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MEMORANDUM TO: File

FROM: Larry W. Camper, Chief /RA/
Decommissioning Branch
Division of waste Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: ENVIRONMENTAL ASSESSMENT FOR MOLYCORP, YORK, PENNSYLVANIA DECOMMISSIONING PLAN

The subject environmental assessment was approved this date and is attached for record purposes.

Attachment:
Environmental Assessment

Docket No.: 040-08794
License No.: SMB-1408

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AN-ML-003704425 NMSS-001

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

March 2000
LICENSE NO. SMB–1408
DOCKET NO. 40-08794

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

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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 York, Pennsylvania. The objective of the decommissioning of the Molycorp, Inc., York, Pennsylvania, facility is to remediate radiological constituents to the extent required to allow the NRC to release the property for unrestricted use and terminate the NRC radioactive materials license for the facility (SMB–1408).

The environmental assessment (EA) reviews the environmental impacts of the decommissioning actions proposed by Molycorp, Inc. at its facility located in York, Pennsylvania. In connection with the review of plans for the proposed action, NRC staff also is preparing a safety evaluation report (SER), which evaluates conformance of the proposed action with NRC regulations and regulatory guidance. On issuance, the SER will be available for inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC.

SUMMARY AND CONCLUSIONS

This EA was prepared by the NRC staff of the Office of Nuclear Material Safety and Safeguards (hereafter referred to as the NRC staff). Based on the NRC staff evaluation of the Molycorp, Inc. final decommissioning plan, 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., York, Pennsylvania, facility in accordance with the commitments in NRC license SMB–1408 and the final decommissioning plan) will not result in a significant adverse impact on the environment.

1.0 INTRODUCTION

1.1 Background

Molycorp, Inc. is the current holder of an NRC radioactive source materials license SMB–1408 (NRC Docket 40-08794) for the possession of radioactive material resulting from operations at their facility located at 350 North Sherman Street, York, Pennsylvania. License SMB–1408 was last renewed on September 24, 1998, and is currently under timely renewal. The license authorizes Molycorp, Inc. to possess at any one time a maximum of 315 kg (693 lb) of uranium in the form of natural uranium as oxide and fluorocarbonate and 100,000 kg (220,000 lb) of thorium in the form of natural thorium as oxide, hydrate, fluoride, and fluorocarbonate. Only licensed material present at the site on September 24, 1993, may be possessed. The license authorizes storage, characterization, and decommissioning in accordance with an approved decommissioning plan and transfer of products and waste to authorized recipients. Processing of licensed material is not authorized except incident to decommissioning and packing for shipment. In August 1992, Molycorp, Inc. informed the NRC staff that it intended to decommission the York facilities. The licensee submitted the site decommissioning plan (Radiological Services, Inc., 1999) to the NRC for review on August 14, 1995, and Addendum 1 to the site decommissioning plan (IT Corporation, 1996) on May 2, 1997. Consideration of a license amendment request for decommissioning the Molycorp, Inc. facility in York, Pennsylvania, and opportunity for a hearing, was publically noticed in a May 13, 1996, Federal Register notice (61 Federal Register 22075).

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 at the site, to levels that permit unrestricted use of the site and termination of radioactive source materials license SMB–1408.

1.3 Description of Proposed Action

The objective of Molycorp, Inc. is to decontaminate and decommission the York facilities to permit release for unrestricted use and termination of NRC license SMB–1408. Decontamination and decommissioning of the site will be accomplished in two phases. The first phase will involve decontamination and removal of buildings and other above-grade structures, with the exception of an office building and a warehouse. Second phase activities will include removal of concrete slabs and associated drains and sumps, excavation of contaminated soil, and restoration of excavated areas with clean overburden. Soil and other radioactively contaminated materials will be transported to an NRC-approved interim storage or disposal facility.

Molycorp, Inc. will conduct the following activities to accomplish the decommissioning plan objectives (IT Corporation, 1996; Radiological Services, Inc., 1999):

- Analyze gamma-log data from soil borings completed on-site to determine the location and depth of soils containing Th-232 plus Ra-226 concentrations exceeding 10 pCi/g (the Molycorp, Inc. site characterization criteria used to define affected areas).

- Delineate the areas to be excavated. Because both Th-232 and Ra-226 are present, the boundaries of the areas to be excavated will be estimated by areas that exceed 10 pCi/g Th-232 plus Ra-226. The actual excavation will require real time monitoring to provide more accurate resolution of areas exceeding the unrestricted use criteria.

- Formulate a cost-effective ALARA excavation plan.

- Transport excavated material exceeding the unrestricted use criteria in the SDMP Action Plan (48 Federal Register 52061-52063) to an NRC approved location.

- Survey and mark soil excavation areas, disposal area, and access road to delineate the areas targeted for decommissioning for unrestricted use.

- Excavate the clean soil overlying waste material.

- Excavate and stockpile mateiral exceeding the SDMP Action Plan unrestricted use criteria (48 Federal Register 52061-52063).

- Load, secure, label, and frisk waste material for transport.

- Transport the packaged material to an NRC-approved interim storage or disposal facility.

- Backfill excavated areas with clean soil from the site and certified clean fill material.

- Cap the backfilled open areas with clean topsoil, seed, and mulch to prevent erosion.

- Perform final decontamination of site, road, and disposal area.

- Perform final radiological status surveys to verify unrestricted release status of soils and below-grade structures.

NRC staff reviewed the information provided by Molycorp, Inc. (Radiological Services, Inc., 1999; IT Corporation, 1996) describing the proposed decommissioning actions and requested additional information regarding specific areas that needed clarification (Hickey, 1999). Subsequently, NRC staff concluded that the decommissioning plan (Radiological Services, Inc., 1999; IT Corporation, 1996) plus the supplemental information (Daniels, 1999) provided by Molycorp, Inc. to respond to NRC comments and the results of dose calculations by ICF Kaiser Engineers, Inc. (1997) for excavation, transportation, and storage of York waste provide an adequate information base for assessing potential environmental impacts from the proposed action.

2.0 FACILITY DESCRIPTION/OPERATING HISTORY

The Molycorp, Inc. York facility comprises 2.5 fenced hectares (6.1 acres) of land situated on the outskirts of the City of York, Pennsylvania, at 350 North Sherman Street in Spring Garden Township. Production at the facility included a broad line of inorganic rare earth chemicals used to make catalysts for the chemical industry and for various industrial purposes. From 1930 to 1943, the Molybdenum Corporation of America produced elemental molybdenum and molybdenum ferro-alloys. A variety of rare earth (lanthanide) products (chlorides, nitrates, sulfates, oxides, fluorides, acetates, carbonates, oxalates, and phosphates) were produced in large volumes from 1965 until 1992. The rare earth processing plant was part of the facility that used raw material with concentrations of thorium and uranium. Between 1965 and 1992, the thorium concentrations were sufficient to require Molycorp, Inc. to acquire a source material license on June 18, 1981. The license number is SMB–1408 (NRC Docket 40-08794).

In 1968, a 757,000 L (200,000-gal.) lagoon was built to retain plant effluent. An equalization pond (impoundment) was constructed in 1972 for the discharge of effluent process water. Between 1975 and 1976, the molybdenum and tungsten operations were phased out and lead removal from cerium chloride solutions using sodium sulfide began. In 1977, the first drum filters were used to dewater byproducts for waste treatment. The 1980s included other changes to the York facility: a large quantity of Th-232, Ra-226, and U-238 residues [estimated at 460–690 m^3 (600–900 yd^3)] from the settling pond was located in a pile (landfill) near the southeast corner of the site and seven drum-storage areas, mostly unpaved, with over 13,000 drums of byproducts containing thorium were placed on the northern part of the site. In addition, expansion of the administrative and waste treatment buildings began, which uncovered buried drums of molybdenum.

As required by changing regulations, Molycorp, Inc. submitted an application for a source material license to the NRC on June 18, 1981, for its rare earth chemical operations in York, Pennsylvania. Following NRC issuance of the license , Molycorp responded to NRC inquiries regarding past disposal practices (see letter September 22, 1981) at the York facility. Most of the disposal practices at issue occurred prior to 1981 and NRC regulation of the facility. NRC estimation of the volumes and activities associated with these disposals indicate that the radioactive concentrations resulting from the disposal of thorium in these landfills are well within the unrestricted use cleanup criteria (48 FR 52061) and no adverse environmental impacts are expected from these practices.

The license contained a radiological survey conducted by Eberline Instrument Corporation that evaluated certain ambient conditions for a comparison with occupational criteria. Treated wastewater effluent samples showed activity levels well below NRC limits in 10 CFR Part 20, Appendix B. Condition 13 of the material license required Molycorp, Inc. to submit a plan for the future decommissioning of the York site. By letter dated April 21, 1983, Molycorp, Inc. submitted a plan for the future decommissioning of the facility and requested an amendment to its

license to authorize processing source material to recover yttrium. Only minor amounts of this source material were processed at the facility.

Because of a leaky liner, in 1984 the impoundment was closed according to regulations, blacktopped, and replaced by a 570,000-L (150,000-gal.) aboveground retention tank. In 1987, the cerium process was shut down and relocated to the Molycorp, Inc. Mountain Pass facility. Drums of process materials were repackaged into large sling bags and transported off site at a rate of three to four truck loads per day to the Molycorp, Inc. Mountain Pass facility.

By 1990, the upper landfill had been removed. A new urea tank was installed north of the Rare Earth Chloride (REC) Building in 1991, and then in 1992 milling operations were suspended. A catch basin was later installed to contain storm water runoff heading toward the quarry beyond the north boundary of the site. In March 1993, all production was suspended and most staff were terminated.

In December 1991, as part of its license renewal application, Molycorp, Inc. submitted a revised conceptual decommissioning plan to process and possess lanthanide material containing low concentrations of thorium and uranium (source material). Low concentrations of source materials were also found in the lanthanide chloride residue and in the cerium fluoride. The Environmental Report prepared in July 1992 (Brown, 1992) presented the current environmental conditions and processing/containment analysis at the plant site. In August of 1992, however, Molycorp, Inc. informed the NRC that they intended to close and decommission the York facility. This was followed by a letter to the NRC in January 1993 announcing that all licensed operations using source material had ceased at the York site. NRC then approved the Molycorp, Inc. request to amend their NRC license from that of operating status to that of possession only status of up to 100,000 kg (220,000 lb) of thorium and 315 kg (690 lb) of uranium. On March 22,1993, Molycorp, Inc. informed the NRC they had transferred low-level radioactive byproduct lanthanide material from the York facility to the Mountain Pass plant to process it for the recovery of its rare earth values, as allowed by the Molycorp, Inc. York license.

In 1993, initial cleaning of all buildings, bulk storage, and process tanks began. The residue stored onsite included lead carbonate packaged into 103, 208-L (55-gal.) high-density polyethylene (plastic) drums and a few 1,135-kg (2,500-lb) bags. The drummed material was processed onsite to separate lead, in accordance with a procedure approved by the NRC. Bagged material, such as residuals recovered from the lower landfill, was sent to Mountain Pass for further processing and lanthanide recovery. The cerium fluoride was sold. Currently, 16 drums of lead carbonate and 9 drums containing acids remain onsite, along with 35 bags of by-products waiting to be shipped to the Mountain Pass facility. In early 1995, the abandoned properties along Hudson and Windsor Streets (after right-of-way realignment) were officially deeded to Molycorp, Inc. by the Spring Garden Township.

The operational history of the Molycorp, Inc. York site includes occasional spills affecting some surficial soils and groundwater. Following a site visit by the NRC on August 3, 1993, Molycorp, Inc. submitted the York site groundwater hydrology assessment. It was mutually agreed that the Radiation Surveillance Associates, Inc. (1993) and Vail Engineering, Inc. (1990) documents formed the basis for the York site characterization report. Comments from the NRC were sent to Molycorp, Inc. on March 25, 1994. The supplemental site characterization (Foster Wheeler Environmental Corporation, 1995) was prepared to address the remaining low-level thorium-contaminated soils at the York site.

2.1 Local Geography

The Molycorp, Inc. site at York, Pennsylvania, is bounded by Sherman, Olive, and North Hudson Streets and the rail line operated by Conrail. Commercial areas and an abandoned limestone quarry exist north of the facility.

West of the site (across the street from the site boundary) is the Windsor Park residential area predominantly containing single family dwellings. The area south of the facility contains commercial and multifamily dwellings. East of the site is a commercial area.

2.2 Climate

The York, Pennsylvania, area has a humid continental climate. Prevailing winds are generally from the west. The average annual precipitation is 99.3 cm (39.1 in.) generally distributed evenly throughout the year, although the spring and summer months generally receive slightly more. Extended periods of dry weather are seldom experienced. The average annual snowfall is 80.0 cm (31.5 in.) (Foster Wheeler Environmental Corporation, 1995).

2.3 Soils

The soil survey of York County, Pennsylvania (U.S. Department of Agriculture, 1959), indicates Hagerstown silt loam soils of the Hagerstown-Duffield soil association comprise the undisturbed soils at the Molycorp, Inc. site. This soil is developed on limestone parent material and is commonly moderately eroded. The soil is deep and moderately well drained with a high available moisture capacity; the potential for runoff is classified as medium. The surface horizon of the soil is a dark-brown silt loam and the subsoil is yellowish-brown to red silty clay loam to clay. The native soil at much of the site has been disrupted by construction activities and replaced or covered by fill materials. Approximately 60 percent of the site is covered with asphalt pavement or buildings (Foster Wheeler Environmental Corporation, 1995).

2.4 Geology and Hydrology

The site is on the northern slope of a gentle ridge. The surface decreases in elevation from approximately 123 m (403 ft) in the southwestern corner of the site to 119 m (389 ft) along the northern portion of the site adjacent to Olive Street. The average slope is approximately 2 percent. A surface water catchment basin with a macadam reinforced dam is located at the topographically lowest area adjacent to Olive Street. The site is within the drainage area of Mill Creek, a tributary of Codorus Creek. Molycorp, Inc. directs its stormwater runoff to the 3-hectare (8-acre) pond in an abandoned quarry about 120 m (400 ft) north of the site (Foster Wheeler Environmental Corporation, 1995). The site is located above the 100-year flood plain and was not affected by flood waters during hurricanes Agnes in 1972 or Eloise in 1975 (Brown, 1992). No wetlands exist at the site.

Vail Engineering, Inc. (1990) and Foster Wheeler Environmental Corporation (1995b) have characterized the geology and hydrogeology of the York facility. Bedrock is primarily Cambrian carbonate rocks (limestones and dolostone) with interbedded shales and mudstone. The bedrock dips to the east-southeast at 50–60 degrees. The southern two-thirds of the site has limestone bedrock of the Kinzers Formation that in turn overlies the limestones of the Vintage Formation. The Gnatstown Overthrust fault (inactive) strikes east-northeast to west-southwest across the northern portion of the site and is interpreted to thrust the Kinzer Formation over the Vintage and Ledger Formations. A silty and clayey mylonized zone apparently is associated with the south-southeast dipping thrust fault. Bedrock north of the thrust fault is Vintage limestone and Ledger Formation dolostone. Bedrock is overlain by 2–9 m (7–30 ft) of unconsolidated overburden. The overburden is thickest in the southwestern, southern, and northeastern portions of the site and thinnest in the northwestern and northern areas. The shallow overburden is dominated by fill that is thickest, 1–2 m (4–7 ft), in the northern and western portions of the site and at the location of the former lagoon (settling pond) where fill rests on bedrock. Sand, silt, and minor amounts of clay intermixed with rock, slag, and brick fragments compose the fill. The natural overburden underlying the fill is silty clays, with interbedded silts and layers of very fine sand. Gravel becomes more abundant in the overburden nearer the

interface with bedrock. Approximately 80 percent of the site is covered by fill material, asphalt paving, structural foundations, or a combination of these.

The groundwater potentiometric surfaces are similar for monitoring wells completed in saturated zones (SZs) in the overburden and in the carbonate bedrock south of the Gnatstown Overthrust fault. The overburden contains a SZ south of the thrust fault zone, but is unsaturated to the north over the Vintage and Ledger Formations. The average depth to the water table in the overburden was 2.9 m (9.4 ft), and most wells completed in overburden contain water from 1 to 2 m (5 to 8 ft) below the surface. The average SZ thickness above the limestone bedrock is 1.7 m (5.6 ft) but may range from zero to approximately 5 m (15 ft) and is greatest in the former lagoon area where fill rests on bedrock. A pumping test of well PW–1 confirmed the overburden SZ is hydrogeologically complex. Monitoring well K–1, completed in the upper bedrock SZ, strongly responded to pumping of PW–1 indicating the overburden and upper bedrock SZs are interconnected. North of the thrust fault the elevation of the potentiometric surface in wells (V–1 through V–3) completed in bedrock is approximately 5–6 m (17–20 ft) lower than bedrock wells south of the thrust fault, creating an apparent steep gradient [approximately 0.13 m/m (0.13 ft/ft)] of the potentiometric surface between wells K–1 and V–2.

Shallow groundwater results from infiltration of precipitation over an area approximately 2 hectares (5 acres) within and to the west of the plant site. The general direction of groundwater flow at the facility is to the northeast with a gradient of approximately 0.05 m/m (0.05 ft/ft) (Foster Wheeler Environmental Corporation, 1995). Potentiometric surface elevation maps for the SZ in the upper bedrock presented in the supplementary site characterization report (Foster Wheeler Environmental Corporation, 1995, Figures 4-15 and 4-16) indicate northern groundwater flow in the eastern one-half of the site and northwest flow in the western one-half of the site. Natural artesian flow from a well drilled to a depth of about 60 m (200 ft) in the eastern part of the site more than 20 years ago is directed into a sump that is pumped at a rate of 38 l/min (10 gal./min). The sump is not sealed, and flow from the well exceeding the pumping rate may add to flow in the shallow groundwater system (Vail Engineering, Inc., 1990).

3.0 RADIOLOGICAL STATUS OF THE FACILITY

3.1 Structures and Equipment

Molycorp, Inc. conducted a preliminary radiation survey of the interiors of all process and storage buildings (six buildings) in August 1992 and January 1993. The survey was used to identify and quantify the extent and amount of radiological contamination in buildings used for processing and storage of radioactive materials (Radiation Surveillance Associates, Inc., 1993). This screening survey consisted of gamma measurements at locations in the buildings determined by reference to features inside the buildings. Gamma readings made with a scintillometer were recorded on maps of the building interiors after correction by a calibration factor. This information was used to support decontamination of building interiors accomplished prior to the final radiological survey. The methods used to dismantle and decontaminate process equipment in affected buildings and for disposition of resultant materials are described in Addendum 1 to the decommissioning plan for the facility (IT Corporation, 1996).

Dismantlement, decontamination, and disposition of contaminated equipment occurred prior to the final radiological survey. The final radiological survey report (IT Corporation, 1997) documents methods, data, and results for the radiological survey of interior surfaces conducted in 1997 to support termination of Molycorp, Inc. NRC Source Material License SMB–1408 (NRC Docket 40-08794) and demolition of structures except for Buildings 9 and 15. IT Corporation (1997) final surveys were conducted in 1997 for Buildings 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, and 13 and for associated floor trenches and building penetrations. The final release status surveys described by IT Corporation (1997) were performed in accordance with NUREG/CR–5849 (Berger, 1992). Guidelines used for release of process equipment and structures were those listed in Table 5-2 of Regulatory Guide 1.86, Termination

of Operating Licenses for Nuclear Reactors (U.S. Atomic Energy Commission, 1974). For the radioactive materials that exist at the York site, the guidelines in Regulatory Guide 1.86 are identical to the current guidelines "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use for Termination of Byproduct, Source, and Special Nuclear Material Licenses," (U.S. Nuclear Regulatory Commission, Policy and Guidance Directive FC 83-23, 1983) therefore, further reference to such guidelines in this environmental assessment will refer to the latter. Additional equipment release guidance was provided by Molycorp NRC-approved "Surface Contamination Survey and Release Procedure for Equipment." Building 4, containing a lunch room, locker room, and workshop; Building 6, a stock room; Building 7, a boiler room; and Building 13, the pipe room were determined (IT Corporation, 1996) not affected (unaffected) using the criteria in NUREG/CR–5849 (Berger, 1992) and are not described below. Details regarding the radiological status of affected buildings are described in the next sections. At present, contaminated material is being stored only in Buildings 14, 14A, and 15. A final survey of these buildings will be required after the stored material is removed and decontamination is complete.

Following review of the Molycorp, Inc. site radiological characterization of structures and equipment, the NRC staff finds characterization was performed in accordance with NUREG/CR–5849 (Berger, 1992). The NRC staff review of the decommissioning plan finds it adequate for remediating structures and equipment to radiological levels below the NRC guidelines for unrestricted release (Nuclear Regulatory Commission, 1983). The staff concludes no adverse environmental impacts will result from planned remediation of the site structures and equipment.

3.1.1 Mill Room Building 1 (Including Areas 1A and 1B)

Building 1 was primarily used as a shipping and receiving area and warehouse for storage of material. Various lanthanide products and some concentrates were stored in this building from 1960 to the close of operations. The supplementary site characterization report (Foster Wheeler Environmental Corporation, 1995) notes lanthanide products in solid and liquid forms are stored in the mill room. The building is a brick masonry structure with a reinforced concrete floor and a steel truss roof with corrugated metal and transite panels. Transite is a trade name for fiber reinforced Portland cement in the form of a precast corrugated sheet. Interior partitions are constructed of brick masonry with the exception of a wood frame structure with transite panel sheathing in the southeast corner of the building (IT Corporation, 1997).

The final radiological survey report (IT Corporation, 1997) documents survey methods, data, and results for interior surfaces and concludes all surfaces within Building 1 are within allowed release limits for Th-232, the primary contaminant of concern. The NRC limit or average surface contamination of 1,000 dpm/100 cm^2 for Th-232 (Nuclear Regulatory Commission, 1983) was exceeded for five grids. With one exception, all measurements were within the allowed maximum limit of 3,000 dpm/100 cm^2. The exception was a reported activity of 5,114 ± 336 dpm for Room 1 grid L12. Total calculated residual surface activity in Building 1 was 47±7 µCi of beta emitters and 13±4 µCi of alpha emitters, for a total residual activity of 60±8 µCi.

3.1.2 Tank Room, Building 2

This area was used from 1963 to 1993 for producing a variety of lanthanide chemicals, primarily cerium compounds, from bastnasite, cerium concentrate, and other feed stocks (IT Corporation, 1997). The building was a process area used to convert cerium mineral concentrate into 95 percent pure cerium products. Building 2 is a wood frame and brick masonry structure with wood roof trusses and a wood roof deck. It has a reinforced concrete floor and exterior and interior transite sheathing. A wood frame office area was constructed in the northwest corner of the building. Two centrifuge motors, two centrifuge motor stands, two ovens, and one roto-hearth remained in the building at the time of the final radiological survey (IT Corporation, 1997).

The final radiological survey report (IT Corporation, 1997) concludes all surfaces within Building 2 are within allowed release limits for Th-232, the primary contaminant of concern. The NRC limit or average surface contamination of 1,000 dpm/100 cm^2 for Th-232 (Nuclear Regulatory Commission, 1983) was exceeded for four grids. Contamination remains in an active drainage pit in the upper deck within Room 3. Residual activity from the pit walls was measurable outside the pit when the final survey was conducted. Total calculated residual surface activity in Building 2 was 38±6 µCi of beta emitters and 7±3 µCi of alpha emitters, for a total residual activity of 45±7 µCi.

3.1.3 Tungstic Acid Room or SX Building (99 Percent Ce Room), Building 3

Building 3 was a process area used from 1968 to 1992 to convert cerium mineral concentrate into high purity (99 percent) cerium products. The building is a brick masonry and steel truss roof structure with a concrete floor and corrugated transite roof panels (IT Corporation, 1997).

The final radiological survey report (IT Corporation, 1997) concludes all surfaces within Building 3 are within allowed release limits for Th-232, the primary contaminant of concern. Total calculated residual surface activity in Building 3 was 6±4 µCi of beta emitters and 0.2±0.4 µCi of alpha emitters, for a total residual activity of 6.2±4 µCi.

3.1.4 Moly Building, Building 8 (Including Area 8A)

Various lanthanide chemicals were produced in this building from about 1970 to 1992 (IT Corporation, 1997). Building 8 is a brick masonry structure with a steel frame and wood truss roof and reinforced concrete floor. It has a transite panel ceiling and asphalt shingle roof. Interior partitions are brick masonry with the exception of a concrete block room constructed in the southwest corner of Room 3.

The final radiological survey report (IT Corporation, 1997) concludes all surfaces within Building 8 are within allowed release limits for Th-232, the primary contaminant of concern. Total calculated residual surface activity in Building 8 was 28±5 µCi of beta emitters and 5±2 µCi of alpha emitters, for a total residual activity of 33±7 µCi.

3.1.5 Administration Area and Laboratory, Building 9

The administration area was used for offices, meetings rooms, and associated activities. The laboratory was used to analyze samples and to support process development activities. Building 9 is a wood frame and wood roof truss structure with a steel reinforced concrete floor and an asphalt shingle roof. A partial basement exists under the laboratory in the northern end of the building (IT Corporation, 1997).

The final radiological survey report (IT Corporation, 1997) concludes all surfaces within Building 9 are within allowed release limits for Th-232, the primary contaminant of concern. Total calculated residual surface activity in Building 9 was 15±4 µCi of beta emitters and 2±1 µCi of alpha emitters, for a total residual activity of 17±4 µCi.

3.1.6 Rare Earth Chloride Building, Buildings 10, 10A, and 10B

The REC Building contained process equipment and systems for rare earth processing operations and is divided into three areas, REC Building (10), lanthanides chloride digest area (10A), and boiler room (10B). Buildings 10 and 10A were process areas used to convert bastonasite mineral concentrate into a purified mixture of rare earth chlorides (IT Corporation, 1997). Buildings 10 and 10A are brick masonry and steel roof truss structures with reinforced concrete floors and corrugated metal roof panels. The boiler room is a masonry block and steel frame roof structure with a reinforced concrete floor and prefabricated concrete roof panels.

The final radiological survey report (IT Corporation, 1997) concludes all surfaces within Buildings 10, 10A, and 10B are within allowed release limits for Th-232, the primary contaminant of concern. Total calculated residual surface activity in Building 10 was 31±6 µCi of beta emitters and 2±1 µCi of alpha emitters, for a total residual activity of 33±6 µCi.

3.1.7 Drum Storage, Buildings 11, 11A, and 11B

Building 11 contained a drum storage area (11 and 11A) and the lanthanide chloride evaporator area (11B) used as a process area to evaporate clarified rare earth chloride liquor into a solid material. Buildings 11 and 11A are brick masonry structures with steel roof trusses, reinforced concrete floors, and corrugated metal roof panels. Building 11B is a wood frame and steel roof truss structure with a reinforced concrete floor and corrugated roof panels (IT Corporation, 1997).

The final radiological survey report (IT Corporation, 1997) concludes all surfaces within Buildings 11, 11A, and 11B are within allowed release limits for Th-232, the primary contaminant of concern. Total calculated residual surface activity in Building 11, 11A, and 11B was 10±3 µCi of beta emitters and 3±2 µCi of alpha emitters, for a total residual activity of 13±4 µCi.

3.1.8 Waste Water Treatment, Buildings 14 and 14A

Building 14 is a wood frame and wood roof truss structure with a reinforced concrete floor and exterior corrugated metal walls and roof panels. Building 14A is a prefabricated metal building with structural steel frames and corrugated exterior walls and roof panels. It has a reinforced concrete floor. The waste water treatment facility contained rolling filters and secondary process equipment used to process liquid effluents prior to discharge to the sedimentation pond. It has been used since the 1960s to filter and recover lanthanides from the waste water.

Contaminated material resulting from the decontamination of building interior surfaces is stored in the building in containers. The waste water treatment structure was not included in the final radiological survey of site structures conducted in 1997. Following removal of stored material, Molycorp, Inc. plans to survey and take any necessary action to ensure the building either meets the criteria for unrestricted release or is dismantled and disposed of as waste at an appropriate NRC-approved facility (Daniels, 1999).

3.1.9 Storage Warehouse, Building 15

Building 15 is a prefabricated metal building with a structural steel frame, corrugated exterior metal wall and roof panels, and a reinforced concrete floor. The Storage Warehouse was used to receive and store process materials and equipment. It is currently used to store materials with potentially economic concentrations of lanthanides and soil samples from site characterization.

Building 15 was not included in the final radiological survey of site structures conducted in 1997. Following removal of stored material, Molycorp, Inc. plans to survey and take any necessary action to ensure the building either meets the criteria for unrestricted release or is dismantled and disposed of as waste at an appropriate NRC-approved facility (Daniels, 1999).

3.2 Surface and Subsurface Soils

Radionuclide concentrations and direct radiation levels for surface and subsurface soils at the Molycorp, Inc., York facility have been measured at various locations using a variety of methods. Locations, methods, and key results

of radiological soil characterization surveys are summarized in the Appendix, Table 1. A brief description of the surveys and key results follows.

Direct radiation levels outside and within close proximity to the perimeter fence are reported in Boerner (1985). Locations with elevated radiation levels were supplemented by analysis of soil samples by gamma spectroscopy to estimate radionuclide concentrations. Direct gamma exposure rates at 1 m (3.28 ft) above the surface at site perimeter locations were from 8 to 70 µR/hr with a maximum of 490 µR/hr. The highest exposure rates were measured on the southeast portion of the site caused by the presence of a contaminated pile of residue stored onsite. Boerner (1985) also sampled 8 boreholes in selected northwestern and eastern areas of the site for analysis by gamma spectroscopy. Concentrations of Ra-226, Th-228, Th-232, and U-238 in surface and subsurface soil were less than 4 pCi/g for all borehole locations except two (H7 and H8) located on or near the residue pile in the southeast corner of the property. At these two locations, both thorium and uranium were measured in concentrations above the NRC limits (i.e., 10 pCi/g above background) for unrestricted release (48 Federal Register 52061–52063), although it is recognized that demonstration of compliance with the NRC limits will be based on averaged soil concentration estimates rather than individual values (Berger, 1992). The concentrations at depth were below the NRC limits for unrestricted release. The residue pile and associated contamination adjacent to the perimeter fence were removed by the licensee following investigation (Boerner, 1985), sent to the licensees facility in Mountain Pass California and reprocessed.

In August 1992, Radiation Surveillance Associates, Inc. (1993) issued the preliminary radiological characterization report for the site. This survey included a surface gamma scan of the entire site property on a 7-m (23-ft) grid system and subsurface gamma measurements in 9 boreholes drilled to a depth of approximately 1.8 m (6 ft). Subsurface gamma intensities were using an NaI probe attached to a scaler. The boreholes were placed in areas determined by the surface survey to be contaminated, with the exception of Borehole 4, located in an area never used to store or process radioactive material. Radiochemical analyses of two soil samples were also conducted. Approximately 4 percent of the surface gamma exposure rates were elevated (above 30 µR/hr). Elevated gamma measurements occurred principally in the eastern portion of the site extending from adjacent to the REC Building to the northeastern corner of the site east of the surface water retention basin. An area of elevated gamma measurements (in August 1992) near barrels containing radioactive materials at the northern corner of the site west of the warehouse was resurveyed on January 1, 1993, after the barrels had been removed. The new measurements were within the normal background (6–10 µR/hr), indicating the earlier measurements were influenced by radiation from the contents of the barrels.

The subsurface borehole survey performed by Radiation Surveillance Associates, Inc. (1993) showed contamination was generally restricted to within 0.5 m (1.5 ft) of the surface and was greatest in Borehole 7. The maximum Th-232 equivalent concentration calculated from the gamma intensity was 58.5 pCi/g at a depth of 0.3 m (1 ft) in Borehole 7, located in the northeast corner of the site near the intersection of Olive and Sherman Streets. Thorium isotopic analyses were conducted on two soil samples [surface and 0.6 m (2 ft) below surface] near Borehole 7. Selected surface soil activities are shown in Table 1 of the Appendix.

In 1995, supplementary site characterization surveys were completed by Foster Wheeler Environmental Corporation (1995b). The surveys included 143 downhole gamma logs of geoprobe punch borings (gamma punch) to bedrock on a 20-m (66-ft) grid and 10 soil borings analyzed by gamma spectroscopy to determine Th-232 and Ra-226 concentrations (206 samples). Twenty of the soil boring samples exhibiting elevated concentrations of Th-232 and Ra-226 were isotopically analyzed for thorium, uranium, and radium. An additional set of gamma logs to bedrock was conducted on a 10-m (33-ft) grid for areas exceeding 20 µR/hr from the prior direct gamma survey of the site [7-m (23-ft) grid] by Radiation Surveillance Associates, Inc. (1993). Gamma spectroscopy results show concentrations of Th-232 in the 199 samples were less than the NRC limits (for thorium under unrestricted release)

(48 Federal Register 52061–52063). Seven samples showed elevated concentrations, with the maximum concentration of Th-232 at 97.0 pCi/g. To determine a factor to convert the gamma log count rate results to soil concentrations of Th-232 + Ra-226, Foster Wheeler Environmental Corporation (1995b) correlated the gamma count and spectroscopy results using linear regression. Following conversion of the gamma counts to soil concentrations, areas of the site with Th-232 + Ra-226 concentrations above 10 pCi/g were identified in Figure 2-1 of the decommissioning plan as the areas to be excavated during soil remediation activities (Radiological Services, Inc., 1999).

The downhole gamma logging results were also used to determine the depth and areal extent of soils with combined Th-232 + Ra-226 concentration greater than 10 pCi/g. This information was used to estimate the volume of soil expected to be excavated. The resulting volume estimates include 2,400 m^3 (3,100 yd^3) if the clean overburden is separated from the contaminated soil, or 3,200 m^3 (4,200 yd^3) if no separation takes place (Radiological Services, Inc., 1999).

Following review of the Molycorp, Inc. site radiological characterization studies for soils, the NRC staff finds 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 (48 Federal Register 52061–52063).

3.3 Surface Water, Sediments, and Groundwater

3.3.1 Surface Water and Sediments

Radiological analyses of surface water and sediment samples from the site and from adjacent areas collected were reported by Boerner (1985) and Foster Wheeler Environmental Corporation (1995b). A summary of various survey results is provided in the Appendix, Table 2.

Gross alpha and beta concentrations measured for standing water on the site, from a drainage way adjacent to and east of the site, at the surface water discharge into Mill Creek, and collected from surface water in the quarry north of the site showed generally low levels of radiological contamination. One exception was for radionuclides (U-238, Th-228, Th-232, Ra-226) measured in sediment collected from the drainage retention basin located at the northern margin of the site. Concentrations of uranium and thorium were elevated above unrestricted release limits (48 Federal Register 52061–52063) of 10 pCi/g above background, although it is recognized that demonstration of compliance with the NRC limits will be based on averaged rather than single-soil concentration values (Berger, 1992). Concentrations of the same radionuclides from sediment samples collected offsite from potential drainage pathways from the facility were below the unrestricted release criteria. Areas in the drainage basin sediments with elevated concentrations of uranium and thorium will subsequently be cleaned and surveyed to ensure levels are below NRC criteria prior to license termination.

Following review of the characterization of surface waters around the York site by Molycorp, Inc., NRC concludes the characterization is adequate and radiological contamination of surface waters is below levels that would be a concern for environmental impacts. The planned soil remediation will reduce the source of contamination for surface waters, and, as a result, the surface water concentrations are expected to decrease following soil remediation and be below NRC limits.

3.3.2 Groundwater

Molycorp, Inc. measured site groundwater concentrations of various metals and radionuclides associated with historical processing operations. Specific results of these studies are summarized in the Appendix, Table 3. Key aspects of these studies are also described in the following paragraphs.

An investigation of the shallow groundwater aquifer at the Molycorp, Inc. York site in December 1989 and March 1990 by Vail Engineering, Inc. (1990) concluded high conductivity in the shallow groundwater at the site primarily resulted from leakage of underground pipe lines and sumps carrying water to the treatment plant. This study did not investigate the potential for contamination by radionuclides. Occasional overflows and spills of process water are likely to have contributed to contamination of groundwater. Historical spillage of ore concentrate and waste occurred from storage at the site. Continued leakage from subsurface soils did not appear a significant cause. A shallow well pumping program was implemented to contain groundwater with excessive concentrations within the site area and to remove contaminated water from the aquifer.

Radiological analysis of three water samples collected from boreholes at the site in June 1985 by Boerner (1985) resulted in low gross alpha and beta activity. Water samples collected from five monitoring wells (W13–W17) contained gross alpha levels greater than the prior samples with a maximum just below levels of radiological safety concern. Isotopic analyses were performed on one of the samples collected from a well near the clarifier effluent tank showing Ra-226, Ra-228, Th-232, and Th-228 concentrations to be low, but U-234 (11.1 pCi/L) and U-238 (11.8 pCi/L) were nearing a level of radiological safety concern.

In 1995, Foster Wheeler Environmental Corporation (1995b) measured dissolved radionuclide concentrations (thorium, radium, and uranium) in groundwater specimens collected during 2 sampling periods from 19 monitoring wells in overburden and shallow bedrock. Analyses of groundwater from the 10 monitoring wells in overburden resulted in low concentrations of Th-228, Th-232, U-235, Ra-226, and Ra-228 and slightly elevated levels of Th-230 (0.61–12.17 pCi/L), U-234 (0.77–8.90 pCi/L), and U-238 (0.61–9.01). Analyses of groundwater from the nine monitoring wells in shallow bedrock resulted in low concentrations of the thorium isotopes and somewhat elevated U-234 (0.46–15.35 pCi/L) and U-238 (0.41–14.52).

The characterization of groundwater at the York site by Molycorp, Inc. shows radiological contamination for most samples is well below levels that would be a concern for environmental impacts. Nonetheless, the upper end of the ranges of results for U-234 and U-238 are sufficiently elevated to suggest increased precision is needed to reduce the uncertainty and improve the confidence in estimates of the actual concentrations. The few measurements reported over a short time period do not provide enough data to establish whether concentrations are increasing or decreasing. While NRC expects the Molycorp, Inc. planned soil remediation will reduce the primary source of contamination for groundwater and thereby decrease future concentrations, more information is needed before potential impacts can be assessed. To address these concerns, Molycorp, Inc. has agreed to supplement its groundwater 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 all prior well locations and aid the determination of whether groundwater has been adversely impacted. Analysis of the new characterization results will help NRC determine if additional actions (e.g., groundwater remediation) are needed to mitigate impacts. As a result of this addition to planned decommissioning activities, NRC concludes the plan is acceptable for ensuring potential impacts to groundwater will be adequately characterized and addressed prior to license termination.

3.4 Air

Boerner (1985) reported measurements of the radioactivity of discharges from the tank room (Building 2) and REC (Building 10) scrubber exhausts monitored during periods in 1985 that included processing operations. Gross alpha concentrations ranged from less than $3.80 \times 10^{-15} \pm 5.00 \times 10^{-15}$ to $3.12 \times 10^{-13} \pm 0.64 \times 10^{-13}$ µCi/ml. Gross beta concentrations were from less than 5.10×10^{-15} to $2.87 \times 10^{-13} \pm 1.08 \times 10^{-13}$ µCi/ml.

Concentrations of thorium, uranium, and associated daughters were determined by Foster Wheeler Environmental Corporation (1995b) for 19 samples retained on filters through which on-site air was pumped in 1995 after active processing had terminated at the facility. Thorium concentrations are 8.0×10^{-17} to 4.5×10^{-16} µCi/ml, Ra-226 from 8.1×10^{-17} to 3.5×10^{-16} µCi/ml, U-238 from 1.1×10^{-16} to 1.2×10^{-15} µCi/ml, and U-235 from 7.0×10^{-18} to 2.5×10^{-17} µCi/ml. These concentrations were less than effluent concentrations limits allowed in 10 CFR Part 20, Appendix B, and are therefore found by NRC to be below levels that could lead to adverse environmental impacts. The 10 CFR Part 20, Appendix B, effluent limits apply to all source material licenses. While the reported air concentrations are for the operational period at the York site, they demonstrate the ability of Molycorp, Inc. to comply with the air effluent limit. Also, planned dust control measures and environmental air sampling (see Chapter 4) provide confidence that air quality will not be degraded during decommissioning activities to levels that exceed NRC limits in 10 CFR Part 20.

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

4.1 Decontamination of Equipment, Fixtures, and Tanks

Molycorp, Inc. plans for decontamination of equipment, fixtures, and tanks are provided in Addendum 1 to the site decommissioning plan (IT Corporation, 1996). Equipment and tanks will be deenergized, locked, tagged out, isolated and drained, or depressurized, as necessary. Equipment that cannot be economically decontaminated will be surveyed, and all equipment with contamination above the NRC limits for unrestricted release (Nuclear Regulatory Commission, 1983) or equipment suspected to contain radioactive material will be treated as radioactive waste. The majority of equipment will be relocated from its respective building area and decontaminated for unrestricted release at the waste treatment building. Those items too large to be economically moved will be decontaminated in place.

Scoping surveys will be conducted to identify areas of loose contamination that will be removed to prevent the possible spread of contamination during dismantling and relocation activities. Equipment will be disassembled and relocated from the process areas to the waste treatment building for additional decontamination. Prior to relocation, the exposed surfaces will either be decontaminated, containerized, or wrapped to prevent the spread of loose contamination during relocation activities. Where practicable, open ends of pipes and other equipment openings will be sealed. Large tanks and pieces of equipment may require decontamination in place rather than relocation to the waste treatment building.

Following decontamination, the equipment and tanks will be surveyed for unrestricted release in accordance with Molycorp, Inc. NRC-approved release procedure (“Surface Contamination Survey and Release for Equipment”). Items below the release limits will be staged in a clean lay-down area for unrestricted release. Items contaminated above the release criteria or with inaccessible surfaces that are potentially contaminated will be disassembled, as necessary, cleaned, and resurveyed. It is anticipated that decontamination techniques will consist of simple wiping, hand scrubbing, high-efficiency particulate air (HEPA) vacuuming, scraping, pressure washing, and carbon dioxide (CO_2) blasting.

Use of a centralized decontamination area allows for control of the equipment being decontaminated, radioactive waste generation, and environmental effluents. The following decontamination methods will be available in the waste treatment building:

- General Wipe Down and Hand Scrubbing. This method will be used on equipment and tools with limited contamination. The use of mild-cleaning surfactants may be incorporated to increase decontamination effectiveness. This method of decontamination is not practical for fixed contamination or large items that can be pressure washed more efficiently.

- Pressure Washing. This technology used water at pressures from 10,000 to 140,000 kPa (1,500 to 20,000 psi) to wash the surface free of loosely adhered and in the case of higher pressures, fixed contamination. Control of the effluents for this decontamination method is important to prevent the spread of contamination to surrounding areas. Nonhazardous detergents and soaps can be incorporated with pressure washing to improve effectiveness. Water will be controlled and collected from pressure washing activities and treated and released in accordance with Molycorp, Inc. NRC license SMB–1408 and all local, state, and federal regulations.

- CO_2 Blasting. This method of decontamination is used when conventional methods such as pressure washing are not efficient. Dry ice (or CO_2) blasting is similar to other abrasive blasting techniques but provides a nonhazardous, nonconductive, and nonwaste generating mechanical cleaning action. CO_2 pellets sublime to gas leaving only the contaminants behind. CO_2 blasting will be performed inside temporary enclosures to prevent spread of contamination.

Following review of the methods for decontamination of equipment, fixtures, and tanks, NRC concludes that the methods specified in the decommissioning plan are sufficient to minimize the potential for release of radiological contamination that could lead to environmental impacts.

4.2 Decontamination of Buildings

On completion of process equipment removal from affected buildings, characterization surveys of buildings will be conducted. Areas suspected of having contaminant permeation will be sampled to determine depth and quantity of contamination. Sampling may include core boring, paint scraping, and drain line sludge sampling. The samples will be analyzed and the most economical and practical decontamination methodology selected, if feasible.

Those buildings that contain residual contamination will be decontaminated below NRC guideline values (Nuclear Regulatory Commission, 1983) using the most economical and reliable method available. The Molycorp, Inc. objective is to free release all buildings above grade to allow demolition (if required) of clean buildings. Several buildings, identified as affected, will require some decontamination prior to performing the final status survey.

Areas that contain only loosely adhered contamination will be either HEPA vacuumed, hand wiped, or pressure washed to remove contaminants. Areas with imbedded or fixed contamination, which is not readily removed, will require more aggressive removal, such as CO_2 blasting. If these methods are unsuccessful or unsuited for decontaminating the buildings, more aggressive methods such as scabbling, scarifying, abrasive blasting, and structure removal may be required. Decontamination of ground-level floors will include only the top surface of the concrete slabs. Below-grade decontamination and excavation will be performed as part of the soil remediation phase of the overall decommissioning project. Material from demolition of ground-level floors during the soil remediation phase will be surveyed for contamination as will the soil areas underlying such floors (Daniels, 1999).

Electrical outlets and power boxes will be either deenergized and removed from service prior to decontamination or covered and protected from water spray during decontamination. Special attention will be required on above-grade horizontal surfaces, cracks, crevices, seams, and other areas where contamination could have accumulated during the processing life of the buildings. Localized ventilation with portable HEPA filters will be used to prevent the spread of contamination to surrounding areas and direct air flow away from workers during potential airborne producing activities.

Decontamination of building exteriors will be performed using the methods described herein; however, engineering controls (e.g., HEPA ventilation, containment, and affixative) will be necessary for contamination control when employing these methods. Special attention will be taken to avoid adverse weather conditions that would impede outside decontamination activities.

Spot surveys will be performed during decontamination to assess the effectiveness of the effort and to verify that the NRC limits for unrestricted release are being achieved.

In addition to the decontamination methods described for equipment, the following techniques may be available or required for decontaminating buildings.

- HEPA Vacuuming. This method involves vacuuming contaminated dust and fines from surfaces that are contaminated. The contaminant is vacuumed from the surface and deposited in the vacuum for packaging as radioactive waste. This technique is successful if the contaminant is not fixed or tightly adhered to the surface being cleaned. Oily and sticky contaminates cannot be removed readily with HEPA vacuuming. Air is exhausted through a 99.95 percent efficient filter for particle sizes 0.3 micron or larger.

- Abrasive Blasting/Vacuum Blasting. This technology involves blasting the surface being decontaminated with an abrasive (e.g., aluminum oxide or steel shot) to remove the outer surface layer of the target material. The method is much more aggressive than CO_2 blasting and also generates radioactive waste from the addition of blast media and target material. Incorporation of a reclaimer can reduce substantially the volume of radioactive waste, as well as reduce the amount of media required. A vacuum head can be used with the abrasive blaster, which collects the blast media and removed surface material. This will reduce the opportunity for contamination to spread and additional cleanup required compared to conventional abrasive blasters.

- Surface Scaling and Scabbling. These are destructive decontamination methods that physically remove a layer of the surface being cleaned. These techniques will be used to remove imbedded contamination on concrete surfaces if no other technique is successful and IT Corporation and Molycorp, Inc. mutually agree to proceed. These techniques involve the use of needle scalers, scabblers, and scarifiers to remove concrete surfaces.

Based on the NRC review of building decontamination methods described in the decommissioning plan and supporting documents, NRC concludes that the methods are adequate for ensuring that exposures are maintained as low as reasonably achievable (ALARA) and no adverse environmental impacts will result from building demolition.

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

The Decommissioning Plan for the York, Pennsylvania, Facility (Radiological Services, Inc., 1999) describes the proposed decommissioning activities and methods for protecting workers and the public during removal of contaminated soil. Demolition and removal of subgrade structures (e.g., building floor slabs, foundations, drains, and sumps) will be part of the soil remediation phase of decommissioning (IT Corporation, 1996). The licensee proposes to remove soil and other material with concentrations of thorium and radium above background greater than 10 pCi/g. Final surveys will ensure compliance with the NRC criteria for unrestricted release (48 Federal Register 52061–52063)(Option 1) relevant to Uranium and Thorium with daughters in equilibrium including adoption of the sum of fractions rule when more than one radionuclide is present. The soil and other material will be transported from the site to an NRC-approved interim storage or disposal facility.

The extent of surface and subsurface soils with Th-232 concentrations greater than 10 pCi/g is shown in Figure 2-1 of Foster Wheeler Environmental Corporation (1995a). The concentrations of Th-232 were determined from gamma logging of geoprobe punch borings (gamma punch) and 10 soil borings conducted during supplementary site characterization (Foster Wheeler Environmental Corporation, 1995). The licensee proposes to excavate materials with Th-232 plus Ra-226 concentrations greater than 10 pCi/g. The specific method used for a particular area of the site will be based on cost effectiveness and application of ALARA. First, Molycorp, Inc. will excavate and store clean overburden for later use as fill material, if needed. Contaminated soil will be excavated and stockpiled in a staging area on the site prior to transportation to the NRC-approved disposal facility. Molycorp, Inc. expects that excavation of soil to meet the Th-232 cleanup criteria will also serve to remove residual uranium contamination because the source of contamination (e.g., leaks and spills) is the same for both. Once remediated, the soil will be resurveyed in a manner consistent with NRC-accepted methods (Berger, 1992) to ensure residual thorium and uranium contamination meets the NRC criteria (48 Federal Register 52061–52063).

Following review of decommissioning plans for outdoor areas of the site, NRC concludes that 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 their current radiological condition) would constitute a violation of NRC regulations at 10 CFR 40.42(d), which require that licensees begin decommissioning their facility at the cessation of licenced 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 that the extension is not detrimental to the 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 previous factors are applicable to the decommissioning of the Molycorp, Inc. York facility.

In addition, approval of the request must also be in the public interest. NRC has determined that it is normally in the public interest to have radiologically contaminated areas remediated shortly following permanent cessation of operations. NRC has 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).

For these reasons, the NRC staff concludes that postponing the decommissioning of the Molycorp, Inc. York facility is not in the public interest.

6.2 Proposed Action, Cleanup of Site for Unrestricted Use and Shipment to an Approved Disposal Site

The proposed action is the remediation of radioactive material at the facility to levels that will permit unrestricted use of the site and termination of the license. The environmental impacts of the proposed action are discussed in Sections 4, 5, and 8. Cleanup of the York 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. Because the volume and concentration of the contaminated soils at the Molycorp, Inc. York facility are substantially less than the approved inventories of existing licensed waste disposal facilities, disposal of the contaminated soils at an existing licensed facility represents a small increase in the total inventory of the waste site and is therefore a reasonable option that eliminates the need for an additional waste disposal site at York and should not lead to adverse environmental impacts.

6.3 Alternatives Considered and Impacts

6.3.1 On-Site Storage at the York, Pennsylvania, Site

This alternative involves storage of excavated soils at the York facility for an indefinite period. On-site storage would delay the costs associated with disposal at a licensed NRC facility. This alternative is unfavorable because it removes the York property from productive use, thereby detracting from the economic potential of the local area. While on-site storage is less favorable than the proposed action, it is more favorable than on-site disposal (Section 6.3.2), which would permanently remove the land from productive use.

6.3.2 On-Site Disposal at the York, Pennsylvania, Site

Another alternative to the proposed action is to dispose the contaminated soils at the York site. This alternative is not favored because it removes the land from productive use, thereby creating an economic impact to the local community.

7.0 RADIATION PROTECTION PROGRAMS

7.1 Health and Safety Program

The selected decommissioning contractor will follow the IT Corporation (or equivalent) radiation protection procedures as described in the HS 700 Radiation Protection Program (Portman, 1999). This radiation protection program was reviewed by the NRC inspection staff and found in accord with the radiation protection standards in 10 CFR Part 20. The proposed action is limited in scope and not expected to include unique health and safety issues outside the scope of the radiation protection program. Therefore, NRC finds the HS 700 Radiation Protection Program adequate for the proposed action.

7.1.1 Corporate Organization and Administrative Procedures

The Molycorp, Inc. project manager will function as the representative of the decommissioning project and will provide oversight for all project activities. The project manager will coordinate cost and schedule reporting requirements with the Contractor Project Manager.

The Contractor Project Manager will maintain overall responsibility for performance of project operations for the duration of the project. The Contractor Project Manager reports directly to the Molycorp, Inc. Project Manager for all project related activities and any liaison with their corporate office for project oversight, management direction, and resolution of company related issues. The Contractor Project Manager controls all on-site professional, technical, and labor forces to ensure the adequate and timely completion of project tasks. Duties include the following:

- Maintenance of a single point contact for Molycorp, Inc. on all project related schedule, cost, safety and technical matters, including the coordination of any required communications, meetings, or updates;

- Coordination of the project staff to assure that adequate safety and radiological controls plans and procedures are enforced and that project operations are conducted efficiently and in compliance with all appropriate regulatory requirements;

- Provide sufficient staffing to support the scheduled completion of project tasks;

- Coordinate of appropriate procurement and subcontract activities in support of project goals and schedules

- Provide continuous monitoring of project status and performance and initiate any required corrective actions or reassignment of project personnel

- Report to Molycorp, Inc. representatives of actual and projected project costs and up-to-date scheduled status

- Resolve any cost or schedule related discrepancies or questions

- Comply with all required procedures, operating requirements, permits, or restrictions, and

- Maintain all appropriate project data, documents, and records and the compilation of a final report that accurately reflects the work performed.

The Radiological Engineer will participate in project planning and final reporting activities to ensure regulatory compliance, the adequacy of plans and procedures, and the appropriate development of project specific plans and work instructions. For radiological safety, Molycorp, Inc. intends to use Radiation Protection Procedure HS700 (Portman, 1999). The Radiological Engineer will also be responsible for assuring radiological safety in the execution of decommissioning activities. The Radiological Engineer will also be responsible for ensuring that radiation exposure to personnel and the environment is maintained ALARA and is at all times within regulatory and administrative limits. The Radiological Engineer will report administratively to the Contractor Project Manager and will perform the following:

- Manage the radiological information obtained from the Site Characterization Report and Final Radiological Status Surveys, including performing all calculations to show compliance with project objectives;

- Prepare the Final Radiological Status Survey Report;

- Oversee the bioassay program to ensure proper monitoring of internal and external exposures, and assist in the training of individuals in the biological effects of radiation, as needed

- Prepare and/or review project specific plans, procedures, and work instructions to ensure compliance with applicable guidelines, regulations, and ALARA policies;

- Assist the Site Health and Safety, Radiation Safety Officer, and Radiation Health and Safety Technicians in the performance of the field effort; and

- Provide radiological calculations for dose assessment, ALARA, and safety conditions

The Site Manager will report directly to the Contractor Project Manager and will be responsible for the day-to-day activities on the project. The Site Manager will also be responsible for ensuring that personnel are provided the correct health ands safety resources, as required. The Site Manager will also be responsible for the coordination of daily activities with the Site Health and Safety/Radiation Safety Officer to ensure proper planning, organizing, directing, and controlling of project activities in a manner that does not conflict with the safety and health of employees performing work activities. Specifically, the Site Manager will ensure the safety and health of employees during all project activities and will allocate the necessary resources to ensure that required safety and health activities are carried out. The Site Manager will be responsible for enforcing all applicable plans, procedures, and instructions affecting safety and health. The Site Manager is further responsible for the day-to-day oversight of all

subcontractor activities to ensure that those activities are being performed in a manner consistent with all health and safety requirements.

The Site Health and Safety, Radiation Safety Officer (RSO) will report directly to the Site Manager for the day-today performance of project radiological activities. The RSO will receive direction from the Corporate Health Physicist or Designee (who will be a Certified Health Physicist), in the administration of all project radiological controls programs, final release activities, appropriate documentation, and compliance with all appropriate plans, procedures, practices, and regulatory requirements. The RSO will be responsible for the following:

- Develop the Site Health and Safety Plan, implementing the specific provisions of the plan, and ensure that all site employees, subcontractors, and visitors understand the requirements of the plan;
- Function as the Site Health and Safety Officer with responsibility for implementing the Site Health and Safety Plan
- Assist the Site Manager and other project personnel in the preparation of work plans and procedures
- Conduct appropriate surveys and inspections while ensuring radiological and industrial safety hazards are appropriately identified and that necessary precautions are in place prior to the initiation of work activities;
- Specify appropriate safety and radiological controls, precautions for work permits and work procedures;
- Direct the day-to-day activities of the Radiation Health and Safety Technicians in the performance of project operations and the selection of instrumentation and decontamination techniques appropriate for protecting personnel and reducing exposures;
- Monitor work in progress to ensure compliance with project plans and procedures, regulatory requirements, and good radiological work practices;
- Prevent the performance of work activities that may jeopardize the safety of personnel, violate approved plans, procedures, or practices, or could result in the release of contamination
- Review and maintain all appropriate project personnel and radiological records, including survey data, training documentation, certification and qualification records, release survey records, permits, licenses, and instrumentation records;
- Maintain radiological supplies and instrument inventories; and
- Inspect and assist in the preparation of excavated materials for disposal, including appropriate radiological survey and assay activities.

Following review of the key job positions responsible for radiological safety during decommissioning, the NRC concludes the job descriptions are adequate to provide confidence that radiological safety will be maintained during the proposed decommissioning of the York site.

7.1.2 Qualifications

The minimum qualifications of the Contractor Project Manager are a BS degree in physical sciences, chemistry, biology, math, or engineering and two years of experience in managing nuclear or hazardous waste decontamination and remediation projects; or four years of experience managing nuclear or hazardous waste decontamination and remediation projects or equivalent experience.

The minimum qualifications for the Radiological Engineer include one of the following:

- M.S. degree in radiological health, nuclear physics, or health physics and two years of experience as a health physicist or radiological engineer at nuclear facilities or in nuclear decontamination and remediation projects; or

- M.S. degree in physical sciences, chemistry, biology, mathematics, or engineering and three years experience as a health physicist or radiological engineer at nuclear facilities or decontamination and remediation projects, or

- B.S. degree in radiological health, nuclear physics, or health physics and four years of experience as a health physicist or radiological engineer at nuclear facilities in nuclear decontamination and remediation projects, or

- B.S. degree in physical sciences, chemistry, biology, mathematics, or engineering and six years of experience as a health physicist or radiological engineer at nuclear facilities or in nuclear decontamination and remediation projects.

The minimum qualifications for the Site Manager position consist of one of the following:

- B.S. degree in physical sciences, chemistry, biological sciences, mathematics, or engineering and two years of experience supervising personnel on nuclear jor hazardous waste decontamination and remediation projects; or

- Four years of experience supervising personnel on nuclear or hazardous waste decontamination and remediation projects.

The minimum qualifications for the RSO position consist of one of the following:

- Two years of experience as a RSO on nuclear decontamination and remediation projects or equivalent health physics experience; or

- Certification as an Occupational Health and Safety Technician

Following review of the job qualifications for key personnel responsible for radiological safety, the NRC concludes the qualifications are adequate for ensuring radiological safety from the proposed decommissioning activities.

7.1.3 Training

A training program will be established that meets the following goals:

- Meet or exceed the applicable training requirements specified by the NRC, Occupational Safety and Health Organization, and the Environmental Protection Agency;

- Ensure that all personnel are knowledgeable of requirements of their jobs and are competent in the operation of equipment they use, are safe in their work practices, and understand all risks associated with their work environment;
- Ensure that personnel will meet the requirements specified by Molycorp, Inc. to work at the York site;
- Ensure that personnel maintain a high level of competency in all qualified areas; and
- Indoctrinate new employees to ensure that they understand all requirements that they are expected to meet
- All contractor and subcontractor personnel working on the site will be trained in accordance with the applicable requirements of 29 CFR 1910 or 1926 before participating in decommisioning activities.

NRC concludes the training program is adequate for ensuring radiological safety during the proposed decommissioning activities at the site.

7.1.4 Security

Security at the Molycorp, Inc. York facility is maintained by maintenance of a fence around the perimeter of the site with controlled entry exit at the front gate. NRC concludes this is an adequate level of security to ensure radiological safety will be maintained during decommissioning activities at the site.

7.1.5 Effluent Control Techniques

A variety of effluent control techniques will be used to minimize the potential for off-site migration of radionuclides. For activities that have the potential to generate dusts a combination of soil wetting and HEPA air filtration in the immediate work environment will be employed, as needed. Runoff of liquid effluents will be controlled by use of the existing drainage system which terminates in an on-site catchment basin.

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

7.1.6 External Radiation Exposure 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 RSO when issuing a radiation work permit. The primary dosimiter in use will be the thermoluminescent dosimeter (TLD), however, other types such as self-reading pocket dosimeters or extremity TLD's will be employed, as conditions warrant. TLDs will be processed monthly and records for all recipients of dosimeters will be maintained by the RSO.

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

7.1.7 Airborne Radiation Exposure 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, respirators), and determine whether exposures are being

maintained ALARA. A combination of general air samplers and lapel samplers will be used to ensure compliance with 10 CFR 20 limits.

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

7.1.8 Bioassay Program

A urine bioassay program will be used for all workers that are 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. The frequency of samples collected during the work will depend on the severity of the hazard as determined by the RSO. Urine bioassay samples will be analyzed by Molycorp, Inc. and an approved laboratory.

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

7.1.9 Contamination Control Program

Access controls to controlled areas will be used to control exposures to workers and visitors and 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. Further measures to ensure contamination control include the following:

- Posting areas with removable contamination in excess of guidelines;
- Requiring personnel who enter controlled areas to wear anti-contamination clothing specified by the applicable radiation work permit;
- Ensuring that personnel removed contaminated clothing properly and place used anti-contamination clothing in designated recepticles;
- Monitoring personnel, materials, and equipment for the presence of radioactive contamination upon exiting or removal from the controlled area, and decontaminating personnel or equipment, or controlling items 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.

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

7.1.10 Airborne Environmental Monitoring Program

The primary pathway for off-site releases from decommissioning activities is through resuspension and airborne transport of contaminated soil during excavation. To measure off-site impacts, Molycorp, Inc. proposed the use of two high-volume air samplers at the site boundary (one in each of the prevailing upwind and downwind

directions) and a third background location within a mile of the facility. Use of three air samplers is consistent with acceptable practices for uranium processing facilities regulated by the NRC. Molycorp, Inc. does not anticipate the proposed action will result in the generation of off-site, airborne concentrations that would result in dose to a member of the public in excess of the dose limits in 10 CFR Part 20 (Daniels, 1999). Dose estimates for a site boundary receptor, based on estimates of airborne soil releases from excavation activities, result in a 0.06 mrem dust inhalation dose for the duration of the proposed action (ICF Kaiser Engineers, Inc., 1997). The off-site (public) dose limit in 10 CFR Part 20 is 100 mrem. Given the low estimated exposure beyond the site boundary, the three air samplers are adequate for off-site monitoring of potential releases to ensure compliance with the dose limits of 10 CFR Part 20.

7.1.11 Groundwater and Surface water Monitoring Programs

Prior studies conducted on samples of groundwater at the site are discussed in section 3.3.2. Following consideration of the results of past studies, Molycorp, Inc. plans to implement additional groundwater monitoring at all prior sampling locations prior to license termination to establish improved trend information. This additional survey information will aid the NRC in determining whether groundwater has been adversely affected by activities at the site.

Surface water studies are described in section 3.3.1. In general, surface water samples have shown low levels of radionuclides. Site remediation is expected to remove the source of surface water contamination, therefore, additional sampling of surface water is not needed.

Following review of the groundwater and surface water monitoring programs, NRC concludes the proposed programs are adequate for detecting potential environmental impacts prior to license termination and are therefore adequate.

7.1.12 Quality Assurance

During the course of the York site decommissioning project, one or more audits of project activities and records will be performed by qualified personnel 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 all portable radiological instruments will be performed semi-annually, 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 the RSO will determine whether or not a given instrument requires calibration more frequently than semi-annually. Radiological field survey equipment and laboratory analysis equipment will be calibrated by qualified personnel using standards traceable to the National Institute of Standards and Technology (NIST). Calibration labels will be used to identify calibration date and records will be maintained on file with the manufacturers operating manuals.

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

7.2 Radioactive Waste Management Program

The planned radioactive waste management program at the Molycorp, Inc. York site includes identification, characterization, segregation, packaging, labeling, manifesting, and transporting waste in accordance with NRC. U.S. Department of Transportation (DOT), and other applicable federal, state, and local regulations. Radioactive materials consist of equipment, tools, process material, building debris, decontamination materials (e.g., rags, wipes, or filters), decontamination waste (i.e., water and blast media), soils, residual process equipment waste (sludges), and used personal protective equipment.

Because Molycorp, Inc. intends to comply with all applicable requirements, NRC finds the planned radioactive waste management plans adequate for the materials at the York facility, and no adverse environmental impacts are expected from waste management activities at the site.

8.0 ENVIRONMENTAL IMPACTS

8.1 Radiological Release Criteria

The principal radiological constituents identified during site characterization are Th-232, Th-228, U-238, and Ra-226. Soil release criteria are provided in Table 8.2. These limits will be applied independently except in areas with mixed radionuclides where the sum-of-ratios approach will be used.

The criteria in Table 8.2 have been previously approved for unrestricted release of uranium and thorium contaminated sites, therefore, further analysis of the limits is not necessary. In addition, Molycorp, Inc. will remediate any surface contamination (on equipment and structures) within the NRC limits specified for unrestricted release (Nuclear Regulatory Commission, 1983).
These limits are provided in Table 8.1.

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	5,000 α dpm/100 cm^2	15,000 α dpm/100 cm^2	1,000 α dpm/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	300 dpm/100 cm^2	20 dpm/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	3,000 dpm/100 cm^2	200 dpm/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	15,000 dpm/100 cm^2	1,000 dpm/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.

When surface contamination results from a mixture of radionuclides, and gross alpha measurements are used, Molycorp will use the most restrictive limit from table 8.1. This approach was used for the final radiological survey for buildings at the York site (IT Corporation, 1997). Survey methods were conducted in accordance with NUREG/CR-5849 (Berger, 1992) as noted in Section 3.

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

NRC has issued a draft EA for license SMB–1393 pertaining to the Molycorp, Inc. Washington Site. This EA included analyses of the radiological impacts to workers and the public from

Table 8.2
Soil release criteria[1]

Radionuclide	Maximum Soil Concentration (pCi/g)	Reference
Natural Thorium (Th-232 plus Th-228) if all daughters are in equilibrium	10	(48 Federal Register 52061–52063)
Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium	10	(48 Federal Register 52061–52063)

[1]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.

excavation and transportation of York soils (ICF Kaiser Engineers, Inc., 1997). Supplementary information for the York decommissioning plan includes additional analyses of worker exposures from normal operations and an assessment of the potential for accidents (Daniels, 1999). Because of the limited nature of activities planned for

the York facility, potential worker exposures will most likely result from inhalation of airborne dust and shine from direct radiation. Potential public exposures are limited to inhalation of contaminated airborne dusts. The following sections summarize results of both worker and public radiological exposure estimates.

8.2.1 Radiological Impacts to Workers From Planned Decommissioning Activities

Planned decommissioning activities that could bring workers in contact with radioactive materials include any additional characterization work, decontamination and demolition of buildings and associated structures (piping, foundations), and remediation of soils. In supplemental information for the decommissioning plan (Daniels, 1999), Molycorp, Inc. indicates that past activities resulted in no measurable internal or external dose to any workers. These past activities included building decontamination and radiological characterization similar to the proposed activities. Therefore, radiation doses to workers from these activities are expected to be well within the limits of 10 CFR Part 20. For excavation and loading of contaminated soils, Molycorp, Inc. provided dose calculations as part of an assessment of impacts from transportation and storage of the York waste at the Molycorp, Inc. Washington, Pennsylvania, facility (ICF Kaiser Engineers, Inc., 1997). Separate dose calculations were performed to assess impacts from (1) direct radiation to occupational receptors, (2) inhalation of dusts by occupational receptors, and (3) incidental ingestion of soil by occupational receptors. These calculations were based on assumptions consistent with or more conservative than planned activities specified in the York decommissioning plan. For this calculation, MolyCorp, Inc. assumed a total volume of soil of 3,800 m^3 (5,000 yd^3) was shipped at 10.7 m^3/truck (14 yd^3/truck) for a total of 357 loads from York to Washington, Pennsylvania, and an average soil concentration of thorium at 27 pCi/g. The actual amount of soil to be shipped is expected to be less than 3,800 m^3 (5,000 yd^3), so the value used for the calculations is bounding. The maximum dose reported was for the excavator at York—estimated to receive a dose of 10.6 mrem (predominantly from external exposure). The NRC 10 CFR Part 20 annual worker dose limit is 5 rem (5,000 mrem). Therefore, because the estimate is well below this limit, no adverse impacts are expected based on the exposure calculations.

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

Potential radiological impacts to the public from normal decommissioning operations at the Molycorp, Inc. York facility are limited to similar release mechanisms pertaining to worker exposures (decontamination and excavation dusts), but require transport over greater distances to reach potential receptors. Therefore, much lower concentrations and doses are expected for members of the public in comparison to workers. Because Molycorp, Inc. indicates that worker exposures during past activities were undetectable, the public doses from these activities similarly should be undetectable. At the York site boundary, estimates of potential public exposures from excavation were calculated as 0.059 mrem/yr (ICF Kaiser Engineers, Inc., 1997). This dose is well below the NRC public dose limits (10 CFR Part 20) of 100 mrem/yr providing confidence that the potential for adverse environmental impacts is low. Another potential pathway for public exposure is groundwater. Molycorp, Inc. has amended its decommissioning plan to include additional groundwater characterization to reduce uncertainty in current estimates and determine whether mitigative measures (such as remediation or additional data collection) are warranted. Therefore, the NRC concludes that Molycorp, Inc. has provided adequate plans to ensure that potential radiological impacts to members of the public from the proposed action will not exceed NRC limits and are unlikely to result in adverse environmental impacts.

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 interim storage or disposal 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 York soil (including excavation, loading, transport, and unloading) have been

assessed as part of investigations related to the Washington site (ICF Kaiser Engineers, Inc., 1997). Separate dose calculations were performed to assess impacts from (1) direct radiation to occupational receptors, (2) inhalation of dusts by occupational receptors, (3) incidental ingestion of soil by occupational receptors, (4) inhalation of dusts by site boundary (public) receptors, and (5) direct radiation to site boundary (public) receptors[1]. These calculations were based on assumptions consistent with plans specified in the York decommissioning plan. Molycorp, Inc. assumed a total volume of soil of 3,800 m^3 (5,000 yd^3) was shipped at 10.7 m^3/truck (14 yd^3/truck) for a total of 357 loads from York to Washington, Pennsylvania, with an average soil concentration of thorium at 27 pCi/g. The actual amount of soil anticipated to be shipped is less than 3,800 m^3 (5,000 yd^3). Therefore, the value used in the calculations is bounding. The most significant exposure pathway for the truck driver was from direct exposure. The total radiation dose to the truck driver was estimated at 5.42 mrem for all shipments (including loading, transport, and unloading) and 3.33 mrem for the total driver dose during transport only (for comparison, the 10 CFR Part 20 occupational dose limit is 5,000 mrem/yr). Should the waste be transported to another storage or disposal facility, the travel distance could increase and thereby increase the in-transport dose. For example, NRC staff have considered impacts of shipping the material to the Envirocare waste facility in Clive, Utah, by scaling the doses calculated for transport to Washington, Pennsylvania, by the relative difference in distance traveled [i.e., for a trip of approximately 3,515 km (2,200 mi) from York, Pennsylvania, to Clive, Utah, versus 405 km (250 mi) from York, Pennsylvania, to Washington, Pennsylvania, resulting in a factor of 8.6]. The resulting total dose to the truck driver is thus estimated at 31 mrem for all shipments (i.e., driver transport dose multiplied by Utah scale factor plus 2.1 mrem from loading and unloading). This value is still well below the NRC occupational dose limit in 10 CFR Part 20. It is expected that any public doses from transport would be far less than that for the driver due to the increased distance and exposure time to the transported material under common transportation conditions. The NRC staff review of these calculations indicates all the calculated doses and intakes are well within NRC limits. Therefore, Molycorp, Inc. has provided an adequate basis for concluding the planned decommissioning activities are unlikely to result in adverse environmental impacts.

8.3 Radiological Accident Analysis

The supplemental information for the York facility decommissioning plan (Daniels, 1999) states that potential site accident scenarios are unlikely to lead to doses that exceed 1 percent of the 10 CFR Part 20 dose limits. Potential accident scenarios considered include fire and loading or transfer mishaps. Considering the low potential for fire or explosion in existing building structures, the low quantities of material used during transfer operations, and the lack of highly concentrated radioactive materials at the site, the NRC concludes that accidental releases of radioactive materials in quantities that could affect public health and safety are unlikely. Transportation of waste classified as low-specific activity (LSA) under NRC and DOT regulations, is unlikely to lead to adverse environmental impacts. LSA materials are routinely shipped safely in the United States and compliance with NRC packaging regulations provides assurance that an adequate margin of radiological safety is maintained. Molycorp, Inc. has a procedure in place for emergency response and notifications that provides additional safety assurance (Daniels, 1999). Therefore, NRC concludes the Molycorp, Inc. has adequately addressed the potential for radiological accidents.

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[1]The variations in radon levels make it very difficult to distinguish between naturally occurring radon and radon resulting from licensed material. In addition, it is impractical to predict prospective doses from exposure to indoor radon due to problems in predicting the design features of future building construction. Because of these variations and the limitation of measurement techniques, the Commission believes that it is not practical for licensees to distinguish between radon from licensed activities at a dose comparable to a 25 millirem/year dose criterion and radon which occurs naturally.

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, demolition of buildings, and removal of concrete floors that exceed the radiological criteria for unrestricted release. These are the only operations with a potential to affect the environment. During scoping and characterization surveys, an assessment of each building will be performed to identify the presence of hazardous or mixed wastes. The survey will detail items requiring disposal, recycling, or management as hazardous substances. Complete characterization and management of such wastes will serve to limit any nonradiological impacts, if present. Therefore, NRC concludes that Molycorp, Inc. has an acceptable plan for controlling potential releases of nonradiological hazardous materials.

8.4.2 Economic Impact

Industrial production capability no longer exists at the York site and only custodial and monitoring actions routinely occur. 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 the potential for positive economic impacts exists upon release of the site.

8.4.3 Transportation

Less than 357 shipments of contaminated soil are expected at a rate of 5 trucks per day over 71 days as a result of the proposed action. This level of activity is not expected to significantly impact local transportation systems nor result in a significant increase in vehicle exhaust or accident risks. Using a general fatal accident risk rate for truck transport of 3.8×10^{-8} fatal accidents/km traveled (Nuclear Regulatory Commission, 1997), the round trip distance from York to the Envirocare waste facility in Clive, Utah [7,030 km (4,390 mi) from York], and the estimated 357 shipments, the resulting number of estimated fatalities is 0.09 for the entire project. Transport to the Envirocare facility is a conservative assumption used for the purpose of estimating potential impacts. When an NRC-approved storage or disposal site is selected, the transportation distance is unlikely to be greater than the transport distance to Envirocare. This low level of estimated fatalities for planned transportation supports the conclusion that transportation will not result in adverse impacts.

8.4.4 Air Quality and Noise

Air quality and noise are expected to have moderate impact as a result of the demolition of buildings and excavation/removal of soil and concrete associated with the proposed action. Molycorp, Inc. plans to incorporate control measures such as filtered ventilation and surface wetting to limit fugitive dust generation. Noise impacts are likely to vary over time, but some activities will generate considerable levels of noise. The long-term benefits to the local community of decommissioning the York site are expected to exceed short-term inconveniences, and these are expected to be comparable to normal construction/demolition activities.

8.4.5 Environmental Justice

There are no environmental justice issues with the Molycorp, Inc. York site because there are no disproportionately high minority or low-income populations near the site.

8.4.6 Endangered Species

The Licensee has contacted the Pennsylvania Field Office of the U.S. Fish and Wildlife Service and determined that there are no endangered species on the York site.

9.0 AGENCIES AND INDIVIDUALS CONSULTED

In accordance with NRC Memorandum of Understanding with the Pennsylvania Department of Environmental Protection (PADEP), NRC staff has consulted with PADEP in the preparation of this EA. On August 24, 1999, PADEP provided comments on the EA. These comments mainly focused on two issues: 1) the need for Molycorp to identify the location and impacts associated with disposals of waste prior to obtaining a license from NRC in 1981 and; 2) the question of whether small concentrations of uranium and its daughter products exist in a state of equilibrium on the Molycorp Washington site. Responses to these questions were provided to PADEP in a letter from NRC on March 7, 2000. In addition, the U.S. Fish and Wildlife Service has been notified of the planned decommissioning of the York facility and has indicated to NRC that no endangered species or habitat will be affected by planned decommissioning activities. Similarly, the State of Pennsylvania Historic Preservation Officer has been notified of planned decommissioning of the York facility and has notified NRC that no historic preservation concerns exist with the Molycorp, Inc. York property.

10.0 RECOMMENDED LICENSE CONDITION

Prior to building demolition, Molycorp, Inc. shall ensure one of the following actions are taken regarding building areas that do not meet the NRC guidelines for unrestricted release: 1) all areas within $1m^2$ survey grids that exceed guideline values (Nuclear Regulatory Commission, 1983) will be decontaminated and re-surveyed using methods consistent with NUREG/CR-5849 (Berger, 1992) to show compliance with the NRC guidelines as planned by Molycorp, Inc. on page 6-1 of the final survey report (IT Corporation, 1997); 2) identify the building materials that exceed the NRC guidelines for unrestricted release and plan for disposal of all such material in an NRC approved facility; or 3) provide additional information and/or analyses which clearly demonstrate that any 1 m^2 survey grids previously reported as not meeting the guidelines for unrestricted release (Nuclear Regulatory Commission, 1983) can be shown to meet the guidelines using methods in NUREG/CR-5849 (Berger, 1992). Sampling grids indicated to be above the NRC guidelines in the Molycorp, Inc., final survey report (IT Corporation, 1997) include sampling grid L12 in building 1; and Room 3 west wall grids B17, B23, B24, and C24 in Building 2.

11.0 REFERENCES

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APPENDIX

Table 1
Summary of radiological surveys of soils at Molycorp, Inc. York site

Location	Survey Method	Key Survey Results	Reference
Site perimeter	Direct gamma scan (1m)	8–70 µR/hr (max = 490 µR/hr)	Boerner, 1985
Off-site surface background and uncontaminated site location	Direct gamma scan (1m)	~8.4 µR/hr	Radiation Surveillance Associates, Inc. 1993
Site surface and subsurface	Gamma spectroscopy (eight locations)	<4 pCi/g Ra-226 and Th-232 except 2 surface locations: Hole 7: Th-232 16.1 pCi/g U-238 15.0 pCi/g Hole 8: Th-232 1240 pCi/g Th-228 1310 pCi/g U-238 460 pCi/g Ra-226 120 pCi/g	Boerner, 1985
Entire site soil surface	Direct gamma scan (1m) using 7m Grid	4% of measurements > 30 µR/hr (max = 156 µR/hr)	Radiation Surveillance Associates, Inc. 1993
Site subsurface, nine boreholes in areas with elevated gamma or process history	Gamma using NaI probe and scaler	No average reported, most boreholes <10 pCi/g (Th-232) max 58 pCi/g (Th-232)	Radiation Surveillance Associates, Inc. 1993
Site surface and subsurface at single location with elevated gamma	Gamma using pressurized ionization chamber, isotopic analysis by radiochemical separation and alpha spectroscopy	48.7 µR/hr surface gamma 28.8 pCi/g Th-232 (surface) 1.89 pCi/g Th-232 (–2 ft)	Radiation Surveillance Associates, Inc. 1993
Site subsurface and few offsite (background)	Gamma (punch) logging on 20m site grid (n = 143), conversion to concentration using regression to gamma spec results	42% of punches > 5 pCi/g 17% of punches > 15 pCi/g 2 punches > 50 pCi/g (all are Th-232+ Ra-226 above background of 2 pCi/g)	Foster Wheeler Environmental Corporation, Inc., 1995
Site surface and subsurface	Isotopic analysis by gamma spec of 206 samples from 10 boreholes	All but 7 samples < 5 pCi/g Th-232 and Ra-226 max = 97 pCi/g Th-232 27 pCi/g Ra-226	Foster Wheeler Environmental Corporation, Inc., 1995

Table 2
Summary of surface water radiological surveys for Molycorp, Inc. York site

Location	Survey Method	Key Survey Results	Reference
Standing water onsite	Gross alpha and beta count	Total alpha = 7.86 pCi/L Total beta = 18.7 pCi/L	Boerner, 1985
Water in adjacent drainage way east of site	Gross alpha and beta count	Total alpha = 2.35 pCi/L Total beta = 12.5 pCi/L	Boerner, 1985
Water in quarry north of site	Gross alpha and beta count	Total alpha < 1.22 pCi/L Total beta = 2.74 pCi/L	Boerner, 1985
Surface discharge into Mill Creek	Gross alpha and beta count	Total alpha = 0.62 pCi/L Total beta = 2.59 pCi/L	Boerner, 1985
Sediment from drainage retention basin	Gamma spectroscopy	Ra-226 = 9.06 pCi/g Th-232 = 160 pCi/g Th-228 = 170 pCi/g U-238 = 140 pCi/g	Boerner, 1985
Surface water in quarry north of site	Gross alpha and beta count	Ra-226, Th-228, Th-232, U-238 each <3.0 pCi/L	Foster Wheeler Environmental Corporation, 1995
Sediments in quarry north of site	Gamma spectroscopy	Ra-226, Th-228, Th-232, U-238 each <5 pCi/g	Foster Wheeler Environmental Corporation, 1995

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

Location	Survey Method	Key Survey Results (pCi/L)	Reference

On-site boreholes	Gross alpha, gross beta from three boreholes	Gross alpha: < 2.22–3.46 Gross beta: < 2.81–9.30	Boerner, 1985
On-site boreholes	Gross alpha, gross beta from five boreholes	Gross alpha: < 0.75–11.8 Gross beta: < 3.43–41.6	Boerner, 1985
On-site borehole	Gamma Spectroscopy of one sampled borehole	Ra-226 < 0.05 Ra-228 < 1.04 Th-228 = 0.36 Th-232 = 0.36 U-234 = 11.1 U-238 = 11.8	Boerner, 1985
Site overburden saturated zone	Gamma Spectroscopy of 10 sampled boreholes	Ra-226 = 0.00–2.38 Ra-228 = 0.00–1.22 Th-228 = 0.00–0.57 Th-230 = 0.61–2.39 Th-232 = 0.04–1.58 U-234 = 0.77–8.90 U-235 = 0.04–0.60 U-238 = 0.61–9.01	Foster Wheeler Environmental Corporation, 1995
Site shallow bedrock saturated zone	Gamma Spectroscopy of nine sampled boreholes	Ra-226 = 0.03–1.96 Ra-228 = 0.00–1.36 Th-228 = 0.00–1.40 Th-230 = 0.55–2.39 Th-232 = 0.01–0.80 U-234 = 0.46–15.35 U-235 = 0.00–0.44 U-238 = 0.41–14.52	Foster Wheeler Environmental Corporation, 1995

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