

Washington Remediation Project
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Mr. James Webb
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U.S. Nuclear Regulatory Commission
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Washington, D.C. 20555-0001

April 3, 2007

**Post-Decommissioning Dose Assessment Plan
Molycorp Washington, PA Decommissioning Project
Materials License SMB-1393**

Dear Mr. Webb:

The U.S. Nuclear Regulatory Commission has indicated that a post-decommissioning dose assessment will be required to terminate the Molycorp, Inc. (Molycorp) Materials License SMB-1393. Molycorp intends to perform the required post-decommissioning dose assessment and has prepared the attached plan for review and comment by the NRC. The attached Post-Decommissioning Dose Assessment Plan identifies future Site usage scenarios and proposes critical receptors considering the historical use of the Site, physical conditions, local zoning, and institutional controls which will be in place for the Molycorp Washington, PA property.

Please do not hesitate to contact me should the NRC need any additional information or have any questions. We look forward to the NRC's response to our plan to conduct the post-decommissioning dose assessment.

Sincerely,

MOLYCORP, INC.

A handwritten signature in black ink, appearing to read "John C. Wright, Jr.", with a large, sweeping flourish at the end.

John C. Wright, Jr.
Project Manager

Attachment: Post-Decommissioning Dose Assessment Plan

cc John Nicholson, NRC Rgn I
Robert C. Maiers, P.E., PADEP BRP
Dwight A. Shearer, P.E., PADEP BRP
George Dawes, Molycorp RSO and Asst Prj Mgr
Mark Lafferty, Chevron EMC
Al Shuckrow, Malcolm Pirnie Construction Mgr



Molycorp Washington PA Decommissioning Site

1217 West Wayne Street • Washington, PA 15301

Post-Decommissioning Dose Assessment Plan

April 2007



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1. Summary

According to the Site's Radioactive Materials License, approved Decommissioning Plan, and classification as a Site Decommissioning Management Plan (SDMP)/Complex Site having met the deadline for Decommissioning Plan approval under the SDMP Action Plan Criteria, the new dose-based License Termination Rule criteria do not apply to closure and subsequent license termination at the Molycorp Washington, PA Decommissioning Site. Nevertheless, the Nuclear Regulatory Commission has indicated that, as part of the license termination process, a post-decommissioning dose assessment will be required. Consequently, Molycorp has prepared this document to set forth reasonable exposure scenarios to be used in the post-decommissioning dose assessment taking into account future site conditions and land use.

Based upon past and planned future uses of this site, physical constraints, poor ambient groundwater quality and low yields, and the engineering and institutional controls which will be implemented under the Pennsylvania Act 2 process: the critical receptor to be considered in the dose analysis will be the Industrial/Commercial Worker.

Source terms will be based on the actual post-decommissioning radiological status of the site. Engineering and institutional controls to be implemented under the Pennsylvania Act 2 closure requirements also will be incorporated into exposure scenarios and exposure pathways analyses.

The dose-based risk assessment will be performed using the most recent validated and verified version of RESRAD (Version 6.3).

2. Introduction

Molycorp, Inc. (Molycorp) is implementing an integrated closure plan for its Washington, Pennsylvania manufacturing facility which operated between 1920 and early 2002. This integrated plan addresses the spectrum of environmental issues existing at the site, both radiological and non-radiological.

Molycorp's goal is to restore the site to a condition where it can be used in the future for purposes consistent with current zoning and physical constraints. To achieve this goal, the site is being decommissioned in accordance with the approved Nuclear Regulatory Commission (NRC) Decommissioning Plan so that an unrestricted radiological release can be achieved and Source Materials License SMB-1393 can be terminated. In addition, non-radiological issues are being addressed under Pennsylvania's Land Recycling and Environmental Remediation Standards Act (Act 2) so that this brownfield site can be returned to beneficial use.

Manufacturing operations at this facility produced byproduct slags, some of which contained low level naturally occurring radiological materials, and some of which did not. Slags of both kinds were used as fill materials on portions of the plant and are commingled in some of the manufacturing areas of the plant. Therefore, in these areas, remedial activities address both the Decommissioning Plan and Act 2 requirements.

Radiological decommissioning requires large excavations and shipment of above criteria soil/slag to an off-site disposal facility. When radiological decommissioning excavations are complete, areas will be backfilled with below criteria soil/slag, and clean backfill and topsoil will be imported and placed to restore the pre-excavation grade. As a consequence, the entire former manufacturing area will be covered with a minimum thickness of two feet of clean fill/topsoil. This surface layer will be needed for two purposes: 1) to restore the site to original grade and 2) to meet Pennsylvania Act 2 brownfield release requirements.

According to the Site's Radioactive Materials License, approved Decommissioning Plan, and classification as a Site Decommissioning Management Plan (SDMP)/Complex Site having met the deadline for Decommissioning Plan approval under the SDMP Action Plan Criteria, the new dose-based License Termination Rule criteria do not apply to closure and subsequent license termination at the Molycorp Washington Decommissioning Site. Nevertheless, the Nuclear Regulatory Commission has indicated that, as part of the license termination process, a post-decommissioning dose assessment will be required. Consequently, Molycorp has prepared this document to set forth

reasonable exposure scenarios to be used in the post-decommissioning dose assessment taking into account future site conditions and land use options.

3. Site Background

3.1. Site Location and Description

Molycorp's Washington Facility is located in Canton Township, Washington County, Pennsylvania, approximately 35 miles southwest of Pittsburgh, Pennsylvania. The site consists of approximately 73 acres ranging from woodlands to industrial areas. The site is bounded by transportation, heavy industrial and residential areas to the east, heavy industrial areas to the north, residential areas to the west, and transportation and residential areas to the south.

Molycorp actively utilized approximately 20 acres for manufacturing operations. The main processing areas were bounded to the north by a fence line with Findlay Refractories Company and to the south by Caldwell Avenue. Employee vehicle parking, equipment and miscellaneous storage were located south of Caldwell Avenue. The eastern boundary is the former CSX and Baltimore and Ohio (B&O) railway line adjacent to Green Street. Chartiers Creek serves as the western boundary of the former manufacturing areas. Interstate 70 (I-70) runs along the southeastern area of the site.

Figure 1, an aerial photograph of the site taken in 2003 after completion of building demolition, shows the former plant areas (Areas A and B) including the radiologically impacted portions of the site. Much of the site is relatively flat and, in part, is located within the floodplain of the northward-flowing Chartiers Creek.

3.2. Site History

The site is known to have been used for industrial purposes since at least the late 1800's. Railway Spring and Manufacturing Company purchased the main plant area in 1902. This parcel was owned by the Railway Spring and Manufacturing Company (later known as the Railway Spring Company or the Car Springs Company) until it was sold to the Electric Reduction Company in 1920. The Molybdenum Corporation of America (in 1974 the name was changed to Molycorp, Incorporated) was formed from the Electric Reduction Company. Manufacturing operations by the Electric Reduction Company (and successors) originally were conducted in buildings constructed prior to the 1920 purchase of the site.

Over time, the plant expanded westward as low lying areas were filled with byproduct slags and new buildings were constructed. Construction activities to support facility upgrading were performed over the years as needed. A total of 42 buildings were

constructed on the facility property; however, not all of the buildings were present at the same time as obsolete buildings were replaced by newer buildings. Plant operations ceased in early 2002, and all of the main plant site buildings were demolished later that year, with only the guard house and truck scales remaining in place.

3.3. Regulatory Highlights (Licensed Materials)

In 1963, the Molybdenum Corporation of America obtained a Source Materials License from the Atomic Energy Commission (AEC) because of the processing of ores that contained 0.05 percent (or higher) of natural uranium and/or thorium. Between 1964 and 1970, Molycorp produced ferrocolumbium alloy from concentrates derived from ore mined in Araxa, Brazil that was delivered to the Washington Facility. Slag from the production of the ferrocolumbium alloy was in the form of a refractory glass/ceramic containing thorium.

Waste slags from the ferroalloy operations were utilized on-site to fill in low-lying areas and as a subbase in some building construction. Although the largest quantity of fill consisted of non-radioactive ferromolybdenum slags, thoriated slags associated with ferrocolumbium production and ferrotungsten slags possibly containing uranium also were deposited on the property.

A Nuclear Regulatory Commission contractor, Oak Ridge Associated Universities (ORAU), conducted a radiological survey of the site in 1985, which identified elevated levels of thorium in the dikes which separated RCRA surface impoundments and indicated the potential of subsurface thoriated slags in the western portion of the site. Subsequently, the Washington Facility was listed in NRC's 1990 Site Decommissioning Management Plan list.

Molycorp renewed its NRC license for the Washington facility in 1992. Because the facility had appeared on the 1990 SDMP list, this license renewal included an amendment incorporating a schedule for characterizing and decommissioning the site. Since that time, a number of decommissioning reports and plans have been submitted to the NRC including:

- Site Characterization Report for License Termination of the Washington, PA Facility (Foster Wheeler Environmental Corporation, 1995)
- Decommissioning Plan for the Washington, PA Facility (Foster Wheeler Environmental Corporation, 1995)
- Washington, PA Facility Decommissioning Plan, Part 1 Revision (Radiological Services, Inc., 1999)

- Washington, PA Facility Decommissioning Plan, Part 2 Revision (Radiological Services, Inc., 2000)
- Supplemental Site Characterization Report for the Washington, Pennsylvania Site (Malcolm Pirnie, 2004)
- Technical Basis Document on Classifying Areas, Release Criteria and Final Status Survey (Malcolm Pirnie, 2005)
- Decommissioning Plan Amendment Request and Addendum (Malcolm Pirnie and MolyCorp, 2006)

Based on the findings of the Site Characterization Report, MolyCorp prepared an initial Decommissioning Plan that was submitted to the NRC in late 1995. This plan proposed removing any material that had a level of thorium above 30 pCi/g. The plan did not address contamination below structures.

In 1999, the NRC advised MolyCorp of the results of its review of the 1995 decommissioning plan. As a result of the NRC's review, in June of 1999, MolyCorp submitted to the NRC the Part I Revision to the Decommissioning Plan, which changed the thorium remediation goal. This Decommissioning Plan made provision for use of the AAR method to establish release criteria for the site. The plan also described how MolyCorp would excavate the thorium-bearing slag in various areas of the property.

In July of 2000, MolyCorp submitted the Part 2 Revision to the Decommissioning Plan that addressed a proposal to construct an on-site disposal cell for material that exceeded SDMP Action Criteria. The Decommissioning Plan Part 2 Revision was never approved. MolyCorp has since abandoned its plans to construct the on-site cell.

In September 2003, MolyCorp undertook a Supplemental Site Characterization to address both radiological and non-radiological issues at the site. This Supplemental Site Characterization provided better definition of the location of slags containing licensed materials (natural uranium and natural thorium) above background levels. In addition, the Supplemental Site Characterization confirmed the absence of uranium, thorium and radium in site groundwater, adjacent surface waters and stream sediments above background levels.

Subsequent to completion of the Supplemental Site Characterization in 2004, MolyCorp submitted the Technical Basis Document on Classifying Areas, Release Criteria and Final Status Surveys (Technical Basis Document) in early 2005. This document described MolyCorp's approach to remediating the Washington site, and the derivation and application of AAR subsurface soil averaging guidelines. NRC approved the use of the AAR criteria as set forth in the Technical Basis Document in June 2005. MolyCorp then

proceeded to develop a detailed decommissioning design plan. Molycorp currently is performing remediation activities necessary for decommissioning and subsequent license termination under the approved Decommissioning Plan.

Currently a Decommissioning Plan amendment request is under review. This amendment request is consistent with the application of the SDMP Action Plan Criteria using the AAR Method.

4. Future Land Use

The former Manufacturing areas (Figure 1) have been used for industrial purposes for more than a century and currently are zoned industrial. Future residential use is not expected because of historical and current land use and because of governmental land use zoning. Agricultural usage is not expected or likely because of the prevailing land use in the area. The Draft Master Redevelopment Plan (Figure 2) for this area of Canton Township which was presented to the public in November 2006 designates the future use of the remediated manufacturing areas as light industrial.

Groundwater at the site cannot be used because of poor ambient water quality and low yields. In addition, connection to the available public water supply is required by Canton Township ordinance.

As described in the Pennsylvania Department of Environmental Protection (PADEP) approved Act 2 Cleanup Plan for the Molycorp Washington Facility, Molycorp has agreed to establish a combination of engineering and institutional controls upon completion of site remediation activities. The approved non-radiological clean-up criteria for the site takes into account these engineering and institutional controls, which prevents any future land use scenarios except industrial uses in the former manufacturing areas.

Engineering controls will be established in Areas A and B. The surface of the eastern portion of Area A will be covered in part by a concrete transshipment area. Remaining portions of Area A outside of the transshipment area and all of Area B will be covered with a minimum two feet of clean fill and vegetated.

As described in the Act 2 Cleanup Plan, six institutional controls will be established for the site, four of which apply to Areas A and B:

IC1: This institutional control will prevent groundwater from being used as a source of potable water, irrigation water or process water. (It is worthy to note that none of the radionuclides of concern at the site have been detected above background levels in groundwater or adjacent surface waters during site characterization and site decommissioning activities.)

IC2: This institutional control will prevent an area from being redeveloped for residential purposes unless additional remediation is performed to make the area suitable for residential use.

IC4: This institutional control will require that the engineering control (i.e., soil cover or concrete pad) established in a particular area be re-established after excavation. In addition, any subsurface soil removed during the excavation will have to either be replaced back in the excavation below the engineering control or tested and disposed of appropriately.

IC6: This institutional control will require excavation workers (such as construction workers and utility workers) to take precautions during excavations to limit exposures to chemicals in subsurface soil and groundwater.

These institutional controls will be incorporated into the appropriate property deeds for the site after the active remediation is completed and all engineering controls are established.

In light of the above, the only feasible future land use for Areas A and B of the Washington Remediation Site is industrial/commercial. Therefore, it is concluded that the appropriate exposure scenario for the post-decommissioning dose assessment is an Industrial/Commercial Worker.

5. Dose Assessment

The objective of dose modeling is to assess the total effective dose equivalent (TEDE) to an average member of the critical group from residual contamination. "The critical group is defined as an individual or relatively homogenous group of individuals expected to receive the highest exposure under the assumptions of the particular scenario considered" (NUREG/CR-5512 [Kennedy and Streng, 1992]). The dose analysis provides a reasonable and conservative estimate of radiation dose applicable to the critical population group from residual activity.

The RESRAD computer program is a pathway analysis model designed to evaluate the potential radiological dose incurred by an individual who occupies land containing residual radioactive material (Yu, et al., 2001). RESRAD has been widely accepted and has a large user base. The models used in the software were designed for and have been successfully applied at sites with relatively complex physical and contamination conditions. Therefore, Molycorp plans to utilize the RESRAD code for the post-remediation dose assessment.

Deterministic analyses will be performed for the post-remediation dose assessment. The most recent validated and verified version of RESRAD (currently Version 6.3) will be utilized in the dose assessment.

Sensitivity analyses will be conducted to identify the input parameters that are the major contributors to the variation or uncertainty in the calculated dose. Deterministic sensitivity analyses will be performed by calculating the change in the peak dose resulting from a change in the independent variables, one at a time.

6. Conceptual Model

A detailed conceptual model for the post-remediation dose assessment will be developed when decommissioning has been completed. Major elements of the conceptual model which will be utilized to perform the dose assessment are summarized below.

- **Exposure Scenario: Proposed Dose Receptor** Based upon past and planned future uses of this site, physical constraints, poor ambient water quality and low yields, and the engineering and institutional controls which will be implemented under the Pennsylvania Act 2 process as discussed in Section 3 above, the critical receptor will be the Industrial/Commercial Worker. Note that the groundwater pathway would not be utilized in any critical receptor scenario analysis because groundwater cannot be used due to quality and yield constraints. Public water supply is available at this site and mandatory by ordinance.
- **Constituents of Interest: Radiological** The radiological constituents of interest are those specified in the Decommissioning Plan and further defined in the Technical Basis Document.
 - a. Total Thorium (Th-232 + Th-228)
 - b. Uranium (U-238 + U-234)
 - c. Excess Radium (Ra-226)

These radionuclides will be used in the dose assessment.

- **Source Terms** The source terms will be based on the actual post-decommissioning radiological status of the Site. The Decommissioning Plan allows for backfilling using a combination of well defined on-site and off-site materials, so the final in place source terms will be well defined. Additionally, the dose assessment will consider the scenario in which the in place source terms are disturbed.
- **Exposure Pathway Analysis** The following are some of the exposure parameter considerations for the industrial worker exposure scenario. These considerations take into account the land use restrictions described previously as well as the fact that public water is supplied to the site.
 - a. Exposed individual usually spends less time on-site than a resident (8 hours a day, 2,000 hours per year).
 - b. Exposure pathways
 - i. External gamma exposure
 - ii. Inhalation of dust
 - iii. Ingestion of soil

- iv. No ingestion of meat or milk from livestock raised on-site
 - v. No consumption of water or food obtained from the site.
- **Dose Assessment: RESRAD Version 6.3 Dose Modeling Software** A dose-based risk assessment will be performed using the most recent validated and verified version of RESRAD (Version 6.3).

7. References

Site Characterization Report for License Termination of the Washington, PA Facility (Foster Wheeler Environmental Corporation, 1995)

Decommissioning Plan for the Washington, PA Facility (Foster Wheeler Environmental Corporation, 1995)

Washington, PA Facility Decommissioning Plan, Part 1 Revision (Radiological Services, Inc., 1999)

Washington, PA Facility Decommissioning Plan, Part 2 Revision (Radiological Services, Inc., 2000)

Supplemental Site Characterization Report for the Washington, Pennsylvania Site (Malcolm Pirnie, 2004)

Technical Basis Document on Classifying Areas, Release Criteria and Final Status Survey (Malcolm Pirnie, 2005)

Decommissioning Plan Amendment Request and Addendum (Malcolm Pirnie and MolyCorp, 2006)

Cleanup Plan MolyCorp Washington Site (Malcolm Pirnie, 2006)

Kennedy, W.E. and Streng, D.L. NUREG/CR-5512, PNL 7994, Vol. 1, "Residual Radioactive Contamination from Decommissioning; A Technical Basis for Translating Contamination levels to Annual total Effective Dose Equivalent." Prepared by Pacific Northwest Laboratory for U.S. Nuclear Regulatory Commission: Washington, D.C. October 1992

Yu, C., A.J. Zielen, J.J. Cheng, Y.C. Yuan, L.G. Jones, D.J. LePoire, E. Gnanapragasam, S. Kaboj, J. Arnish, A. Waldo III, W.A. Williams, and H. Peterson, 2001. "Manual for Implementing Residual Radioactive Material Guidelines using RESRAD Version," ANL/EAD/LD-3, Argonne National Laboratory, prepared for U.S. DOE.



