Final Status Survey Report for Building 38 At the Molycorp Site

Washington, PA

MACTEC, Inc.

Revision - 0
Dated 8/30/02

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1.0 BACKGROUND INFORMATION

1.1 GENERAL INFORMATION AND OPERATING HISTORY

Molycorp, Inc 's (Molycorp) predecessor, the Molybdenum Corporation of America, was formed from the Electric Reduction Company in Washington, Pennsylvania on June 16, 1920. The facility was purchased to manufacture ferroalloys

Molybdenum manufacturing was begun in the 1920s. Processing of this material was idled in 1991 Although primarily manufacturing molybdenum products, the plant also produced ferrocolumbium (FeCb, 1964 to 1971), as well as other ferroalloys, e g , tungsten.

In the late 1960s new federal requirements necessitated Molycorp to obtain a Source Material License from the Atomic Energy Commission for possession and use of materials containing 0 05 percent or greater by weight uranium, thorium, or a combination of both Most of the material that was processed by the corporation for ferrocolumbium contained thorium above the 0.05 percent limit The slag resulting from this production was in a glass/ceramic form containing an average of 1.2 percent thorium Almost immediately upon receiving a Source Material License in December 1968, various investigations were undertaken to address the new regulatory requirements

Applied Health Physics, Inc was contracted by Molycorp to conduct a series of leaching studies on ferrocolumbium slag during the late 1960s These studies indicated that radioactive materials were fixed and would not leach into the groundwater in excess of prescribed limits During this period, Molycorp applied unsuccessfully to the Pennsylvania Department of Health's Industrial Wastes Section and AEC for an onsite burial permit. Ferrocolumbium slag cleanup was concentrated in the early to mid-1970s time frame.

In June 1971, an AEC compliance inspection revealed that thorium-bearing slag had been inadvertently buried onsite in violation of the terms and conditions of their license and AEC regulations The AEC issued a Notice of Violation and requested Molycorp to take remedial action to excavate these materials and dispose of them in accordance with AEC regulations and guidance documents Applied Health Physics was contracted to perform a thorough radiological survey of the site and to provide health physics and waste disposal services necessary to comply with AEC's request. Survey measurements indicated exposure levels at 1.2 mR/hr in some areas

In 1972, thoriated material from the site was disposed of at the West Valley, New York, burial site The disposal was terminated when New York officials decided that the volume of waste was too large and the contamination level insignificant to use up valuable burial area. Molycorp performed cleanup operations to segregate and stabilize the remaining thoriated material in a capped pile containing about 27,700 cubic yards of slag on the south property. A 1975 Applied Health Physics, Inc. report indicated the average concentration of thorium-232 in the slag pile was 1,250 pCi/g, with exposures within the 0 2 mR/hr Nuclear Regulatory Commission maximum level allowed at the time (AEC was reorganized as the NRC in 1974) This pile was eventually removed and disposed of.

In 1978, one of two molybdenum-roasting furnaces was shut down as part of a consent decree with the Pennsylvania Department of Environmental Resources (PADER) Air Quality Agency due to exceedances of SO_2 standards All remaining processes continued until 1991

Oak Ridge Associated Universities, an NRC contractor, conducted a radiological survey of the site in 1985 The survey identified elevated (twice background or greater) levels of thorium in the dikes that separated the surface impoundments, and indicated the potential of subsurface thoriated slags in the western portion of the site

RSA, Inc conducted a subsurface survey for Molycorp in 1990 to characterize the thorium contamination across the western portion of the site (i e , the impoundment area), and the areas immediately to the north, west, and northwest. Thirty-two holes were drilled on the site and radiation measurements were logged at every six inches of depth from the surface down to bedrock, both above and below water table Radiation levels were also logged in monitoring wells previously drilled on the site In addition to the subsurface survey, RSA, Inc. conducted a survey of the radiation exposure rates inside the study area This survey consisted of approximately 400 measurements of the gamma radiation field at a height of one meter above ground level. Findings reveled that, in general, the subsurface concentrations of thorium were above those in the surface soils in almost every hole drilled A general pattern was that the underground radiation levels decreased to background at a depth of about ten feet While a majority of the holes exhibited concentrations of greater than 0.01 percent thorium, in only a few holes did the thorium content exceed an average of 0 05 percent at some point below the surface of the ground.

The Molycorp Source Material License (SMB 1393) was renewed in 1992 and included an amendment incorporating a schedule for decommissioning the site In November 1992, Molycorp submitted a Site Characterization Plan (SCP) to the NRC for approval.

Molycorp submitted the "Decommissioning Plan for the Washington, PA Facility" to the NRC in July 1995 In a letter dated June 1, 1999, (John C Daniels, Molycorp Project Manager, to John W N Hickey, NRC Branch Chief) Molycorp informed the NRC that the Decommissioning Plan would be revised and re-submitted in two parts

Part 1 Revision of the current Decommissioning Plan was submitted and approved June 30, 1999, and describes the activities required to remediate the site to unrestricted use levels in accordance with the SDMP Action Plan (57 FR 13389). The soil, slag or other material exceeding the SDMP Action Plan criteria will be transported to an NRC approved location for final disposition

Part 2 Revision of the Decommissioning Plan was to provide for the disposition of the material that exceeded the SDMP Action Plan criteria to a designated on-site impound at the Washington, PA site The Decommissioning Plan Part 2 Revision was never approved

1.2 Reason for Decommissioning

Decommissioning of the Molycorp Washington, PA Facility is being performed due to the cessation of molybdenum production at the facility. Several factors included age of equipment and the production of molybdenum elsewhere in the United States and overseas, have led to the shutdown of the production process and closure of the facility In December 2001, all activities were halted and a majority of the workforce was terminated

1.3 MANAGEMENT APPROACH

This report focuses on the approach taken by management to decommission buildings located at the Molycorp Washington, PA Site This report does not address the decommissioning activities of soils or subsurface contamination at the site

The approach taken by management for the decommissioning of buildings includes the characterization and classification of site buildings and areas, performance of radiological surveys to identify and quantify surface radioactive material, identification of elevated dose rates, performance of remedial actions (as required), removal of materials and equipment from buildings, performance of the final surveys to release buildings from radiological controls, and the performance of any remedial action necessary to meet the release criteria of the final status survey

Once buildings have been surveyed for final status, and the NRC has reviewed and approved the building Final Status Survey Report and completed their verification surveys, the buildings will be demolished and the rubble removed As identified earlier, subsurface (soil) decommissioning activities are not being performed under the current work scope (decommissioning work.)

Management supported and required the use of all regulatory and approved decommissioning plans and standards for the decommissioning process at Molycorp. The final status survey was conducted in accordance with; NUREG/CR 5849, "Manual for Conducting Radiological Surveys in Support of License Termination," RSI's "Decommission Plan for the Washington, PA Facility, Part 1 Revision," and the requirements of Molycorp's "U.S Nuclear Regulatory Commission Material License, Amendment No. 5, SMB-1393 " Individual requirements of each reference were compiled in MACTEC's "Survey Plan for Determining the Final Status of Buildings at the Molycorp Site" and used as the plan for performing the final status survey

Approved radiation protection procedures were used during the performance of radiological surveys in support of final status surveys Qualified radiation protection staff was hired and trained to the requirements of the sampling plan. A radiological engineer (CHP) was assigned to support the project and oversee the day-to-day radiological survey operations The MACTEC Corporate RSO was involved at all decision-making levels, and communicated directly with the NRC, State of Pennsylvania, ORISE Support Personnel and MACTEC Senior Management.

Radiological survey equipment was identified and selected to provide the highest sensitivity for the existing site conditions Radiological survey equipment selection was based partially on equipment used for earlier final status surveys performed by Radiological Services, Inc (RSI) in 2001. Additional radiological survey equipment was selected and implemented to what RSI had used in the past. The selection and addition of a hand-held gas-filled proportional instrument and detector package provided a greater sensitivity for the detection of radioactive material, and complemented the previously used selection of instruments used by RSI All radiological survey equipment used for final surveys was calibrated by an instrument calibration facility using radioactive sources traceable to National Institute of Science and Technology (NIST) When radiological survey instrumentation was due for calibration, or the instrument malfunctioned, the instrument was removed from service and sent off-site for calibration or repair.

Radiation protection personnel worked closely with decommissioning and construction personnel on the project The Project Manager interacted closely with the workforce, Radiological Engineer and the HP

technicians The Project Manager was provided weekly HP activity reports detailing the current week's activities and the coming week's goals

2.0 SITE INFORMATION

2.1 SITE LOCATION

The Molycorp, Inc project site (the site) is located in southwestern Pennsylvania on the outskirts of Washington County approximately 35 miles southwest of Pittsburgh. The site is separated from the populated City's urbanized are by the ramps and structures associated with Interstate 70 (I-70) The region is generally comprised of towns located close to transportation corridors surrounded by agricultural lands and open areas.

The site consists of approximately 20 acres, which represents the fenced portion of the 59-acre parcel owned by Molycorp Inc. that lies entirely within Canton Township at 300 Caldwell Avenue, Washington, Pennsylvania, 15301. The fenced area is situated between 1,010 and 1,045 feet above mean sea level with relatively flat topography.

Molycorp's property has frontage along two dedicated public streets in Canton Township – Caldwell Avenue and Weirich Avenue The site is transversed by Chartiers Creek that flows south to north through the property. The property is served by the CSX operated railroad via two lines that were formerly owned by the Tylerdale Connecting Railroad Company and the Baltimore and Ohio Railroad

Adjacent property owners can be classified into three major categories on the current use of the land – residential, industrial, and public. The residential property lies to the east of the site on Green Street and to the west along Weirich Avenue The industrial property is located predominately north of the site and includes property under the ownership of the Findlay Refractories Company and Allegheny Ludlum Corporation Darrt Development Company owns several scattered parcels located to the south and east of the site. Land under public ownership includes the Canton Township Volunteer Fire Company property, the right-of-way for I-70, and other public streets The Washington Institute of Technology owns a 38-acre parcel with a commercial building adjacent to the southwestern property line This building was used as a mining education and training facility. However, it has not been used for this purpose for some time and has fallen into a state of disrepair and, therefore, is considered a vacant parcel.

A ten-acre parcel of vacant land under the ownership of L and C Cox on Weirich Avenue between Comfort Lane and Point View Drive (behind Allegheny Lundlum) may be the site of future commercial development The property owner has formally requested that the zoning be changed from R-2 Residential to General Commercial

2.2 BUILDING STATUS

All buildings/areas did not have the same potential for residual contamination and therefore did not require the same level of survey coverage. For the purposes of establishing the degree of survey effort required, building surfaces were segregated into affected and unaffected buildings/areas The definitions for the areas

- Affected area· Accessible areas that have potential radioactive contamination (based on facility operating history) or known radioactive contamination (based on past or preliminary radiological surveillance)

- Unaffected area· All accessible areas not classified as affected These areas are not expected to contain residual radioactivity, based on knowledge of site history and previous survey information.

All 21 buildings located on site had been characterized (as identified in NRC Material License, Amendment No 5, SMB-1393) for radiological hazards and classified as either affected or unaffected 15 buildings had been characterized and classified as unaffected, two (2) buildings had been surveyed for final status; and six (6) buildings had been characterized and classified as affected (or containing affected areas). Building classification and radiological information are described in Table 2 1

TABLE 2.1 - BUILDING CLASSIFICATION AND RADIOLOGICAL INFORMATION

Classification	Building	Radiological Information
A	1	Lab Area, soil samples in the lab and a small source in a lab office. Possible fixed contamination exists on the floor of one of the lab rooms
A	19	Building contains rad material samples in an individual office. The office has been classified as an affected area
A	26	Building 26 contains a temporary rad storage area (~20'x30') identified with a rad boundary and radiological postings The building also contains an above ground 4 section tank (one section being potentially contaminated, internal) and a stainless steel filter (~3 ft. dia by 4 ft.) that is contaminated.
A	29	Concrete floor with sumps, floor sumps are potentially contaminated and need to be characterized The rest of the building is identified as unaffected
A	31	Concrete floor with a steel liner on top. Steel walls and roof, insulated walls Licensed material mixer was stored in building.
A	33	Concrete floor, steel walls and roof, insulated. Equipment/supplies were originally stored in building The building was erected in 1979 and is otherwise radiologically clean Categorized as affected due to the storage of sample containers (contaminated dirt) in the back corner of the building
U	2	Heat exchange in front of Building 2 Several stories high, mixture of solid and grating floors Concrete and tin construction
U	13	Concrete floor, steel and brick walls, some insulation on walls and ceiling

U	14	Most of the building internals have been removed, brick structure Roof is rusted and partially disintegrated
U	21	Concrete floor, steel and cinder block walls, steel ceiling Maintenance shop in use until March 2002.
U	22	Concrete floor, metal walls and roof. Equipment/supply storage is the main purpose of this building.
U	23	Concrete floor, steel walls and ceiling.
U	25	Concrete floor, steel walls and ceiling
U	28	Concrete floor, steel walls and roof, 2 walls insulated, equipment/ supplies located previously stored on shelve located in the building
U	32	Concrete floor, one wall insulated, steel roof, equipment/supplies previously stored on shelves located in the building, steel front door.
U	34	Concrete floor, steel walls and roof, large conveyor system inside building. Sand pits are located in building.
U	35	Concrete floor, insulated walls and ceiling. Equipment/supplies previously stored in the building The building was erected in 1988
U	36	Concrete floor with sumps, double walled construction ½ way up, insulated walls and ceiling
U	37	Concrete floor, corrugated steel walls and roof Smaller inside storage building, cinder block construction, roof area was used for storage of additional equipment/supplies
FS Surveyed	39	Building 39 previously surveyed for final status
FS Surveyed	42	Building 39 previously surveyed for final status

2.3 GROUNDS

The Molycorp Washington, PA facility produced a ferrocolumbium alloy from Brazilian ore (pyrochlore) between 1946 and 1970. While the use of pyrochlore was commonplace by that time, this particular ore contained thorium as an accessory metal The thorium was also in concentrations that required Molycorp to acquire a Source Materials License This operation resulted in the production of a thorium-bearing slag A portion of this slag was ball-milled (turned into a granular powder) and used as fill over portions of the site

While significant amounts of this slag have been removed from the site, remaining slag in soil continued to play a significant role in the survey and release of buildings on site Building steel walls and concrete floors showed significant readings above "normal" background levels when surveyed by hand-held or portable detectors

In two instances during the final status survey of buildings 39 and 42, performed by RSI, survey results indicated elevated levels of radioactivity on building walls (even though smears in the same locations indicated that no removable radioactivity existed.) To identify the source of elevated radioactivity, two sections (approximately 2' by 2') of the building's wall were removed from the building by RSI These wall pieces were resurveyed in areas where background radiation levels were considered "normal" and found to be free of radioactivity (no readings greater than background)

Because this elevated background condition exists at the Molycorp site, MACTEC devised instrument detector windows for some of their instruments and used them in areas where thorium slag in soil created a background nuisance during survey activities

3.0 DECOMMISSIONING ACTIVITIES

Decommissioning activities of the buildings on site were performed as a "first step" to release the site for unrestricted future use. The scope of work conducted at the site during this phase of work included D and D of all above surface structures and buildings.

All existing structures (buildings, tanks, dryers, bag houses, utilities, etc) will be removed from the site. Wastes created during the D and D activities will be identified, segregated, and processed for shipment to the appropriate waste facility Waste will be removed from site in accordance with all applicable federal, state and local regulations and authorities

3.1 OBJECTIVES

The objectives for this phase of D and D activities included.

- Removal of equipment and surplus supplies from buildings
- Characterization of hazards associated with the buildings (performance of effective radiological surveys)
- Remediation or disposal of hazards identified in the characterization process
- Completion of Final Status Survey
- Unrestricted release of buildings
- Demolition of buildings

3.2 RESULTS OF PREVIOUS SURVEYS

Numerous radiological studies and surveys have been conducted at the Molycorp Washington, PA site Since the late 1960, regulatory requirements and pressure from local agencies have driven surveys and studies of the hazards associated with the production of various ferroalloys. Recently, RSI has completed and submitted for review the Final Status Survey for buildings 39 and 42 Listed below is a brief history of the previous surveys performed on the Molycorp site

Applied Health Physics, Inc was contracted by Molycorp to conduct a series of leaching studies on ferrocolumbium slag during the late 1960s These studies indicated that radioactive materials were fixed and would not leach into the groundwater in excess of prescribed limits During this period, Molycorp applied unsuccessfully to the Pennsylvania Department of Health's Industrial Wastes Section and AEC for an onsite burial permit Ferrocolumbium slag cleanup was concentrated in the early to mid-1970s time frame.

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Foster Wheeler Environmental Corporation conducted a site characterization of the Molycorp Washington, PA site in 1994 and published its report titles "Site Characterization Report for License Termination of the Washington, PA Facility, 1995 " This three-volume report was conducted to meet the Site Characterization Plan's objectives

- To determine the extent of the distribution of thoriated residues on the site, in the structures and in the environmental media
- To determine the rate(s) of migration, if any, of thorium or its daughters through various pathways to man
- To assess associated non-radiological constituents and determine their affects on the radiological constituents and potential impacts on decommissioning
- To quantify parameters that affect potential human exposure to existing site radiological materials
- To support evaluation of alternative decommissioning actions wan detailed planning of a preferred approach for decommissioning, decontamination, and waste disposal.

3.3 DECONTAMINATION PROCEDURES

Most of the above surface buildings have been previously decontaminated and identified as unaffected buildings or areas These classifications are noted in Molycorp's NRC License, SMB-1393 and identified in Section 2 2 Buildings classified as affected will be surveyed, and where remediation is necessary, decontamination will be performed It has been estimated that very little radioactive waste will be generated during the entire project scope Items found to be contaminated above the limits have and will be controlled as radioactive material, temporarily stored on site, and ultimately disposed of as radioactive waste.

MACTEC's "Survey Plan for Determining the Final Status of Buildings at the Molycorp Site" contains the procedures and requirements for the survey of the buildings on site RSI's Radiation Protection Procedures (currently the approved procedures used on site) contain the procedural requirements for operational radiation activities on the site

4.0 FINAL SURVEY PROCEDURES

The basis of the Molycorp radiological survey design conformed to NUREG/CR 5849, "Manual for Conducting Radiological Surveys in Support of License Termination," RSI's "Decommission Plan for the Washington, PA Facility, Part 1 Revision," and the requirements of Molycorp's "U S Nuclear Regulatory Commission Material License, Amendment No 5, SMB-1393." These references provide adequate information and sampling requirements to ensure a proper survey had been planned and performed The requirements listed in these references were compiled into a sampling plan (MACTEC's "Survey Plan for Determining the Final Status of Buildings at the Molycorp Site") and used as the guidance document for sampling instructions

4.1 SAMPLING PARAMETERS

Sampling parameters were identified from NUREG/CR 5849, "Manual for Conducting Radiological Surveys in Support of License Termination," RSI's "Decommission Plan for the Washington, PA Facility, Part 1 Revision," and the requirements of Molycorp's "U.S. Nuclear Regulatory Commission Material License, Amendment No 5, SMB-1393 " QC samples were included in the sampling requirements

Site buildings or areas were classified by contamination potential and grouped into survey units having a common history, contamination potential, or that were naturally distinguishable from other site areas, to assure that the number of survey data points from each survey unit adequately represented the radiological environment of that survey unit Survey units are subdivisions of the whole area of interest within the sampling plan

Unaffected survey units identified by direct measurement that exceed 25% of the guideline levels were reclassified as affected areas, gridded as necessary, and resurveyed accordingly

Representative surveying was accomplished for buildings by using a systematic grid approach to ensure spatial representation of the survey unit of interest. The grid system provided reference locations to aid in proper sample identification and distribution, and ensured that minimum sample surface areas were sampled.

Direct and loose surface measurement locations were identified on the actual surface being surveyed. The physical probe location was traced on the surface being surveyed. When necessary, survey readings were recorded on the physical surface at the location of the survey

Survey results were obtained and used for comparison against the limits for unrestricted release, as defined in the site's NRC License. These limits are included in MACTEC's "Survey Plan for Determining the Final Status of Buildings at the Molycorp Site" as Appendix A.

Table 4 1 identifies the release limits of the license

Table 4.1 - Acceptable Surface Contamination Levels (dpm/100cm^2)

Radionuclide [1]	Average	Maximum	Removable
U-nat, U-235, U-238, and associated decay products	5,000 α	15,000α	1,000α
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000	15,000	1,000

(1) Where surface contamination by both alpha and beta-gamma emitting nuclides exist, the limits established for alpha and beta-gamma emitting nuclides should apply independently

Even though limited quantities of natural uranium have been identified at the Washington, PA site, and is included as a part of the site's NRC License, the more restrictive limits for release (for surface activity) are for the natural thorium radionuclide, which is the significant radionuclide of concern Therefore, the limits for release are due to the natural thorium radionuclide, and the limits are 1,000 dpm/100cm^2 average, 3,000 dpm/100cm^2 maximum and 200 dpm/100cm^2 removable.

Because both alpha and beta radiations are a product of the decay of natural thorium (in equilibrium), the limits listed above apply independently to both alpha radiation and beta radiation.

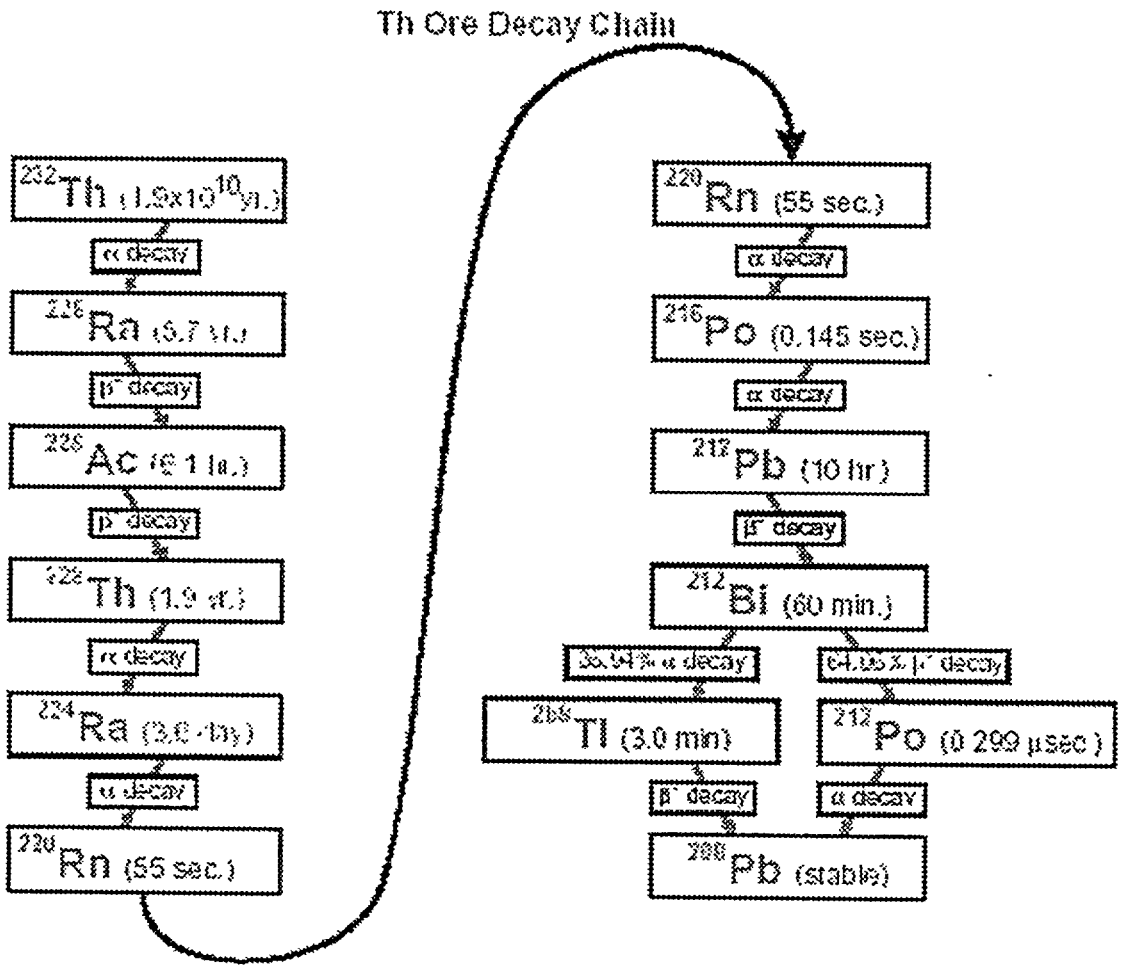
Due to the inherent difficulty of properly quantifying the alpha radiation component during the decay of natural thorium when using a hand-held instrument, a ratio of alpha decays to beta decays was identified and beta radiation was used as a surrogate to quantify the alpha activity This was not the case for determining removable contamination The Ludlum 2929 was calibrated and set up for the measurement of both alpha and beta radioactivity.

The detectable ratio of alpha to beta is a 2:1 for natural thorium decay. In actuality, the decay of natural thorium produces 6 alphas and 4 betas to reach stable lead. However, one of the betas emitted during the decay process (from Ra-228) is not detectable (39 keV E-max) The other three betas emitted are detectable and are suitable as a surrogate.

The alpha readings recorded on the various data forms and record sheets were actual instrument readings, obtained from the instrument during the survey, and do not represent this ratio factoring The use of alpha to beta ratio factoring is incorporated in the data set just prior to statistical analysis and comparison to limit values

Figure 4 1 is a graphical representation of the decay of natural thorium

FIGURE 4.1 - NATURAL THORIUM DECAY CHAIN



4.2 SAMPLING SCHEDULE

Scanning of surfaces to identify locations of residual surface activity was performed according to Table 4.2

TABLE 4.2 - SURFACE SCAN SCHEDULE

Building/ Structure Status	Survey Location	Surface Scan (4.6)
Affected Areas	Building floor and lower walls (<2 m from floor)	100% - Floor and lower walls (<2 m from floor) and other surfaces found to have residual activity in excess of guideline values during characterization surveys
Affected Areas	Upper surfaces (>2 m from floor) of affected areas found to be non contaminated during the characterization	Limited - Areas found to be non contaminated during the characterization survey, scans in the immediate vicinity of direct measurement
Affected Areas (4 10 1)	Exterior of piping, ventilation ducting, electrical boxes, conduit, or other interior surfaces that may contain residual contamination	B-G scans, biased, to determine locations that exceed 2x background. *At these locations, and available access points to pipe and duct interiors, direct alpha measurements and smear sample will be obtained.*
All Buildings (4 10 2)	Exterior surface of the roof	Gamma scan only - 1 measurement per 4 m^2 (see Exposure Rates Table)
All Buildings (4 10.2)	Exterior walls	B-G scan, 10% of lower wall surfaces (<2 m from floor)
Unaffected Areas	Building floor and lower wall surfaces (<2 m from floor)	B-G scan, 10% of floor and lower wall surfaces (<2 m from floor)
Equipment/ Structures Located in Affected Areas/Buildings	Equipment/Structure	Free Release Survey - If equipment/structure is identified as being used for processing licensed material. Biased - If equipment/structure was never used for processing licensed material
Equipment/ Structures Located in Unaffected Areas/Buildings	Equipment/Structure	Biased - If equipment/structure is suspected of being used for processing licensed material. Not Required - If equipment/structure was never used for processing licensed material.

Result Requirements		Locations of surface activity exceeding twice background will be marked for further evaluation

Building interior surface scans were conducted for alpha and beta-gamma radiations Scans of exterior building surfaces were for beta and gamma radiations to identify the presence of elevated areas that might indicate residual gross activity.

For hand-held instrumentation, the detector was kept as close as possible to the surface and moved across the surface at a slow speed Scan surveys were performed by moving the detector over the surface area at a maximum speed of 1-2 inches per second and a distance of approximately 1/2 inch for beta and 1/4 inch for alpha When the count rate increased, the rate of movement of the detector was decreased or stopped. If the increase in count rate was real (not a random variation in the background count rate), a static 60-second measurement was performed over the area of increased count rate to quantify the activity Audible indicators (headphones or instrument speaker) were used to identify locations having elevated activity levels All scanning results were noted on standard survey forms as well as task-specific generated forms

When elevated levels of surface activity were identified with the Ludlum Model 239-1F floor monitor, the surface was marked and scanned with a hand held unit with a detector size of ~ 100 cm^2 and an appropriate detector efficiency

Gamma exposure rate measurements (gamma scan) were conducted with the instrument at 1 m above the floor at systematically and randomly selected locations

Direct measurements were performed according to Table 4 3

TABLE 4.3 - DIRECT SURFACE MEASUREMENT SCHEDULE

Building/ Structure Status	Survey Location	Direct Measurement (4.7)
Affected Areas	Building floor and lower walls (<2 m from floor)	Floor and lower walls (<2 m from floor) and other surfaces found to have residual activity in excess of guideline values during characterization surveys (1)
Affected Areas	Upper surfaces (>2 m from floor) of affected areas found to be non contaminated during the characterization	Measurements will be performed at a minimum of 30 locations on both vertical and horizontal surfaces and sufficient additional locations to provide coverage at a minimum of one location per 20 m^2 of surface area (1)

Affected Areas (4.10 1)	Exterior of piping, ventilation ducting, electrical boxes, conduit, or other interior surfaces that may contain residual contamination	Where B-G scans exceed 2x background - obtain direct alpha measurements. At available access points to pipe and duct interiors - obtain direct alpha measurements
All Buildings (4 10 2)	Exterior and interior surfaces of air exhaust equipment and at roof drains	Biased
All Buildings (4 10 2)	Exterior walls	A minimum of 30 random direct measurements or an average of at least 1 measurement location per 50 m^2 surface area, whichever is greater, of the survey unit (4 10 2)
All Buildings (4 10.2)	Exterior surface of the roof	Biased in areas of plausible contamination (based on gamma scan results)
Unaffected Areas	Building floor and lower walls (<2 m from floor)	A minimum of 30 random direct measurements or an average of at least 1 measurement location per 50 m^2 surface area, whichever is greater. (5849)
Equipment/ Structures Located in Affected Areas/Buildings	Equipment/Structure	Free Release - If equipment/structure is identified as being used for processing licensed material Biased - If equipment/structure was never used for processing licensed material.
Equipment/ Structures Located in Unaffected Areas/Buildings	Equipment/Structure	Biased - If equipment/structure is identified as being used for processing licensed material Not Required - If equipment/structure was never used for processing licensed material
Results Requirements		If direct measurements indicate residual activity exceeds 25% of the guideline, the area is surveyed per affected area requirements

[1] If scanning methods are capable of detecting residual Th activity of less than 1,000 dpm/100 cm^2, direct surface activity measurements will be systematically performed at two-meter intervals on floors and lower walls and at the same intervals on upper surfaces If scanning methods produce an MDA that exceeds 1,000 dpm/100 cm^2, measurements will be performed at one-meter intervals On upper surfaces of affected areas that are not scanned for the presence of residual activity, measurements will be performed at a minimum of 30 locations on both vertical and horizontal surfaces These locations will include surfaces where radioactive material would likely settle and sufficient additional locations to provide coverage at a minimum of one location per 20 m^2 of surface area

Direct surface measurements were conducted by integrating counts over a 1-minute period

When scans or measurement exceeds guideline levels, the location was noted for further remediation or resolution. Localized scanning and measurements were repeated after any remediation activities were performed.

Smear surveys were preformed according to Table 4.4.

TABLE 4.4 - LOOSE SURFACE MEASUREMENT SCHEDULE

Building/ Structure Status	Survey Location	Removable Surface Activity
Affected Areas	Building floor and lower walls (<2 m from floor)	Collected from each location where a direct surface activity measurement is made (alpha and beta analysis).
Affected Areas	Upper surfaces (>2 m from floor) of affected areas found to be non contaminated during the characterization.	Collected from each location where a direct surface activity measurement is made (alpha and beta analysis).
Affected Areas (4 10 1)	Exterior of piping, ventilation ducting, electrical boxes, conduit, or other interior surfaces that may contain residual contamination	Where B-G scans exceed 2x background - obtain alpha smear sample At available access points to pipe and duct interiors - obtain alpha smear sample
All Buildings (4 10 2)	Exterior and interior surfaces of air exhaust equipment and at roof drains	Biased to locations where contamination is most likely.
All Buildings (4.10 2)	Exterior walls	Collected from each location where a direct surface activity measurement is made (alpha and beta analysis)
All Buildings (4 10.2)	Exterior surface of the roof	Samples of roofing material (volumetric) will be obtained where direct measurements indicate contamination is present.
Unaffected Areas	Building and Structure Surfaces	Collected from each location where a direct surface activity measurement is made (alpha and beta analysis).

Equipment/ Structures Located in Affected Areas/Buildings	Equipment/Structure	Collected from each location where a direct surface activity measurement is made (alpha and beta analysis)
Equipment/ Structures Located in Unaffected Areas/Buildings	Equipment/Structure	Collected from each location where a direct surface activity measurement is made (alpha and beta analysis)

A smear for removable contamination was obtained at each location where a direct surface activity measurement was taken, unless otherwise stated in Table 4.3

Smears were counted for gross alpha and beta with the appropriate instrument

As a precaution against accidental contamination of the instrumentation used to analyze the smear samples, screening of samples that had a high potential of containing elevated levels of radioactivity was performed.

Exposure rate measurements were performed according to Table 4 5.

TABLE 4.5 - EXPOSURE RATE MEASUREMENT SCHEDULE

Building/ Structure Status	Survey Location	Exposure Rate Measurement (4.8)
Affected Areas	Building Surfaces	Gamma exposure rates measured 1 meter perpendicular to building surfaces at 1 measurement per 4 m^2.
All Buildings	Exterior Roof Surface (gamma scan)	Gamma exposure rates measured 1 meter perpendicular to building surfaces at 1 measurement per 4 m^2. (4.10.2)
Unaffected Areas	Building Surfaces	Gamma exposure rates measured 1 meter perpendicular to building surfaces at 1 measurement per 50 m^2 (calibrated for natural thorium)

Gamma exposure rates were measured at 1 m above ground or floor surfaces using a gamma scintillation instrument

Where necessary, samples of paint were obtained from 100 cm^2 areas of painted surfaces where direct and removable activity measurements suggest contamination (> surface contamination levels) may have been

painted over. These samples were analyzed for beta activity Direct measurements and smear surveys were made of the underlying surface, after removal of the paint

Samples of roofing materials (non-metal roofs) were obtained where direct measurements indicate contamination was present in the roofing material. Roof material samples were controlled as volumetric samples and analyzed as such.

Each piece of equipment that required monitoring was its own entity and was described by name and serial number on survey forms and/or logs Special attention (increased sample density) was given to areas where there was a high potential for contamination Equipment previously identified as not affected (not contaminated) was not surveyed unless there was indication that it had become contaminated

4.3 Background Levels Identified

Material-specific background levels were established by RSI in late 2001 for each type of instrument used for total surface contamination measurements during their final status surveys of Buildings 39 and 42. Similar instrumentation was selected for use by MACTEC to take advantage of this previously available information

Background measurements were collected on surfaces of similar construction as the buildings at the site and having no possibility of being impacted by site operations Measurements to establish background for a specific material were collected from multiple locations to provide an estimate of the variability or uncertainty. Background determination was performed using the same instrumentation that was used for final status survey data collection. An average background value was determined for each material surveyed and this value was subtracted from each measurement to determine a net count or count rate Background determinations were required and performed for concrete and a class of material designated a generic material

The required number of background measurements per material type is as follows:

- Concrete - 20 measurements
- Cinderblock - 20 measurements
- Generic Material - 10 measurements for each type of material surveyed (i e , wood, insulation, corrugated steel, etc)

It was previously identified in the final status survey report for Buildings 39 and 42, submitted by RSI, that significant background radiation levels existed at the Molycorp site, primarily due to gamma radiation from the thorium slag in the soil RSI had reported levels as high as 30 micro-R per hour.

During survey activities performed by MACTEC at the site, a significant component of the measured activity was indeed identified to be from the elevated gamma background coming from the slag in the soil. A method was devised to minimize the interference of this background radiation when using the hand-held detectors, and produce more accurate results of beta activity, the primary indicator used for the detection and quantification of natural thorium A shield or "beta window" was used to eliminate the beta component of a measurement made in areas where background levels proved to be a nuisance. A second measurement was taken without the shield in place This measurement process produced two readings, one containing a

beta-gamma interaction with the detector, and one containing only a gamma interaction with the detector The difference between the two readings provided a beta-only component of the measurement, with the gamma background removed This reading was then compared against the materials background that was determined at the off-site location and a net beta reading was obtained

The material used to shield the beta radiation was a thin piece of aluminum (approximately 3/16 inch think) A test was performed to validate the aluminum's ability to shield the beta radiation. A beta source was counted without the shield, and then the shield was put in place The source was again counted Results of the tests indicated that in all cases, when the shield was in place, the instrument indicated background values and completely shielded out any beta radiation.

4.4 · .MAJOR CONTAMINATES IDENTIFIED

The major contaminate (significant radionuclide of concern) at the Molycorp Washington, PA site was identified to be natural thorium. Trace amounts of natural uranium were also identified as a contaminate Both of these materials are identified in the site's NRC License.

No other licensed material has been brought on site, based on the site Facility Superintendent's knowledge of process and site operations.

Results of preliminary assessment and characterization survey support the conclusion and identify the significant radiological contaminant to be thorium-232, from the processing of certain types of ore concentrates in the production of ferrocolumbium Most of the material Molycorp processed for ferrocolumbium was a pyrochlore, which contained thorium above the 0 05 percent limit. It is possible that buildings and structures involved with the processing of pyrochlore and production of ferrocolumbium may have been contaminated with thorium-232 The average activity ratio of Th-228 and Th-230 to Th-232 found in slag/soil samples are

Th-228 Th-232	1 03%
Th-230 Th-232	0 16 %

4.5 GUIDELINES ESTABLISHED

All final status survey measurements were compared to the values listed in the Site's NRC License. The criteria specified in the guideline for natural thorium are more conservative than natural uranium, and were applied at the site for final status survey

4.6 EQUIPMENT AND PROCEDURES SELECTED

Instrument and procedure selection was based on several criteria The first criterion that was considered was the use of instruments and procedures that had been previously used on site for final status surveys Since RSI had just completed the final status survey of two buildings at the site, prior to MACTEC's arrival, using similar procedures and instruments made sense Because MACTEC's radiation protection operating procedures had not yet been approved for use at the site, RSI's radiation protection procedures were used. RSI's radiation protection procedures had previously been approved for use on site by the NRC Verbal approval was given by the NRC to allow MACTEC to continue work using RSI's radiation protection procedures until their procedures were approved

4.7 INSTRUMENT MDA

The detection sensitivity of a measurement system refers to the statistically determined quantity of radioactive material or radiation that can be measured or detected at a preselected confidence level. This sensitivity is a factor of both the instrumentation and the technique or procedure being used Typically, detection sensitivity has been defined (EPA 1980) as the level above which there is less than a 5% probability that radioactivity will be reported present when it is really absent (Type I error) or reported absent when it is really present (Type II error).

Minimum detectable activity (MDA) is an *a priori* estimate of the minimum activity level which is practically measurable with a specific instrument, and sampling and/or measurement technique. The basic equation for determining field instrument MDA (NUREG/CR-5849) is:

$$MDA = \frac{2.71 + 4.65\sqrt{B_R * t}}{t * E * \frac{A}{100}}$$

Where:

B_R = background count rate
t = sample count time (min)
E = efficiency
A = area of probe

FIGURE 4 2

Instrument MDAs were calculated on a daily basis and recorded on the applicable survey forms Where instrument MDAs did not meet criteria (25% of the release limit value,) instrument background count times and sample count times were increased until MDA values became acceptable or a surrogate radiation with an acceptable MDA value for the sample was used

4.8 INSTRUMENT SELECTION

Instrument and equipment selection was made based on previous use and the criteria of NUREG/CR-5849, for MDA sensitivity. In addition to the previous use criteria, instruments were selected based on the ability to detect the desired radiation and at a desired level, ease of use, availability and cost

- For dose rate measurements, the Ludlum Micro-R meter was selected and used It was selected due to it's relatively flat energy response curve and because it had been used on site previously for final status surveys

- For surface scans of large areas (floor and walls), the Ludlum Floor Monitor (239-1F/2350-1) with the 582 cm^2 detector (43-37) was selected. The MDA for the instrument was considered acceptable until an area of elevated activity was detected by the instrument. During surveys with the floor monitor, when an area of elevated activity was detected, the probe size was theoretically reduced from 582 cm^2 to a size of 100 cm^2 (a postulated physical size of the elevated activity) The MDA of the instrument with its newly reduced probe size (100 cm^2 probe size) became unacceptable for scanning For areas where the floor monitor detected elevated activity, the area was identified and resurveyed with a 100 cm^2 hand-held gas proportional detector. Instrument MDA was calculated and recorded at the start of the job, at the job site. If the instrument was relocated to a different location during the same day of work, the MDA was again calculated and recorded for the new location The floor monitor was set up and calibrated to detect both alpha and beta radiations

- For surface scans of areas with elevated readings, the Ludlum 2350-1 with the 43-68 or 43-106 was selected Due to the detector's relative size (compared to the 43-37) the MDA for the detector was acceptable. However, using a hand-held instrument to survey large surface areas is not efficient in either cost or time. The primary duty of the large area hand-held gas-flow proportional detector was scanning areas where elevated levels of activity had been identified by the floor monitor. When required to be used, the instrument's MDA was calculated and recorded at the start of the job, at the job site. If the instrument was relocated to a different location during the same day of work, the MDA was again calculated and recorded for the new location The instrument's lower MDA allowed for the sample population density of other sample mediums (for affected area surveys units) to be less dense When the MDA of the scanning instrument could not reach 25% of the release limit, the sample population density increased for the other sample mediums (direct and loose surface measurements) and a greater number of samples were required to be obtained. The instrument was set up and calibrated to detect both alpha and beta radiations

- For static (direct) surface measurements, the Ludlum 2360 with the 43-89 detector or Ludlum 2350-1 with the 43-68 or 43-106 was selected The MDAs were acceptable. Instrument MDA was calculated and recorded at the start of the job, at the job site If the instrument was relocated to a different location during the same day of work, the MDA was again calculated and recorded for the new location When background radiation created an unacceptable MDA for the instrument, the instrument was reconfigured to count with a longer count time. Background count times were also increased to lower instrument MDA to acceptable levels when necessary. Durability, ease of use and cost were a consideration in the selection of these instruments. The instruments were set up and calibrated to detect both alpha and beta radiations

- For counting samples (smears and air samples), the Ludlum 2929 with 43-10-1 detector was selected. Instrument MDA was calculated and recorded daily, and found to be acceptable Durability, ease of use, familiarity and cost were a consideration in the selection of this instrument. The instrument was set up and calibrated to detect both alpha and beta radiations

Table 4 6 provides information on the instruments selected to be used for final status surveys at the Molycorp Washington, PA site. Information on MDA calculations can be found in "Survey Plan for Determining the Final Status of Buildings at the Molycorp Site," Appendix B

TABLE 4.6 - INSTRUMENT SELECTION

Instruments	Probe	Radiation	MDA (dpm/100 cm^2)	Use
Ludlum, Model 2360	43-89	Alpha	67	Static Surveys
Ludlum, Model 2360	43-89	Beta	520	Static Surveys
Ludlum, Model 2929	43-10-1	Alpha	29	Counter Scaler
Ludlum, Model 2929	43-10-1	Beta	182	Counter Scaler
Ludlum, Model 2350-1	43-68/43-106	Alpha	105	Scan Surveys
Ludlum, Model 2350-1	43-68/43-106	Beta	625	Scan Surveys

Ludlum, Model 239-1F	43-37	Alpha	64	Floor Monitor
Ludlum, Model 239-1F	43-37	Beta	1186	Floor Monitor
Ludlum, Model 19	Internal	Gamma		Exposure Rates

4.9 INSTRUMENT USE TECHNIQUES

Instruments selected for performing final status surveys were provided by GTS Duratek, Field Engineering and Field Services group, Kingston, TN. Prior to delivery, instrument calibrations and operations were verified by the vendor, and shipped to Washington, PA. Upon arrival, the instruments were inspected and verified operational Instrument backgrounds were preformed QC check control limits were established and Chi-squared tests were performed

Prior to daily use, instruments were response checked and compared against their two and three sigma warning and control limit values. For scaler instruments, daily backgrounds were determined and MDCs were calculated in addition to their response checks. After daily use, hand-held instruments were once again source response checked to ensure that the instrument did not fail during the day's work. All instrument "daily checks" data was logged in the appropriate data log record

Qualified HP technicians were trained on the use of the instruments, and provided access to the instrument's User Manuals Surveys were performed in accordance with approved radiological survey procedures on site Survey results were reviewed by the Radiological Engineer for accuracy and completeness

4.10 PROCEDURES FOLLOWED

The requirements of NUREG/CR 5849, "Manual for Conducting Radiological Surveys in Support of License Termination" were followed for most statistical methodologies used during the performance of surveys and testing of data for the final status survey. In one instance, the methodology found in "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) was used for determining the scanning MDA of those instruments used for scanning This methodology provided a more accurate MDA result than would have been calculated from the guidance found in NUREG/CR-5849.

4.11 SURVEYING ORGANIZATION

Characterization and final status surveys were performed by a team composed of qualified personnel currently employed or subcontracted by MACTEC, Inc

The team was operated under the supervision of the Project Manager, Mr Vern Taylor, of MACTEC, Inc who has overall authority of the project.

The day-to-day operations of the site were the responsibility of the Site Superintendent, Mr. John Peek of MACTEC, Inc.

Radiological field measurements and sample collection were the responsibility of Mr. Michael McDonald of MACTEC, Inc. Mike is a Board Certified Health Physicist (CHP) in comprehensive practice and a Registered Radiation Protection Technologist (RRPT)

Radiological surveys were performed by a team of HP technicians One Senior HP Technician was assigned as the Lead Technician and was given the responsibility of the team.

5.0 SURVEY FINDINGS

Detailed data reports (Survey Findings Report) for each survey unit sampled are provided as an appendix to this report. Field data collection forms, survey report forms, instrumentation information (background, QC, MDA, and source response data forms), statistical test results, and comparisons to release limits are all provided as a single package Each package also contains a summary of the final status survey for that survey unit and includes information on anomalies discovered during the survey process Where significant differences existed between final status survey results and results of previous surveys for the survey unit, explanations are provided

Raw survey data was compiled into survey data tables, where appropriate, and presented with calculational results and comparisons, and are presented in the Survey Findings Report

5.1 TECHNIQUES FOR REDUCING/EVALUATING DATA

Survey information was obtained from the instrument's meter face used at the time of the survey. This data was recorded on a Radiological Survey Location Indicator data sheet, in the instrument's units. For scans and static measurements, the units were in counts per minute (cpm). Smear data was recorded after counting, subtracting background, and conversion to units of disintegrations per minute per 100 square centimeters (dpm/100cm^2). Dose rate measurements were recorded in units of micro-Roentgen per hour (uR/hr) and taken directly from the instruments meter face Information used in the conversion from cpm to dpm (instrument efficiencies) was recorded on the Radiation Protection Survey Report form For scans, the highest reading for the given immediate scan area was recorded in cpm

Where "hot spots" needed to be evaluated, additional readings were taken and the average hot spot activity was calculated in accordance with NUREG/CR-5849, Section 8 5 2 - Elevated Areas of Activity.

5.2 STATISTICAL EVALUATION AND COMPARISON TABLES

The statistical methodology used to provide the true representation of the data in relationship to the applicable limits is found in Sections 2 0 and 8.0 of NUREG/CR-5849. Comparison tables and tests used in the analysis are presented as part of each survey unit's Survey Findings Report package, as an appendix to this report

6.0 SUMMARY

Final status survey of the buildings located at the Molycorp Washington, PA site were performed in accordance with the requirements listed in NUREG/CR 5849, "Manual for Conducting Radiological Surveys in Support of License Termination," RSI's "Decommission Plan for the Washington, PA Facility, Part 1 Revision," Molycorp's "U.S. Nuclear Regulatory Commission Material License, Amendment No. 5, SMB-1393," and MACTEC's "Survey Plan for Determining the Final Status of Buildings at the Molycorp Site"

According to the findings of the final status surveys performed at the Molycorp Washington, PA site, all release criteria have been met. Results of the final status survey demonstrate that the residual radioactivity in Building 38 is below the unrestricted use criteria and confirm that the buildings are suitable for unrestricted use.

7.0 REFERENCES

1) *Manual for Conducting Radiological Surveys in Support of License Termination*, NUREG/CR-5849, Draft, December 1993

2) *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) Revision 1*, NUREG-1575, Rev. 1, US Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Washington, DC, August 2000

3) *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*, American National Standard, ANSI/ASQC E4-1994.

4) *Quality Assurance for Radiological Monitoring Program - Effluent Streams and the Environment*, NRC Regulatory Guide 4.15, 1979.

5) *Termination of Operating Licenses for Nuclear Reactors*, Nuclear Regulatory Commission, Regulatory Guide 1.86, 1974

6) *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG/CR-1507, Final, 1997

7) *Statistical Methods for Evaluating the Attainment of Cleanup Standards*, Pacific Northwest Laboratory, Richland, WA, December 1992

8) *Radiation Detection and Measurement*, Knoll, 1979.

9) *Washing, PA Facility, Decommissioning Plan, Part 1 Revision*, June 30, 1999, Radiological Services Inc.

10) *Radiation Protection Program, Health Physics Procedures*, June 1999, Radiological Services Inc

11) *Site Characterization Report for License Termination of the Washington, PA Facility*, January 1995, Radiological Services Inc

12) *U.S. Nuclear Regulatory Commission Materials License*, Molycorp, Inc, SMB-1393, Docket No 040-08778, Amendment 5.

13) Antech Ltd. - Waltz Mill, Project No 02-0284W, Analytical *Survey Results for Composite Tile Sample at Molycorp, Washington, PA*, May 13, 2002

Appendix A

Building 38 Data Package

Molycorp Washington, PA

Building 2 Data Package

This data package contains final status survey information for Building 2, Molycorp, Washington, PA site.

Field data collection forms, survey report forms, statistical test results, and comparisons to release limits are provided

Summary

No anomalies were reported during the survey of Building 2. Elevated levels of background radiation, from soil radioactivity, continued to be a presence during survey activities.

Results from the final status survey of Building 2 provides evidence that release criteria have been met, demonstrates that residual radioactivity is below the unrestricted use criteria, and confirms that Building 2 is suitable for unrestricted use.

	DDO-138 Radiation Protection Survey Report	Site Molycorp / Washington PA

Section 1: Survey Information

Date	Time	Location	Survey Issue Log Number
8-20-02	1600	Bldg # 38	02-0795

RWP Number	Purpose of Survey	Page
N/A	FSS ☐ RWP ☐ Routine Survey ☐ Unconditional Release ☒ Other	1 of 7

Survey Title: FSS

1 Minute STATIC's
Concrete (FLOOR)

INST #1

	BKG	MDA
β-	144	238
α	8	78

1 Minute STATIC's
Block (WALLS) Interior & Exterior

INST #2

	BKG	MDA
β-	94	199
α	8	81

Model 19 # 22526 Due 1-29-03

1 Minute STATIC's

		BKG	MDA
metal #1	α	2	46
	β-	27	109

Bkgd Readings 10 MR/hr

1 Minute STATIC's

		BKG	MDA
metal #2	α	2	48
	β-	27	112

Smear Number	Beta dpm/100cm²	Alpha dpm/100cm²
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15	N/A	
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		

Legend

00 = mRem/h gamma | 00 C = mRem/h gamma contact | ⓓ = Smear Location | 7 = Air Sample Location | -X-X-X- = Rope Boundary, or Barrier

00 β = mRem/h beta | 00 βC = mRem/h beta contact | --ⓓ-- = Large Area Wipe | = Bulk Material Sample

Section 2. Instrument Used

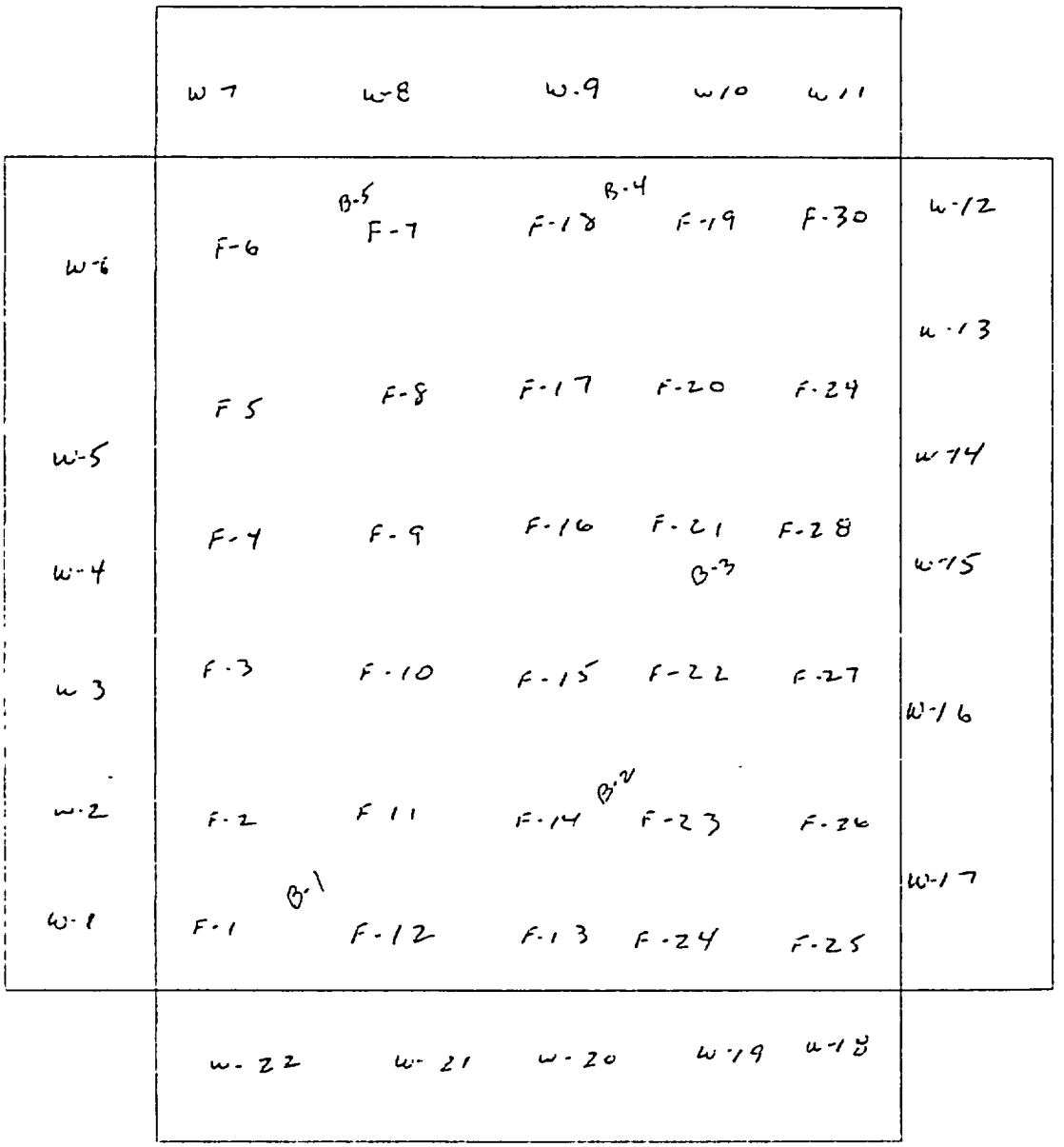
	Instrument Model/SN	Cal Due Date	Probe Model/SN	Cal Due Date	Detector Eff β⁻(cpm/dpm) α	MDA β⁻	MDA α	Other BKG β⁻	Other BKG α
# 1	2350-1/95356	1-29-03	43-106/133866	1-29-03	.246/.204	729	51	360	1.2
# 2	2350-1/129414	8-2-03	43-106/128914	2-2-03	.240/.195	693	38	310	0.6
	2929/115563	6-14-03	43-10/127216	6-14-03	.231/.347	134	14	73	.28

Section 3 Review and Approval

Survey Performed By (Sign)	Area Posted and/or Barricaded	Date and Time
Mark Blanchard / John Haber	☐ Yes ☒ No ☐ Not Required	8-20-02 / 1600
Radiation Safety Officer (Print Name & Sign)		**Date and Time**
Steve Kowalski / Steve Kowalski		8-26-02 / 0900

Building 38
North

SURVEY # 02-0795



Interior

Scale:
4m x 4m

Radiological Survey Results - Survey Location Indicator

Survey # 02-0795

Survey Area Information: FSS Bldg #38 (Floor)

Instrument Data	Instrument Model/SN	Cal Due	Probe Model/SN	Cal Due	α Scan MDA	β Scan MDA	α Static MDA	β Static MDA

Performed By:	Print Name	Signature	Date

Location	β Scan (cpm)	α Scan (cpm)	β Static (unsh) (cpm)	β Static (sh) (cpm)	α Static (cpm)	ER (μrem/hr)	Smears (dpm/100 cm²) α	Smears (dpm/100 cm²) β
F-1	590		562	407		11	-.8	-43
F-2	610		582	409		11	-.8	13
F-3	540		533	389		12	-.8	-39
F-4	570		535	402		12	-.8	-52
F-5	560		531	362		12	-.8	-26
F-6	480		459	371		11	-.8	-22
F-7	460		449	311		11	-.8	4.3
F-8	520		499	368		11	-.8	-52
F-9	490		476	320		11	-.8	-13
F-9 QC	500		446	341		11	-.8	4.3
F-10	490		473	299		11	-.8	-8.7
F-11	510		486	327		10	2	8.7
F-12	500		473	346		11	5	-8.7
F-13	540		513	339		11	2	-4.3
F-14	580		554	351		11	-.8	-61
F-15	490		472	308		10	-.8	17
F-16	500		476	349		10	2	-26
F-17	440		427	327		10	-.8	8.7
F-18	450		431	338		10	-.8	13
F-19	480		440	296		10	2	0
F-20	500		473	333		10	-.8	-17
F-21	520		476	288		10	-.8	39
F-22	460		423	316		10	-.8	-13
F-23	490		459	320		10	2	-4.3
F-24	500		474	328		11	-.8	0
F-25	510		478	279		10	-.8	48
F-26	450		426	292		10	-.8	13

Radiological Survey Results - Survey Location Indicator

Survey # 02-0795

Survey Area Information: FSS Bldg #38 (Floor)

Instrument Data	Instrument Model/SN	Cal Due	Probe Model/SN	Cal Due	α Scan MDA	β Scan MDA	α Static MDA	β Static MDA

Performed By	Print Name	Signature	Date

Location	β Scan (cpm)	α Scan (cpm)	β Static (unsh) (cpm)	β Static (sh) (cpm)	α Static (cpm)	ER (μrem/hr)	Smears (dpm/100 cm²) α	Smears (dpm/100 cm²) β
F-27	480		461	304		10	-.8	22
F-28	470		454	303		10	-.8	-4.3
F-29	460		445	313		10	-.8	17
F-30	500		470	344		10	-.8	13
B-1	380		342	252		11	-.8	4.3
B-2	290		268	248		10	-.8	13
B-3	280		261	224		11	2	-8.7
B-4	390		365	288		11	-.8	-17
B-5	370		346	261		10	-.8	0

Inst #1

B - Beams

Radiological Survey Results - Survey Location Indicator

Survey # 02-0795

Survey Area Information: Bldg # 38 Interior Walls

	Instrument Model/SN	Cal Due	Probe Model/SN	Cal Due	α Scan MDA	β Scan MDA	α Static MDA	β Static MDA
Instrument Data								

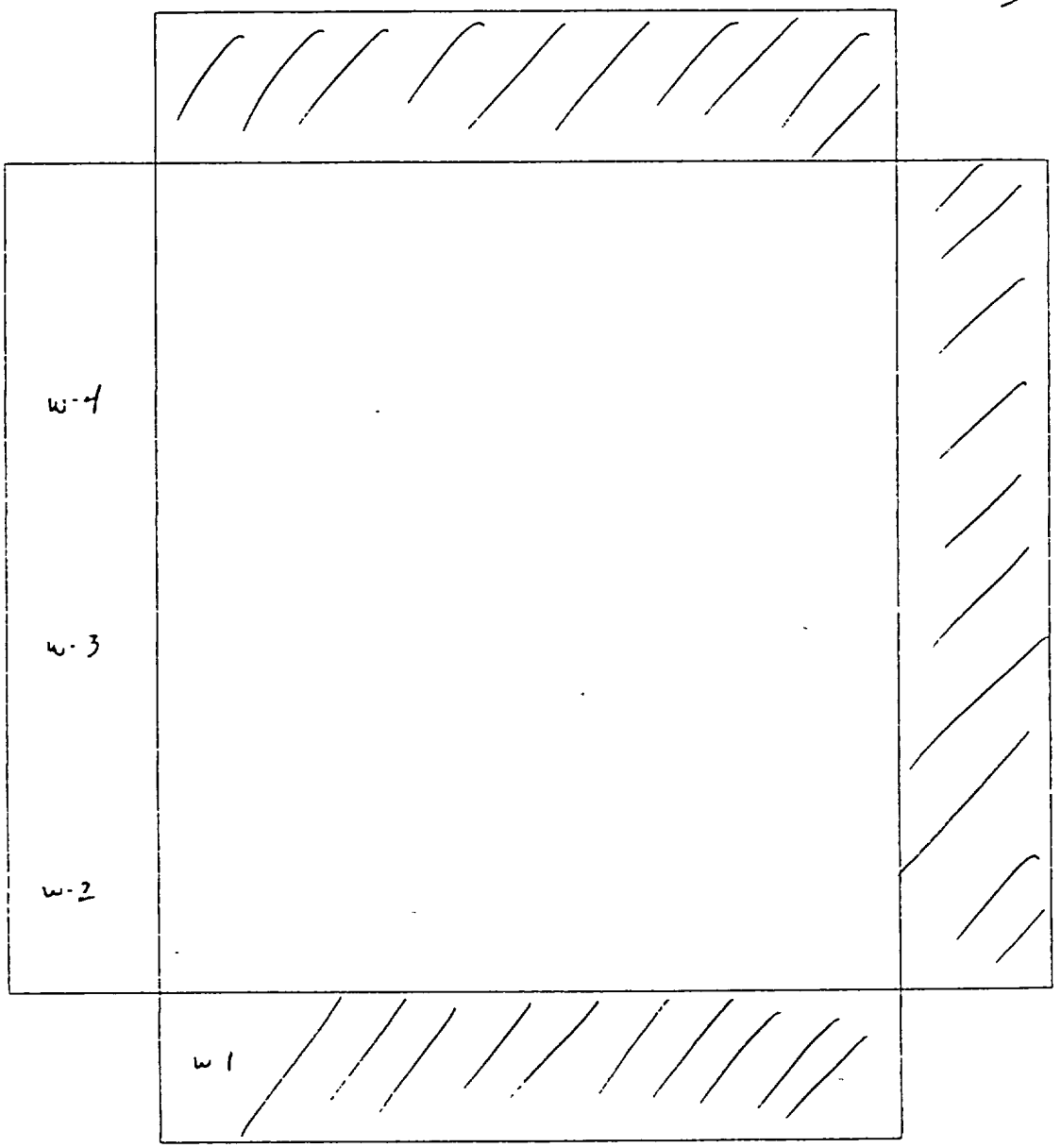
	Print Name	Signature	Date
Performed By			

Location	β Scan (cpm)	α Scan (cpm)	β Static (unsh) (cpm)	β Static (sh) (cpm)	α Static (cpm)	ER (μrem/hr)	Smears (dpm/100 cm²) α	Smears (dpm/100 cm²) β
W-1	440		429	279		11	-.8	-30
W-2	420		409	296		11	-.8	-56
W-3	460		448	287		10	-.8	-30
W-4	470		448	344		10	-.8	-39
W-5	490		464	342		11	2	-22
W-6	520		487	363		12	-.8	-39
W-7	420		419	348		12	-.8	-22
W-7QC	430		414	339		11	-.8	-30
W-8	420		400	350		10	-.8	Ø
W-9	460		447	308		10	-.8	35
W-10	490		471	356		10	-.8	-22
W-11	460		449	308		10	-.8	-56
W-12	390		363	267		10	-.8	-26
W-13	400		379	284		10	-.8	8.7
W-14	390		362	267		11	-.8	-22
W-15	420		385	303		10	-.8	Ø
W-16	430		401	275		10	-.8	-26
W-17	380		373	275		10	-.8	-62
W-18	410		395	285		10	2	-26
W-19	360		337	272		10	-.8	52
W-20	380		355	273		10	-.8	-17
W-21	430		403	267		11	-.8	-8.7
W-22	410		375	302		11	-.8	-13

Inst. # 2

Building 38
North

Survey # 02-0795



Exterior

//// = Not Accessible

Scale:
4m x 4m

Radiological Survey Results - Survey Location Indicator

Survey #02-0795

Survey Area Information: FSS Bldg #38 Exterior Walls

	Instrument Model/SN	Cal Due	Probe Model/SN	Cal Due	α Scan MDA	β Scan MDA	α Static MDA	β Static MDA
Instrument Data								

	Print Name	Signature	Date
Performed By.			

Location	β Scan (cpm)	α Scan (cpm)	β Static (unsh) (cpm)	β Static (sh) (cpm)	α Static (cpm)	ER (μrem/hr)	Smears (dpm/100 cm²) α	Smears (dpm/100 cm²) β
W-1	480		449	391		12	-.8	7.8
W-2	410		390	288		11	2	4.3
W-2 QC	390		370	286		11	-.8	-8.7
W-3	380		354	298		10	-.8	4.3
W-4	400		383	302		11	-.8	-8.7

Inst #2

Results of Surface Scans

Molycorp - Building 38 Foundation Only Survey Unit

Building Floor

Location (see map)	Beta Scan gross cpm	Beta Scan net cpm
F1	590	230
F2	610	250
F3	540	180
F4	570	210
F5	560	200
F6	480	120
F7	460	100
F8	520	160
F9	490	130
F10	490	130
F11	510	150
F12	500	140
F13	540	180
F14	580	220
F15	490	130
F16	500	140
F17	440	80
F18	450	90
F19	480	120
F20	500	140
F21	520	160
F22	460	100
F23	490	130
F24	500	140
F25	510	150
F26	450	90
F27	480	120
F28	470	110
F29	460	100
F30	500	140

All floor scans performed with Ludlum 2350-1 No 95356 with 43-106 No. 133866

Monitor Info
Scan MDA Beta - 729 dpm/100 cm^2
Scan background Beta - 360 cpm
Detector Eff. Beta - .246

Results of Surface Scans

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Interior)

Location (see map)	Beta Scan gross cpm	Beta Scan net cpm
W1	440	130
W2	420	110
W3	460	150
W4	470	160
W5	490	180
W6	520	210
W7	420	110
W8	420	110
W9	460	150
W10	490	180
W11	460	150
W12	390	80
W13	400	90
W14	390	80
W15	420	110
W16	430	120
W17	380	70
W18	410	100
W19	360	50
W20	380	70
W21	430	120
W22	410	100

All interior wall scans performed with Ludlum 2350-1 No 129414 with 43-106 No 128914

Scan MDA Beta - 693 dpm/detector area
Scan background Beta - 310 cpm
Detector Eff. Beta - .240

Results of Surface Scans

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Exterior)

Location (see map)	Beta Scan gross cpm	Beta Scan net cpm
W1	480	170
W2	410	100
W3	380	70
W4	400	90

All interior wall scans performed with Ludlum 2350-1 No.129414 with 43-106 No. 128914

Scan MDA Beta - 693 dpm/detector area
Scan background Beta - 310 cpm
Detector Eff. Beta - .240

Results of Surface Scans

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Beams (Steel)

Location	Beta Scan gross cpm	Beta Scan net cpm
B1	380	70
B2	290	-20
B3	280	-30
B4	390	80
B5	370	60

All beam scans performed with Ludlum 2350-1 No.129414 with 43-106 No 128914

Scan MDA Beta - 693 dpm/detector area
Scan background Beta - 310 cpm
Detector Eff. Beta - .240

Elevated Scan Readings

Molycorp - Building 38 Foundation Survey Unit

No elevated scan results were reported

Direct Measurements (Total Activity)

Molycorp - Building 38 Foundation Only Survey Unit

Building Floor

Location (see map)	Unshield Beta cpm	Shield Beta cpm	Gross Beta cpm	Bkgd cpm	Net cpm	Direct Beta (dpm/100cm^2)	Uncertainty 95% CL	MDA (dpm/100cm^2)	Direct Alpha (1) (dpm/100cm^2)
F1	562	407	155	144	11	45	138	238	89
F2	582	409	173	144	29	118	142	238	236
F3	533	389	144	144	0	0	135	238	0
F4	535	402	133	144	-11	-45	133	238	-89
F5	531	362	169	144	25	102	141	238	203
F6	459	371	88	144	-56	-228	121	238	-455
F7	449	311	138	144	-6	-24	134	238	-49
F8	499	368	131	144	-13	-53	132	238	-106
F9	476	320	156	144	12	49	138	238	98
F10	473	299	174	144	30	122	142	238	244
F11	486	327	159	144	15	61	139	238	122
F12	473	346	127	144	-17	-69	131	238	-138
F13	513	339	174	144	30	122	142	238	244
F14	554	351	203	144	59	240	148	238	480
F15	472	308	164	144	20	81	140	238	163
F16	476	349	127	144	-17	-69	131	238	-138
F17	427	327	100	144	-44	-179	124	238	-358
F18	431	338	93	144	-51	-207	123	238	-415
F19	440	296	144	144	0	0	135	238	0
F20	473	333	140	144	-4	-16	134	238	-33
F21	476	288	188	144	44	179	145	238	358
F22	423	316	107	144	-37	-150	126	238	-301
F23	459	320	139	144	-5	-20	134	238	-41
F24	474	328	146	144	2	8	136	238	16
F25	478	279	199	144	55	224	148	238	447
F26	426	292	134	144	-10	-41	133	238	-81
F27	461	304	157	144	13	53	138	238	106
F28	454	303	151	144	7	28	137	238	57
F29	445	313	132	144	-12	-49	132	238	-98
F30	470	344	126	144	-18	-73	131	238	-146

Building foundation floor direct measurements were performed with 2350-1 No. 95356 and 43-106 No. 133866

	Beta
Efficiency	0 246
Floor Background (cpm)	144
Floor MDA (dpm/100 cm^2)	238

(1) - A beta to alpha ratio factoring (1:2, beta to alpha) was used to provide alpha activity.

Direct Measurements (Total Activity)

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Interior)

Location (see map)	Unshield Beta cpm	Shield Beta cpm	Gross Beta cpm	Bkgd cpm	Net cpm	Direct Beta (dpm/100cm^2)	Uncertainty 95% CL	MDA (dpm/100cm^2)	Direct Alpha (1) (dpm/100cm^2)
W1	429	279	150	94	56	233	128	199	467
W2	409	296	113	94	19	79	117	199	158
W3	448	287	161	94	67	279	130	199	558
W4	448	344	104	94	10	42	115	199	83
W5	464	342	122	94	28	117	120	199	233
W6	487	363	124	94	30	125	121	199	250
W7	419	348	71	94	-23	-96	105	199	-192
W8	400	350	50	94	-44	-183	98	199	-367
W9	447	308	139	94	45	188	125	199	375
W10	471	356	115	94	21	88	118	199	175
W11	449	308	141	94	47	196	125	199	392
W12	363	267	96	94	2	8	113	199	17
W13	349	284	65	94	-29	-121	103	199	-242
W14	362	267	95	94	1	4	112	199	8
W15	385	303	82	94	-12	-50	108	199	-100
W16	401	275	126	94	32	133	121	199	267
W17	373	275	98	94	4	17	113	199	33
W18	395	285	110	94	16	67	117	199	133
W19	337	272	65	94	-29	-121	103	199	-242
W20	355	273	82	94	-12	-50	108	199	-100
W21	403	267	136	94	42	175	124	199	350
W22	375	302	73	94	-21	-88	106	199	-175

Building foundation wall direct measurements were performed with 2350-1 No. 129414 and 43-106 No. 127216

	Beta
Efficiency	0 24
Cinder Block Wall Background (cpm)	94
Cinder Block Wall MDA (dam/100 cm^2)	199

(1) - A beta to alpha ratio factoring (1:2, beta to alpha) was used to provide alpha activity.

Direct Measurements (Total Activity)

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Exterior)

Location (see map)	Unshield Beta cpm	Shield Beta cpm	Gross Beta cpm	Bkgd cpm	Net cpm	Direct Beta (dpm/100cm^2)	Uncertainty 95% CL	MDA (dpm/100cm^2)	Direct Alpha (1) (dpm/100cm^2)
W1	449	391	58	94	-36	-150	101	199	-300
W2	390	288	102	94	8	33	114	199	67
W3	354	298	56	94	-38	-158	100	199	-317
W4	383	302	81	94	-13	-54	108	199	-108

Building foundation wall direct measurements were performed with 2350-1 No 129414 and 43-106 No 127216

	Beta
Efficiency	0.24
Cinder Block Wall Background (cpm)	94
Cinder Block Wall MDA (dam/100 cm^2)	199

(1) - A beta to alpha ratio factoring (1:2, beta to alpha) was used to provide alpha activity.

Direct Measurements (Total Activity)

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Beams (Steel)

Location (see map)	Unshield Beta cpm	Shield Beta cpm	Gross Beta cpm	Bkgd cpm	Net cpm	Direct Beta (dpm/100cm^2)	Uncertainty 95% CL	MDA (dpm/100cm^2)	Direct Alpha (1) (dpm/100cm^2)
B1	342	252	90	27	63	263	88	112	525
B2	268	248	20	27	-7	-29	56	112	-58
B3	261	224	37	27	10	42	65	112	83
B4	365	288	77	27	50	208	83	112	417
B5	346	261	85	27	58	242	86	112	483

Building foundation wall direct measurements were performed with 2350-1 No. 129414 and 43-106 No. 127216

	Beta
Efficiency	0.24
Metal Background (cpm)	27
Metal MDA (dam/100 cm^2)	112

(1) - A beta to alpha ratio factoring (1.2, beta to alpha) was used to provide alpha activity.

Elevated Direct Measurements (Total Activity)
Molycorp - Building 38 Foundation Only Survey Unit

No elevated direct measurements were reported.

Removable Surface Activity Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Building Floor

Location (see map)	Removable Beta (dpm/100cm^2)	Uncertainty 95% CL	MDA	Removable Alpha (dpm/100cm^2)	Uncertainty 95% CL	MDA
F1	-43	28.3	134	-0 8	3.0	14
F2	13	17.4	134	-0 8	3.0	14
F3	-39	27.1	134	-0 8	3.0	14
F4	-52	30.9	134	-0.8	3.0	14
F5	-26	22.8	134	-0.8	3.0	14
F6	-22	21.3	134	-0.8	3.0	14
F7	4 3	12.6	134	-0.8	3.0	14
F8	-52	30.9	134	-0.8	3.0	14
F9	-13	17.4	134	-0.8	3 0	14
F10	-8.7	15.2	134	-0.8	3.0	14
F11	8 7	15.2	134	2	4.7	14
F12	-8.7	15.2	134	5	7.5	14
F13	-4 3	12.6	134	2	4.7	14
F14	-61	33.2	134	-0.8	3.0	14
F15	17	19.2	134	-0 8	3.0	14
F16	-26	22.8	134	2	4.7	14
F17	8.7	15.2	134	-0 8	3.0	14
F18	13	17.4	134	-0 8	3.0	14
F19	0	9.4	134	2	4.7	14
F20	-17	19.2	134	-0.8	3.0	14
F21	39	27.1	134	-0.8	3.0	14
F22	-13	17 4	134	-0.8	3 0	14
F23	-4.3	12 6	134	2	4.7	14
F24	0	9.4	134	-0.8	3.0	14
F25	48	29 8	134	-0.8	3 0	14
F26	13	17 4	134	-0.8	3 0	14
F27	22	21 3	134	-0 8	3 0	14
F28	-4 3	12.6	134	0	0.4	14
F29	17	19 2	134	-0 8	3.0	14
F30	13	17.4	134	-0 8	3.0	14

Ludlum 2929 No 115563 with 43-10 No. 127216 Info:

	Beta	Alpha
Background (cpm)	73	0 28
Bkgd ct. time	60	60
Sample ct time	1	1
Efficiency	0.231	0.347
MDA	134	14

Removable Surface Activity Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Interior)

Location (see map)	Removable Beta (dpm/100cm2)	Uncertainty 95% CL	MDA	Removable Alpha (dpm/100cm2)	Uncertainty 95% CL	MDA
W1	-30	24 2	134	-0.8	3.0	14
W2	-56	31.9	134	-0 8	3.0	14
W3	-30	24.2	134	-0.8	3.0	14
W4	-39	27.1	134	-0.8	3.0	14
W5	-22	21.3	134	2	4 7	14
W6	-39	27.1	134	-0.8	3.0	14
W7	-22	21.3	134	-0.8	3.0	14
W8	0	9.4	134	-0 8	3 0	14
W9	35	25.9	134	-0.8	3.0	14
W10	-22	21.3	134	-0.8	3.0	14
W11	-56	31.9	134	-0.8	3.0	14
W12	-26	22.8	134	-0.8	3 0	14
W13	8 7	15.2	134	-0.8	3 0	14
W14	-22	21.3	134	-0.8	3 0	14
W15	0	9 4	134	-0.8	3.0	14
W16	-26	22.8	134	-0.8	3.0	14
W17	-62	33 4	134	-0.8	3.0	14
W18	-26	22.8	134	2	4.7	14
W19	52	30.9	134	-0.8	3 0	14
W20	-17	19.2	134	-0.8	3 0	14
W21	-8.7	15 2	134	-0.8	3 0	14
W22	25	22.4	134	-0.8	3 0	14

Ludlum 2929 No. 115563 with 43-10 No. 127216 Info

	Beta	Alpha
Background (cpm)	73	0.28
Bkgd ct. time	60	60
Sample ct. time	1	1
Efficiency	0 231	0.347
MDA	134	14

Removable Surface Activity Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Exterior)

Location (see map)	Removable Beta (dpm/100cm2)	Uncertainty 95% CL	MDA	Removable Alpha (dpm/100cm2)	Uncertainty 95% CL	MDA
W1	78	37 2	134	-0.8	3.0	14
W2	4.3	12.6	134	2	4.7	14
W3	4.3	12 6	134	-0 8	3.0	14
W4	-8 7	15.2	134	-0 8	3.0	14

Ludlum 2929 No. 115563 with 43-10 No 127216 Info:

	Beta	Alpha
Background (cpm)	73	0.28
Bkgd ct time	60	60
Sample ct. time	1	1
Efficiency	0.231	0 347
MDA	134	14

Removable Surface Activity Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Beams (Steel)

Location (see map)	Removable Beta (dpm/100cm2)	Uncertainty 95% CL	MDA	Removable Alpha (dpm/100cm2)	Uncertainty 95% CL	MDA
B1	4.3	12.6	134	-0 8	3 0	14
B2	13	17.4	134	-0 8	3.0	14
B3	-8.7	15.2	134	2	4.7	14
B4	-17	19.2	134	-0 8	3.0	14
B5	0	9.4	134	-0 8	3.0	14

Ludlum 2929 No 115563 with 43-10 No 127216 Info:

	Beta	Alpha
Background (cpm)	73	0.28
Bkgd ct. time	60	60
Sample ct. time	1	1
Efficiency	0 231	0 347
MDA	134	14

Elevated Removable Surface Activity Measurements

Molycorp - Building 38 Foundation Only Survey Unit

No elevated removable surface activity was reported above limits

Exposure Rate Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Building Floor

Location (see map)	Exposure Rate (uR/hr)	Net Exp Rate (uR/hr)
F1	11	1
F2	11	1
F3	12	2
F4	12	2
F5	12	2
F6	11	1
F7	11	1
F8	11	1
F9	11	1
F10	11	1
F11	10	0
F12	11	1
F13	11	1
F14	11	1
F15	10	0
F16	10	0
F17	10	0
F18	10	0
F19	10	0
F20	10	0
F21	10	0
F22	10	0
F23	10	0
F24	11	1
F25	10	0
F26	10	0
F27	10	0
F28	10	0
F29	10	0
F30	10	0

Background dose rate: 10 uR/hr with Model 19, No 22526

Exposure Rate Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Interior)

Location (see map)	Exposure Rate (uR/hr)	Net Exp Rate (uR/hr)
W1	11	1
W2	11	1
W3	10	0
W4	10	0
W5	11	1
W6	12	2
W7	12	2
W8	10	0
W9	10	0
W10	10	0
W11	10	0
W12	10	0
W13	10	0
W14	11	1
W15	10	0
W16	10	0
W17	10	0
W18	10	0
W19	10	0
W20	10	0
W21	11	1
W22	11	1

Background dose rate 10 uR/hr with Model 19, No. 22526

Exposure Rate Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Walls (Exterior)

Location (see map)	Exposure Rate (uR/hr)	Net Exp Rate (uR/hr)
W1	12	2
W2	11	1
W3	10	0
W4	11	1

Background dose rate. 10 uR/hr with Model 19, No. 22526

Exposure Rate Measurements

Molycorp - Building 38 Foundation Only Survey Unit

Foundation Beams (Steel)

Location (see map)	Exposure Rate (uR/hr)	Net Exp Rate (uR/hr)
B1	11	1
B2	10	0
B3	11	1
B4	11	1
B5	10	0

Background dose rate .10 uR/hr with Model 19, No. 22526

Summary of Building Surface Direct Reading (Total Activity) Results

Molycorp - Building 38 Foundation Only Survey Unit

Beta				Alpha			
n	$\bar{x}$	s	μ_α	n	$\bar{x}$	s	μ_α
61	27	126.2	54.0	61	54	252.4	107.9

$t_{1-\alpha}$ 1 671

Guidelines/Conditions Satisfied?

Beta	Alpha
Yes	Yes

Summary of Exposure Rate Measurements

Molycorp - Building 38 Foundation Only Survey Unit

n	$\bar{x}$	s	μ_α
61	0 6	0.7	0.7

$t_{1-\alpha}$ 1.671

Guidelines/Conditions Satisfied?

Yes

Appendix B

Background Assessment Data

Molycorp Washington, PA

Background Assessment

Material-specific background levels were established by RSI in late 2001 during their final status surveys of Buildings 39 and 42 and by MACTEC in early 2002 during their final status surveys, for each type of instrument used for total surface contamination measurements. In June, 2002 new instrumentation was implemented for use and backgrounds established.

Background measurements were collected on surfaces of similar construction as the buildings at the site and having no possibility of being impacted by site operations. Measurements to establish background for a specific material were collected from multiple locations to provide an estimate of the variability or uncertainty. Background determination was performed using the same instrumentation that was used for final status survey data collection An average background value was determined for each material surveyed Background determinations were required and performed for concrete, cinderblock, and a class of material designated a generic material.

The number of background measurements obtained per material type:

- Concrete - minimum of 20 measurements
- Cinderblock - minimum of 20 measurements
- Generic Material - minimum of 10 measurements for each type of material surveyed (i.e., wood, insulation, corrugated steel, etc)

MACTEC performed material-specific backgrounds for poured concrete, cinderblock, and corrugated steel/drywall with it's four large-area gas-proportional instruments. The most conservative background values were selected and used for all background subtracts for direct (static) type surveys performed

Background measurements were calculated from surveys obtained at the Canton Volunteer Fire Department Station 52-1, Canton Township, PA on their surfaces and structures. A mean value for each instrument was calculated. The most conservative background value was selected and used by the Health Physics technicians for all instrument background subtractions.

Included in this appendix are the results of MACTEC's background assessment data.

Concrete Background Assessment

Molycorp Washington, PA

Poured Concrete Surfaces

Ludlum Model 2350-1 (117563) with 43-106 (128912)

	Beta - Direct Measurements (cpm)			Alpha - Direct Measurements (cpm)
	Unshield	Shield	Net	Net
	549	429	120	14
	641	449	192	13
	629	487	142	9
	630	501	129	16
	651	498	153	14
	629	480	149	10
	634	494	140	8
	684	467	217	5
	728	458	270	11
	741	576	165	10
Mean (cpm)	168			11
Stand Deviation	46.3			3 3
n_b	6			7

Readings taken at the Canton Volunteer Fire Department Station 52-1, Canton Township, PA on their poured concrete surfaces

Concrete Background Assessment
Molycorp Washington, PA

Poured Concrete Surfaces

Ludlum Model 2350-1 (95356) with 43-68 (91046)

	Beta - Direct Measurements (cpm)			Alpha - Direct Measurements (cpm)
	Unshield	Shield	Net	Net
	460	330	130	10
	482	397	85	14
	592	381	211	15
	589	381	208	12
	561	348	213	23
	555	408	147	11
	491	388	103	13
	511	392	119	6
	1014	409	605	18
	606	375	231	17
	523	429	94	12
	590	386	204	14
	703	407	296	17
	662	389	273	13
	551	408	143	10
	518	346	172	7
	478	349	129	12
	465	345	120	5
	520	403	117	14
	522	407	115	13
Mean (cpm)	186			13
Stand Deviation	115.5			4 2
n_b	29			8

Readings taken at the Canton Volunteer Fire Department Station 52-1, Canton Township, PA on their poured concrete surfaces.

Concrete Background Assessment
Molycorp Washington, PA

Poured Concrete Surfaces

Ludlum Model 2350-1 (126190) with 43-106 (133871)

	Beta - Direct Measurements (cpm)			Alpha - Direct Measurements (cpm)
	Unshield	Shield	Net	Net
	500	350	150	9
	418	314	104	6
	447	326	121	8
	494	312	182	5
	483	351	132	3
	466	306	160	6
	478	347	131	9
	469	327	142	8
	426	353	73	12
	429	343	86	7
	499	349	150	10
	462	330	132	9
	496	372	124	8
	491	336	155	9
	458	295	163	12
	527	337	190	11
	464	327	137	13
	521	302	219	12
	492	323	169	4
	484	319	165	8
Mean (cpm)	144			8
Stand Deviation	34 4			2 8
n_b	4			8

Readings taken at the Canton Volunteer Fire Department Station 52-1, Canton Township, PA on their poured concrete surfaces

Metal/Drywall Background Assessment
Molycorp Washington, PA

Metal/Drywall Surfaces

Ludlum Model 2350-1 (117566) with 43-68 (19046)

	Beta - Direct Measurements (cpm)			Alpha - Direct Measurements (cpm)
	Unshield	Shield	Net	Net
	268	246	22	3
	268	238	30	2
	291	275	16	1
	286	245	41	2
	290	274	16	1
	312	283	29	3
	333	312	21	2
	325	275	50	1
	274	251	23	1
	266	237	29	4
Mean (cpm)	28			2
Stand Deviation	10 8			1 1
n_b	11			21

Readings taken at the Canton Volunteer Fire Department Station 52-1, Canton Township, PA on their metal/drywall surfaces

Metal/Drywall Background Assessment
Molycorp Washington, PA

Metal/Drywall Surfaces

Ludlum Model 2350-1 (117563) with 43-106 (128912)

	Beta - Direct Measurements (cpm)			Alpha - Direct Measurements (cpm)
	Unshield	Shield	Net	Net
	288	266	22	3
	305	224	81	4
	277	252	25	5
	331	291	40	2
	294	290	4	3
	312	301	11	1
	311	302	9	1
	315	300	15	1
	320	285	35	3
	313	286	27	1
Mean (cpm)	27			2
Stand Deviation	22 2			1.4
n_b	56			26

Readings taken at the Canton Volunteer Fire Department Station 52-1, Canton Township, PA on their metal/drywall surfaces

Appendix C

Instrumentation Data

Molycorp Washington, PA

Instrumentation Data

This data package contains instrumentation information (background, QC, and source response data forms) for the instruments used during the final status survey of Building 1 at the Molycorp Washington, PA site.

EFF .240 B⁻

Daily Instrumentation Operational Check Sheet

Instrument 2350 1 129414 Probe 43-106 128914

Cal Due 8-2-03 Cal Due: 2-2-03

Source ID.	Mean Source Count Rate:	Mean +2 σ Value:	Mean -2 σ Value:
Tc 99 3935	4643	4791	449.5

Radiation Type:	Sigma Value.	Mean +3 σ Value:	Mean -3 σ Value:
β-	74	4864	4421

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-7-02	0605	5	1552	310	1	4704	—	—	66	Sat
8-7-02	1720	—	—	—	1	4687	—	✓	—	Sat
8-8-02	0615	5	1559	312	1	4727	✓	—	67	Sat
8-8-02	1600	—	—	—	1	4687	—	—	—	Sat
8-12-02	0610	5	1625	325	1	4599	—	—	68	Sat
8-12-02	1635	—	—	—	1	4709	✓	✓	—	Sat
8-13-02	0650	5	1568	314	1	4687	✓	✓	67	Sat
8-13-02	1650	—	—	—	1	4729	—	—	—	Sat
8-14-02	0610	5	1565	313	1	4614	—	—	67	Sat
8-14-02	1658	M 5	M 1454	—	1	4710	—	—	—	Sat
8-15-02	0615	5	1454	291	1	4663	—	—	64	Sat
8-15-02	1645	—	—	—	1	4724	✓	✓	—	Sat
8-19-02	0610	5	1468	294	1	4710	—	—	65	Sat
8-19-02	1625	—	—	—	1	4624	✓	✓	—	Sat
8-20-02	0625	5	1534	307	1	4668	—	—	66	Sat
8-20-02	1635	MA	—	—	1	4686	—	—	—	Sat

EFF. 195 α

Daily Instrumentation Operational Check Sheet

Instrument 2350-1 129414 Probe. 43-106 128914

Cal Due: 8-2-03 Cal Due: 2-2-03

Source ID: Th 230 3927 | Mean Source Count Rate: 739 | Mean +2 σ Value: 799 | Mean -2 σ Value: 679

Radiation Type: α | Sigma Value: 30 | Mean +3 σ Value: 829 | Mean -3 σ Value: 649

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8 7-02	0615	5	8	1.6	1	736	—	—	8	Sat
8-7-02	1721	—	—	—	1	720	✓	✓	—	Sat
8-8-02	0615	5	5	1	1	765	—	—	7	Sat
8 8-02	1605	—	—	—	1	737	—	—	—	Sat
8-12-02	0615	5	10	2.0	1	736	—	—	8	Sat
8-12-02	1630	—	—	—	1	731	✓	✓	—	Sat
8-13-02	0705	5	18	3.6	1	709	—	—	10	Sat
8 13-02	1645	—	—	—	1	731	—	—	—	Sat
8-14-02	0615	5	10	2	1	712	—	—	8	Sat
8-14-02	1630	—	—	—	1	721	—	—	—	Sat
8-15-02	0625	5	7	1.4	1	751	—	—	7	Sat
8-15-02	1645	—	—	—	1	707	✓	✓	—	Sat
8-19-02	0635	5	5	1	1	753	—	—	7	Sat
8-19-02	1635	—	—	—	1	702	—	—	—	Sat
8-20-02	0625	5	4	.8	1	711	—	—	7	Sat
8-20-02	1640	—	—	—	1	746	—	—	—	Sat

Daily Instrumentation Operational Check Sheet

EFF = .240

Instrument: 2350-1 # 129414 Probe: 43-106 # 128914

Cal Due: 8-2-03 Cal Due: 2-2-03

Source ID:	Tc 99 #3935	Mean Source Count Rate:	4643	Mean +2 σ Value:	4791	Mean -2 σ Value:	4495
Radiation Type:	B-	Sigma Value:	74	Mean +3 σ Value:	4864	Mean -3 σ Value:	4421

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-21-02	0610	5	1625	325	1	4612	✓	✓	68	Sat
8-21-02	1700	—	—	—	1	4518	✓	✓	—	Sat
8-22-02	0620	5	1464	293	1	4672	✓	✓	65	Sat
8-22-02	1610	—	—	—	1	4637	✓	✓	—	Sat
8-26-02	0615	5	1508	302	1	4501	✓	✓	66	Sat
8-27-02	0610	5	1432	286	1	4423	✓	✓	61	Sat
8-27-02	1620	—	—	—	1	4528	✓	✓	—	Sat
8-28-02	0730	~~605~~	1409	282	1	4501	✓	✓	64	Sat
8-28-02	1700	—	—	—	1	4478	✓	✓	—	Sat
8-29-02	0610	5	1287	257	1	4506	✓	✓	61	Sat
8-29-02	1600	—	—	—	1	4511	✓	✓	—	Sat

Daily Instrumentation Operational Check Sheet

EFF: .195

Instrument 2350-1 # 129414 Probe: 43-106 # 128914

Cal Due. 8-2-03 Cal Due: 2-2-03

Source ID:	Th 230 # 3937	Mean Source Count Rate:	739	Mean +2 σ Value:	799	Mean -2 σ Value:	679
Radiation Type:	α	Sigma Value	30	Mean +3 σ Value:	829	Mean -3 σ Value:	649

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-21-02	0620	5	7	1.4	1	701	✓	✓	7	Sat
8-21-02	1700	—	—	—	1	671	✓	✓	—	Sat
8-22-02	0630	5	6	1.2	1	742	✓	✓	7	Sat
8-22-02	1805	—	—	—	1	713	✓	✓	—	Sat
8-26-02	0615	5	7	1.4	1	725	✓	✓	7	Sat
8-27-02	0615	5	7	1.4	1	725	✓	✓	7	Sat
8-27-02	1820	—	—	—	1	654	✓	✓	—	Sat
8-28-02	0715	5	4	0.8	1	685	✓	✓	6	Sat
8-28-02	1700	—	—	—	1	721	✓	✓	—	Sat
8-29-02	0615	5	7	1.4	1	731809 ND	✓	✓	7	Sat
8-29-02	1600	—	—	—	1	716				

EFF = .246

Daily Instrumentation Operational Check Sheet

Instrument 2350 #95356 Probe. 43-106 # 133866

Cal Due 1-29-03 Cal Due: 1-29-03

Source ID. Re 99 #3935 Mean Source Count Rate: 4741 Mean +2 σ Value: 4873 Mean -2 σ Value: 4609

Radiation Type: B⁻ Sigma Value: 66 Mean +3 σ Value: 4939 Mean -3 σ Value: 4543

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-14-02	0605	5	1520	304	1	4720	—	—	66	Sat
8-14-02	1605	—	—	—	1	4810	—	—	—	Sat
8-15-02	0610	5	1543	309	1	4776	✓	✓	66	Sat
8-15-02	1630	—	—	—	1	4854	✓	✓	—	Sat
8-19-02	0615	5	1367	273	1	4612	—	—	63	Sat
8-19-02	1630	—	—	—	1	4648	✓	✓	—	Sat
8-20-02	0650	5	1725	345	1	4891	—	—	70	Sat
8-20-02	1615	—	—	—	1	4665	—	—	—	Sat
8-21-02	0610	5	1628	327	1	4554	✓	✓	68	Sat
8-21-02	1610	—	—	—	1	4825	—	—	—	Sat
8-22-02	0615	5	1529	306	1	4640	—	—	66	Sat
8-22-02	1600	—	—	—	1	4895	✓	✓	—	Sat
8-26-02	0615	5	1530	306	1	4625	—	—	66	Sat
8-26-02	1650	—	—	—	1	4779	✓	✓	—	Sat
8-27-02	0610	5	1526	305	1	4547	✓	✓	66	Sat
8-27-02	1655	—	—	—	1	4579	—	—	—	Sat

EFF = .204

Daily Instrumentation Operational Check Sheet

Instrument 2350-1 # 95356 Probe: 43-106 # 133866

Cal Due 1-29-03 Cal Due: 1-29-03

Source ID	Mean Source Count Rate	Mean +2 σ Value.	Mean -2 σ Value.
Th 230 3931	718	776	660

Radiation Type:	Sigma Value.	Mean +3 σ Value:	Mean -3 σ Value:
α	29	805	631

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-14-02	0615	5	11	2.2	1	662	⌐	⌐	8	Sat
8-14-02	1630	—	—	—	1	701	⌐	⌐	—	Sat
8-15-02	0630	5	11	2.2	1	712	⌐	⌐	8	Sat
8-15-02	1620	—	—	—	1	703	⌐	⌐	—	Sat
8-19-02	0640	5	7	1.4	1	723	⌐	⌐	7	Sat
8-19-02	1630	—	—	—	1	707	⌐	⌐	—	Sat
8-20-02	0650	5	14	2.8	1	717	⌐	⌐	9	Sat
8-20-02	1620	—	—	—	1	666	⌐	⌐	—	Sat
8-21-02	0630	5	11	2.2	1	672	⌐	⌐	8	Sat
8-21-02	1615	—	—	—	1	747	⌐	⌐	—	Sat
8-22-02	0625	5	10	2	1	690	⌐	⌐	8	Sat
8-22-02	1600	—	—	—	1	668	⌐	⌐	—	Sat
8-26-02	0625	5	12	2.4	1	693	⌐	⌐	9	Sat
8-26-02	1655	—	—	—	1	710	⌐	⌐	—	Sat
8-27-02	0615	5	14	2.8	1	723	⌐	⌐	9	Sat
8-27-02	1650	—	—	—	1	688	—	—	—	Sat

Daily Instrumentation Operational Check Sheet

EFF=.231

Instrument 2929 # 115563 Probe. 43·10 # 127216

Cal Due 6·14-03 Cal Due: 6-14-03

Source ID: Te 99 # 3935 Mean Source Count Rate 3722 Mean +2 σ Value: 3824 Mean -2 σ Value: 3620

Radiation Type: B- Sigma Value. 51 Mean +3 σ Value: 3875 Mean -3 σ Value: 3569

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-13-02	0600	60	4340	72	1	3727	—	✓	.31	Sat
8-14-02	0600		4220	70	1	3719	—	—	31	Sat
8-15-02	0605		4256	71	1	3736	—	—	31	Sat
8-19-02	0605		4243	71	1	3782	—	—	31	Sat
8-20-02	0625		4237	73	1	3810	✓	—	31	Sat
8-21-02	0600		4114	69	1	3727	—	—	31	Sat
8-23-02	0605		4161	69	1	3793	—	—	31	Sat
8-26-02	0605		4199	70	1	3723	—	—	31	Sat
8-27-02	0700		4355	73	1	3875	✓	✓	31	Sat
8-28-02	0700		4160	69	1	3820	—	—	31	Sat
8-29-02	0605		4031	67	1	3784	—	—	30	Sat
		60								

Daily Instrumentation Operational Check Sheet

Eff = .347

Instrument: 2929 # 115563 Probe. 43-10 # 122216

Cal Due: 6-14-03 Cal Due: 6-14-03

Source ID: Th 230 # 3937 Mean Source Count Rate: 1376 Mean +2 σ Value. 1448 Mean -2 σ Value. 1304

Radiation Type: α Sigma Value: 36 Mean +3 σ Value: 1484 Mean -3 σ Value: 1268

Background					Source Check				Results	
Date	Time	Count Time (min)	Gross Counts	BKGD CPM	Count Time (min)	Gross Counts	W/I 2 σ Value	W/I 3 σ Value	LLD	SAT/ UNSAT
8-13-02	0630	60	10	.17	1	1357	✓	✓	4	Sat
8-14-02	0600		9	.15	1	1425	—	—	4	Sat
8-15-02	0605		15	.25	1	1365	—	—	5	Sat
8-19-02	0605		10	.17	1	1409	—	—	4	Sat
8-20-02	0625		17	.28	1	1340	✓	✓	5	Sat
8-21-02	0600		6	.1	1	1371	—	✓	4	Sat
8-22-02	0600		14	.23	1	1410	—	—	5	Sat
8-26-02	0600		10	.17	1	1438	—	—	4	Sat
8-27-02	0710		5	.08	1	1386	✓	✓	4	Sat
8-28-02	0710		7	.12	1	1365	—	—	4	Sat
8-29-02	0605		10	a.17	1	1389	—	—	4	sat
		↓								

Ludlum Model 19 Micro-Rem

Routine Performance and Background Data Form

Instrument ID #: 22526	Cal. Due: 1-29-03	Source ID #: Cs-137 A6143
Mean Source Value: 160	Mean plus + 20% Value: 192	Mean plus - 20% Value: 128

Date	Time	Meter Scale				Background Reading	Sat/Unsat
		25 µrem (sat/unsat)	50 µrem (sat/unsat)	250 µrem +/-20% value	500 µrem +/-20% value		
7-30-02	1045			160		10	Sat
7-31-02	0630			160		11	Sat
8-2-02	0605			160		10	Sat
8-5-02	0605			150		11	Sat
8-6-02	0630			160		12	Sat
8-7-02	0615			170		11	Sat
8-8-02	0620			170		11	Sat
8-12-02	0630			170		11	Sat
8-13-02	0655	N		165	N	10	Sat
8-14-02	0630		A	170	A	12	Sat
8-15-02	0625			170		12	Sat
8-19-02	0620			170		11	Sat
8-20-02	0625			170		10	Sat
8-21-02	0635			160		10	Sat
8-22-02	0615			160		11	Sat
8-26-02	0610			160		10	Sat
8-27-02	0635			160		10	Sat
8-28-02	0715			160		10	Sat
8-29-02	0630			150		10	Sat

Ludlum Model 19 Micro-Rem

Routine Performance and Background Data Form

Instrument ID #: 22526	Cal. Due: 1-29-03	Source ID #: Cs-137 A6143
Mean Source Value: 160	Mean plus + 20% Value: 192	Mean plus - 20% Value: 128

Date	Time	Meter Scale				Background Reading	Sat/Unsat
		25 µrem (sat/unsat)	50 µrem (sat/unsat)	250 µrem +/-20% value	500 µrem +/-20% value		
8-30-02	0700			160		11	SAT
9-3-02	0630			150		10	Sat
		N			N		
			A			A	