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

July 27, 2000

David J. Allard, Director
Bureau of Radiation Protection
Pennsylvania Department of Environmental
Protection
P.O. Box 8469
Harrisburg, PA 17105-8469

SUBJECT: REVIEW OF THE DRAFT ENVIRONMENTAL ASSESSMENT FOR THE MOLYCORP, WASHINGTON, PA, DECOMMISSIONING PLAN, PHASE I

Dear Mr. Allard:

I am responding to your letter of July 14, 2000, which forwarded your agency's comments on the subject assessment developed by my staff. Our response to your comments is enclosed. We are in the process of incorporating the resolution to your comments and finalizing the environmental assessment (EA). We are also preparing a notice for publication in the Federal Register (FR) which will summarize the EA and its findings. Copies of the final EA and FR notice will be forwarded as soon as they are completed.

I regret any problems we may have caused concerning the availability of the reference material associated with your review. We have enjoyed a very productive relationship with your agency and we look forward to further interactions with you and your staff as we move forward with our Decommissioning Program.

We recognize that the decommissioning of the Molycorp, Washington facility has significance to the Commonwealth of Pennsylvania because of Molycorp's desire, as addressed in its Phase II DP, to dispose of decommissioning waste on site. However, the Phase I decommissioning plan (DP) addresses the remediation of currently contaminated portions of the site to criteria approved by the Commission for unrestricted release. Issues associated with on site disposal will be reviewed in conjunction with the review of the Phase II DP. Approval of the Phase I DP does not foreclose the option of off site disposal.

We received the Phase II DP on July 14, 2000. We are making copies of the DP and we will forward a copy to you as soon as the copies are available. Our first step in the review of this DP is an acceptance review. An acceptance review is an administrative review to determine if there is sufficient information to begin a technical review. Our goal is to complete the acceptance review within 30 days of receipt. If the DP is accepted, we will coordinate our technical review with Mr. Robert Maiers of your staff.

If you have any questions concerning this response, please call me at (301) 415-7234 or Mr. Robert Nelson of my staff at (301) 415-7298.

Sincerely,

Larry W. Camper, Chief
Decommissioning Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosures:
1. Responses to Comments
2. Environmental Assessment

cc: Molycorp, Washington Dist. List

Docket No.: 040-08778
License No.: SMB-1393

63A

**RESPONSES TO COMMENTS FROM
THE PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
CONCERNING THE DRAFT ENVIRONMENTAL ASSESSMENT
FOR THE MOLYCORP, WASHINGTON, PA
DECOMMISSIONING PLAN, PHASE I**

Comment 1: Molycorp's proposal for onsite disposal of radioactive waste will be the subject of future review by the Commonwealth and action by NRC. However, BRP is concerned that a comprehensive environmental assessment process is not being conducted now for the complete remediation of this site. Instead, the environmental assessment is being segmented into two parts, and the assessment of remediation actions proposed to be taken in the first step (waste consolidation) has not explicitly addressed the need to keep all feasible options open for the second step (waste disposal).

Response:

The environmental assessment (EA) includes consideration of potential environmental impacts from Molycorp's proposed action to remediate the contamination at the facility buildings and on facility grounds necessary to comply with the NRC SDMP unrestricted release criteria (57 FR 13389). NRC staff is aware of no unique safety or compliance issues associated with the proposed onsite disposal option that would impact the assessment of impacts from remediation activities covered in the present EA. One benefit to separating the cleanup and disposal actions is that a rejection of the onsite disposal proposal will not substantially delay the remediation of the site. Specific safety concerns with the on-site disposal proposal can and should be raised during the environmental review process associated with that future licensing action where the question of on-site disposal will be assessed. Conclusions in this EA do not foreclose any options for waste disposal for the Washington site.

Comment 2: This EA for Part 1 of the site remediation does not reflect Molycorp's proposed plan to dispose of waste in an onsite impoundment, as clearly stated in their decommissioning plan (DP) - Part 1. In fact, statements in the EA such as: "(T)he objective of the decommissioning of (the site) ...is to remediate radiological constituents to the extent required to allow the NRC to release the property for unrestricted use and terminate the ...license for the facility" are disingenuous. If the Molycorp proposal for waste disposal were to be approved, part of the site would, in fact, be restricted from access and use, and long-term institutional controls maintained, contrary to statements in the EA.

Response:

NRC staff agree that the EA statement quoted by PADEP needs additional clarification. While the staff is aware of Molycorp's plans to propose a disposal impoundment on the site, that proposal is part of a separate licensing action which is not included in the proposed action reviewed in the present EA. As a result, the scope of the EA is limited to review of the proposed action (see EA Sections 1.2 and 1.3) under the Part 1 decommissioning plan. While the Part 2 proposed action is mentioned briefly in the general information chapter of the Part 1 decommissioning plan, the objectives of the Part 1 proposed action are clearly stated in the decommissioning plan, Section 2.1.1 Decommissioning Objectives and include "to transport the

material containing average contamination levels in excess of SDMP Action Plan unrestricted use criteria to an NRC approved location."

Under the Part 2 decommissioning plan, Molycorp proposes an on-site disposal facility in a location that does not overlap the areas designated for remediation under the Part 1 decommissioning plan. Therefore, Molycorp will be able to complete remediation activities and final surveys for these affected areas and release such areas for unrestricted use under the Part 1 plan. NRC staff agree that the phrase "...and terminate the license" in the EA statement highlighted by PADEP requires modification. While license termination is ultimately the intended result of most decommissioning actions, in this particular case a more appropriate statement is that the remediated land areas could be "released for unrestricted use." The EA has been modified to reflect this point. Therefore, NRC staff sees no need to further modify the EA for review of the Part 1 decommissioning plan to include information about the Part 2 decommissioning plan because all the environmental impacts associated with the Part 2 proposal will be considered in a separate licensing action.

Comment 3: BRP is concerned that different sets of remediation criteria for each of the two remediation steps will be applied to the site, and future questions regarding any residual radioactivity may be very difficult to resolve unambiguously. Applying more than one set of criteria to a remediated site is, with one exception, unique among the current 29 SDMP licensees nationwide, and PA will probably be inheriting this potentially ambiguous situation when the Commonwealth becomes an NRC Agreement State.

Response:

The License Termination Rule (LTR), specifically 10 CFR 20.1401(b)(3), allows licensees who have submitted an acceptable decommissioning plan by August 20, 1998, to use Site Decommissioning Management Plan (SDMP) criteria ["Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites" (57 FR 13389)]. This portion of the LTR is commonly known as the "grandfathering" provision. Although the plan being reviewed by this EA is dated June 30, 1999, this plan is a revision to the original DP submitted in 1995. Therefore, the plan can be considered under the grandfathering provision of the LTR. The rationale for the grandfathering provision is contained in Section F.2 of the statements of consideration for the final rule (62 FR 39057). There are several SDMP sites, in addition to the Molycorp, Washington site, that have opted to use the grandfathering provision (and SDMP criteria) for the contaminated portion of a site and the LTR for that portion of the site which would be subject to restricted release criteria. NRC will evaluate these sites against the appropriate criteria contained in the rule. Further, as stated in the statements of consideration, the SDMP Action plan criteria are consistent with the final rule.

Comment 4: Discussion of the decommissioning alternatives considered in Section 6.3 is incomplete, since the option of offsite disposal of the radioactive waste materials is not included. In spite of the fact that the EA excludes the offsite disposal option, the EA does include in Section 8.2.3 an assessment of the impacts of shipping all 105,000 cu. yd. of the contaminated material for offsite disposal. Since the EA demonstrates in Section 8.2.3 that the impacts from offsite disposal are insignificant, the EA certainly should address, in some detail, the alternative of offsite disposal for all material contaminated above NRC limits. (See also comment 5 below).

Response:

NRC staff did not intend to exclude the option for offsite disposal in the EA. To the contrary, the proposed action includes disposal at "an NRC approved location" which does not preclude disposal offsite. In responding to this comment, NRC staff noticed that the description of the proposed action in the EA in Section 6.2 (Proposed Action) inadvertently failed to mention the proposed disposal action. To address this omission, NRC staff have added a sentence to EA Section 6.2; "Under the proposed action, the radioactive wastes resulting from remediation activities will be disposed of at an NRC approved location." Because the focus of the proposed action is on remediation, impacts related to offsite disposal were assessed only to bound potential radiological impacts to workers and the public from transportation of wastes (see response to Comment 5).

Comment 5: Based on a 7/13/00 telephone conversation between BRP (R. Maiers) and Molycorp (G. Dawes), it is understood that because of the relatively high specific activity levels of materials in the slag pile, it will all be removed from its present location and shipped from the Washington, PA site for disposal offsite at an NRC approved disposal facility. It is also understood from this conversation that this offsite disposal will be conducted as an activity under the Part 1 Decommissioning Plan, independent of the final plans for other contaminated materials during Part 2. However, the NRC EA makes no mention of this planned activity and therefore NRC has not provided any environmental assessment of this plan. In spite of this deficiency in the NRC EA, and based on the insignificant impacts from offsite transportation of all 105,000 cu. yd. of contaminated material (discussed in Comment 4 above), BRP is convinced that offsite disposal of the 10,000 cu. yd. of contaminated slag pile materials is clearly the most environmentally sound option.

Response:

As indicated in the NRC response to Comment 4, shipment of radioactive materials to an NRC approved location (the proposed action reviewed in the EA) includes the possibility that materials will be shipped off-site. The transportation radiological impacts assessment (in EA Section 8.2.3) as cited in the PADEP comment includes shipment of the total estimated inventory of excavated soils (105,000 cu. yd.). This total excavated material includes the 10,000 cu. yd. from the slag pile and the remainder of excavated site soils. Because radiological impacts from transportation of contaminated slag/soils is positively correlated with the container dose rate and number of shipments, and the greatest number of shipments possible (the case presented in the EA) produced low dose results, conducting calculations for fewer shipments is unnecessary, because doses would be lower. It is true the dose rate estimates for slag material alone (1.5 mrem/hr) is greater than that assumed for the shipment of all 105,000 cu. yd. (0.25 mrem/hr). The higher dose rate estimate for the slag material results from the higher average activity concentration associated with the slag alone. Although the average activity concentration for all of the waste is smaller, the large increase in the number of shipments needed to transport all site material (an order of magnitude more shipments) offsets the lower dose rate and produces a bounding estimate for transportation exposure.

Comment 6: As noted in the EA, NRC is requiring additional information from Molycorp, including:

- Plans for surveys beyond the fence line (also see Comment 17, below)

- A supplemental characterization plan for determining uranium contamination
- A supplemental groundwater characterization and monitoring plan that includes additional radium measurements

In accordance with the NRC-PA MOU, the above information should also be provided for the Commonwealth's review and comment. BRP's concurrence with the subject EA is contingent upon satisfactory resolution of any comments that may be provided upon review of this additional information, as well as the comments provided here.

Response:

NRC will provide all supplemental plans for PADEP review and comment.

Comment 7: The EA does not address any oil or gas wells, or coal mines in the area. The potential impacts from these local features should be assessed and included in the EA, especially in light of the coal deposits discussed in Section 2.3.2 [now Section 2.3.1], and the observations from pumping tests discussed in Section 2.3.4 of the EA. It is noted in the latter section, that high water conductivity pathways were found at several test locations. There are indications that the clay layer may not be continuous, or is locally breached allowing for contaminants to move deeper into the ground. The conclusion of this section, that the hydraulic conductivity of the bedrock is comparable to the overlying units implying a potential transport pathway, is of significant concern to BRP.

Response:

Staff's review of Molycorp's site characterization information found some discussion of the existence of coal mining in the area of Washington but not on or adjacent to the Molycorp facility area (see Figure 3-9 in Molycorp's environmental report). This information combined with the site characterization data reviewed provide no evidence to suspect oil and gas wells or coal mines in the immediate site area. However, given the early history of coal mining in the U.S. and general lack of documentation of early exploration, it is not possible to rule out the presence of unknown abandoned mines. Detailed characterization to determine the presence of such features is considered less important to understanding the potential transport pathways than monitoring for the presence of transported material. Furthermore, the need to understand the detailed features of the geologic strata that lead to hydrologic connectivity from surface to bedrock becomes a moot point if the consideration of potential impacts already assumes such connectivity exists. Thus, the review of available data in the EA concludes that hydrologic connectivity may exist between the upper strata and the bedrock unit and this is a sufficient basis for requesting the additional characterization wells in the bedrock. NRC staff believe that the additional characterization to detect potential migrating contaminants will serve to identify if groundwater remediation is necessary. The removal of the source contamination during remediation of soils will also help protect the groundwater from the potential for future leaching and contamination problems. The assumption of hydrologic transport pathways has also led to an increased emphasis in the EA on erosion, leaching, and waste water control during excavation. Therefore, given the information requested in the EA, and the emphasis already placed on avoiding re-mobilization of contaminants, NRC staff do not believe additional investigation of drilling history in the area will provide useful information that will enhance protection of the local groundwater.

Comment 8: The EA states that the Molycorp License SMB-1393 is currently under timely renewal and authorizes only the possession of a maximum of 11,000 kg of uranium, with no mention of thorium possession limits. However, Molycorp's renewal application for license SMB-1393, transmitted in a 7/30/97 letter from G. Dawes to R. Bellamy, is for 120,000 kg thorium and no licensable uranium. This discrepancy should be corrected. In addition, Molycorp (G. Dawes) has stated in their 4/3/00 letter to NRC (L. Camper) that the estimated site inventory of uranium is significant with about 11.9 curies of total uranium present. NRC should determine if the quantities of uranium now estimated to be present requires that the SMB-1393 license be amended to include this uranium.

Response:

NRC is aware of the omission of thorium in the present license. Both the uranium and thorium inventories in the license will be updated with the more current inventories reported by Molycorp.

Comment 9: The EA states that based on data obtained in 1997, there are no registered wells within 2 km. of the site. Since residential expansion is occurring in the area, NRC should obtain more current data. Also, since only municipal or industrial wells are usually registered (or permitted), there is the possibility that unregistered wells exist at some residences in the area. NRC should determine whether any wells exist, or confirm that every residence or any other facility in the area receive all their drinking water from a municipal system.

Response:

Consistent with the SDMP Action Plan criteria, the staff is using the maximum contaminant levels for radionuclides in public drinking water, as established by the EPA, as the reference standard for protection of groundwater and surface water.

Past groundwater sampling results indicate concentrations of radionuclides in groundwater are below the EPA standards although, as stated in the EA, additional monitoring is being requested to improve the present understanding of radiological conditions. Because the source of contamination will be removed during excavation, the potential for future contaminant leaching of affected soils to groundwater is greatly reduced. As a result, future groundwater radiological concentrations are expected to decrease following remediation of the contaminated soils.

NRC staff has concluded that additional information on local wells will not increase the level of protection provided by the application of EPA standards and the monitoring required by license condition. In response to the comment, the staff has removed the reference to "no registered wells within 2 kilometers of the site."

Comment 10: The EA discusses surveys of the potentially contaminated buildings, indicating that walls and floors will be investigated for contamination. Floor drains, sumps, and similar locations should also be surveyed. The EA states that Molycorp has not identified any tanks that may be contaminated, whereas the April 3, 2000 letter from Molycorp does identify several tanks that are "affected." This discrepancy should be resolved.

Response:

Section 4.0 of the EA (3rd paragraph) states that pipe drains will be surveyed as well as subgrade pipes and ventilation ducts. The areas mentioned in the comment are covered by the proposed action and the statements in the EA. Furthermore, NRC will inspect the survey program to ensure any fixtures or equipment that may be contaminated are properly surveyed. To further clarify the EA, "fixtures and" was inserted before "equipment" in the topic sentence of the 3rd paragraph in Section 4.0 to be more inclusive of the suggested items. Regarding the comment about the radiological status of tanks, the statement in the EA is correct that no tanks have been designated as affected. Close inspection of Table A-1 in the cited April 3, 2000 memo confirms the affected classification column that mentions tanks refers only to the land under the structures and not the tanks themselves. Because the table does not include any classifications for equipment, NRC staff asked Molycorp to provide additional information on the radiological status of equipment. Molycorp responded on May 16, 2000 (letter from G. Dawes, Molycorp to L. Person of NRC) where they indicated plans for survey and classification of equipment radiological status. This information is discussed in paragraph 4 of EA Section 3.1.

Comment 11: Results of equipment surveys prior to removal from the site are stated in the EA to be available for NRC inspection. BRP may decide to audit some of these surveys and also may perform some independent measurements prior to removal of equipment. It is requested that NRC keep BRP informed of progress in this area.

Response:

NRC, at selected times, may audit/inspect equipment which has been surveyed by Molycorp prior to removal from the Washington site. As in the past, NRC will continue to provide PADEP with quarterly inspection schedules within the State. PADEP should contact Region I, after reviewing the quarterly schedule, to confirm inspection dates and to notify NRC if it would like to accompany any inspection. With regard to independent inspections by PADEP, NRC has no objection to such inspections by PADEP.

Comment 12: As stated in the EA, contamination from radium may pose a significant problem in remediation of the site. Specifically, the EA states: "(S)ignificant radium activities measured in many leachates suggest that radium may be the key radioelement of concern at the Molycorp site." The EA cites data, which indicates that radium in the slag is 30 times more leachable, and therefore, more mobile than the thorium. However, there is no discussion of the options for remediation of the radium or environmental impact of these options. Furthermore, there is no mention of precautions to be taken because of the presence of radium, such as radon monitoring to be included in the airborne radiation monitoring program.

Response:

NRC staff does not share the view that the cited EA statement indicates that radium presents a "problem" for remediation. The intent of the quoted statement is that, of all the radionuclides present, radium should be the focus of attention when considering the potential for mobilization (e.g., it should be included in groundwater monitoring and in reviews of monitoring plans). Past levels of radium measured in groundwater and surface water do not exceed EPA standards so there is no information collected to date that suggests public health and safety has been compromised from leached material. Additional measurements, recommended as a license

condition in the EA, will improve the understanding of radium levels in waters on or near the site.

Radium must be remediated in soils, as a daughter product of uranium, to meet the unrestricted release criterion. The cleanup standard for radium is derived from the uranium criterion using the equilibrium assumption and the sum of ratios rule when more than one radionuclide is present. All soil remediation and survey plans in the EA have been reviewed with the understanding that the cleanup criterion includes uranium daughters such as radium. Final surveys conducted by Molycorp will have to demonstrate that the radium levels are below the criterion. The details of the compliance demonstration approach, given the presence of a number of radionuclides and the potential for disequilibrium conditions, will be contained in the final survey plan (see EA license condition No. 2). For other potentially contaminated media, such as surface water and groundwater, additional sampling will help to determine if EPA standards are exceeded and remediation is necessary. At present, site characterization information indicates that remediation will probably not be needed for surface or groundwater, therefore, it is premature to discuss remediation options. If surveys indicate remediation is needed, then NRC will request that Molycorp submit a remediation plan that will be reviewed for potential impacts.

With regard to precautions for radon, Molycorp has established a radiation protection program to comply with the public and worker protection requirements in 10 CFR Part 20. This program has been reviewed by NRC staff and has been found to be sufficient to ensure workers and the public are protected and the regulations are met. Molycorp will have to monitor all radionuclides expected to exist in air at concentrations that exceed 10 % of the NRC derived air concentration limit (DAC) in 10 CFR Part 20. NRC will inspect the radiation protection program to ensure that implementation is sufficient to demonstrate compliance with the 10 CFR Part 20 requirements. The NRC inspection will review the completeness of the air monitoring program and consider whether the appropriate radionuclides are monitored to ensure safety.

Comment 13: Also, the EA does not discuss any attempts by Molycorp to determine whether the radium contamination of onsite groundwater is from decay of the uranium, from natural background, or both. In the 4/3/00 Molycorp letter, they commit to submit by October 2000 for NRC review detailed data and statistical analyses to define the equilibrium status of the uranium daughters. BRP is concerned about the radium contamination being found at the site and requests that this Molycorp submission be provided for our review also.

Response:

By including the recommended license condition that requires that Molycorp provide the information requested in the PADEP comment, NRC staff has concluded that the EA has sufficiently covered the issue of concern. NRC will provide PADEP a copy of the final survey plan containing the information in question when the report is received by NRC.

Comment 14: BRP agrees with the NRC conclusion that with only one test well bored into the bedrock, Molycorp has inadequate information to characterize the radiologic status of the site. We agree that additional wells that penetrate the bedrock are required. In addition to the expanded groundwater monitoring program being required by NRC, a comprehensive program should be carried out by Molycorp to determine the radionuclide makeup of the local background, including naturally occurring radium.

Response:

NRC has given Molycorp the flexibility to propose the monitoring program for groundwater that NRC staff will review and approve, if acceptable. If Molycorp can meet the EPA drinking water standards using a total radium measurement (that includes background), then they would not need to measure background. If the standards are exceeded using the total radium measurement, they are allowed to subtract background from the total measured radium for compliance purposes. If background is to be subtracted from the total radium measurement, Molycorp's monitoring program must describe the method by which background will be determined. Under these circumstances, it would be premature to require Molycorp to include additional background characterization studies at this time.

Comment 15: Although mention is made in the EA of erosion control practices, further emphasis needs to be placed on the need to preclude inadvertent contamination of clean soils as the remediation proceeds. In addition, the NRC should specify the procedures and oversight that need to be in place to ensure that deliberate mixing with clean soils to reduce the concentrations of contaminated volumes of soils or other materials does not occur.

Response:

The EA includes discussion and review of Molycorp's proposed controls to limit the spread of contamination during excavation in Sections 7.1.2 Effluent Control Techniques, 7.1.4 Airborne Radiation Monitoring Program, 7.1.6 Contamination Control Program, 7.1.7 Environmental Monitoring Programs, and 7.2 Radioactive Waste Management Program. In addition, further emphasis has been placed on erosion and waste water controls during excavation in the recommended license condition No.1 in section 10 of the EA. These plans will be submitted in the near future for NRC review and approval. NRC will provide a copy of the plan and coordinate its review with PADEP.

Regarding the comment on intentional dilution of soils, NRC will not allow Molycorp to demonstrate compliance by dilution and NRC inspectors will ensure this does not occur to the extent practicable. Given the large amount of contaminated soils at the site, NRC staff expects that dilution to any significant degree would be difficult.

Comment 16: The EA list of measures to be taken to ensure contamination control should be expanded to satisfy Comment 15, above. In addition, measures to be taken to control contamination in the case of inclement weather should also be included in this list.

Response:

See response to Comment 15. Regarding the comment about inclement weather, the NRC staff review considered a number of possible weather conditions in considering the potential impacts of the proposed action. A primary concern includes protection from erosion and collection of runoff during severe precipitation events. Molycorp has committed to using impermeable liners and covers for stockpiled materials and will provide a plan for management of water runoff at the site. NRC staff will provide copies of this plan to PADEP, coordinate its review with PADEP, and will ensure (through review and comment) that the forthcoming plans will contain sufficient detail to address any foreseeable weather impacts on material control during excavation.

Comment 17: The scan surveys beyond the fence line prior to, and following excavation should be expanded to include soil sampling for areas found by the scans to have elevated activity levels. In addition, to ensure contamination has not migrated beyond the fence line, scan surveys should extend outward until background levels are observed.

Response:

NRC staff agrees with the comment. NRC will require Molycorp to use the same approach it intends to apply to remediation within the fence to areas outside the fence. Any areas beyond the fence found to exceed the unrestricted release criteria will follow the process outlined in NUREG/CR-5849 for scoping, characterization, and final survey. This approach will ensure that characterization and cleanup of areas beyond the fence will be complete. Text was added to the 5th paragraph of EA Section 3.2 (the radiological status of surface and subsurface soils) to clarify that the same methods for characterization and remediation of affected areas inside the fence will be applied to areas of elevated activity identified outside the fence. In addition, text was added to the 4th recommended license condition in the EA to include affected "areas outside the facility fence" to further clarify the point.

Comment 18: Prior to finalization of the EA, we recommend that NRC make a careful review for numerous editorial errors that detract from the quality of the document. Some examples are:

a. Pagination of the Table of Contents does not agree with the text, and
b. A sampling density of 1/25 m^3 should be 1/25 m^2.

Response:

Following the PADEP review, the EA has been put through an extensive editorial review by a professional editor.

The sampling density noted in the comment is assumed to be the value in the EA (Section 1.3) for sampling a pile of clean excavated soil. Because the sampling of the pile(s) is to be done using a 3-dimensional grid as proposed by Molycorp, the volume-based units are correct. The units were incorrectly stated in the original Molycorp memo (Letter from G. Dawes to L. Camper, April 03, 2000), therefore, staff expect this is the reason for the discrepancy.

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ENVIRONMENTAL ASSESSMENT OF THE PROPOSED DECOMMISSIONING PLAN FOR THE MOLYCORP, INC. FACILITY IN WASHINGTON, PENNSYLVANIA

July 2000
LICENSE NO. SMB–1393
DOCKET NO. 40-08778

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
Division of Waste Management

Enclosure 2

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FOREWORD

The U.S. Nuclear Regulatory Commission (NRC) is considering a license amendment to authorize Molycorp, Inc. to decommission its facility in Washington, Pennsylvania. In preparation for cleanup of the site, Molycorp, Inc. submitted its initial decommissioning plan (DP) to the NRC in July 1995 (Foster Wheeler Environmental Corporation, 1995a). The DP has been supplemented twice: (i) first on June 30, 1999, (DP Part 1) to reflect the licensee's intent to decommission a portion of the site using interim cleanup criteria contained in NRC's "Action Plan to Ensure Timely Cleanup of site Decommissioning Management Plan Sites" (SDMP Action Plan) (57 Federal Register 13389) and; (ii) on July 14, 2000 (DP Part 2)(Radiological Services, Inc., 2000) for that portion of the site intended to meet the requirements of the new License Termination Rule (LTR) in 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination," published in July of 1997 (62 Federal Register 39057). This environmental assessment addresses only the Part 1 decommissioning. Part 2 will be the subject of a separate evaluation. Under the Part 1 decommissioning plan (hereafter, decommissioning plan) Molycorp, Inc. will remediate contaminated soils on the main facility grounds and at a separate location where slag materials have been concentrated by past operations (i.e., slag pile) to unrestricted release levels. The decision to dispose of the materials on site will be addressed in Part 2.

This environmental assessment (EA) reviews the environmental impacts of the decommissioning actions proposed by Molycorp, Inc. in the decommissioning plan (Part 1) at its facility located in Washington, Pennsylvania. In connection with the review of plans for the proposed action, NRC staff are preparing a safety evaluation report (SER), that evaluates compliance of the proposed action with NRC regulations. On issuance, the SER will be available for inspection and copying at the NRC "Electronic Reading Room," http://www.nrc.gov/ADAMS/index.html.

SUMMARY AND CONCLUSIONS

This EA was prepared by the NRC staff of the Office of Nuclear Material Safety and Safeguards (NMSS) (hereafter referred to as the NRC staff). Based on the NRC staff evaluation of the Molycorp, Inc. final decommissioning plan (Radiological Services, Inc., 1999), it was determined that proposed decommissioning can be accomplished in compliance with the NRC public and occupational dose limits, effluent release limits, and residual radioactive material limits. In addition, the approval of the proposed action (i.e., decommissioning of the Molycorp, Inc., Washington, Pennsylvania, facility in accordance with the commitments in NRC license SMB–1393 and the final decommissioning plan) will not result in significant adverse impact on the environment.

1.0 INTRODUCTION

1.1 Background

Molycorp, Inc. is the current holder of NRC radioactive source materials license SMB–1393 (NRC Docket 40-08778) for the possession of radioactive material resulting from operations at its facility located at 300 Caldwell Ave, Washington, Pennsylvania, 15301. License SMB–1393 was last renewed on September 1, 1992, and is currently under timely renewal. The license authorizes Molycorp, Inc. to possess at any one time a maximum of 11,000 kg (24,251 lb) of

natural uranium in the form of slags and contaminated soils. The license is in the process of being amended to authorize possession of up to 120,000 kg (264,554 lb) of thorium. The license authorizes storage, transfer, and decommissioning in accordance with an approved decommissioning plan. In June 1999, Molycorp, Inc. informed the NRC staff that it intended to decommission the Washington facilities by submitting the site decommissioning plan (Radiological Services, Inc., 1999) to the NRC for review. Consideration of a license amendment request for decommissioning the Molycorp, Inc. facility in Washington, Pennsylvania, and the opportunity for a hearing was published in the November 16, 1999 Federal Register notice (64 Federal Register 62227).

1.2 Purpose and Need for Proposed Action

The proposed action is necessary to allow Molycorp, Inc. to remove radioactive material attributable to licensed operations, to levels that permit unrestricted use of that portion of the site.

1.3 Description of Proposed Action

The decommissioning activities identified in the decommissioning plan (Radiological Services Inc., 1999) as supplemented by Dawes (2000a) include:

- Identify the location, depth, and thickness of areas containing greater than 10 pCi/g (0.37 Bq/g) total thorium using the gamma-log data from the site characterization report (Foster Wheeler Environmental Corporation, 1995b). These areas are summarized in Table 2-1 and displayed in Figure 2-2a of the decommissioning plan and further discussed in Dawes (2000a)

- Mobilize equipment, set up decontamination facilities, and implement erosion control measures in preparation for excavation activities

- Survey the site area to establish spatial coordinates of contaminated areas identified from site characterization radiological surveys

- Excavate clean overburden and stockpile onsite. Remedial support radiological surveys will be conducted during excavation using NaI detectors or *in-situ* gamma spectroscopy and periodic soil samples to confirm areas that exceed unrestricted use limits

- Excavate all soil and slag containing average contamination levels in excess of the unrestricted use criteria approved by the Commission in "Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites," April 16, 1992 (57 Federal Register 13389)

- Stockpile excavated material in preparation for loading onto transports. Stockpiling duration is estimated at 2 weeks. Excavation and stockpiling of waste will not occur until NRC has approved a disposal location for that waste. Erosion controls include: high-density polyethylene or very low density polyethylene liners, fugitive dust control by water spray or other suppressants, cover for stockpiles existing longer than 2 weeks, and routine air and surface water samples near stockpiles

- Sample excavated material to be transported consistent with requirements of the NRC-approved disposal location

- Transport the material containing average contamination levels in excess of the unrestricted use criteria to an NRC-approved location. Loading and transport will occur during excavation activities to limit the amount of time contaminated material is stockpiled.

- Conduct final surveys on excavated areas to demonstrate compliance with the unrestricted use limits (57 Federal Register 13389). A supplemental characterization plan will be submitted to NRC for review and approval prior to the start of decommissioning activities

- Survey the stockpiled clean overburden using a sample density of 1/25 m^3 to confirm the soil meets the unrestricted use criteria (57 Federal Register 13389)

- Backfill excavated areas that meet the unrestricted use criteria in 48 Federal Register 52061–52063 with the clean overburden

2.0 FACILITY DESCRIPTION/OPERATING HISTORY

The Molycorp, Inc. site is a metals processing facility located in southwestern Pennsylvania in Washington County approximately 56 km (35 mi) southwest of Pittsburgh. The address is 300 Caldwell Avenue, Washington, Pennsylvania, 15301.

The operating history of the plant began with ferroalloy manufacturing operations (e.g., ferrocolumbium, tungsten) in the 1920s that continued until 1991. Ferrocolumbium operations processed pyrochlore concentrates (i.e., natural ore) by exothermic reaction of pyrochlore with aluminum. The pyrochlore concentrates contained naturally occurring thorium (1.87 to 2.08 percent) and uranium (0.04 to 0.06 percent) that remained in slag material following ferrocolumbium production (Foster Wheeler Environmental Corporation, 1995b). Radiologically contaminated slags were retained on the plant site, along with a larger quantity of (uncontaminated) ferromolybdenum slags (from the manufacture of molybdenum products). Both slags were used as landfill on the property. In 1972, some of the thoriated material from the site was disposed at the West Valley, New York, low-level radioactive waste burial site. Molycorp, Inc. also performed cleanup operations to segregate and stabilize some of the slag and soil onsite. Segregated material (about 21,200 m^3 or 27,700 yd^3) was placed in a capped pile on the property south of Caldwell Avenue (hereafter referred to as the slag pile). A 2.44-m (8-ft) steel security fence surrounds the area that is posted with radiation area signs. Details of the radiological status of the facility are provided in Section 3.0 of this EA.

2.1 Local Geography

The Molycorp, Inc. Washington site lies within the Pittsburgh Low Plateau Section of the Appalachian Plateau Physiographic Province. It is characterized by stream erosion dissection. The geomorphology of this area generally consists of rounded hills and ridges separated by open valleys. The elevation of the Washington facility ranges from approximately 308 m (1010 ft) along Chartiers Creek to 344 m (1128 ft) on the hill area in the southern portion of the property (ICF Kaiser, 1997).

The region, in general, consists of towns located close to transportation corridors surrounded by agricultural and open areas. Washington city is the largest population center in the county and the seat of the county government. The Molycorp, Inc. site is in close proximity (less than 0.8 km or 0.5 mile) to the urbanized area of Washington. While many of the city neighborhoods and the downtown area are separated from the facility location by Interstate 70, some residential dwellings exist in close proximity to the facility property.

The Molycorp, Inc. land holdings in Washington, Pennsylvania comprise eight land parcels with a total of 220 km^2 (55 acres). The facility is located on 81 km^2 (20 acres). A legal land description is provided by Foster Wheeler Environmental Corporation (1995). The Molycorp, Inc. property is traversed from south to north by Chartiers Creek. The creek lies to the west of the contaminated site. Two CSX rail lines serve the property. Adjacent land uses include residential housing, industrial facilities, and public lands.

2.2 Climate

The Molycorp, Inc. Washington facility is located in the humid continental climatic region. This region experiences distinct seasons with temperature, cloud cover, and precipitation affected by the Great Lakes.

The summer season is generally mild but frequently humid because of invasions of tropical air from the Gulf of Mexico. The winter months are brisk with occasional periods of extreme cold. Cloud cover is persistent during the winter because of the frequent passage of moisture-laden air masses from the Great Lakes and west-to-east migratory storms. However, lake-effect precipitation is not significant. Spring and fall are transitional seasons with moderate-to-cool temperatures. Rapid and wide variations in day-to-day weather conditions are common during the spring and fall (Foster Wheeler Environmental Corporation, 1995b).

Total annual precipitation in Washington County averages 96 cm (38 inches), most of which occurs April through September. Average seasonal snowfall is 79 cm (31 inches). Average monthly temperature ranges from -1.1 to 20 °C (30 to 69 °F) (Foster Wheeler Environmental Corporation, 1995b; Seibert et al., 1983).

2.3 Geology and Hydrology

Characterization of the geology and hydrology of the Washington facility and the surrounding region is important to understand the potential for migration of contaminants and to assess the validity of radiological characterization studies.

2.3.1 Geology and Hydrogeology

The 220-km^2 (55-acre) Washington site of Molycorp, Inc. is divided into three areas. About 36 percent of the land is developed, 45 percent exists in a flood plain where Chartiers Creek and Sugar Run traverse the property, and 6 percent is classified as wetland.

The description of geology and hydrogeology is based on the flood plain area. This includes the area surrounding the streams that bisect the main production areas and the upland section (or the hill area). The hill area is adjacent to the production area on the southern edge of the facility. The topography includes steep slopes and hillsides in the southwestern portion of the site. The description of geology and hydrogeology provided herein is based on earlier site

characterization by Foster Wheeler Environmental Corporation (1995) and more recent field work completed by ICF Kaiser (1997). Data were also obtained from United States Geological Survey (Berryhill et al., 1971).

The valley is filled with alluvium consisting of sand, cobbles, and silty material. No major faults are mapped within the area, although cores taken from boreholes indicate the presence of fractures in several bedrock units. The bedrock beneath the site consists of the Permian age Washington formation and the underlying Pennsylvanian-Permian age Waynesburg formation. The bedrock dips to the west and southwest at an angle reported to be less than 10 degrees (ICF Kaiser, 1997, Figure 3-5) and consists of alternating sequences of sand, clay, limestone, and coal deposited during the Pennsylvanian and Permian ages. The Washington formation, which outcrops at the hill area, consists of alternating strata of shale and sandstone with several coal beds. The formation varies in composition and texture horizontally with discontinuous limestone beds. The formation is known to be a poor water-bearing unit with well yields ranging between 4E-3 to 0.3 m^3/min [1 to 70 gallons per minute (gpm)] with a median well yield of 8E-3 m^3/min (2 gpm) (ICF Kaiser, 1997). The Waynesburg formation, which stratigraphically underlies the Washington Formation, consists of cyclic sequences of sandstone, shale, limestone, and siltstone with some claystone, and coal. The unit also is known to vary in texture and composition horizontally, and like the Washington, is a poor producer of water. The mean yield of wells completed in the Waynesburg formation is 4E-2 m^3/min (10 gpm) (Foster Wheeler Environmental Corporation, 1995b). The Monongahela Group, which outcrops approximately 600 m (2000 ft) north of the Washington facility, stratigraphically underlies the Waynesburg formation.

2.3.2 Water Supply

Municipal water delivered to the surrounding areas including Canton Township, North Franklin Township, and the City of Washington is provided by Pennsylvania American Water Company. Water is pumped from two pumping stations on the Monongahela River. According to ICF Kaiser (1997), neither the surface water nor the groundwater from the Molycorp, Inc. site discharge into the Monongahela River.

2.3.3 Surface Water

Two surface streams cross the Molycorp, Inc. property adjacent to the facility. Chartiers Creek flows through the property from the south to north. Sugar Run flows from the southwest to the northeast joining Chartiers Creek within the property boundary. The Chartiers Creek watershed drains a total area of approximately 666 km^2 (167 acres) (ICF Kaiser, 1997) into the Ohio River at Carnegie, Pennsylvania.

Average stream flow in Chartiers Creek, as it enters the site, is estimated at over 30 m^3/min (8000 gpm) (Foster Wheeler Environmental Corporation, 1995b) with estimates of 0.105 m^3/min (28 gpm) runoff resulting from the Molycorp, Inc. property. Baseflow resulting from groundwater within the Molycorp, Inc. property is estimated from hydrographs at 2.6E-2 to 3.0E-2 m^3/min (7 to 8 gpm). The 100-year flood plain elevation of Chartiers Creek, based on the Federal Emergency Management Agency flood insurance rate map, ranges from 311.8 m (1023 ft) at the north end of the plant to 312.4 m (1025 ft) at the south property line (Federal Emergency Management Agency, 1986). Stream flow measurements of Sugar Run were conducted by ICF Kaiser (1997) and ranged from 3.71 to 5.32 m^3/min (980 and 1410 gpm). The 100-year flood plain elevation for Sugar Run ranges from 312.4 m (1025 ft) at the

confluence of Chartiers Creek to 313.0 m (1027 ft) at the west end of the site (Federal Emergency Management Agency, 1986). A small portion of the site along Sugar Run and near the confluence of Sugar Run and Chartiers Creek is considered to be a wetland.

2.3.4 Characterization of Site Hydrogeology

The characterization of site hydrogeology on the lowland area has been conducted by Foster Wheeler Environmental Corporation (1995), while the hill area has been investigated through fieldwork by ICF Kaiser (1997). A soil boring, piezometer, and monitoring well installation program has been initiated to accurately define the extent of fill material, underlying overburden units, and radioisotope contamination at the site. In total, 418 boreholes were drilled to depths between 1.3 to 11.0 m (4.3 to 36 ft) in the lowland area. The borings, piezometers, and wells have been completed in the alluvium, Chartiers Creek fill material, and the underlying Waynesburg Formation. Water levels measured within the lowland area varied between 0.61 to 1.5 m (2 to 5 ft) from the soil surface. Various fill materials including slag, refractory bricks, and mixed natural sediments fill the lowland area between 0.61 to 3.6 m (2 to 12 ft) with an average of 2.1 m (7 ft). A clay zone underlies the fill material at the site. The presence of a clay layer could act as an aquitard and inhibit contaminant transport to bedrock, although site data show that the clay layer may not be continuous across the site. A highly variable, mixed alluvium that varies in thickness from 1.5 to 4.9 m (5 to 16 ft) underlies the clay. The upper portion of the claystone bedrock, which underlies the mixed alluvium, is weathered and fractured. The permeability of the upper portion of the claystone is comparable to the overlying alluvium.

The unsaturated zone is generally less than 1.2 m (4 ft) thick in the fill material. The water table is mainly within the fill material but is known to fall into the underlying clayey deposits. Two infiltration tests were conducted in the fill material, which yielded moderately low infiltration rates of 0.3 to 0.06 m/d (0.9 and 0.2 ft/d) (Foster Wheeler Environmental Corporation, 1995b).

Hydraulic tests in the lowland area, composed of 2 constant rate pumping tests and 20 slug tests, were conducted by Foster Wheeler Environmental Corporation (1995). The results from the pumping tests indicated transmissivities range between 11.0 to 18.2 m^2/d (118 to 196 ft^2/d), while storativity varied between 0.062 to 0.064 (ICF Kaiser, 1997). The radius of influence after 41 hours of pumping was determined to be 34 m (110 ft). With an estimated thickness of alluvium ranging between 1.5 to 3.0 m (5 to 10 ft) in the pumping test area, the hydraulic conductivity from the pumping test ranged between 4.0 to 8.2 m/d (13 to 27 ft/d). The strongest responses recorded through pumping in the fill material were in observation wells completed in the fill material. One observation well completed in the lower, mixed alluvium separated by the clay layer from the fill layer, responded to the pumping test. This response indicates that the clay layer may not be continuous or may be locally breached allowing for contaminants to move deeper. Hydraulic conductivities obtained from 17 slug tests conducted in the fill ranged from 0.14 to 0.85 m/d (0.45 to 2.8 ft/d) with an average of 0.38 m/d (1.25 ft/d), while in the mixed alluvium beneath the clay, hydraulic conductivity ranged from 0.018 to 0.66 m/d (0.059 to 2.2 ft/d) with an average of 0.17 m/d (0.57 ft/day). The rapid recovery of water levels in three slug-tested wells did not allow for the collection of data in those wells. The rapid recovery could be an indication of the presence of high conductivity pathways at those three test locations. A high conductivity zone suggests the possible presence of preferential transport pathways. The single slug test conducted in the bedrock yielded a hydraulic conductivity of 0.22 m/d (0.73 ft/d) (Foster Wheeler Environmental Corporation, 1995b). This test suggests that the hydraulic conductivity of the bedrock is comparable to the overlying units, implying the existence of potential transport pathways.

The general direction of groundwater flow estimated from interpolated water table elevations is westward toward Chartiers Creek with a horizontal hydraulic gradient averaging 0.03 ft/ft (Foster Wheeler Environmental Corporation, 1995b) for the fill material and the lower, mixed alluvium. The water level in the mixed alluvium is approximately 0.9 m (3 ft) lower than the water level in the fill. Because the clay layer that separates the two units is approximately 3.0 m (10 ft) thick, a downward vertical hydraulic gradient of 0.3 ft/ft exists across the clay layer (Foster Wheeler Environmental Corporation, 1995b; ICF Kaiser, 1997). A significant vertical hydraulic gradient was observed in the slurry wall area, resulting from the presence of the wall. The wall separates the surface impoundments area of the facility from Chartiers Creek. A groundwater flow model, developed for the site using the code MODFLOW (MacDonald and Harbaugh, 1988) and calibrated using site data, was able to confirm the overall direction of flow and gradients in the fill and the underlying mixed alluvium. Calibration of the groundwater flow model using the pumping test data was not successful.

3.0 RADIOLOGICAL STATUS OF THE FACILITY

3.1 Structures and Equipment

Molycorp, Inc. classified the radiological status of buildings at the Washington site (Dawes, 2000a,b). While Molycorp, Inc. expects the potential for significant contamination is low for all buildings, it has classified a number of buildings as "affected" to ensure safety. Buildings associated with processing, handling, storage, and any other past uses of radiologically contaminated materials were classified as affected. Such classification triggers an increased final survey measurement density to ensure the buildings meet the unrestricted use criteria for structures and equipment summarized in Table 8.1. Buildings were classified as unaffected if the prior use history did not involve radiologically contaminated materials. This classification is consistent with the approach recommended in NUREG/CR–5849 (Berger, 1992) for identifying potentially contaminated locations. To verify the radiological status, unaffected buildings will undergo scoping surveys in areas where contamination, if present, would be most likely to exist.

Specific buildings classified as affected include buildings 1, 19, 26, 29, 31, and 33. These buildings were used to store contaminated soil samples or other material from the site (buildings 1, 19, 31, and 33), store drums of pond residues (building 26), or support ferrocolumbium production operations (building 29). Building 1 was a laboratory that stored soil samples and conducted bench-scale thorium separation tests on slag.

All other buildings at the site are considered unaffected because they were not involved in ferrocolumbium production or storage of radioactive material. Dawes (2000a) indicates all unaffected buildings will undergo a scoping survey to verify the designated radiological status. This survey will consist of limited scan surveys and direct measurements in biased areas such as high traffic areas or selected horizontal surfaces. Measurements exceeding the instrument minimum detectable activity (MDA) will be investigated with an expanded scoping survey. If the average activity level for the direct measurements exceeds 10 percent of the thorium surface contamination unrestricted release limit or an individual measurement exceeds 25 percent of the limit, the building will be classified as affected.

Most equipment on the site was not used for ferrocolumbium (i.e., licensed) operations, but this equipment has not yet been characterized for radiological contamination. To confirm the radiological status of equipment on the site, Molycorp, Inc. will conduct a comprehensive inventory to identify each piece or type of equipment, document its use and operational history,

and categorize it according to contamination potential. Equipment not used for processing licensed material and is located in an unaffected building will not be surveyed. Equipment not used for processing licensed material, yet located in an affected building, will undergo a limited scoping survey to ensure residual contamination does not exceed unrestricted release limits. Any equipment used for processing licensed material will recieve an unrestricted release survey prior to removal from the site. Results of the categorization and equipment surveys will be available for NRC inspection.

Following review of the available information, NRC staff find the characterization effort and decommissioning plan adequate for determining areas of elevated radioactivity on structures and equipment necessary for demonstrating compliance with NRC unrestricted release limits.

3.2 Surface and Subsurface Soils

Radionuclide concentration and direct radiation levels for surface and subsurface soils at the Molycorp, Inc. Washington facility have been measured at various times and locations using a variety of methods. A brief description of the surveys and key results follows.

In 1971, analysis of 21 samples collected by Applied Health Physics, Inc. (AHP) from a pile of slag indicated a maximum ^{232}Th concentration of 795 pCi/g (29.4 Bq/g), with radiation levels up to 1.2 mR/hr (0.31 μC/kg per hr). AHP reported that ^{232}Th concentrations in the settling basins ranged from 218 to 327 pCi/g (8.07 to 12.1 Bq/g) (Applied Health Physics, 1971).

In 1972, AHP excavated an estimated 887,500 pounds of soil and thoriated slag and shipped it to Nuclear Fuel Services, Inc. in West Valley, New York (Applied Health Physics, Inc., 1975). The average thorium content of these shipped materials was reported to be 1.3 percent thorium. Direct gamma scans (1m) were used to confirm that the soil/slag removal resulted in meeting a target contamination level for surface gamma readings of < 250 μR/hr (64.5 nC/kg per hr).

In 1975, Molycorp, Inc. stored an additional 7646 m^3 (10,000 yd^3) of soil/slag on site at the south end. This pile of slag was then covered with clean soil and revegetated (ICF Kaiser, 1997). Various estimates of the average and total thorium concentration in this slag pile and on the site grounds have been provided by Molycorp, Inc. (Foster Wheeler Environmental Corporation, 1995b; Felmy et al., 1998; Dean, 1999). The most recent estimates suggest the pile contains 1064 pCi/g (39.4 Bq/g) average total thorium and a total of 14.7 Ci (544 GBq) total thorium and 7.34 Ci (272 GBq) total uranium (Dawes, 2000a). Surface exposures at the slag pile were reported in 1975 to be < 250 μR/hr (64 nC/kg per hr) (for comparison, background at the site is approximately 10 μR/hr or 2.6 nC/kg per hr). The site is estimated to contain 23.9 Ci (884 GBq) of total thorium and 11.9 Ci (440 GBq) of total uranium (Dawes, 2000a). Molycorp, Inc. stated this inventory includes subsurface contamination, the volume stored in the rolloff boxes, and the soil/slag pile.

In April 1985, an extensive radiological surface survey was conducted by Oak Ridge Associated Universities (Martin, 1985). The survey included surface and 1-m scans and gamma-spectrometry analysis of soil samples for ^{232}Th, ^{228}Th, ^{238}U, and ^{226}Ra. A 20-m grid was used for the western third of the plant site and the entire south property. A 5-m grid system was used for an area near the northern property line with elevated radiation levels. Measurements and samples were also collected at 100-m intervals along the perimeter, 10-m intervals along the south-property perimeter near the soil/slag pile, 50-m intervals along rail lines, and 20-m

intervals along Chartiers Creek. In addition, similar measurements and samples were collected from six off-site locations. Direct measurements were made with NaI(Tl) detectors and rate meters, while soil samples were analyzed using gamma spectroscopy. Above-background thorium levels were measured in dikes separating eight surface impoundments located west of the plant area. Surface activities were measured at or above background levels, indicating the potential for subsurface thoriated slag in the northwest portion of the site. The maximum ^{232}Th concentration at the plant site was 1380 pCi/g (51.1 Bq/g), while the maximum ^{232}Th concentration at the soil/slag pile was 1890 pCi/g (70.0 Bq/g). Off-site (i.e., background) measurements were typical for the region, with radionuclide concentration ranges for ^{232}Th of 1.00 to 2.05 pCi/g (0.037 to 0.076 Bq/g), ^{228}Th of 0.95 to 1.71 pCi/g (0.035 to 0.063 Bq/g), ^{238}U of 0.77 to 2.03 pCi/g (0.028 to 0.075 Bq/g), and ^{226}Ra of 0.89 to 1.19 pCi/g (0.033 to 0.044 Bq/g). The ^{232}Th concentrations along the plant site's northern and western boundaries and the south property's eastern and southern boundaries exceeded 10 pCi/g (0.37 Bq/g). Because the characterization terminates at the facility boundary and, therefore, does not provide any information to confirm that contamination has not migrated beyond the fence line, Molycorp, Inc. agreed to conduct scan surveys beyond the fence line prior to and following excavation. Any areas beyond the fence line with elevated activity will be characterized and remediated using the same approach applied to affected areas within the fence line, e.g., NUREG/CR-5849 (Berger, 1992).

In 1990, RSA, Inc. conducted a subsurface survey across the western portion of the site and areas immediately to the north, west, and northwest of the impoundment area (Radiological Services Incorporated, 1999). The survey included down-hole analysis in 32 new boreholes, and in existing monitoring wells at the site. In addition, a surface survey was conducted with 400 measurements using a scintillation detector. RSA, Inc. reported that about 70,463 m^3 (92,163 yd^3) of soil/slag remained at the site with concentrations exceeding 10 pCi/g (0.37 Bq/g), and 31,452 m^3 (41,138 yd^3) remained at the site with concentrations between 5 and 10 pCi/g (0.2 and 0.4 Bq/g).

In 1995, a remediation action took place where eight impoundments located east of Chartier's Creek and west of the plant area were drained. Thoriated slag was found in two of the drained impoundments. The sludge from these two impoundments was placed into eight, 15-m^3 (20-yd^3) lined and covered rolloff boxes. Including the material stored in rolloff boxes and the slag pile, the total volume of material expected to be excavated is approximately 80,300 m^3 (105,000 yd^3) (Dawes, 2000a).

In 1995, the site characterization report discussed survey results of 12,499 measurements collected from 418 boreholes. Two methods were used to delineate the subsurface distribution of thoriated slag/soil. The first method was down-hole gamma logging (NaI) at 6-inch intervals conducted in all boreholes, with count rates converted to a ^{232}Th concentration. The second method was gamma spectroscopy of borehole soil samples. Gamma-ray spectroscopy was used for about 20 percent of the boreholes at 6-inch intervals. In addition, four off-site boreholes, two west of the site and two east of the site, were analyzed to quantify natural background conditions. It was reported that more than 99,109 m^3 (3.5×10^6 ft^3) of soil/slag with ^{232}Th concentrations > 5 pCi/g (0.18 Bq/g) remained at the site. Most soils with ^{232}Th concentrations > 10 pCi/g (0.37 Bq/g) were reported to be near the surface.
In 1996, another remediation action took place at the Findlay property adjacent to the northern plant property line. During this action, 184, 15-m^3 (20-yd^3) lined and covered rolloff boxes of thoriated soil/slag were excavated and remain in storage on site awaiting final disposition at an NRC-approved location in accordance with the proposed decommissioning actions.

In 1998, an inspection of the Molycorp, Inc. Washington facility by the NRC Region I office included a limited radiological survey. A radiological survey of the soil/slag pile, various buildings, the impoundment area, and rolloff boxes was conducted using a Ludlum 19 survey meter. The reported exposure rates were 50 to 500 μR/hr (10 to 100 nC/kg per hr) for the soil/slag pile, 5 to 20 μR/hr (1 to 5 nC/kg per hr) for the moly building, 10 to 50 μR/hr (2 to 10 nC/kg per hr) for the impoundment area, and 5 to 15 μR/hr (1.2 to 3.9 nC/kg per hr) for the rolloff boxes (Bellamy, 1998). For comparison, background exposure rates in the facility area are approximately 10 μR/hr (2 nC/kg per hr).

Molycorp, Inc. soil characterization activities have focused on measurement of thorium and its daughter products; however, site characterization results suggest uranium is present at some locations in greater quantities than expected. For example, 184 samples analyzed as part of the Findlay cleanup yielded a uranium to thorium ratio of 1.22 (Daniels, 1997). Similarly, samples of the impoundment material [U:Th of 0.549 (Daniels, 1997)] and the soil/slag pile (U:Th of 0.156) show orders of magnitude more uranium than assumed to be in the source ore (Foster Wheeler Environmental Corporation, 1995b). To ensure compliance with unrestricted release limits, Molycorp, Inc. will develop and submit for NRC review and approval, a supplemental characterization plan that describes methods appropriate for determining the uranium concentration and demonstrating compliance with unrestricted release criteria for uranium and thorium, taking into account the sum of ratios rule (see Section 8.1).

Because Molycorp, Inc. plans to include uranium in the supplemental characterization plan and in demonstration of compliance with cleanup limits, the NRC staff conclude that Molycorp, Inc. can safely remediate the site without extensive preexcavation characterization of uranium concentrations. If the final survey detects uranium in excess of the unrestricted release limits, remediation and final surveys will continue until the unrestricted release limits are satisfied. Based on this information, the NRC staff find the characterization effort and decommissioning plan adequate for determining areas of elevated radioactivity in soils that require remediation to limit concentrations to the NRC limits for unrestricted release. Removal of the source contamination is expected to significantly reduce potential environmental impacts.

3.3 Surface Water, Sediments, and Groundwater

Migration of contamination away from the site to surface water, sediments, and groundwater requires mobilization of the radionuclides from the slag/soil material. To assess the evidence of past migration or the likelihood of future migration, leachability of the radionuclides under site-specific conditions and results of environmental sampling are important factors that need to be considered.

Alpha autoradiographic analyses indicate that glass components and nonmetallic mineral phases in the slag contain radioactive components (Pickett et al., 1998). However, autoradiographs show that the highest areas of radioactivity within the slag are associated with metal particles. Microscopic examination of the metal particles shows no evidence of corrosion, indicating they are much less susceptible to dissolution than the glass components. If radioisotopes are structurally bound to the metal particles, and their solubility is low—as suggested from optical examination—then release of radionuclides to the aqueous environment will likely be in low concentrations.

Leach and percolation tests conducted by Molycorp, Inc. concluded leaching of radioisotopes from the slag into groundwater is negligible (Foster Wheeler Environmental Corporation, 1995b; ICF Kaiser, 1997). In percolation tests only 10 out of 52 leachate samples had detectable gross alpha concentrations. However, a reported maximum leachate concentration of 69 pCi/L (2.6 kBq/m^3) gross alpha indicates a potential for significant localized release of radionuclides at the site.

Leach tests using the ANSI/ANS–16.1 protocol (American Nuclear Society, 1986) were conducted on six specimens of slag from the Washington site by IEA Radiological Laboratory (ICF Kaiser, 1997). The ANSI/ANS protocol involves immersion of an intact specimen of known surface area in demineralized water for a series of 10 intervals ranging in duration from 2 hours to 43 days for a total duration of 90 days. However, as requested by Molycorp, Inc. only six leaching changeouts for each specimen were performed at intervals of 2, 5, 15, 30, 45, and 90 days (see Appendix K, ICF Kaiser, 1997). Early leaching changeouts prescribed in ANSI/ANS-16.1 at intervals of 2, 7, and 24 hours were not performed. In addition, ^{232}Th was the only radioisotope analyzed in the leachates, and the procedure used to prepare slag specimens for the tests was not described. Based on the leachability testing, Molycorp, Inc. concluded the slag to be "non-leachable." Maximum ^{232}Th leachate activities for the six tests ranged from 0.03 to 0.14 pCi/L (1.1 to 5.2 Bq/m^3), and total ^{232}Th leachate activities ranged from 0.05 to 0.41 pCi/L (1.8 to 15 Bq/m^3).

A leach test on a sample of slag collected from the slag pile using the ANSI/ANS-16.1 protocol also was conducted by Pickett et al. (1998). This testing was sponsored by NRC to aid the development of decommissioning guidance. The test specimen consisted of a slag block shaped into a parallelepiped. The maximum thorium leachate concentration for this test was 0.0012 mg/L (0.13 pCi/L or 4.8 Bq/m^3). The total thorium leachate concentration was 62 mg/L (0.67 pCi/L or 25 Bq/m^3). Uranium was not detected in any of the leachates. Total radium activities were measured in only the first three intervals at 2, 7, and 24 hours and were 94, 69, and 45 pCi/L (3600, 2600, and 1700 Bq/m^3), respectively. The radium activities were considered minimum value because the method for analyzing solutions involved counting only alpha decays.

The ANSI/ANS test leads to calculation of a leachability index (L) based on the assumption that release of a radionuclide from the waste form is controlled by diffusion from a homogeneous solid. However, data from the test conducted by Pickett et al. (1998) indicate that leaching from the slag is not in general controlled by diffusion but is related to specific chemical interactions (e.g., solubility) between the leachate and the various minerals composing the slag, likely influenced by pH variations during the test. Despite the failure of the diffusion model, the leachability indices are useful for comparing relative mobilities among elements. In the terminology of the ANSI/ANS standard, a more easily leached element has a lower value for L. Data suggest that radium (L = 11.3) in the slag tends to be relatively mobile, whereas thorium (L = 18.3) is relatively immobile (Pickett et al., 1998). This observation is supported by leach rate calculations. Leach rates were calculated as a fraction of the available element present in the solution (i.e., mass or activity in solution divided by that in the solid), divided by the time duration of the interval. Leach rates for radium ranged from about 1E-7/s to 7E-9/s, whereas leach rates for thorium ranged from about 4E-11/s to 2E-13/s.

Two Environmental Protection Agency (EPA) leach methods, the Toxicity Characterization Leach Procedure (TCLP) (U.S. Environmental Protection Agency, 1995a) and the Synthetic Precipitation Leaching Procedure (SPLP) (U.S. Environmental Protection Agency, 1995b),

which involve application of acidic leachants to sample powders for 18 hrs, also were conducted on the slags (Pickett et al., 1998). For the TCLP, the activity of thorium in the leachate was 49 pCi/L (1800 Bq/m^3); however, the uranium concentration in the leachate was below detection limits. Neither uranium nor thorium was detected in the SPLP leachate. Total radium in the TCLP and SPLP leachates was quite high with activities of 815 pCi/L (30.2 kBq/m^3) and 497 pCi/L (18.4 kBq/m^3), respectively. Leach rates were calculated for the EPA tests by dividing the amount of an element in solution by the amount in the solid and dividing the result by total leach time. The leach rate for thorium in the TCLP was about 1E-8/s. Leach rates for radium were about 3E-7/s in the TCLP and about 2E-7/s in the SPLP.

Observed thorium leachate concentrations in the leach tests are consistent with available solubility data on the Molycorp, Inc. slags (Felmy et al., 1998). A 2E-6 M thorium concentration in the TCLP test is reasonable for pH less than 6, and a maximum 5E-9 M thorium concentration in the ANSI/ANS test is reasonable for higher pH solutions. The leach tests show that radium is more rapidly leached than thorium and uranium. Significant radium activities measured in many leachates suggest that radium may be the key radioelement of concern at the Molycorp, Inc. site. Elevated ^{228}Ra in groundwaters at the site (Foster Wheeler Environmental Corporation, 1995b) support this interpretation of the available data.

Following review of the available information, the NRC staff conclude the leaching studies conducted by Molycorp, Inc. provide an insufficient basis to determine that no radioactive materials are leaching from the slag. While evidence suggests thorium has a low migration potential, other daughters of uranium and thorium are present and were not tested by Molycorp, Inc. However, Molycorp, Inc. groundwater radiological characterization studies conducted to date have analyzed for those radioisotopes that are expected to have the greatest potential for migration based on a review of NRC-sponsored research on the slag material. Furthermore, NRC will ensure that measurement of radium is continued in future groundwater monitoring work. Thus, NRC staff conclude that Molycorp, Inc. emphasis on key radionuclides of concern for potential migration from the site was not affected by its conclusions from leach studies, and therefore, the ability to detect migrating contaminants and ensure safety was maintained and will be maintained in future monitoring activities.

3.3.1 Surface Water and Sediments

Radiological analyses of surface water and sediment samples from the site were reported by Foster Wheeler Environmental Corporation (1995) and by ICF Kaiser (1997). To aid the reader, a summary of various survey results for surface water and sediments is provided in the Appendix. Key aspects of these studies are described in the following paragraphs.

In 1994, initial samples of surface water and sediments were collected during site characterization. Surface water and sediments were sampled for uranium, radium, and thorium at upstream and downstream sections of Chartiers Creek. Stream flow measurements were taken at the time of sampling. Only ^{228}Ra was detected in surface water samples, with concentrations ranging between 5 to 6 pCi/L (190 to 220 Bq/m^3) at the upstream section, while a concentration of 3 pCi/L (110 Bq/m^3) was detected in the downstream area. These results suggest a possible source of ^{228}Ra outside the facility grounds, or perhaps significant measurement error. While most reported levels are low, the highest radium concentrations are notable because they exceed the EPA 5 pCi/L (190 Bq/m^3) radium drinking water standard. Sampling of groundwater in monitoring wells adjacent to the creek showed similar ^{228}Ra levels.

Additional surface water samples were collected in 1997 following completion of site characterization (ICF Kaiser, 1997). Samples were collected for upstream and downstream locations on Sugar Run, Chartier Creek, and a ponded area in the northern end of the hill area. Samples were analyzed for thorium, radium, and uranium. Radiological analyses of the samples yielded a presence of ^{228}Ra at less than 1 pCi/L (37 Bq/m^3) in the upstream locations on both Chartiers Creek and Sugar Run, while the downstream locations were below detection limits (ICF Kaiser, 1997). The other radioactive isotopes (^{234}U, ^{238}U, and ^{226}Ra) were above the detection limit yet less than 0.5 pCi/L (18 Bq/m^3) at either location. The pond samples showed a slightly higher value of ^{228}Ra at less than 1.5 pCi/L (56 Bq/m^3), ^{238}U at 2.38 ± 0.37 pCi/L (88.1 ± 13.7 Bq/m^3), and ^{234}U at 2.70 ± 0.41 pCi/L (100 ± 15.2 Bq/m^3). These results indicate a reduction in contaminant levels since 1994 to levels that do not adversely impact public health or the environment.

In 1994, stream sediments and stream bank materials were sampled for ^{232}Th at seven locations along Chartiers Creek. Four samples were obtained at each location including both sides of the stream bank, and two samples were obtained from the first 6 inches of sediments across the stream section. Concentrations of ^{232}Th from the stream samples ranged from 0.23 to 0.89 pCi/L (8.5 to 33 Bq/m^3), suggesting no significant site-related impacts (ICF Kaiser, 1997).

Additional sediment samples were collected in Sugar Run, Chartiers Creek, and from the ponded area located at the northern portion of the hill area. Sediment samples were collected from the middle of the channel and were analyzed for thorium, radium, and uranium. The results showed radionuclide concentrations less than 1 pCi/L (37 Bq/m^3) for both upstream and downstream locations on both Sugar Run and Chartiers Creek. The pond samples showed similar results (about 1 pCi/L or 37 Bq/m^3 for uranium, thorium, and radium) (ICF Kaiser, 1997).

While NRC staff expect the Molycorp, Inc. planned soil remediation will reduce the primary source of contamination for surface water and sediments and thereby decrease future concentrations, more information is needed before a final conclusion can be drawn that a downward trend in contaminant concentrations can be expected. This is primarily due to the levels of contaminants reported in the first set of surface water measurements. Additionally, the small number of sampling times for both surface water and sediments is insufficient to establish trends. Sedimentation is also a concern during excavation due to the proximity of the excavated areas to the creek. To address these concerns, Molycorp, Inc. agreed to supplement its surface water/sediments monitoring program with additional radiological characterization efforts to establish current concentrations of the radionuclides of concern. The characterization activities will provide additional data by which trends can be assessed for prior sampling locations and will aid the determination of whether surface water has been adversely impacted. Analysis of the new characterization results will help NRC staff determine if additional actions (e.g., remediation) are needed to mitigate impacts. As a result of this addition to planned decommissioning activities, NRC staff conclude the plan is acceptable for ensuring potential impacts to surface water will be adequately characterized and addressed prior to license termination.

3.3.2 Groundwater

Radiological analyses of groundwater samples from the site were reported by Foster Wheeler Environmental Corporation (1995) and by ICF Kaiser (1997). A summary of various survey results is provided in the Appendix. Key aspects of these studies are described in the following

paragraphs.

Groundwater sampling was conducted twice [between June 28 and July 12, 1994 (Round 1) and between July 26 and August 3, 1994 (Round 2)] at more than 30 monitoring wells during site characterization. The samples were subjected to radiological analyses for thorium, radium, and uranium. Only one well (BR1) penetrated the bedrock for sampling. The other wells sampled groundwater from the overburden, including the fill material, clay, and mixed alluvium. Analyses of groundwater on site show radiation levels are generally at background levels in samples obtained from the overburdens, however, the maximum concentrations of ^{228}Ra reported for a few wells exceed the EPA drinking water limit of 5 pCi/L (190 Bq/m^3)(e.g., 5.32 ± 2.20 pCi/L or 197 ± 81.4 Bq/m^3 in MW21 and 5.16 ± 3.55 pCi/L or 191 ± 131 Bq/m^3 in MW26). These data suggest additional sampling is needed to improve concentration estimates and establish the trend in groundwater concentrations.

Radioactivity is close to detection limits in the one sample from the bedrock unit. The availability of only one groundwater sample in the bedrock unit (BR1) is insufficient to characterize the radiological status of the unit. The spatial variability of the fill, clay, and mixed sediments makes it difficult to limit the possibility that contamination could be at higher levels at different locations than the one sampled. The bedrock well is reported to have elevated levels of molybdenum (Foster Wheeler Environmental Corporation, 1995b), which indicates hydrologic communication between the water in the bedrock unit and surface soils of the facility. The soils contain molybdenum from past Molycorp, Inc. operations unrelated to licensed operations. Site characterization hydrologic data reported by Foster Wheeler Environmental Corporation (1995) support a conclusion that there is hydrologic communication between the overburden and bedrock units (see Section 2.4.4).

From review of the available data, NRC staff note the characterization of groundwater at the Washington site by Molycorp, Inc. shows radiological contamination for a few samples exceeds current EPA drinking water standards (proposed standards were considered as a guideline for uranium, which currently has no limit). Drinking water standards were considered appropriate because site characterization information did not rule out potential future use of groundwater as a drinking source; however, future drinking water use is expected to be unlikely because nearby residents obtain water from municipal sources. NRC staff also expect the Molycorp, Inc. planned soil remediation will reduce the primary source of contamination for groundwater and thereby decrease future concentrations. Nonetheless, the levels of radium in some samples suggest the need for additional monitoring to establish a trend. The extent of excavation activities and shallow depth of the water table also present concerns for potential mobilization of contaminants. To address these concerns, Molycorp, Inc. agreed to submit a supplemental groundwater characterization and monitoring plan to NRC for review and approval prior to commencement of decommissioning activities. This plan will focus on: (i) greater coverage of radiological conditions in the bedrock unit to the west of the site boundary (the direction of groundwater flow) to assess whether offsite migration has occurred, (ii) more recent estimates of radionuclide concentrations before and after excavation, and (iii) improved temporal data to assess trends in key radiological contaminant levels. The plan will also include proposed measures to control contaminant migration and identification of water management activities for excavation of soils in the saturated zone. Analysis of the new characterization results prior to license termination will help NRC staff determine if additional actions (e.g., remediation) are needed to mitigate impacts. Considering this proposed addition to planned decommissioning activities, NRC staff conclude the plan is acceptable for addressing potential adverse impacts to groundwater prior to and following the start of decommissioning activities.

3.4 Air

Air sampling conducted during site characterization (Foster Wheeler Environmental Corporation, 1995b) indicates ambient concentrations of thorium in air are low. This is expected because no significant dust generating activities were or are being conducted at the site prior to the planned excavation of soils. Twenty two air samples were collected by air pump filters at four locations on site during a period of 6 months. Filters analyzed for ^{232}Th by alpha spectroscopy indicated concentrations ranged from 3.1E-5 to 3.2E-3 pCi/m^3 (1.1 to 120 μBq/m^3). Concentrations are below the effluent levels allowed by the NRC under 10 CFR Part 20, Appendix B (i.e., 4E-3 pCi/m^3 or 150 μBq/m^3). No air samples were taken for uranium; however, given the reported uranium to thorium ratio in Dawes (2000a) of 0.018 to 1.60, the amount of airborne uranium would meet the relevant effluent limit as well.

Following review of the available information, NRC staff find the characterization results are acceptable for concluding that past radiological concentrations in the air at the Molycorp, Inc. Washington site have been well below NRC effluent limits.

4.0 EVALUATION OF PROPOSED METHODS FOR DECONTAMINATION AND DISMANTLEMENT OF STRUCTURES, BUILDINGS, AND EQUIPMENT

Any structures with surface contamination in excess of the surface contamination criteria for unrestricted release (Table 8.1) will undergo decontamination by wiping, vacuuming, or scabbling. A final survey will then be conducted to ensure the structure meets the unrestricted release criteria. Building materials and resulting decontamination wastes exceeding surface contamination criteria for unrestricted release will be transported to an NRC-approved location.

Buildings 28, 32, 33, 34, 35, 36, 38, 39, and 42 have been identified by Molycorp, Inc. as standing on contaminated soils (Dawes, 2000a). For these structures, Molycorp, Inc. has tentatively planned to demolish the building and remove the foundations so soil can be remediated in the same manner as planned for open soil areas. Any buildings not demolished will undergo foundation removal to facilitate soil remediation using the same methods planned for remediating soils in open areas.

To confirm the radiological status of fixtures and equipment on the site, Molycorp, Inc. will conduct a comprehensive inventory to identify each piece or type of equipment, document its use and operational history, and categorize it according to contamination potential (Section 3.1). Molycorp, Inc. has not identified any tanks as affected. Exteriors of subgrade pipes and ventilation ducts in affected areas will be surveyed by beta-gamma scans to determine if contamination is present. The drains of pipes also will be surveyed for contamination. Any survey locations exceeding two times background levels will undergo direct alpha measurements and smear samples for removable contamination at available access points. If contamination is detected in pipes, a radiological pipe crawler will be used to measure the contamination levels on the internal surfaces of the pipes, and results will be used to determine appropriate remediation actions. Other equipment such as ducts, electrical boxes, and conduits or other interior surfaces in affected areas will be measured directly as well as by taking smear samples. Any equipment located in an affected building or used for processing licensed material will be surveyed to show compliance with unrestricted release requirements prior to release. Fixtures and equipment that do not meet unrestricted release limits and that cannot be decontaminated, will be treated as radioactive waste and sent to an NRC-approved facility.

Following review of the proposed methods for decontamination of structures, buildings, and equipment, NRC staff conclude the proposed approach is acceptable for minimizing potential environmental impacts of decommissioning activities.

5.0 EVALUATION OF PROPOSED METHODS FOR DECONTAMINATION OF OUTDOOR AREAS OF THE SITE

The decommissioning plan outlines the proposed methods for decontaminating outdoor areas of the site. Molycorp, Inc. plans to excavate all soils and slag material with average concentrations of total thorium greater than or equal to 10 pCi/g (0.37 Bq/g) and to transport this material to an NRC-approved location. The major construction tasks are summarized in Section 1.3.

Final surveys will ensure compliance with the NRC criteria for unrestricted release (57 Federal Register 13389) relevant to uranium and thorium with daughters in equilibrium, including adoption of the sum-of-ratios rule when more than one radionuclide is present.

The excavated soil and other contaminated material in excess of NRC unrestricted release limits will be transported from the site to an NRC-approved facility. The unrestricted release criteria for soils are provided in Table 8.2. Given the existence of both thorium and uranium at the site, compliance with the sum-of-ratios rule requires determination of the specific release limits from the measured average concentrations of thorium and uranium and the criteria in Table 8.2. The proposed approach for determining the site-specific release criteria is discussed in Section 8.1.

The areas to be excavated are shown in Figure 2-2a of the decommissioning plan (Radiological Services, Inc., 1999). Affected areas were determined from site characterization gamma logging surveys discussed in Section 3.2. NRC considers gamma logging appropriate for determining the spatial extent of contamination; therefore, the site characterization work represents an acceptable application of this survey method. The decommissioning plan indicates areas to be excavated vary in depth; however, excavation depth ranges from just below the surface to 5.8 m (19 ft) below. Because the site characterization report indicates the average water level depth is 1.22 m (4 ft) from the surface (Foster Wheeler Environmental Corporation, 1995b), the potential exists for excavation of contaminated soils below the water table. To ensure Molycorp, Inc. has adequate plans in place to control releases and mitigate potential impacts associated with excavating below the water table, Molycorp, Inc. agreed to submit additional detailed information in a supplemental groundwater monitoring plan for NRC review and approval prior to the start of excavation (see Section 3.3.2).

Following review of decommissioning plans for outdoor areas of the site, NRC staff conclude the proposed methods in the decommissioning plan are adequate to ensure no adverse environmental impacts will result from planned activities.

6.0 DECOMMISSIONING ALTERNATIVES AND IMPACTS

6.1 No Action

The "no-action" alternative (i.e., to allow Molycorp, Inc. to leave the buildings and grounds in current radiological condition) would constitute a violation of NRC regulations at 10 CFR 40.42(d), which require that licensees begin decommissioning facilities at the cessation

of licensed operations. Further, the no-action alternative would result in (1) perpetual care of the site in its current condition to prevent public access and exposure to the radiological contamination, thereby foreclosing productive uses of the site; and (2) possible off-site exposure resulting from migration of the radiological contamination.

Allowing the licensee to leave the facility in its current radiological condition would require that the Commission grant a request to extend the time period for decommissioning pursuant to 10 CFR 40.42(f), if the Commission determines the extension is not detrimental to public health and safety and is otherwise in the public interest. For NRC to consider a licensee request for an extension, the licensee must submit the request to the Commission no later than 30 days before notification is required (i.e., not later than 30 days after the facility reverts from "active" to "decommissioning" status).

A request for an extension or alternative schedule for decommissioning may be approved, if warranted, after considering the following:

- Technical feasibility to complete decommissioning within the 24-month period
- Sufficiency of available waste disposal capacity to allow completion of the decommissioning within the 24-month period
- Potential for significant volume reduction in waste requiring disposal by allowing short-lived radionuclides to decay
- Potential for significant reduction in radiation exposure to workers by allowing short-lived radionuclides to decay
- Other site-specific factors such as the regulatory requirements of other agencies, lawsuits, groundwater treatment activities, monitored natural groundwater restoration, action that could result in more environmental harm then deferred cleanup, and other factors beyond control of the licensee

The NRC staff reviewed the decommissioning plan for the facility and determined that neither the notification deadline nor the extension criteria are applicable to the decommissioning of the Molycorp, Inc. Washington facility.

In addition, approval of the request also must be in the public interest. NRC determined that it is normally in the public interest to have radiologically contaminated areas remediated shortly following permanent cessation of operations. NRC stated, "When decommissioning is delayed for long periods following cessation of operations, there is a risk that safety practices may become lax as key personnel relocate and management interest wanes. In addition, bankruptcy, corporate takeover, or other unforeseen changes in company financial status may complicate and perhaps further delay decommissioning." (59 Federal Register 36027). "In addition, waste disposal costs have, in the past, increased at rates significantly exceeding the rate of inflation and as such, delaying remediation will result in higher costs to the public if government eventually assumes responsibility for the decommissioning. Therefore, in evaluating a licensee request for an extension, NRC staff should consider whether the licensee has adequately addressed how postponing decommissioning would serve the public interest" (Orlando et al., 1997).

The NRC staff conclude that postponing decommissioning of the Molycorp, Inc. Washington facility (i.e., the no action alternative) is not in the public interest.

6.2 Proposed Action

The proposed action is the remediation of radioactive material at the facility to levels that will permit unrestricted use of the site. Under the proposed action, radioactive wastes resulting from remediation activities will be disposed of at an NRC approved location. The environmental impacts of the proposed action are discussed in Sections 4, 5, and 8. Cleanup of the Washington site is expected to mitigate potential future environmental impacts attributable to existing radiological contamination resulting from past operations at the site. Decommissioning the facility for unrestricted release also frees the land for future productive use.

6.3 Alternatives Considered and Impacts

6.3.1 On-Site Disposal at the Washington, Pennsylvania, Site

An alternative to the proposed action is to dispose the contaminated soils at the Washington site. This alternative is not being considered in this EA because the potential environmental impacts are to be considered as part of another licensing action subject to a different set of NRC decommissioning requirements (Part 2).

6.3.2 On-Site Storage of Excavated Soil at the Washington, Pennsylvania, Site

This alternative involves storage of excavated soils at the Washington facility for an indefinite period. On-site storage would delay the costs associated with disposal at an NRC-approved facility. This alternative is unfavorable because it removes the Washington property from productive use, thereby detracting from the economic potential of the local area. This option also delays the ultimate resolution of the waste problem, which is undesirable.

7.0 RADIATION PROTECTION PROGRAMS

7.1 Health and Safety Program

The selected decommissioning contractor will follow the radiation protection procedures as described in the Radiation Protection Program (Daniels, 1999). The draft Radiation Protection Program was reviewed by NRC staff and found to be in accord with the radiation protection standards in 10 CFR Part 20. The proposed action is limited in scope and is not expected to include unique health and safety issues outside the scope of the Radiation Protection Program. However, Molycorp, Inc. will submit for NRC review and approval the final radiation protection plans prior to starting any decommissioning activities. Therefore, NRC staff have confidence the adequacy of the Radiation Protection Program will be confirmed prior to start of decommissioning activities.

7.1.1 Security

Security at the Molycorp, Inc. Washington facility is maintained by a fence around the perimeter of the site with controlled entry at the front gate. NRC staff conclude this is an adequate level of security to ensure radiological safety during decommissioning activities at the site.

7.1.2 Effluent Control Techniques

Effluent control techniques will be used to minimize the potential for off-site migration of radionuclides. In supplemental information provided by Molycorp, Inc. Dawes (2000a,b) states that controls will be maintained to ensure that concentrations of source material in air and water at site boundaries will be maintained well below the 10 CFR Part 20, Appendix B, Table 2, effluent limits. Controls include but are not limited to, erosion control measures (e.g., silt fencing, berms), liners for stockpiles of soils that exceed unrestricted release limits, fugitive dust emission control by water spray or other dust suppressants, covers for stockpiles expected to remain in place for more than two weeks, temporary air monitoring stations in stockpile areas, and routine air and surface water samples in the vicinity of stockpiles. Any water pumped from controlled areas will be stored and batch sampled before discharge to ensure compliance with the effluent limits.

Following review of the proposed effluent control techniques, NRC staff conclude the methods proposed by Molycorp, Inc. are adequate for ensuring radiological safety from decommissioning activities at the site.

7.1.3 External Radiation Monitoring Program

External radiation monitoring will be conducted through the use of personal dosimeters for workers and visitors in radiation areas. The need for and type of dosimeter will be determined by the Radiation Safety Officer (RSO) when issuing a radiation work permit. The primary dosimeter in use will be the thermoluminescent dosimeter (TLD); however, other types such as self-reading pocket dosimeters or extremity TLDs will be employed, as conditions warrant. TLDs will be processed monthly and records for all recipients of dosimeters will be maintained by the RSO. The RSO will investigate if a worker's exposure reaches the procedural action level of 250 mrem (2.5 mSv) in a calendar year.

Following review of the Molycorp, Inc. program for external radiation control, NRC staff conclude the program is adequate for ensuring radiological safety of workers and the public.

7.1.4 Airborne Radiation Monitoring Program

Airborne particulate monitoring will be performed to demonstrate compliance with 10 CFR Part 20 intake limits, meet posting requirements for airborne radioactivity areas, determine whether precautionary measures need to be taken (e.g., engineering controls, time limits, or respirators), and determine whether exposures are being maintained As Low As Reasonably Achievable (ALARA). Personal lapel samplers will be worn by at least one member of the excavation crew and each heavy equipment operator to ensure compliance with 10 CFR Part 20 limits during soil excavation activities. The use of lapel samplers will be evaluated during excavation activities by comparison to general air samplers, and adjustments to the program will be made, as needed. Portable air sampling will be employed during excavation in the work area and at work area boundaries. This will provide three layers of sampling to ensure worker protection. Also, routine air samples will be taken at site boundaries and areas of high traffic for staff. Portable air sampling equipment will be available for use during abnormal conditions. Particulate surveys also will be conducted in accordance with ALARA procedures.

Following review of the Molycorp, Inc. program for airborne monitoring, NRC staff conclude the proposed program is adequate to ensure worker safety during decommissioning activities at the site.

7.1.5 Bioassay Program

A urine bioassay program will be used for all workers required to wear dosimeters. An initial baseline sample will be collected prior to start of work as well as an exit sample at the end of work. Additional samples will be taken if the administrative action level of 10 DAC-hours is exceeded or as deemed necessary by radiological controls management. Urine bioassay samples will be analyzed by Molycorp, Inc. and an approved laboratory. The radiological engineer will be responsible for interpretation of bioassay data and performance of dose calculations.

Following review of the Molycorp, Inc. bioassay program, NRC staff conclude the proposed program is adequate for ensuring worker safety during site decommissioning activities.

7.1.6 Contamination Control Program

Access controls for controlled areas will be used to limit exposures to workers and visitors and to avoid the spread of contamination. Frequent surveys of clean areas for surface contamination will limit the spread of contamination. Areas exceeding guideline levels will be cleaned promptly. Concentrations of airborne radioactivity will comply with standards in 10 CFR Part 20, Appendix B, Table 1 or 2, as appropriate. Concentrations in liquids to be released from the site will comply with the standards in 10 CFR Part 20, Appendix B, Table 2 or 3, as appropriate. Further measures to ensure contamination control include the following:

- Posting areas with removable contamination in excess of guidelines
- Requiring staff who enter controlled areas to wear anti-contamination clothing specified by the applicable radiation work permit
- Ensuring that staff remove contaminated clothing properly and place used anti-contamination clothing in designated receptacles
- Monitoring staff, materials, and equipment using alpha probes for the presence of radioactive contamination upon exit or removal from the controlled area and decontaminating staff or equipment. Contaminated items that cannot be decontaminated will be controlled as radioactive material, as appropriate.
- Performing contamination surveys frequently inside controlled areas, along the perimeter of controlled areas, and at the exits of controlled areas
- Wetting soils during excavation activities to prevent the spread of fugitive dust
- Continuous air monitoring during radioactive soil handling

Following review of the Molycorp, Inc. contamination control program, NRC staff conclude the program is adequate to ensure worker and public radiological safety.

7.1.7 Environmental Monitoring Programs

Supplemental information provided by Molycorp, Inc. (Dawes, 2000a,b) states that a monitoring program for air, surface water, sediments, and groundwater will be implemented to ensure controls are effectively maintaining concentrations of source material in air and water at site boundaries well below the 10 CFR Part 20, Appendix B, Table 2, effluent limits. At least five sediment samples and two stream samples will be collected monthly during excavation, including at the storm drain outlet. Temporary air monitoring stations will be placed in stockpile areas, and routine air samples will be collected in the vicinity of stockpiles. Molycorp, Inc. also agreed to submit a supplemental groundwater characterization monitoring plan prior to the start of excavation activities. This plan will include consideration of additional monitoring of groundwater before and after excavation to provide data to assess any impacts to groundwater from excavation activities. Any groundwater pumped from contaminated soils will be stored and sampled for demonstrating compliance with effluent limits prior to release.

Following review of the environmental monitoring program, NRC staff conclude the proposed program is acceptable for ensuring no adverse environmental impacts. The details of the groundwater monitoring program will be evaluated by NRC staff prior to the start of decommissioning activities to provide further confidence the program is sufficient to detect potential releases from excavation activities.

7.1.8 Quality Assurance

During the course of the Washington site decommissioning project, one or more audits of project activities and records will be performed by qualified staff from the contractor quality assurance department. Records and activities will be reviewed and compared to the requirements of the contractor procedures. Results of audit findings will be addressed by contractor corporate management and the contractor project manager and reviewed by Molycorp, Inc.

Calibration of portable radiological instruments will be performed semiannually, or more frequently, if specified by the instrument operating manual and after repairs or maintenance that could have invalidated the current calibration. The certified health physicist, radiological engineer, or RSO will determine whether or not a given instrument requires calibration more frequently than semiannually. Radiological field survey equipment and laboratory analysis equipment will be calibrated by qualified staff using standards traceable to the National Institute of Standards and Technology. Calibration labels will be used to identify calibration dates, and records will be maintained on file with the manufacturers' operating manuals. Portable survey instruments, self-reading pocket dosimeters, counter-scalers, and air sampling equipment will have a current calibration prior to use.

Following review of the Molycorp, Inc. quality assurance program, NRC staff conclude the proposed program is adequate to ensure radiological safety will be maintained during site decommissioning activities.

7.2 Radioactive Waste Management Program

Molycorp, Inc. plans to conduct all handling, shipment, and storage of radioactive wastes in accordance with NRC regulations in 10 CFR 20.2006 "Transfer for Disposal and Manifests," U.S. Department of Transportation Regulations in 49 CFR Parts 100–177 "Transportation of

Hazardous Materials," and applicable sections of 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Wastes." Excavated contaminated soils will be stockpiled in staging areas prior to loading and shipping to an NRC-approved location. All stockpiled contaminated soils will be placed in polyethylene liners and periodically wetted or covered to prevent spreading of contamination. Any equipment that cannot be decontaminated to meet NRC guidelines for unrestricted release (Table 8.1) will be sent as radioactive waste to an NRC-approved facility (Dawes, 2000b).

Following review of Molycorp, Inc. radioactive waste management program plans, NRC staff conclude the plan is acceptable for controlling potential waste streams to limit adverse environmental impacts.

8.0 ENVIRONMENTAL IMPACTS

8.1 Radiological Release Criteria

The principal radiological constituents identified during site characterization are ^{232}Th, ^{238}U, and their daughter products. Molycorp, Inc. will remediate any surface contamination (on equipment and structures) within the NRC limits specified for unrestricted release (Nuclear Regulatory Commission, 1983). The criteria in Table 8.1 have been previously approved for unrestricted release of structures and equipment, therefore, further analysis of the limits is not necessary. When surface contamination results from a mixture of radionuclides, and gross alpha measurements are used, Molycorp, Inc. will use the most restrictive limit from Table 8.1. Survey methods will be conducted in accordance with NUREG/CR–5849 (Berger, 1992).

Soil release criteria are provided in Table 8.2. The criteria have been previously approved for unrestricted release of uranium and thorium contaminated sites, therefore, further analysis of the limits is not necessary. Following completion of remediation activities, a final survey of the site will be conducted to demonstrate compliance with the unrestricted release limits in Table 8.2. Because the Washington site contains a mixture of thorium and uranium, these limits will be applied using the sum-of-ratios rule. Formulation of the specific approach for final survey and compliance with the sum-of-ratios rule is dependent on the results of ongoing analyses to determine the relative concentrations of uranium and thorium in soils and the equilibrium status of daughter products. Molycorp, Inc. has agreed to submit to NRC for review and approval a supplemental characterization plan prior to excavation of contaminated soils. The supplemental characterization plan will describe the details of survey methods, instrumentation, and analysis methods in addition to site-specific data to support conclusions regarding the equilibrium status of daughter products and the approach to compliance with the sum-of-ratios rule.

Following review, NRC staff conclude that sufficient information about the radiological status of the site exists to allow the NRC to determine with confidence that a supplemental characterization plan can be submitted prior to excavation that ensures Molycorp, Inc. will comply with the unrestricted release criteria in a manner that minimizes the potential for adverse environmental impacts.

8.2 Radiological Impacts to Workers and the Public from Planned Decommissioning Activities

8.2.1 Radiological Impacts to Workers from Planned Decommissioning Activities

Molycorp, Inc. provided bounding dose estimates for workers in Dawes (2000a). Dose rates from direct radiation (gamma) from the thorium-bearing soil and slag mixture were calculated. The dose estimates involve conservative assumptions, and actual doses from decommissioning

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Table 8.1 Acceptable surface contamination levels

Nuclides[a]	Average[b,c,f]	Maximum[b,d,f]	Removable[b,e,f]
U-nat, U-235, U-238, and associated decay products	5,000α dpm/100 cm^2 (83.33 Bq/100 cm^2)	15,000α dpm/100 cm^2 (250.0 Bq/100 cm^2)	1,000α dpm/100 cm^2 (16.67 Bq/100 cm^2)
Transuranics, Ra-226, Ra-228, Th-230, Th-118, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2 (1.667 Bq/100 cm^2)	300 dpm/100 cm^2 (5.00 Bq/100 cm^2)	20 dpm/100 cm^2 (0.333 Bq/100 cm^2)
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm^2 (16.67 Bq/100 cm^2)	3,000 dpm/100 cm^2 (50.0 Bq/100 cm^2)	200 dpm/100 cm^2 (3.333 Bq/100 cm^2)
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90, and others noted above	5,000 dpm/100 cm^2 (83.33 Bq/100 cm^2)	15,000 dpm/100 cm^2 (250.0 Bq/100 cm^2)	1,000 dpm/100 cm^2 (16.67 Bq/100 cm^2)

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate factor for background, efficiency, and geometric factors associated with the instrumentation.
[c]Measurements of average contamination should not be averaged over more than 1 m^2. For objects of less surface area, the average should be derived for each such object.
[d]The maximum contamination level applies to an area of not more than 100 cm^2.
[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally, and the entire surface should be wiped.
[f]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 mg/cm^2 of total absorber.
Source: Nuclear Regulatory Commission (1983)

activities are expected to be lower due to specific controls not included in the dose calculation assumptions. Two exposure scenarios were considered: worker dose from excavation of the contaminated material in the slag pile and worker doses from general work activities. The Microshield Version 5.05 code was used for the calculations. Assumptions for the slag pile

Table 8.2 Soil release criteria[a]

Radionuclide	Maximum Soil Concentration	Reference
Natural Thorium (Th-232 plus Th-228) if all daughters are present and in equilibrium	10 pCi/g (0.37 Bq/g)	(57 Federal Register 13389)
Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium	10 pCi/g (0.37 Bq/g)	(57 Federal Register 13389)

[a]If only one radionuclide is present, the maximum concentration is the value listed in this table. If more than one radionuclide is present, however, the ratio between the measured concentration and the corresponding limit listed in this table is determined. The sum of such ratios for all radionuclides present must not exceed one.

calculations include: the pile is a plane with dimensions approximating the longest dimension of the pile, the pile is 1m thick, the thorium concentration is based on site measurements from the slag pile, and the uranium concentration is conservatively assumed to be half the thorium concentration. The dose rate, calculated for a distance of 1.52 m (5 ft) from the surface of the slag pile, is 1.5 mrem/hr (15 μSv/hr). An operator of a tractor assumed to excavate and load 764.6 m^3 (1000 yd^3) per day will take 10 days to remove the total volume of the slag pile. The estimated dose for a single operator conducting all the excavation work is 120 mrem (1.2 mSv).

Dose calculations for general work activities consider direct external exposure to contaminated soils. The dose rates used for the calculation are the site average near areas of soil contamination (0.29 mR/hr or 75 nC/kg per hr), and the general area dose rate estimate in the vicinity of excavated material (0.49 mR/hr or 130 nC/kg per hr). For the excavated material dose rate, it was assumed the soil was a finite slab with a 10 x 1-m base and 3.0 m (10 ft) in height with concentrations equivalent to those measured for the slag pile (the most concentrated material on site). The dose rate for general areas was based on an infinite slab 1m thick consisting of a uniform concentration of thorium and uranium estimated as site averages. Taking an average of the two dose rates (for excavated material and site average) and assuming a 12-week work duration with an average crew of 10, the total crew dose is estimated at 1.65 person-rem (16.5 person-mSv).

Because inhalation of resuspended soils may occur during excavation activities, Molycorp, Inc. also estimated inhalation doses to workers. Control measures are expected to limit dust generation; however, calculations assume no controls to provide a bounding estimate. The scenario involves excavation of the slag pile. An equipment operator is assumed to work 80 hours for 10 work days to excavate the slag pile. No personal protection measures are assumed. Respirable dust emission factors were derived from EPA sources (U.S. Environmental Protection Agency, 1995c) and site-specific assumptions. The estimated dust emission rate was 1.39 lb/day. Dust is assumed to be uniformly mixed into a volume of air (30 m^3). The resulting dose to the excavator from inhalation is 470 mrem (4.7 mSv).

Following review, NRC staff conclude the dose estimates are based on conservative exposure assumptions that reflect potential work activities for decommissioning. The magnitude of calculated doses is well within the 10 CFR Part 20 worker dose limit of 5000 mrem/yr (50 mSv/yr). NRC staff expect controls will maintain exposures ALARA. Therefore, NRC staff

conclude no adverse impacts to workers are expected from planned decommissioning activities.

8.2.2 Radiological Impacts to Members of the Public from Planned Decommissioning Activities

Molycorp, Inc. estimated public doses (Dawes, 2000b) conservatively by assuming a person outside the fence is exposed to the equivalent of the allowed airborne concentration limits (10 CFR Part 20, Appendix B) for the duration of excavation activities. Assuming 80,300 m^3 (105,000 yd^3) of total excavated material at a rate of 800 m^3/d (1000 yd^3/d), Molycorp, Inc. estimates the inhalation dose to be 4.8 mrem (48 µSv). Because Molycorp, Inc. will implement an airborne monitoring program to maintain the airborne effluent levels below the 10 CFR Part 20 limits, it is unlikely the airborne concentrations will be as high as the limit each day, and actual public doses are expected to be much less. For comparison, the public dose limit in 10 CFR Part 20 is 100 mrem/yr (1 mSv/yr).

Considering the planned decommissioning activities, NRC staff conclude Molycorp, Inc. provided conservative public dose estimates that are well below the dose limits in 10 CFR Part 20.

8.2.3 Radiological Impacts to Workers and Members of the Public from Transportation of Low-Level Waste

Transportation of contaminated soils to an NRC-approved facility could result in radiological exposures to workers and the public, although such exposures are expected to be low. The radiological impacts from transportation of Washington soil have been assessed by Molycorp, Inc. These calculations were based on assumptions consistent with plans specified in the Washington site decommissioning plan, as supplemented by Dawes (2000a,b). Doses to workers and the public from rail shipments were calculated by scaling doses calculated for similar shipments in NUREG–0130 (Smith et al., 1978). Scaling of the doses was done for the dose rate, number of shipments, and the distance traveled (site-specific parameters that differ from the NUREG–0130 calculations). Molycorp, Inc. assumed a total volume of soil of 80,300 m^3 (105,000 yd^3) was shipped by rail for a total of 1330 railcars from Washington to the Envirocare waste facility in Clive, Utah [a distance of approximately 2000 mi (3200 km)]. Because this calculation includes shipment of all affected soils (including slag pile) at the site to an offsite facility a great distance away, the calculation is considered to bound all potential rail shipment options. The dose rate for each railcar was estimated by calculating the average dose rate for contaminated site areas [1m from an infinite plane containing 72.8 pCi/g (2.69 Bq/g) thorium and 36.4 pCi/g (1.35 Bq/g) uranium 1m thick, from Dawes (2000a)]. The total occupational radiation dose estimate is 2.2 person-rem (22 person-mSv) for all shipments. Actual transportation worker exposures will be maintained below the limits in 10 CFR Part 20. The public dose estimate is 0.57 person-rem (5.7 person-mSv).

The NRC staff review of these calculations indicates the calculated doses are below levels of concern for adverse impacts. Therefore, NRC staff conclude Molycorp, Inc. has provided an adequate basis for determining the planned decommissioning activities are unlikely to result in adverse environmental impacts from transportation.

8.3 Radiological Accident Analysis

The supplemental information for the Washington facility decommissioning plan provides dose calculations for a worst case accident scenario (Dawes, 2000a) and a more probable accident scenario (Dawes, 2000b). The worst case accident scenario analyzed by Molycorp, Inc. involves a haul truck accident that ruptures the truck fuel tank and causes the 15-m^3 (20-yd^3) load to spill. Diesel fuel from the truck soaks into the spilled load (assumed highly concentrated material from the slag pile) and catches fire leading to an airborne release for the duration of the fire. Emissions from the fire are assumed to be released in a manner similar to a burning coal refuse pile and are dispersed into a 30-m^3 volume of air. The event is assumed to last 8 hours, and no respiratory protection is assumed for emergency response staff. In this scenario, the estimated dose to a firefighter at the accident scene for 8 hours is 243 mrem (2.43 mSv). For comparison, the EPA Protective Action Guideline used for protecting members of the public from impacts of accidents involving release of radioactive material is 1000 mrem (10 mSv) (U.S. Environmental Protection Agency, 1992). The more credible accident scenario involves a spill of contaminated soils from a truck or railcar near the site boundary. A respirable dust emission factor is obtained from an EPA compilation of emission factors (U.S. Environmental Protection Agency, 1995c), and material assumptions are the same as for the worst case accident. The spill scenario results in an estimated dose of 20 mrem (0.2 mSv).

Other potential accident scenarios considered by Molycorp, Inc. include natural disasters such as flooding, earthquakes, tornadoes, and fire. Flooding was considered to be unlikely because the excavation areas are not within the 100-year flood plain. Earthquakes and tornadoes were also considered unlikely given the short duration of decommissioning activities. The existence of a 200-gallon fuel tank on site was noted, but the potential for ignition of the tank was considered negligible.

NRC staff review of analyses of potential impacts of accidents concludes that a variety of potential scenarios were considered and analyses indicate the risk to workers and the public from adverse impacts due to accidents is low. Therefore, NRC staff conclude that Molycorp, Inc. adequately addressed the potential for radiological accidents.

8.4 Nonradiological Impacts

8.4.1 Nonradiological Releases

There are no planned direct uses of chemicals in the proposed action; only the excavation of soil, possible demolition of buildings, and removal of concrete floors that exceed the radiological criteria for unrestricted release. If any chemical hazards are identified, Molycorp, Inc. has agreed to control items requiring disposal, recycling, or management as hazardous substances in accordance with state and federal regulations.

The presence of metal contamination in soils and groundwater from molybdenum processing at the Molycorp, Inc. facility is noted in the site characterization report (Foster Wheeler Environmental Corporation, 1995b). At present, NRC staff are not aware of any pending regulatory actions regarding the metals contamination at the site that would impact (or be impacted by) the proposed decommissioning activities. Molycorp, Inc. indicated they will be testing any effluents created by decommissioning actions for metals as well as radiological constituents prior to release of the material to ensure compliance with applicable NRC, state, and federal regulations. NRC staff have informed the Pennsylvania Department of

Environmental Protection, which is responsible for regulating toxic metal contamination in soil and water, so it can consider whether measured amounts present a potential for environmental impacts and whether any further regulatory action is necessary to mitigate potential impacts.

8.4.2 Economic Impact

Intermittent industrial production capability exists at the Washington site. Remediation and dismantling activities associated with decommissioning would temporarily increase the work force at the site. Decommissioning actions will increase the local demand for goods and services. Unrestricted release of the site as a consequence of decommissioning could permit future commercial development of the property. Hence, beneficial economic impacts are anticipated during site decommissioning and following release of the site.

8.4.3 Transportation

The favored rail option for transportation of contaminated soils to the NRC approved facility will increase local rail traffic, but is expected to have no adverse nonradiological impacts.

8.4.4 Air Quality and Noise

Air quality and noise are expected to have minor transient impacts as a result of excavation/removal of soil and possible building demolition activities associated with the proposed action. Molycorp, Inc. plans to control dust generation by surface wetting. Noise impacts are likely to vary with time, but some activities will generate considerable levels of noise. The long-term benefits to the local community of decommissioning the Washington site are expected to exceed short-term inconveniences, and these inconveniences are expected to be comparable to those associated with normal construction/demolition activities.

8.4.5 Environmental Justice

NRC staff conducted an analysis (Sobel, 1999) of local census data in accordance with the NRC NMSS environmental justice procedure to determine whether the potential exists for environmental justice concerns regarding the proposed decommissioning actions at the Molycorp, Inc. Washington site. The analysis included consideration of local population demographics regarding racial composition and income. No potential for environmental justice was identified with regard to race because no minority exceeds 9 percent of the population in census block groups near the site (the NMSS criterion is that a minority must be at least 20 percent above the state or county level). A potential for environmental justice issues due to low-income populations was identified for one block group (7512-3), which is the block group surrounding the site (the NMSS criterion is at least 20 percent above state or county levels). However, because this EA has not identified any significant adverse environmental impacts associated with the proposed decommissioning actions, NRC staff conclude there are no environmental justice issues with the site. The remediation of radiological contamination on the site is expected to have beneficial impacts on the local community.

8.4.6 Endangered Species

Molycorp, Inc. consulted the Pennsylvania Bureau of Wildlife Management of the Pennsylvania Game Commission to obtain information regarding state and federal threatened or endangered species in the area. Consultation of a Fish and Wildlife database found 34 endangered,

threatened, or special concern species in Washington County (ICF Kaiser, 1997). Most of these species are birds. A letter to IT Corporation from the Pennsylvania Game Commission (dated October 2, 1996, and provided in ICF Kaiser, 1997, Appendix A) documents that there is no record of threatened or endangered species occurring on or near the Molycorp, Inc. Washington facility.

NRC staff reviewed the information on endangered species provided by Molycorp, Inc. and concludes that because no known species exist on the site and the proposed decommissioning activities will occur on previously cleared land, adverse impacts to endangered species are unlikely.

9.0 AGENCIES AND INDIVIDUALS CONSULTED

In accordance with NRC Memorandum of Understanding with the Pennsylvania Department of Environmental Protection (PADEP), NRC staff consulted with PADEP in the preparation of this EA. On July 14, 2000, PADEP provided comments on the EA (Allard, 2000). The EA has been revised to include the staff's resolution of those comments. In addition, the Pennsylvania Bureau of Wildlife Management of the Pennsylvania Game Commission was consulted and noted that no endangered species have been documented as occurring on or near the site. Similarly, the National Register of Historic Places was consulted and indicated that no historic properties are listed for the Molycorp, Inc. Washington site. Also, the Pennsylvania Historical and Museum Commission indicated there are no archeological sites of significance in the facility area.

10.0 RECOMMENDED LICENSE CONDITIONS

Based of the foregoing assessment, the following license conditions are recommended:

A. Prior to excavation of contamination, Molycorp inc., shall submit to NRC for review and approval a supplemental characterization and monitoring plan for groundwater, surface water, and sediments. The plan will provide the following information:

   1. Radiological characterization of the bedrock unit near the western boundary of the site prior to and after excavation, sufficient to provide evidence that contamination is not migrating off site in the bedrock unit;

   2. Updated groundwater, surface water, and sediment monitoring data from previously sampled locations prior to and after excavation, sufficient to establish radiological trends for thorium and uranium and their significant daughter products and to provide assurance that post excavation contamination levels are within acceptable limits; and

   3. The planned extent of excavation below the water table and control measures (e.g., engineering controls, waste water management plans, and contamination controls) that will be used to limit migration of both radiological and non-radiological contamination.

B. Prior to excavation of contamination, Molycorp, Inc., shall submit a detailed supplemental characterization plan for NRC review and approval. The supplemental characterization plan should include information from site surveys that establish the

equilibrium status of uranium-238, thorium-232, and their daughter products at the Washington site. In the event a total uranium thorium ratio approach is proposed for estimating total uranium concentrations for demonstrating compliance with the unrestricted release criteria, then the survey plan must include the following:

1. Site-specific information that supports the uranium to thorium ratio;

2. Survey results that demonstrate the U:Th ratios across the site are reasonably homogenous or the applicability of all U:Th ratios to specific survey locations across the site; and

3. Detailed information on survey protocols, instrumentation, and proposed analysis methodologies (e.g., statistics, inferences, and application of sum-of-ratios rule) for survey results that will be necessary to demonstrate compliance with unrestricted release criteria.

If Molycorp, Inc. cannot justify the application of a U:Th ratio approach, then appropriate laboratory techniques should be used to measure uranium concentration in soils directly.

C. Molycorp, Inc. shall ensure that any soils designated as affected that exist underneath buildings and structures or outside the facility fence will be subject to the same remediation and final survey methods used for affected open land areas;

D. Prior to conducting any approved decommissioning operations on the Washington site, Molycorp, Inc. shall submit to NRC for review and approval a final set of radiation protection procedures that address compliance with all applicable 10 CFR Part 20 requirements for protection of workers and the public from potential radiological hazards resulting from those decommissioning activities.

11.0 CONCLUSIONS:

Based on the NRC staff evaluation of the Molycorp, Inc. final decommissioning plan (Radiological Services Inc. 1999), it was determined that the proposed decommissioning can be accomplished in compliance with the NRC public and occupational dose limits, effluent release limits, and residual radioactive material limits. In addition, the approval of the proposed action (i.e., decommissioning of the Molycorp, Inc., Washington, Pennsylvania, facility in accordance with the commitments in NRC license SMB–1393 and the final decommissioning plan) will not result in significant adverse impact on the environment.

12.0 REFERENCES

American Nuclear Society, American National Standard Measurement of the Leachability of Solidified Low-Level Radioactive Wastes by a Short Term Test Procedure, ANSI/ANS–16.1, LaGrange Park, IL: American Nuclear Society, 1986.

Applied Health Physics, Inc. Results of Radiological Evaluation of Columbium Slag Waste Disposal Problem, Washington, PA: Applied Health Physics, Inc. 1971.

Applied Health Physics, Inc. Summary of Actions Taken During 1972–1974 to Comply with Requirements of the Nuclear Regulatory Commission, Bethel Park, PA: Applied Health Physics, Inc., 1975.

Bellamy, R.R., Letter to R. Dankmeyer, Molycorp, Inc., Washington, DC: Nuclear Regulatory Commission, dated October 8, 1998.

Berger, J.D., Manual for Conducting Radiological Surveys in Support of License Termination, NUREG/CR–5849, Washington, DC: Nuclear Regulatory Commission, 1992.

Berryhill, H.L., Jr., S.P. Schweinfurth, and B.H. Kent, Coal-bearing Upper Pennsylvanian and Lower Permian Rocks, Washington Area, Pennsylvania: Part 1, Lithofacies; Part 2, Economic and Engineering Geology, U.S. Geological Survey Professional Paper 621, Reston, VA: U.S. Geological Survey, 1971.

Daniels, J.C., Letter to L.S. Person, Nuclear Regulatory Commission, Washington, PA: Molycorp, Inc., January 28, 1997.

Daniels, J.C., Letter to R. Neal (SIC), Nuclear Regulatory Commission, Washington, PA: Molycorp, Inc., August 31, 1999.

Dawes, G.W., Letter to L. Camper, Nuclear Regulatory Commission, Washington, PA: Molycorp, Inc., April 3, 2000a.

Dawes, G.W., Letter to L. Person, Nuclear Regulatory Commission, Washington, PA: Molycorp, Inc., May 16, 2000b.

Dean, J.J., Letter to L. Camper, Nuclear Regulatory Commission, Washington, PA: Molycorp, Inc., December 14, 1999.

Federal Emergency Management Agency, Flood Insurance Rate Map, Washington, DC: Federal Emergency Management Agency, November 1986.

Felmy, A.R., R. Dhanpat, and V.L. LeGore, Solubility and Leaching Controls on Radionuclides in SDMP Wastes: Summary Report (draft), Richland, WA: Pacific Northwest National Laboratory, 1998.

Foster Wheeler Environmental Corporation, Decommissioning Plan for the Washington, PA Facility, Perryville, NJ: Foster Wheeler Environmental Corporation, July, 1995a.

Foster Wheeler Environmental Corporation, Site Characterization Report for License Termination of the Washington, Pennsylvania Facility, Volumes 1–3, Perryville, NJ: Foster Wheeler Environmental Corporation, January, 1995b.

ICF Kaiser, Washington Facility Environmental Report, Volumes 1 and 2, 67861–04–C, Pittsburgh, PA: ICF Kaiser, April 1997.

MacDonald, M.G., and A.W. Harbaugh, A Modular Three-Dimensional Finite-Difference Groundwater Flow Model, Techniques of Water-Resources Investigations, 06–A1, Reston, VA: U.S. Geological Survey, 1988.

Martin, K.L., Radiological Survey of Molybdenum Corporation of America, Washington, Pennsylvania, Oak Ridge, TN: Oak Ridge Associated Universities, 1985.

Nuclear Regulatory Commission, Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use for Termination of Byproduct, Source, and Special Nuclear Material Licenses, Policy and Guidance Directive FC 83-23, Washington, DC: Nuclear Regulatory Commission, 1983.

Orlando, D., et al., NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees, NUREG/BR–0241, Washington, DC: Nuclear Regulatory Commission, 1997.

Pennsylvania Department of Environmental Protection, Gene Wolbert, Personal Communication with Dan Rembert, ICR Kaiser Engineers, February 24, 1997.

Pickett, D.A., J.D. Prikryl, D.R. Turner, and J.L. Russell, Evaluation of Leach Tests for Estimating Release from Slag Sites Subject to Decommissioning, Final Report, San Antonio, TX: Center for Nuclear Waste Regulatory Analyses, 1998.

Radiological Services Incorporated, Molycorp Washington, Pennsylvania, Facility Decommissioning Plan, Part 2 Revision, New London, CT: Radiological Services, Inc., July 14, 2000.

Radiological Services Incorporated, Molycorp Washington, Pennsylvania, Facility Decommissioning Plan, Part 1 Revision, New London, CT: Radiological Services, Inc., June 30, 1999.

Seibert, D.R., J.B. Weaver, R.D. Bush, D.J. Belz, D.D. Rector, J.S. Hallowich, and R.J. Grubb, Soil Survey of Greene and Washington Counties, Pennsylvania, Washington DC: U.S. Department of Agriculture, Soil Conservation Service, 1983.

Smith, R.I., et al., Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station, NUREG/CR–0130, Volume 1, Washington, DC: U.S. Nuclear Regulatory Commission, 1978.

Sobel, P., Memorandum to R. Person, Nuclear Regulatory Commission, Washington, DC: Nuclear Regulatory Commission, June 24, 1999.

U.S. Environmental Protection Agency, Toxicity Characterization Leaching Procedure, Method 1311, EPA Manual SW–846, Washington, DC: U.S. Environmental Protection Agency, 1995a.

U.S. Environmental Protection Agency, Synthetic Precipitation Leaching Procedure, Method 1312, EPA Manual SW–846, Washington, DC: U.S. Environmental Protection Agency, 1995b.

U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary and Area Point Sources, 5th Edition, EPA–450/3–77–010, Washington, DC: U.S. Environmental Protection Agency, January, 1995c.

U.S. Environmental Protection Agency, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, EPA 400–R–92–001/ANR–460, Washington, DC: U.S.

Environmental Protection Agency, May, 1992.

Allard, D. J., Letter to Larry W. Camper, U.S. Nuclear Regulatory Commission, Washington, DC: Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection, July 14, 2000.

APPENDIX

Table 1: Summary of surface water radiological surveys for Molycorp, Inc. Washington site

Location	Survey Method	Key Survey Results (pCi/L)	Reference
Upstream Chartiers Creek (CR1)	not provided	Ra-228 = 5 – 6	Foster Wheeler Environmental Corporation (1995)
Downstream Chartiers Creek (CR4)	not provided	Ra-228 = 3	Foster Wheeler Environmental Corporation (1995)
Adjacent Monitoring Wells	not provided	Ra-228 = 3 – 4	Foster Wheeler Environmental Corporation (1995)
Upstream Sugar Run (Sugar02)	Radon emanation method; beta count	Ra-228 < 1; U-234, U-238, Ra-226 above detection limit but < 0.5	ICF Kaiser (1997)
Downstream Sugar Run (Sugar01)	Radon emanation method; beta count	Ra-228 below detection limit	ICF Kaiser (1997)
Upstream Chartiers Creek (Char02)	Radon emanation method; beta count	Ra-228 < 1	ICF Kaiser (1997)
Downstream Chartiers Creek (Char01)	Radon emanation method; beta count	Ra-228 below detection limit; U-234, U-238, Ra-226 above detection limit but < 0.5	ICF Kaiser (1997)
Ponded Area— Northern End of Hill Area	Radon emanation method; beta count	Ra-228 < 1.5 U-238 = 2.38 ± 0.37 U-234 = 2.70 ± 0.40	ICF Kaiser (1997)

Table 2: Summary of sediment radiological surveys for Molycorp, Inc. Washington site

Location	Survey Method	Key Survey Results	Reference
Chartiers Creek 28 sample locations	not provided; work done by IEA laboratory	0.23 – 0.89 pCi/g; uncertainty 0.06 – 0.18 pCi/g	Foster Wheeler Environmental Corporation (1995)
Upstream Sugar Run (Sugar02)	gamma spectroscopy	radionuclides* < 1 pCi/L	ICF Kaiser (1997)
Downstream Sugar Run (Sugar01)	gamma spectroscopy	radionuclides* < 1 pCi/L	ICF Kaiser (1997)
Upstream Chartiers Creek (Char02)	gamma spectroscopy	radionuclides* < 1 pCi/L	ICF Kaiser (1997)
Downstream Chartiers Creek (Char01)	gamma spectroscopy	radionuclides* < 1 pCi/L	ICF Kaiser (1997)
Ponded Area— Northern End of Hill Area	gamma spectroscopy	Ra-228 < 1pCi/L; U-238 = 1.04± 0.13 pCi/L; U-234 = 1.01± 0.13 pCi/L	ICF Kaiser (1997)

* thorium, radium, and uranium

Table 3: Summary of groundwater radiological surveys for Molycorp, Inc. Washington site

Location	Survey Method	Key Survey Results (pCi/L)	Reference
Site overburden saturated zone	not provided	Ra-226 = 0.5 – 2.23 ± 1.88 Ra-228 = 2.0 – 5.70 ± 2.72 Th-228 = 0.5 – 1.36 ± 0.78 Th-230 = 0.5 – 2.97 ± 0.97 Th-232 = 0.5 – 1.38 ± 0.39 U-234 = 0.5 – 3.58 ± 0.49 U-235 < 0.5 U-238 = 0.5 – 2.6 ± 0.39	Foster Wheeler Environmental Corporation (1995)
Site shallow bedrock saturated zone	not provided	Ra-226 < 0.5 Ra-228 < 2 Th-228 < 0.5 Th-230 < 0.5 Th-232 < 0.5 U-234 < 0.5 U-235 < 0.5 U-238 < 0.5	Foster Wheeler Environmental Corporation (1995)

REFERENCES:

Foster Wheeler Environmental Corporation, Site Characterization Report for License Termination of the Washington, Pennsylvania Facility, Volumes 1–3, Perryville, NJ: Foster Wheeler Environmental Corporation, January, 1995.

ICF Kaiser, Washington Facility Environmental Report, Volumes 1 and 2, 67861–04–C, Pittsburgh, PA: ICF Kaiser, April, 1997.