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October 14, 1994

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

Subject: Revised Surface Contamination and Release Procedure

Dear Chad,

Enclosed is the revised *Surface Contamination and Release Procedure* as per your letter dated September 30, 1994. This document has been revised to address the two issues which you brought up.

Thank you for your time and please contact me if you have any questions.

Sincerely,

John Benfield  
Chief Chemist

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$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}, \quad C = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}.$$

NOTE

**MOLYCORP, INC.**  
**SURFACE CONTAMINATION SURVEY AND**  
**RELEASE PROCEDURE**

This procedure provides guidance to perform radiological surveys of all equipment in affected areas on the site. The objective of the procedure is the detection of surface contamination and the determination of the eligibility of equipment for unrestricted release based on the contamination survey. The types of monitoring outlined in the procedure include qualitative and quantitative measurements for contamination. Qualitative surveys are used to detect the existence of contamination, while quantitative surveys determine specific levels of contamination and the eligibility of items for unrestricted release.

Contamination of equipment occurs from the refining of lanthanide products which contained low levels of source material (thorium, uranium, and associated decay products). Surface contamination exists in residues, dust, and scale which may be contained in or on containers, piping, process equipment, etc. Each piece of equipment will be surveyed prior to its release from the site for unrestricted use. Items which are identified through the survey as contaminated will be decontaminated, resurveyed, and released if clean or held for disposal.

Every rational effort will be made to decontaminate all potentially contaminated process equipment. These items will be cleaned of all reasonably removable licensed material residues by use of vacuum cleaners, hand scrubbing, steam cleaners, high pressure power washers, etc. as may be compatible with the item's material(s) of construction. Every effort will be made to clean the equipment to the lowest level (ALARA) of residual surface radioactivity. Cleaning of process equipment will be performed under controlled conditions and all effluents from the cleaning operation will be recovered for appropriate disposal. Care will be taken in the generation of waste which will be difficult to dispose of.

Instrumentation and Measurements Units - Portable alpha survey instruments capable of measuring counts per minute, such as the Eberline PRS-1 with an APB 100 probe, shall be used to conduct surveys for surface contamination. Calibration of the instrument shall occur on a regular frequency and be documented on the survey data log. Operational checks will be made and documented prior to the survey initiation.

Limits of contamination specified in Regulatory Guide 1.86, which is attached to this procedure, are expressed in terms of alpha activity (dpm/100cm<sup>2</sup>). Since the instrument readings are in counts per minute (cpm) conversions shall be recorded on the data log. The following equations shall be used to convert cpm to dpm/100cm<sup>2</sup>:

$$dpm/100cm^2 = \frac{(c/m - B/m)}{E} \left( \frac{100}{A} \right) \quad (\text{Surface Activity})$$

$$dpm/100cm^2 = \frac{(c - b)}{t \bullet E} \left( \frac{100}{A} \right) \quad (\text{Removable Activity})$$

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where:

- $c$  = Total integrated counts recorded by measurement
- $c/m$  = Total countrate from an analog (rate) instrument
- $t$  = Time period (minutes) over which the count was recorded
- $b$  = Count during recording period, due only to background levels of radiation
- $B/m$  = Background count rate on a analog instrument
- $E$  = Detection efficiency on an instrument in counts per disintegration
- $A$  = Active surface area of the detector in  $\text{cm}^2$

Determination of Minimum Detectable Activity (MDA) - The MDA for the survey instrument will be determined for scanning to ensure that it is less than 200 dpm/100 $\text{cm}^2$ . This will enable the surveyor to determine the need to perform surveys for removable contamination. The MDA will also be determined for surface activity measurement to ensure that it is below 1000 dpm/100 $\text{cm}^2$ . This procedure for estimating the MDA for survey instruments is given in NUREG/CR-5849 (Instrument Detection Sensitivity, Section 5.2).

$$MDA = \frac{3 \bullet B_R}{E \bullet \frac{A}{100}} \quad (\text{Scanning})$$

$$MDA = \frac{2.71 + 4.65 \sqrt{B_R \bullet t}}{t \bullet E \bullet \frac{A}{100}} \quad (\text{Surface Activity Measurement})$$

where:

- $B_R$  = Background rate in counts per minute
- $E$  = Detector efficiency in counts per disintegration
- $A$  = Active probe area in  $\text{cm}^2$
- $t$  = Counting time in minutes

Qualitative and Quantitative Surveys - Both types of surveys will be used to detect and measure contamination existing on equipment designated for release from the site. Qualitative surveys will be used on all equipment to be released for unrestricted use. This scan survey will be performed using an audible response detector to identify locations with elevated surface activity. Quantitative surveys (stationary measurements) will then be conducted on all equipment which show elevated activity. Wipe samples will also be taken on all locations which show elevated activity. Documentation of the qualitative and quantitative surveys will be retained for each item surveyed. All non-contaminated equipment and materials shall be documented as such prior to release from the site.



Release Limits - The objective of the survey program is to determine contamination levels and to assess individual pieces of equipment's eligibility for unrestricted release. Regulatory limits for release of equipment are included in the Regulatory Guide attached to this procedure. The radionuclide associated with contamination at this site is thorium-232 in secular equilibrium with its daughters, therefore the regulatory limits for thorium-nat, listed below, shall be used as the release criteria for survey purposes at this site.

Average Activity Limit <sup>a</sup>	1000 dpm/100cm <sup>2</sup>
Maximum Activity Limit <sup>b</sup>	3000 dpm/100cm <sup>2</sup>
Removable Activity Limit	200 dpm/100cm <sup>2</sup>

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<sup>a</sup> Measurements of average contamination shall not be averaged over more than one square meter. For objects of less surface area, the average shall be derived for each object.

<sup>b</sup> The maximum contamination level applies to an area of not more than 100cm<sup>2</sup>

## Surface Contamination Survey Procedure:

### Equipment Required:

- Copy of the survey procedure
- Data Log Form
- Survey Instrument, calibrated and checked
- Wipe pads

### Procedure:

1. On the log, record the following information: date of survey, survey operator, survey instrument data i.e. calibration date, efficiency, check source reading, etc.
2. During the survey, document on the log the following information: item description and identification number, measured total alpha activity (average and maximum), measured removable activity if wipe test are required, and fixed activity if calculated.
3. Measure the background alpha activity of the instrument. Typically this is 0 - 10 cpm. Investigate any discrepancy from typical background. Decontamination of the detector or repair of the instrument may be required.
4. The initial step of the survey is to measure (if practical) for total contamination. All surfaces of the item must be surveyed. This includes interior as well as exterior surfaces. Interior surfaces of piping, pumps, etc. may be determined by taking measurements at all traps and all other appropriate access points, provided contamination at these locations is likely to be representative of any interior contamination. Slowly sweep the item with the detector probe as close as possible to the surface and record the maximum and average activity on the data log. The maximum contamination reading applies to an area of not more than 100cm<sup>2</sup>. The average contamination reading applies to areas of not more than 1m<sup>2</sup>. Larger objects will have an average reading for each square meter, while objects smaller than one square meter will have the average reading derived from each object. Convert the measured activity to dpm/100cm<sup>2</sup>. This is the total contamination measurement. If the limits for removable, average and maximum contamination are not exceeded the equipment may be released from the site as is. If the surface activity level exceeds 200 dpm/100 cm<sup>2</sup>, but the average and maximum limits are met, the item will be swipe tested and the quantity of removable determined prior to release from the site. If the removable, average or maximum limit is exceeded, the item will be held for decontamination and resurvey.
5. Removable contamination surveys must be conducted on equipment with surface contamination levels in excess of 200 dpm/100cm<sup>2</sup>. Using a wipe pad, swipe and area approximately 10 x 10cm. Count the activity of the wipe pad for

one minute (longer count times may be used for greater accuracy) with the survey instrument. Record the counting results and convert to dpm/100cm<sup>2</sup>. Determine whether the limit for removable activity is exceeded. Calculate the quantity of fixed contamination by subtracting the removable quantity from the total contamination. Compare all the survey results with the release limits. If all pass, the item may be released from the site. If any fail, the item should be held for decontamination.

6. Record all information on the data log and retain all survey information.

7. Items which are of a size which prevents survey or have surfaces which are inaccessible for survey and are potentially contaminated shall be considered to be contaminated above the requirements for unrestricted release. These items will either be dismantled in such a manner that proper survey techniques can be performed, transported to another NRC licensed facility, or disposed of as low-level radioactive waste at a licensed disposal facility.