Docket No. 40-8778
License No. SMB-1390

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

OCT 29 1992

Dear Ms. Dankmyer:

SUBJECT: COMMENTS ON SUB-SURFACE SURVEY FOR THORIUM CONTENT AT MOLYCORP'S SITE IN WASHINGTON, PENNSYLVANIA

We have completed our review of the report entitled, "A Sub-surface Survey for Thorium Content at the Molycorp Plant Site in Washington, PA" and have enclosed our comments for your consideration. We expect that you will address these comments in any revision of this report, or in the Site Characterization Report for the Washington site.

It is clear from this report that Molycorp has taken a significant first step in characterizing the Washington, PA site. The report indicates that down-hole gamma logging is an effective tool in identifying the general zone of sub-surface contamination in close proximity to each borehole. This sub-surface characterization method would appear equally effective in roughly estimating what areas of the site are free of significant sub-surface contamination. The Nuclear Regulatory Commission's major concern with the report is in the procedure used to convert down-hole gamma measurements to sub-surface soil concentrations. NRC is not prepared to accept the derived sub-surface concentrations for the reasons outlined in the enclosed comments.

If you have any questions or wish to discuss these comments further, please do not hesitate to contact me on 301-504-2546.

Sincerely,

[Original signed by]

Chad Glenn, Project Manager
Decommissioning and Regulatory
Issues Branch Division of Low-Level
Division of Low-Level Waste Management
and Decommissioning
Office of Nuclear Material Safety
and Safeguards

Enclosure: As stated
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NRC COMMENTS ON REPORT ENTITLED "A SUB-SURFACE SURVEY FOR THORIUM CONTENT AT THE MOLYCORP PLANT SITE IN WASHINGTON, PENNSYLVANIA"

General Comment

Molycorp's procedure for converting direct gamma measurements to sub-surface soil concentration of ^{232}Th remains unproven. The staff's difficulties with Molycorp's procedure concern: 1) the calibration factor selected for converting direct gamma measurements to sub-surface soil concentration; 2) the effect of shielding on down-hole gamma measurements by less contaminated soil; and 3) the lack of radiochemical analysis from core data to substantiate the subsurface soil concentrations.

First, the 2.82 (μR/hr)/(pCi/g) calibration factor is based on direct radiation emanating from an infinite (area > 100 m^2 and thickness > 1 meter) slab (volume) source containing uniformly distributed radionuclides of the ^{232}Th chain in secular equilibrium. At Molycorp's site in Washington, PA, although the radionuclides of the ^{232}Th chain are in equilibrium, they exist as discrete and finite volumes of sub-surface soil and slag. The discrete nature of contamination at this site does not support the use of this calibration factor.

In addition, shielding provided by relatively less contaminated or clean soil between a source of radiation and the detector in the borehole could result in gross underestimates of the ^{232}Th concentration. Similarly, a finite volume of relatively high concentration of ^{232}Th, located immediately adjacent to the borehole could result in overestimates of the derived average ^{232}Th concentration. The resulting high degree of uncertainty in the derived average ^{232}Th concentration would propagate into the resulting doses to individuals calculated for times during decontamination and decommissioning and following unrestricted release. Precise determination of the extent and quantity of residual activity is a prerequisite to assessing doses to be used as bases for NRC decommissioning decisions.

Another difficulty in the procedure for converting direct gamma measurements to subsurface concentration is the lack of analytical results of core data. On page 44, the report states that two of the boreholes drilled for the study were cored, and soil samples from the cores were taken at 18 inch intervals for radiochemical analysis to verify the calibration of gamma radiation in boreholes. Page 46 indicates that core samples were also taken for radiochemical analysis from 2 other boreholes (BH29 and BH32). However, the subject report does not present any results from the analysis of core samples. As a result, the validity of the analytically derived concentrations have not been demonstrated and remains unproven.

It is also unclear how Molycorp intends to use the sub-surface concentrations derived from gamma measurements (Appendices B and C). Is the intent to use these analytically derived concentrations as a relative indicator of concentration, or will these concentrations be used to demonstrate compliance with some established cleanup criterion? If the intent is to use these calculated values to show compliance with an established cleanup standard,

then additional information would be required to demonstrate the accuracy of the calculated concentrations. This demonstration should be based on direct measurement of soil concentration via sample analysis, portable survey meter, or some combination of these methods. If, on the other hand, the calculated values are intended to be used only as a relative indicator of concentration, then no further confirmation of concentration may be necessary.

It should be noted that a critical part of the decommissioning process is the termination or final survey. The licensee is expected to conduct this survey once the cleanup activities have been completed. The recommended survey procedure, generally acceptable to NRC, is contained in draft NUREG-5849. To avoid the difficulties discussed above, it may be reasonable to combine sub-surface soil characterization with excavation as proposed on page 12 of the subject report. Under this approach, material expected to contain ^{232}Th levels above 5 pCi/g (excluding background) could be excavated and consolidated onsite until a decision is reached on the final disposition of this waste. This cleanup level corresponds to Option 1 of NRC Branch Technical Position "Disposal or Onsite Storage of Thorium or Uranium from Past Operations" referenced in NRC's Action Plan (Federal Register, Vol. 57, No.74, April 16, 1992, pp. 13389-13392). Molycorp also referred to a cleanup level of 5 pCi/g in a meeting with representatives of NRC and Pennsylvania-DER earlier in the year. Existing sub-surface gamma logging data would be useful in estimating the depth and thickness of the contaminated zone. Following cleanup, a detailed final survey should provide assurance, at the 95% confidence level, that the residual ^{232}Th activity is below the decommissioning criteria.

Specific Comments

1. Page 5, second paragraph; page 44, fourth paragraph:
   From which two boreholes were soil samples obtained at 18 inch intervals, and have the samples been analyzed for radioactivity? When will the results be made available to NRC? In the July 8, 1992 meeting between representatives of Molycorp, the Commonwealth of Pennsylvania, and NRC, NRC staff inquired about the availability of the analytical results of core samples and Molycorp's consultant indicated that this information would be provided to NRC in the near future.

2. Page 8, second paragraph:
   A count rate of 2000 cpm cannot be assumed to be representative of background. Exposure rate measurements from borehole 28 do not represent natural background. The drillers log in Appendix D indicates slag, brick, and glass fragments to a depth of seven feet. Also, page 44 of the report, indicates that this borehole was drilled in a pile of ferromolybdenum slag. The borehole logging data in Appendix C indicates a count rate of roughly 2000 cpm through this contaminated interval. Background levels should be determined from boreholes in virgin soil.

3. Page 15, second paragraph; page 21, first paragraph:
The report states that the NaI scintillometer was calibrated by taking simultaneous pressurized ionization chamber (PIC) and scintillometer reading at several locations within the Molycorp plant site. The report goes on to state that the cosmic ray contribution to the PIC readings was subtracted. Why would cosmic rays not produce a response in a NaI scintillation detector as they would in an ion chamber?

4. Page 48, last paragraph:
The 1985 Oak Ridge Associated Universities (ORAU) report described four water wells at this facility. The location of three of the water wells in ORAU's report appear to correspond to water wells WW2, WW3, and WW4 in this study. However, the location of WW1 in this study does not correspond with WW1 in the ORAU report. Also, WW5 is not mentioned in ORAU's 1985 survey. Additional information would be helpful in clarifying the relationship of water wells described in ORAU's 1985 survey report with the wells described in this report. In addition, it would be useful to know if the recent study analyzed any well water samples for radioactivity content.

5. Page 6, second paragraph:
In a number of places in the report, 0.01% thorium appears to be used as the threshold for the excavation of radioactively contaminated material. For example, in a discussion of the use of a NaI survey meter to guide excavation, the report states that the use of this detector will make it possible to assess the local content of thorium and "guide the depth of excavation as well as to sort out materials exceeding 0.01% from those below 0.01% thorium." The report should discuss how the licensee proposes to use this radiation level in future decontamination and decommissioning work along with a justification for the selection of this level.

6. Page 3, third paragraph, Executive Summary:
The report states that the radiation exposure rates at 1 meter above the ground are predominantly the result of naturally occurring radioactive materials. Page 33 of the report states that natural background in the study area is 9.33 μR/hr, and the gamma surface survey (Site Map III) indicates that the entire study area exceeds background levels. Exposure rates over portions of the south, southwest, and northern part of the study area, exceed background by a factor of 2 or more. Therefore, residual contamination levels appear to contribute significantly to the surface exposure rates over a large portion of the study area. Also, the statement on page 11 indicating that 31 μR/hr is roughly twice natural background is inconsistent with the natural background level of 9.33 μR/hr noted in the report.

7. Page 12, second paragraph:
This section states that the lack of correlation between radiation profiles in 2 pairs of boreholes (BH#16-BH#29, and BH#16-BH#32 drilled 5 feet apart) demonstrates that it is not feasible to accurately model the subsurface activity by extrapolating between boreholes. However, an examination of the gamma profiles between these 2 sets of bore holes suggests that it may be possible to correlate the depth and zone of contamination over short distances between boreholes. Therefore, it may be useful to attempt to construct cross-sections across the study area in an effort to establish the extent to which the study area can be characterized and modeled by extrapolating between boreholes.

Based on the July 8, 1992 meeting between NRC, Molycorp, and the Pennsylvania-DER, NRC understands that Molycorp plans to expand the surface and sub-surface characterization of the site. Surface and sub-surface surveys similar to those conducted in the study area may be effective in determining those areas of the site without significant levels of contamination. The use of these characterization tools may assist in confining cleanup efforts to areas where there is significant contamination. However, it should be noted that the final survey of the affected areas must demonstrate that cleanup of soil volumes, containing ^{232}Th concentrations above the guideline level, has been achieved.

8. Page 12, first paragraph, Conclusions and Recommendations:
The discussion of a proposed approach for excavating contaminated material in the study area generally appears reasonable with the following changes. In step 1, areas to be excavated should be defined using both surface and sub-surface survey data. Limiting excavation to those areas where the surface exposure rate at 1 meter exceeds 30 μR/hr would leave substantial sub-surface contamination in place as evidenced by the gamma logs of the boreholes throughout the study area. Also, the 30 μR/hr threshold for excavation and consolidation of contaminated material is inconsistent with the 25 μR/hr level (including background) proposed by Molycorp in the July 8, 1992 meeting.

9. In certain cases, the physical separation of discrete volumes of contaminated material, via a sifting process, is sometimes effective in isolating the radioactive component in large volumes of material. This method is effective where the contaminated material is consolidated in fragments large enough to be separated. However, based on a description of the ferrocolumbium process in a 1971 Health Physics Report to Molycorp, entitled "Results of Radiological Evaluation of Columbium Slag Waste Disposal Problem", the contaminated slag at Molycorp's Washington facility was crushed in a ball mill and pumped to large settling basins where it dried to a hard grey mass and was subsequently used as fill. This crushing process may make it impractical to effectively separate thorium slag from soil. Also, the tables in Appendices B and D suggest that a significant amount of radioactivity is present in soil. These observations suggest that the physical separation of slag, via sifting, may not be an effective decontamination approach at Molycorp's Washington, PA site. Notwithstanding these observations, if Molycorp believes that sifting of contaminated soil may be effective is isolating

the source of contamination, Molycorp may wish to consider a pilot study to test the feasibility of this idea.