medium to use in the air sampler, air flow rates, as well as choice of counting techniques. These factors should be

selected to ensure that the desired monitoring sensitivity, expressed as a lower limit of detection (LLD), is achieved. A good guide as to the appropriate LLD to use in any application is that it should not exceed 10 percent of the value to which compliance is to be demonstrated.

ALARA

Licensees are required, by 10 CFR 20.1101(b), to demonstrate that the doses received by their workers, or by members of the public, as a result of their activities, are ALARA. The most effective method to maintain internal doses ALARA is usually to contain the radioactive material and prevent it from entering the air in the work space. Other methods might be use of wet processes, which have the effect of preventing or minimizing the generation of aerosols, or use of other engineering controls, depending on the details of the aerosol-generating process and the configuration of the workplace. Regardless of the choice of engineering controls, their use must include periodic maintenance to ensure continued effectiveness, as well as periodic checks to ensure that the systems remain effective.

If engineering controls fail to maintain airborne concentrations at sufficiently low levels, then other methods may be used, such as limiting stay times, or restricting access to the contaminated areas. Alternatively, respirators may be used to limit intakes during periods when other measures are not sufficiently effective. It should be noted, however, that 10 CFR Part 20 specifies that respirators are to be used only when other methods of control of intake fail to achieve the desired result or are impractical.

The above discussion on air sampling and ALARA is not exhaustive, and only highlights some of the most frequently encountered problems. Licensees should thoroughly evaluate their operations, and design and implement programs that would properly protect the workers, minimize intakes, and show compliance with applicable regulations. These evaluations are not one-time efforts, but should be ongoing and integral parts of the overall radiation protection program on site.

This information notice requires no specific action or written response. If you have any questions about this matter, please call one of the technical contacts listed below or the appropriate regional office.

Donald A. Cool, Director
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

Technical contacts: Sheri Arredondo, Region I
(610) 337-5342
Internet:saal@nrc.gov

Sami Sherbini, NMSS
(301) 415-7902
Internet:sxs2@nrc.gov

Attachments:
1. List of Recently Issued NMSS Information Notices
2. List of Recently Issued NRC Information Notices