



COVIDIEN

*Karen Burke  
Director Environmental Remediation  
Hazelwood, 10-3-S  
Phone 314-654-5838  
Fax 314-654-6486*

March 17, 2008

Attn: Document Control Desk  
US Nuclear Regulatory Commission  
Washington DC 20555 - 0001

RE: NRC Docket 40-06563,  
License STB – 401  
License Amendment to Remove URO from Plant 6W – Response to RAIs and  
Removal of Burial Pit #10

This letter submits a final response for additional information (RAI) concerning the License Amendment to remove URO from Plant 6W and a request to include Burial Pit #10 in the License Amendment request.

Mallinckrodt initially submitted responses for additional information concerning URO removal as requested by NRC staff on January 28, 2008. Responses to those RAI, included specification of maximum acceptable areal contamination on the surface of equipment to be released from the restricted URO work area and justification thereof. In the RAIs NRC staff had requested a more restrictive specification for surface release criteria related to the potential dose consequent even though the initial specification submitted would be substantially below 25 mrem/yr even if the contaminant were all uranium series or all thorium series.

In order to continue making progress on the approval of the License Amendment, Mallinckrodt is proposing a revision to the specification, and is submitting a revised Table 6-4 Equipment Surface Release Limits, to replace both previously submitted versions of the table. Along with this revised specification is a discussion of the basis of values in Table 6-4.

Mallinckrodt's original License Amendment to Remove URO from Plant 6W submitted to the U.S. Nuclear Regulatory Commission on November 20, 2007 did not address Burial Pit #10 due to the fact that it is located beneath the floor of Building 101. Building 101 is an active finished product warehouse. However, due to newly obtained information regarding the structural integrity of the building and roof and a potential new project to renovate the building, Mallinckrodt is requesting the amendment to include removal of Burial Pit #10.

UM5501

UM55

Mr. Buckley

3/18/2008

Page 2 of 2

In the event that St. Louis Plant management decides to vacate Building 101, it would allow for access to the burial pit for removal. Additionally, it would allow for FUSRAP activities to continue within the Building 101 footprint. If this occurs a supplemental Delineation Agreement between Mallinckrodt and U.S. Army Corps of Engineers would be prepared and submitted to the U.S. Nuclear Regulatory Commission.

If you have any further questions concerning the URO removal application or concerning these responses, please contact me.

Sincerely yours,



Karen Burke

Attachments: Revised URO Removal Table 6-4  
Discussion of Revised Table 6-4

cc: John Buckley  
Thomas Youngblood  
Henry Morton  
Pat Duft

#### 6.2.4 ALARA

An objective of radiation protection during URO removal is to achieve as low as reasonable exposure to regulated radioactive material and radiation from it. The most effective emphasis will be to consider during preparation of each radiation safety work permit whether any particular action and or engineered control beyond good health physics practice would be reasonable to specify to try to reduce exposure.

#### 6.2.5 Survey And Release Criteria For Equipment<sup>1</sup>

Although Mallinckrodt prefers to dispose of contaminated equipment when it is cost-effective, equipment that is to be released without restriction on use will be subject to NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," as specified in Materials License STB-401, condition 16. Table 6-4 lists equipment surface release limits for the uranium series and thorium series distributions representative of C-T URO and adjacent soil. The composite maximum acceptable average areal density (MAAAD<sub>α</sub>) for equipment, 2400 dpmα/100 cm<sup>2</sup> is derived by the sum-of-fractions method. A composite MAAAD<sub>α</sub> = 2400 αdpm/100 cm<sup>2</sup> applies to surfaces of all URO-affected equipment surveyed for unrestricted release.

**Table 6-4**  
**Equipment Surface Release Limits**

Equipment Location	Average (dpmα/100 cm <sup>2</sup> )	Maximum (dpmα/100 cm <sup>2</sup> )	Removable (dpmα/100 cm <sup>2</sup> )
Any	2400	7200	500

### 6.3 ENVIRONMENTAL PROTECTION PROGRAM

An environmental protection program has been developed as needed to monitor air and water effluents discharged from the URO removal project.<sup>2</sup> Those provisions, described herein, shall apply to the URO removal project.

In recognition that both the amount of radioactivity and the general environmental hazards may be reduced as URO remediation progresses, the Environmental Protection Program may be modified to be commensurate with the activities being performed.

#### 6.3.1 The Program

An Environmental Safety Program will be developed and implemented as required to monitor air and water effluents discharged from the C-T URO removal project. During URO-soil

<sup>1</sup> Examples of *equipment* are described in CT Phase I DP, section 4.4.1.1.

<sup>2</sup> C-T Phase I DP, §3.4, Jan 9, 2002.

## NRC RAI CONCERNING THE TECHNICAL BASIS FOR MAXIMUM ACCEPTABLE SURFACE CONTAMINATION

---

### NRC Request for Additional Information:

Please provide the bases for the surface contamination Derived Concentration Guideline Level (DCGL) for equipment release surveys in Table 6-4. The license amendment request proposes 2400 dpm/100 cm<sup>2</sup>. Mallinckrodt should explain the basis for 2400 dpm/100 cm<sup>2</sup> or to demonstrate (by RESRAD-BUILD, etc.) that 2400 dpm/100 cm<sup>2</sup> will not exceed the applicable dose criteria.

### Response:

Explanation of Proposed Limit: Materials License STB-401, condition 16 specifies that equipment considered for release from a restricted area without restriction on use will be subject to NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material,"<sup>1, 2</sup>

The initially proposed limit of surface contamination on equipment subject to removal from Plant 6W was derived by apportioning the sum-of-fractions of the limits for uranium series and thorium series compliant with license condition 16 and with NRC Policy and Guidance Directive FC 83-23. The basis of apportionment was the U-to-Th ratio represented by 69 representative material samples collected in C-T processing facilities in Plant 5. In those samples, the U series to Th series ratio averaged 2-to-1.

More recent measurements of U series and Th series in URO and in adjacent soil in Plant 6W were proposed as bases of a derivation of maximum acceptable areal contamination on equipment associated with the URO project and subject to removal from Plant 6W. The uranium-to-thorium ratio and the U<sup>238</sup>-to-Th<sup>232</sup> ratio in each sample were calculated. An histogram of the distribution of U<sub>nat</sub>-to-Th<sub>nat</sub> is Figure 1 and of U<sup>238</sup>-to-Th<sup>232</sup> is in Figure 2 herewith. In these histograms, U-to-Th ratios in URO and adjacent soil samples were combined into one population; for the numbers of samples are roughly proportionate to the amount of URO and adjacent soil to be excavated and thus to the potential contamination by either URO or adjacent soil, or a mixture of the two.

Three or four of the samples exhibit U<sub>nat</sub>-to-Th<sub>nat</sub> or U<sup>238</sup>-to-Th<sup>232</sup> ratio less than one and those were of URO. However, the histograms also indicate that they comprise only about 6 or 7% of the total population of samples. Samples exhibiting a ratio no greater than two comprise only about 10% of the total population of samples. Overall risk of equipment being contaminated by U<sub>nat</sub>-to-Th<sub>nat</sub> radioactivity ratio less than two is thus relatively low.

---

<sup>1</sup> NRC Materials License STB-401, Docket 40-06563.

<sup>2</sup> NRC. "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material." July 1982. Enclosure 2 in Policy and Guidance Directive FC 83-23. Termination of Byproduct, Source, and Special Nuclear Material Licenses. Nov 1983.

Furthermore, it has been shown<sup>3</sup> that a Derived Concentration Guideline Level (DCGL) for uranium series and thorium series on a surface, if related to potential radiological dose, would exhibit relatively low sensitivity to U-to-Th ratio. The maximum acceptable areal density corresponding to FC 83-23 guidance and proposed herein would pose prominently lower potential radiological dose rate than would be derived by a DCGL derived by radiological dose modeling within the range of all uranium series or all thorium series contamination and posing no more than 25 mrem/yr potential dose rate,

In view of NRC staff caution concerning maximum acceptable U series and or Th series contamination on surfaces of equipment considered for release from the restricted work area, Mallinckrodt is revising its proposed maximum acceptable areal U series and Th series contamination on surfaces of equipment to be released without restriction on disposition or use to values in the following Table 6-4.

Table 6-4. Equipment Surface Release Limits

Equipment Location	Average (dpma/100cm <sup>2</sup> )	Maximum (dpma/100cm <sup>2</sup> )	Removable (dpma/100cm <sup>2</sup> )
Any	2400	7200	500

Mallinckrodt's request for license amendment application, Table 6-4 Equipment Surface Release Limits, is revised identically and is submitted herewith to replace the previously submitted table.

<sup>3</sup> C-T Phase I Decommissioning Plan, Appendix D, Figure D3 "DCGL<sub>w</sub> for Building Surfaces as a Function of U-to-Th Ratio," February 1, 2002.

Figure 1. Uranium-to-Thorium Ratio in URO and Adjacent Soil in Plant 6W

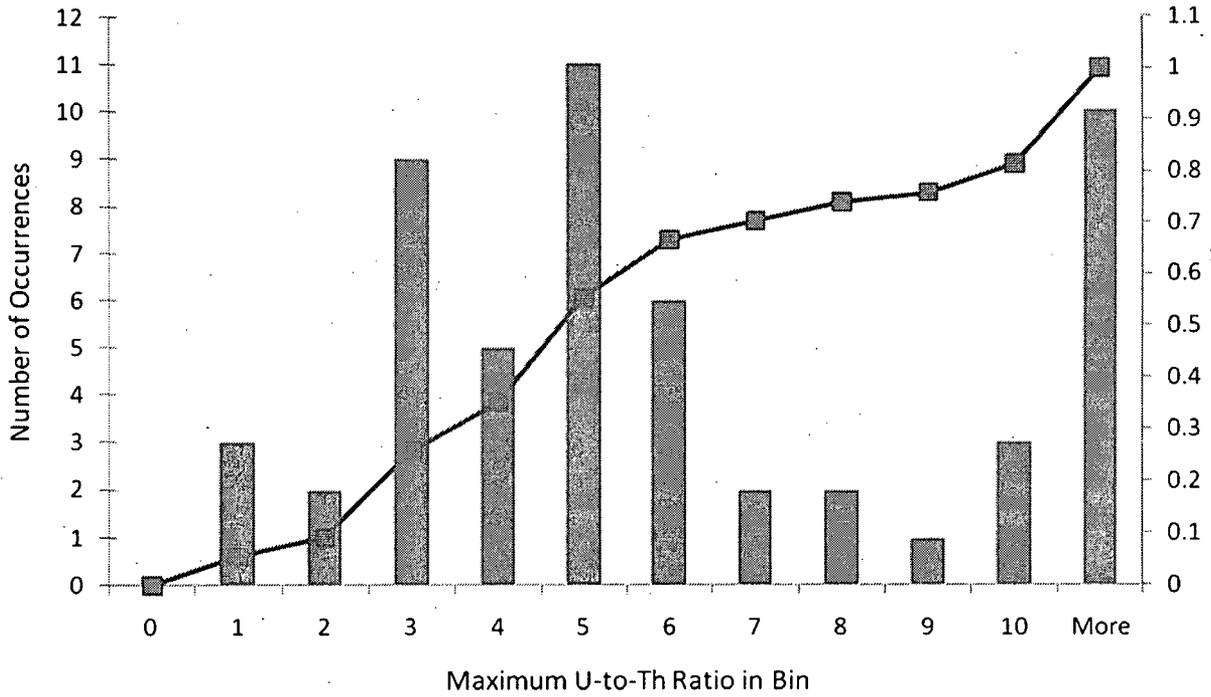


Figure 2. U238-to-Th232 Ratio in URO and Adjacent Soil in Plant 6W

