RESPONSE TO MISSOURI DEPARTMENT OF NATURAL RESOURCES COMMENTS ON THE C-T PHASE II DECOMMISSIONING PLAN FOR THE MALLINCKRODT INC. SITE, DOWNTOWN ST. LOUIS, MO

MDNR Letter Dated March 6, 2009

1. MDNR Comment 1

Section 2, Executive Summary. This section describes work remaining for Plant 7, which indicates that it will be addressed under a document entitled C-T Phase IIa. The text in this section and other sections of the plan imply that the U.S. Army Corps of Engineers is responsible for contamination in Plant 7. The department knows of no agreement having been reached between Mallinckrodt and the U.S. Corps of Engineers (USACE) regarding responsibility division. Also, the Executive Summary notes that there will be inaccessible areas (i.e., Plant 6 under building 101). Will the U.S. Nuclear Regulatory Commission (NRC) license STB-401 remain in effect until all areas are remediated or will another license be issued?

NRC Response

NRC does not agree that Mallinckrodt implies that USACE is responsible for the contamination in Plant 7. The Decommissioning Plan (DP) states that delineation of responsibility for contamination in Plant 7 must still be determined. Please note the following:

1. Page 1-2, paragraph 4, states, "Delineation of responsibility for remediation, particularly in areas known as Plants 6 and 7 within the St. Louis Plant site, remains to be decided between Mallinckrodt and the U.S. Army Corps of Engineers."

The staff is unable to locate the discussion regarding inaccessible areas in the Executive Summary as referenced by the state. However, the NRC will not terminate Mallinckrodt's license until all C-T processing areas meet the unrestricted release criteria of 10 CFR Part 20.1402. Currently inaccessible C-T process areas in Plant 6 (burial trench 10 under Building 101) will have to be remediated by Mallinckrodt prior to license termination. In addition, a delineation agreement for Plant 7W must be reached and remediation completed in the C-T process areas before license termination.

2. MDNR Comment 2

The Phase II preferred plan states the implementation will "complete" the decommissioning process. Very little, if any, hazardous chemical sampling results have been provided by Mallinckrodt. Knowing the processes used here and sample findings at other similar industrial sites, it is reasonable to conclude that hazardous chemicals will be encountered with the radioactive waste, which will require characterization/treatment of mixed waste. The Executive Summary provides evidence that spills occurred at the raffinate area (which would have mixed waste material). The state's Hazardous Waste Program's Permits Section will need to be involved when this occurs, as it has regulatory authority in this area. Please provide more detail on this aspect.

NRC Response

The NRC is not responsible for ensuring that Mallinckrodt is in compliance with the requirements of 40 CFR 260 – 270, nor the Department of Transportation regulations regarding the transportation of hazardous material. The DP describes the decommissioning activities necessary to remove residual radioactive material, including mixed waste, from C-T process areas such that these areas meet NRC's unrestricted release criteria. However, the NRC does regulate mixed waste. NUREG-1757 describes the information to be included in the DP regarding mixed waste. Section 12.3 of the DP states that Mallinckrodt site characterization activities have not identified any mixed waste in the soil or other materials to be remediated during decommissioning. Further, it states that if mixed waste is encountered during remediation, Mallinckrodt will characterize the waste, identify a disposal method…and notify NRC. Mallinckrodt has a RCRA part B permit authorizing on-site storage of hazardous and mixed waste. The staff is satisfied that Mallinckrodt has adequately addressed mixed waste in the DP given the results of characterization studies performed to date.

In order to address the state's concern, the NRC proposes that Mallinckrodt revise Section 12.3 of the DP by adding the following statement, "If hazardous chemicals or mixed waste are identified during decommissioning activities, Mallinckrodt will notify the State of Missouri Hazardous Waste Program Permit Section. Mallinckrodt will dispose of all hazardous chemical and mixed waste in accordance with appropriate state and federal regulations."

3. MDNR Comment 3

The Phase II preferred plan's goal is decommissioning in order for the area to be "released to unrestricted use in an industrial setting". For the foreseeable future this setting appears to be reasonable; however, it is unrealistic to conclude that the site will be industrial for the next 1000 years, without an enforceable, durable instrument or layers of instruments that give future generations a historic accounting of what the site's environmental restrictions are. While there are no guarantees of what type of instrument can provide this long-term assurance, deed restrictions, environmental covenants and other similar land use controls can and are currently being used at other sites with success. Although the rationale in the preferred plan may meet with approval by NRC, how will Mallinckrodt ensure that this aspect is addressed?

NRC Response

Mallinckrodt's goal is to decommission the site to the extent necessary for unrestricted release and to continue industrial productivity at the site. In accordance with Section 5 of NUREG-1757, Mallinckrodt must evaluate the potential doses resulting from residual radioactivity remaining on the site after decommissioning activities are completed. The unrestricted release criterion in 10 CFR Part 20.1402 does not require an investigation of all possible scenarios; its focus is on the dose to members of the critical group for the compliance scenario. The critical group is the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

The dose assessment time period (for demonstrating compliance) is 1000 years for all scenarios (i.e., dose assessments must evaluate the peak dose over the 1000-year time period after license termination). However, a 100-year timeframe is used for estimating reasonably foreseeable future land use scenarios (i.e., land uses reasonably likely to occur within 100 years, based on regional information and planning for similar land areas), which may be used as the compliance scenario for the dose assessments.

Based on the historical land use of the site, Mallinckrodt's plans to continue industrial use of the site, and current City of St. Louis zoning restrictions the staff believes that the most likely land use scenario for Plant 5 is industrial. If Mallinckrodt completes decommissioning in accordance with the DP, NRC will terminate its license without land use restrictions. NRC would not have a regulatory basis for requiring institutional controls as a condition of license termination.

4. MDNR Comment 4

With reference to comment 3 above, this plan states that "material" from the area can be used at other areas of the plant. Based on the cleanup goals of the preferred plan (Alternative 2) versus the lower concentration goals of the FUSRAP areas (Alternative 3), soils used as backfill from the C-T Phase II area will re-contaminate the cleanup being conducted by the USACE. It appears that the C-T Decommissioning plan needs to develop a management plan for this issue. How will the Phase II plan address this concern?

NRC Response

The NRC staff disagrees with the states assertion that soils used as backfill will re-contaminate the cleanup being conducted by USACE. Section 12.1.6 of the DP provides Mallinckrodt's plan for waste disposition. In summary, it says:

- Material which is indistinguishable from background may be released without restriction.
- Material which is distinguishable from background but contains radioactivity concentrations less than the unimportant quantity of source material, as defined in 10 CFR 40.13, will be disposed of in accordance with an NRC-authorized transfer to a disposal facility, subject to the cognizant state regulatory agencies in which the disposal facility is located.
- Material which contains greater than unimportant quantities of source material, as defined in 10 CFR 40.13, will be disposed of at an NRC-regulated disposal facility authorized by license to receive it.
- Material whose radioactivity concentration is less than the DCGL (29.3 pCi/g soil) <u>may</u> be used for backfill in on-site excavations deeper than 4 feet below grade.

The USACE cleanup criteria, as specified in the Record of decision (ROD) is 5 pCi/g composite for soil to a depth of 6 inches, 15 pCi/g composite for soil from 6 inches to 4 feet deep, and 50 pCi/g for U-238 in soil to a depth of 4 feet. Below 4 feet, the criterion is 50 pCi/g Ra, 100 pCi/g Th, and 150 pCi/g U-238.

It is clear that the C-T project DCGL is lower than the USACE cleanup criteria for soil below 4 feet. Therefore, the staff does not agree that Mallinckrodt's option to use material whose radioactivity concentration is less than the DCGL (29.3 pCi/g soil) for backfill in on-site excavations deeper than 4 feet below grade could somehow re-contaminate areas remediated by USACE.

5. MDNR Comment 5

Further, if this "material" is used for backfill at other sites, since there has been little to no characterization of the hazardous chemical constituents for Phase II, it is likely that additional solid waste management units will be created, which require coordination with the state's Hazardous Waste Program's Permits Section. Prior to backfilling the excavated material, it is recommended that Mallinckrodt characterize the excavated material for potentially hazardous constituents, to determine if the contamination level in the excavated soil is below EPA's Region VI medium specific screening levels. Prior to backfilling, the department's advice to Mallinckrodt is preparation of a comprehensive sampling protocol to adequately characterize the excavated material. The number of samples should be such that the excavated material is safe for backfilling at a 95% upper confidence interval. The department recommends the use of clean characterized soil for backfilling. What provision does the plan or Mallinckrodt have for this aspect?

NRC Response

See response to Comments 2 and 5.

6. MDNR Comment 6

This plan and previous drafts have rationalized that groundwater at this site is a non-issue. This is inaccurate from the state's perspective. Most, if not all of the groundwater hydrology information in this Phase II plan is derived from data collected and reports by other agencies (i.e. USACE and the U.S. Department of Energy). Conclusions reached in this Phase II plan mis-interprets the groundwater concerns and requirements of the state, which are noted in the Record of Decision of the Downtown Site (1998, page 8, second paragraph), "The B unit does qualify as a potential source of drinking water under the guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy". Leakage and spills from the raffinate tanks and the site's sewer system points to the need for characterization of chemical and radioactive contamination. How will this issue be addressed?

NRC Response

The NRC believes that the site wide data collected and reports prepared by the USACE and DOE accurately depict the groundwater hydrology for the entire Mallinckrodt site and any additional hydrologic investigations would be redundant.

The NRC does not agree that the groundwater concerns and requirements have been misinterpreted in the Decommissioning Plan. The 1998 Record of Decision does not justify how the B Unit qualifies as a potential source of drinking water. The Record of Decision describes

the B Unit as a highly unlikely source of drinking water with high levels of **naturally** occurring dissolved solids and metal concentrations (iron and manganese above their Secondary Maximum Contaminant Levels, SMCLS) within the B Unit.

The groundwater supply throughout the Eastern Missouri Region is typically non-potable due to high salinity. Groundwater from the alluvial deposits in the St. Louis area "generally contain very hard calcium-magnesium-bicarbonate type with iron and manganese content commonly high." (Water Resources Report Number 62, Missouri Department of Natural Resources, 2002).

Total uranium was the only radionuclide detected in filtered samples at elevated concentrations across the Mallinckrodt site within the upper zone (A Unit) and no radionuclides were detected above US EPA MCL in filtered samples from the lower zone (B Unit) (USACE, Groundwater Characterization Report of 1997/1998).

Soil and groundwater samples will be taken for chemical and radioactive contaminants throughout the decommissioning of the site to ensure effluent release criteria and soil DCGLs are met. The NRC will follow procedures defined in the Memorandum of Understanding between the EPA and the NRC regarding soil and groundwater contamination exceeding the defined limits. In summary:

- The NRC will consult with the EPA if there is radioactive groundwater contamination in excess of EPA's MCLs.

- The NRC will defer to EPA regarding matters involving hazardous materials not under NRC's jurisdiction.

7. MDNR Comment 7

It appears that a new RESRAD modeling has been completed for this revision of the Phase II plan. Based on a cursory review of the modeling information, the groundwater exposure input was not used. Based in part on comment 6, above, please provide a model that includes an evaluation of the following exposures:

i. Future construction worker scenario and exposure to soils after remediation of elevated sources
ii. Future on site residential scenario and exposure to soil and groundwater for an estimate of baseline
iii. Current/future on and offsite industrial worker scenario and vapor intrusion for radon and other volatile chemicals for both soil and groundwater
iv. Future offsite residential scenario (representing no land use restriction on adjoining properties) of vapor intrusion of radon and other volatile chemicals in groundwater, and
v. The leaching of contaminants to groundwater pathway.

NRC Response

NRC prepared a Technical Evaluation Report (TER) (ADAMS Accession No. ML091831289) to document its review of the dose modeling evaluations included in the Phase 2 DP. Please see the TER.

8. MDNR Comment 8

In addition to cleanup values/DCGL's concerns noted in the cover letter, review of pavement cleanup values shown in Table 5.4, appear to be excessively high. For example, the targeted cleanup value for Ra 226 is 19,000 pCi/100 sq cm, U 238 is 1,050,000 pCi/100 sq cm. Although the table suggests these values are protective for 20 mrem/yr, how will this material be managed (i.e. used as fill or disposed of off-site) should pavement replacement occur? We would like to discuss these values with you and our RESRAD analyst at your convenience.

NRC Response

NRC staff reviewed the derivation of the DCGLs for pavement and determined that the dose from these concentrations is less than 20 mrem/yr.

MDNR Letter Dated November 3, 2003

9. MDNR Comment 1

The delineation of responsibility for remediation in areas of Plant 6 and 7 at the Mallinckrodt site has yet to be determined. Will the clean-up of the areas in Plant 6 and 7 be the same as those established in the St. Louis Record of Decision (ROD)? The clean-up criteria presented in the Plan for Plant 5, et al, is based on the Nuclear Regulatory Commission's dose-based standards. Will Mallinckrodt employ both sets of regulatory requirements for this decommissioning?

NRC Response

A delineation agreement for Plant 6 has been reached between Mallinckrodt and the USACE. Also, see response to Comment 1.

The remediation criteria for the C-T process areas of Plant 7 are provided in the DP and are not the same criteria used by USACE for the remainder of Plant 7. In accordance with 10 CFR Part 20, Subpart E, Mallinckrodt is required to demonstrate that the C-T process areas result in a dose of less than 25 mrem/yr, plus ALARA, for unrestricted release.

10. MDNR Comment 2

Section 1, **Executive Summary, page 1-2, Decommissioning Goals**, second paragraph (also discussed in Section 8, page 8-1) - The Phase II C-T plan only addresses Plant 5, the C-T processes and support building floor slabs, subsurface sewer system, contaminated soils, and the wastewater neutralization basins in Plant 7. Will there be other phases of the decommissioning that will address areas in Plants 6 and 7? Will the NRC license STB-401 remain in effect till the areas in Plants 6 and 7 are completed or will another license be issued?

NRC Response

Decommissioning of C-T process areas in Plant 6 is addressed under License Amendment No. 4 of Mallinckrodt's license. NRC approval of License Amendment No. 4 is dated May 12, 2008 (ML080940414). Therefore, the Phase 2 DP must only consider Plant 5 and the C-T process areas of Plant 7. With regard to Plant 7, the DP states that delineation of responsibility for contamination in Plant 7 must still be determined. Please note the following:

2. Page 1-2, paragraph 4, states, "Delineation of responsibility for remediation, particularly in areas known as Plants 6 and 7 within the St. Louis Plant site, remains to be decided between Mallinckrodt and the U.S. Army Corps of Engineers."

The NRC will not terminate Mallinckrodt's license until all C-T processing areas meet the unrestricted release criteria of 10 CFR Part 20.1402. A delineation agreement for Plant 7W must be reached and remediation completed in the C-T process areas before license termination.

11. MDNR Comment 3

Section 2.1, **Introduction**, page 2-1 - The work plan states that the implementation of the Phase II Plan will complete the decommissioning process so that all surface and subsurface areas can be released for unrestricted use in an industrial setting. The plan does not consider the investigation and remediation of the chemical contaminants released during the C-T process. As a point of reference, the chemical contaminants must be investigated and/or remediated in accordance with the corrective action requirements of Mallinckrodt's Missouri Hazardous Waste Management Facility (MHWMF) Part I Permit. A joint approach to oversee the decommissioning and decontamination activities at the Mallinckrodt Plant between the NRC and the department appears to be needed.

NRC Response

See response to Comment 2.

12. MDNR Comment 4

Section 2.3.1.2, **History,** page 2-5 - The work plan states that in 1942 Mallinckrodt began producing highly refined UO_2 at the rate of 1 ton/day. The work plan does not state how much raw material was needed to produce 1 ton of UO_2. This information is important to determine the magnitude of potential contamination and should be supplied in the revised work plan.

NRC Response

Section 2.3.1.2 of the DP provides a history of operations at Mallinckrodt. The information requested deals with the MED-AEC activities in Plants 1 and 2 at the site, and has no bearing on the C-T decommissioning activities in Plants 5 and 7. NRC staff does not believe additional information is required in the DP.

13. MDNR Comment 5

Section 2.6, **Prior On-site Burials**, page 2-9 - The work plan states that the un-reacted ore residue produced in the C-T Process contained natural uranium, thorium, and their progeny in addition to the non-radioactive constituents. More details must be supplied for the nonradioactive constituents to determine if these constituents may require action pursuant to the corrective action provisions of the MHWMF Part I Permit.

NRC Response

Un-reacted ore (URO) from C-T processes was buried in 10 trenches in Plant 6. Mallinckrodt and USACE have a delineation agreement which specifies that Mallinckrodt is responsible for an exact volume of material surrounding each of the 10 burial trenches. Decommissioning of the burial trenches in Plant 6 is addressed under License Amendment No. 4 to Mallinckrodt's license. NRC approval of License Amendment No. 4 is dated May 12, 2008 (ML080940414). In accordance with License Amendment No. 4, Mallinckrodt is excavating and disposing of all material specified in the delineation agreement.

NRC staff does not believe additional information is required in the DP.

14. MDNR Comment 6

Section 3.2, **Population Distribution,** page 3-2 - The work plan claims that the population of St. Louis decreased between 1990 and 2000, and states other population-related statistics. It is unclear why data, which is three years old was used for this assessment.

NRC Response

The NRC staff agrees that more recent population data could have been used. However, the staff does not believe that more recent population data would have a significant impact on the proposed decommissioning activities.

NRC staff does not believe additional information is required in the DP.

15. MDNR Comment 7

Section 3.7, **Groundwater Hydrology,** page 3-9 - The work plan states that there are two distinct hydrostratigraphic units in the subsurface separated by a relatively impermeable barrier of silt and clay. A review of the extensive boring logs produced by USACE at this site reveals that in some areas of the site this appears to be true. However, at other areas, the relatively impermeable barrier is very thin or non-existent. Therefore, at best, this barrier should-be referred to as a discontinuous semi-confining unit.

This unit has not been extensively studied at the site. Contaminant information collected in this subsurface unit (both chemical and radiological) may be useful in determining migration pathways for contamination from the site.

NRC Response

The relatively impermeable barrier appears extensively across the Mallinckrodt site and is present in all geologic drill logs that the NRC has reviewed (DOE/OR/20722-258 Volume III Rev. 1, September, 1990).

NRC staff does not believe additional information is required in the DP.

16. MDNR Comment 8

Table 3-2, St. **Louis Climatological Data** - The data used in this table is almost 30 years old. More recent data is available and should be used as part of this work plan.

NRC Response

The NRC staff agrees that more recent climatological data could have been used. However, the staff does not believe that more recent climatological data would have a significant impact on the proposed decommissioning activities.

NRC staff does not believe additional information is required in the DP.

17. MDNR Comment 9

Figure 3-8, **Monitoring Well Locations** - This figure shows 8 monitoring wells located on a east-west line south of building 238. It is unclear if any samples have ever been collected from these wells and analyzed for chemical contamination. Groundwater contours are also illustrated on this figure. The data that supports the groundwater flow depiction should be included in the work plan.

NRC Response

The eight wells that are seen on Figure 3-8 are not monitoring wells. The boring logs were drilled on March 21, 1947, to create the geologic cross-sections seen in Figures 3-6 and 3-7.

There was no need to sample for contamination in 1947 since Mallinckrodt had just begun development of plant 5 in 1947.

The NRC agrees that the groundwater contour data should be supported with well logs, well construction data and dates the water levels were taken. To resolve this issue, NRC will request Mallinckrodt provide a reference to Figure 3-8 to indicate where supporting material can be found.

18. MDNR Comment 10

Section 4.3, **Contaminated Systems and Equipment,** page 4-2 - The work plan summarizes the data collected from sewer pipes at manholes and no analysis has been completed for chemical constituents. Leaking sewers have historically been a concern because of the potential for contaminant releases to the subsurface and/or groundwater. Non-radiological contamination should be addressed in any investigation/remediation of the sewer system.

NRC Response

The NRC agrees that Mallinckrodt should consider non-radiological contamination in its investigation/remediation of the sewer system. However, NRC is not responsible for ensuring that Mallinckrodt is in compliance with the requirements of 40 CFR 260 – 270, nor the Department of Transportation regulations regarding the transportation of hazardous material. The DP describes the decommissioning activities necessary to remove residual radioactive material, including mixed waste, from C-T process areas such that these areas meet NRC's unrestricted release criteria. However, the NRC does regulate mixed waste. NUREG-1757 describes the information to be included in the DP regarding mixed waste. Section 12.3 of the DP states that Mallinckrodt site characterization activities have not identified any mixed waste in the soil or other materials to be remediated during decommissioning. Further, it states that if mixed waste is encountered during remediation, Mallinckrodt will characterize the waste, identify a disposal method and notify NRC. Mallinckrodt has a RCRA part B permit authorizing on-site storage of hazardous and mixed waste. The staff is satisfied that Mallinckrodt has adequately addressed mixed waste in the DP given the results of characterization studies performed to date.

In order to address the state's concern, the NRC proposes that Mallinckrodt revise Section 12.3 of the DP by adding the following statement, "If hazardous chemicals or mixed waste are identified during decommissioning activities, Mallinckrodt will notify the State of Missouri Hazardous Waste Program Permit Section. Mallinckrodt will dispose of all hazardous chemical and mixed waste in accordance with appropriate state and federal regulations."

19. MDNR Comment 11

Section 4.5, **Soil Contamination,** page 4-4 - References are made to historical subsurface soil sampling results. Boring logs generated during sample collection should be submitted as part of the work plan. Even though non-radiological constituents were not included as contaminants of concern in the USACE investigation, visual and olfactory evidence was described on many of

the historical boring logs. Boring logs associated with any of the soil samples referenced in the work plan should be included.

NRC Response

The NRC staff believes that historical subsurface soil sampling results need not be provided in the DP since Mallinckrodt provides the reference that contains the information. To resolve the State's comment, NRC will make the referenced documents publicly available in NRC's Agency-wide Document Access and Management System (ADAMS).

20. MDNR Comment 12

Section 4.5, page 4-3, **Soil Contamination;** Section 4.7, page 4-7, **Groundwater;** Section 4.8.2, page 4-9, **Sewers (Manholes);** and Section 4.8.4, page 4-10, **Subsurface Material** - These sections discuss the radiological characterization of these areas. Sampling for chemical hazardous materials is not discussed. Has Mallinckrodt characterized these areas for other hazardous materials in addition to radiological wastes?

NRC Response

See response to Comment 2.

21. MDNR Comment 13

Figure 4-17, **Plan View of Contaminated Soils in Plant 5** - SWMUs located in this same area include the following:

1. Unit F5-1 Bottles under Building 250.
This was discovered during the installation of a manufacturing unit in building 250. Soil sampling revealed elevated metals concentrations in the soil.
2. SWMU 20 Building 250 Drum Staging Area.
This is a drum storage and staging area for wastes generated in building 250. COCs include acetone, chloroform, methylene chloride, toluene, xylenes, and spent palladium catalysts.

Will these areas be addressed as part of the C-T Decommissioning Plan if subsurface soil is eventually released for unrestricted or other use as well as a determination if mixed waste is to be disposed of? If not, please explain the rationale.

NRC Response

See response to Comment 2.

22. MDNR Comment 14

Table 5-1, page 5-13, and **Table 5-2,** page 5-14 - Under NRC regulations, pathway analysis includes the estimation of radiation doses that might be received by a typical member of a small group of people from future uses of the site as much as 1,000 years into the future. It would seem that the criteria presented in Table 5-1 and 5-2 would result in dose levels greater that 25 mrem/year for future use of the site. The criteria shown in these tables for industrial and construction scenarios does not appear to be consistent with the recommended criteria in Table I of the *Memorandum of Understanding between the Environmental Protection Agency and the Nuclear Regulatory Commission.* The Plan does not show a model of the sum of fractions for the criteria displayed in Table 5-1 and 5-2. It would appear that the sum of the dose factors for each criteria in these Tables is greater than 25 mrem.

NRC Response

NRC prepared a Technical Evaluation Report (TER) (ADAMS Accession No. ML091831289) to document its review of the dose modeling evaluations included in the Phase 2 DP. Please see the TER.

The DP does include DCGLs for certain radionuclides that exceed soil concentration values in Table 1 of the NRC/EPA Memorandum of Understanding (MOU) on "Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites." As such, on June 22, 2009, NRC transmitted the required Level 1 consultation letter to EPA (ADAMS Accession No. ML091460665).

23. MDNR Comment 15

Section 5.3, page 5.3, **Land Use Scenario, first** paragraph - How will the Plan outline institutional controls to ensure that the exposure scenario remains the same? It cannot be assumed that this site will continue to be industrialized in the distant future. Institutional controls and long-term stewardship will be necessary if radiological and chemical contaminants remain in the soils and the groundwater. Institutional controls and long-term stewardship will identify for future occupants that restrictions are due to the radiological and chemical contaminants at the site.

NRC Response

See response to Comment 3.

24. MDNR Comment 16

Section 5.5.3.2, page 5-5, **Groundwater,** first paragraph - This section states that the groundwater will not be a source of drinking water in the future. The St. Louis Downtown Site (SLDS) Record of Decision (ROD) 1998, page 8, second paragraph, last sentence states: "The B Unit does qualify as a potential source of drinking water under the *Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy".* Though the use of the groundwater as a drinking water source does not seem likely as this time, we cannot predict future events. The fact that the aquifer is a potential drinking water source mandates that chemical and radiological contamination must be sampled and assessed. If contamination is found in this aquifer, alternatives for remediation, such as, treatment, contamination removal, or, establishing long-term care such as monitoring with institutional controls to restrict future use must be considered.

NRC Response

See response to Comment 6.

25. MDNR Comment 17

Section 5.5.3.2, **Groundwater,** page 5-5 - This section discusses that both the shallow and deep ground water cannot reasonably be used as a drinking water source. For this reason, it will not be examined as part of any subsequent risk assessment. However, it is not mentioned that the Mississippi River is protected as a drinking water source and that groundwater from the site discharges to the Mississippi River. In addition, exposures to construction workers and indoor air may result from contaminated groundwater. While domestic consumption of contaminated groundwater may not need to be evaluated in the risk assessment, all other potential human and ecological exposure pathways for groundwater will need to be evaluated.

NRC Response

NRC prepared a TER (ADAMS Accession No. ML091831289) to document its review of the dose modeling evaluations included in the Phase 2 DP. Please see the TER.

26. MDNR Comment 18

Section 5.7.1.2, page 5-7, **Thickness of Contaminated Zone** - The default value of 2 meters is used in the RESRAD calculations to derive the DCGL. Two meters equals about 6.5 feet. Has the subsurface soil in Plant 5 been characterized? What is the depth of the contamination in the C-T areas? Will contaminated soil be removed to depth? Mallinckrodt has stated that the C-T areas will be re-used in an industrial scenario. How will Mallinckrodt protect the construction worker if contaminated soil has not been remediated to depth?

NRC Response

Subsurface soil contamination is summarized in Section 4.5 of the DP. Section 8.5 of the DP describes the planned decommissioning activities for contaminated soil in Plant 5. All soil above the established DCGL's (surface and subsurface) will be excavated and disposed of in accordance with the Radioactive Waste Management Program presented in Chapter 12 of the DP. Chapter 10 of the DP describes the Radiation Safety Program that will be implemented during decommissioning to assure that workers are adequately protected.

NRC staff does not believe additional information is required in the DP.

27. MDNR Comment 19

Section 5.7.1.9, page 5-10, **Building Shielding Against Gamma Irradiation** - Though the Plan explains that concrete slab floors and brick or concrete block walls would be protective for the industrial work scenario, radon emissions have not been addressed for new and/or old buildings in the C-T areas.

NRC Response

NRC does not consider radon in its calculation of site wide dose. NRC Consolidated Decommissioning Guidance, NUREG-1757, Vol. 2, Rev. 1, page J-11, indicates that the analyst using RESRAD for dose assessments is not required to include the radon pathway. NRC provided its rationale for not including the radon pathway in the Federal Register, Vol. 62, No. 139, July 21, 1997, page 39083, when it addressed comments on the proposed License Termination Rule regarding radon. Because of the wide variability of naturally occurring radon levels it is not practical to distinguish between radon from licensed activities and radon which occurs naturally in demonstrating compliance with the 25 mrem/y dose criteria. NRC stated that licensees will not be expected to demonstrate that radon from licensed activities is indistinguishable from background on a site-specific basis, and that licensees that demonstrate that the radium requirements for unrestricted release are met need not include doses from the radon pathway.

28. MDNR Comment 20

Section 5.8, page 5-12, **RESRAD Calculations** - We were unable to reproduce results using the plan's assumptions. Please review the Department of Health's comments attached to this document.

NRC Response

NRC staff previously reviewed the RESRAD calculations provided by Mallinckrodt and was able to reproduce their results.

29. MDNR Comment 21

Section 6.2.1, page 6-10, **Consideration of Preferred Alternative** - Mallinckrodt states that Alternative 2 meets all regulatory requirements. The Alternative does not discuss institutional controls or long-term stewardship for possible inaccessible areas or other soils left in place. There is no characterization of subsurface soils for chemical hazardous materials used during the C-T process or otherwise on this property. The Plan does not consider the groundwater issues on site. The site cannot be considered clean and released for unrestricted use without these hazards being addressed.

NRC Response

Mallinckrodt is requesting license termination and unrestricted release of the C-T process areas of the site in accordance with the requirements of 10 CFR 20.1402. If Mallinckrodt can adequately demonstrate that the C-T process areas of the site results in a dose of less than 25 mrem/yr, plus ALARA, to an average member of the critical group, the areas will be considered acceptable for unrestricted release and thus no institutional controls or long-term stewardship are required.

For a discussion of the potential non-radiological hazards, see the NRC response to Comment 2. For a discussion of groundwater contamination at the site, see the NRC response to Comment 6.

30. MDNR Comment 22

Section 6.1.2.1, page 6-2, **Description of the Facility if the DCGL Remediation Concentration Guideline Levels,** second paragraph, second sentence - The department has concerns on the use of any "radioactive material" to be deposited into any excavation on Mallinckrodt property without appropriate institutional controls. How will this be addressed?

A. What criteria does Mallinckrodt propose to use if and when a decision is made to deposit material in an excavation on Mallinckrodt property?
B. Mallinckrodt must define "material". Does material include soils, rubble, etc?
C. Does Mallinckrodt propose to deposit this waste in other excavations on site (not part of the C-T decommissioning)? If so, what long-term stewardship measures will accompany this action?
D. Mallinckrodt should be aware that future changes in applicable clean-up criteria might require the removal of this material from their property.
5 DNR Comments
E. Depositing this "material" on site may require deed restrictions and other institutional controls to be placed on disposal areas.
F. This disposal action must be in compliance with all state and local ordinances.
G. The department recommends that a permanent record be maintained of the quantities, activity levels (prior to removal), and locations of disposal areas.
H. A formal request and plan on a site by site basis must be submitted to the Hazardous Waste Program if Mallinckrodt has plans to deposit "material" in an excavation.
I. "Material" to be deposited in an excavation needs to be characterized for chemical hazardous waste materials as well as radioactive materials.
J. How will the intent of the *As Low As Reasonably Achievable* (ALARA) process be met?

NRC Response

See response to Comment 4.

31. MDNR Comment 23

Section 6.1.2.1, page 6-3, **Description of the Facility if the DCGL Remediation Concentration Guideline Levels,** second paragraph, last sentence - It can not be stated that public exposure will be insignificant unless all sampling has been performed to measure contaminants off site. Even though Mallinckrodt is located in an industrial area, several members of the public do business in this area daily as well as the public areas available from the river front and public streets.

NRC Response

Mallinckrodt is required to demonstrate that their site meets the 25 mrem/yr limit prior to termination of their license. It is expected that this demonstration will be done through the development of DCGL values that correspond to 25 mrem/yr and a Final Status Survey that demonstrates that the material remaining on site contains radionuclide concentrations less than the DCGL values. It is expected that the dose to a member of the public who is not on the site would be less than the dose on site because they would be further away from the source.

32. MDNR Comment 24

Section 6.1.2.1, page 6-3, **Description of the Facility if the DCGL Remediation Concentration Guideline Levels,** third paragraph, first sentence - What criterion will be used to achieve the less than 25 mrem/year and no more than 100 mrem/year for disposal of remediation waste?

NRC Response

Chapter 5 of the DP describes the dose modeling analyses used to develop the DCGL's for the C-T process areas. The DCGL's correspond to the concentrations of radioactive materials in the soil which will result in a dose of 25 mrem/yr to the average member of the critical group.

Prior to disposal of Unimportant quantities of waste (as defined in 10 CFR 40.13) at a RCRA landfill, Mallinckrodt must submit a dose assessment to demonstrate that disposal will result in a TEDE of less than 100 mrem/yr. Mallinckrodt submitted a dose assessment for disposal of unimportant quantities of waste during Phase 1 decommissioning activities to NRC on June 24, 2002. This dose assessment is publicly available in ADAMS under Accession No. ML021910478).

33. MDNR Comment 25

Section 6.1.2.3, page *6-3,* **Summary of the Impacts on Community Resources Such as Land Use and Property Values,** first paragraph, second sentence - "Any impacts on adjacent

land and nearby population would be mainly due to transportation of remediation workers on local roadways and of solid waste shipments on the railroad that bisects the SLDS." Please clarify this section. It is not clear why the transportation of remediation workers on local roadways would cause any impact on adjacent population or land.

NRC Response

The NRC staff agrees that the transportation of remediation workers will have no significant impact on adjacent population or land. In Section 6.1.2.3, Mallinckrodt is conservatively trying to evaluate all possible transportation impacts from decommissioning activities.

NRC staff does not believe additional information is required in the DP.

34. MDNR Comment 26

Section 6.1.2.4, **Summary of Impacts on the Geology, Hydrology, Air Quality and Ecology in and Around the Site,** page 6-4, Geology, second sentence - Please see comment 22 on the use of contaminated material as backfill.

NRC Response

See response to comment 4.

35. MDNR Comment 27

Section 6.1.2.4, page 6-4, Hydrology,
A. First paragraph - This paragraph states that all site water drains to a municipal sewer system. Metropolitan Sewer District in St. Louis issues permits to Mallinckrodt to release site waters into the sewers. What treated water is discharged into the Mississippi River?
B. Second paragraph - See comment 16 on groundwater. There is no guarantee that a reduction of radioactive residue due to the C-T activities/remediation will be diminished in the groundwater. To verify this concept the groundwater needs to be monitored at regular intervals.
C. Third paragraph - The department disagrees with this statement. Pollution problems cannot be solved by dilution. This is not necessarily the optimum solution.

NRC Response

The NRC staff reads this paragraph to mean that the Metropolitan Sewer District in St. Louis discharges treated water into the Mississippi River, as stated in the referenced Section 3.6.

The NRC staff reads the second paragraph to mean that Mallinckrodt's removal of radioactive material from the soil will result in a diminished potential for radioactive material to enter the groundwater. The staff agrees with this statement.

The staff agrees that dilution is not the solution for contamination. However, the staff does not believe that the third paragraph implies that dilution will be used as the remediation method.

NRC staff does not believe additional information is required in the DP.

36. MDNR Comment 28

Section 6.1.2.4, **Air Quality** - This section states that air quality will be monitored "as needed". The air should be monitored at all times (24/7) during decommissioning activities to ensure the safety and health of workers and the public.

NRC Response

See Section 11.2.5.2 of DP. NRC staff does not believe additional information is required in the DP.

37. MDNR Comment 29

Section 6.1.2.5, page 6-5, **Description of Impacts on Minority or Low-income Populations** - The department questions the statements concerning "unrestricted release of the land". If contamination remains in inaccessible areas, institutional controls will be needed. The selected alternative does not discuss this possibility. The department also disagrees that this decommissioning will ensure radiological safety in these areas. EPA's guidance states that no greater than 15 mrem/yr dosage and/or a risk range of 10^{-4} to 10^{-6} is protective of human health. While this guidance may not be recognized or applicable to NRC issues, some means of addressing this concern should be presented.

NRC Response

The NRC will not terminate Mallinckrodt's license until all C-T processing areas meet the unrestricted release criteria of 10 CFR Part 20.1402. Currently inaccessible C-T process areas in Plant 6 (burial trench 10 under Building 101) will have to be remediated by Mallinckrodt prior to license termination. In addition, a delineation agreement for Plant 7W must be reached and remediation completed in the C-T process areas before license termination.

Mallinckrodt, as an NRC licensee, is required to meet the decommissioning criteria provided in 10 CFR Part 20, Subpart E. Mallinckrodt is requesting that its license be terminated and the C-T process areas released for unrestricted use in accordance with the requirements of Part 20.1402. The NRC staff will terminate Mallinckrodt's license upon a satisfactory demonstration that the C-T process areas result in a dose of less than 25 mrem/yr, plus ALARA, after remediation.

38. MDNR Comment 30

Section 6.1.2.6, page 6-5, **Summary of the Irreversible and Irretrievable Commitment of Resources** - This section is unclear. What is meant by "waste removed from SLDS would also occupy space at a developed disposal site." Please define "remediation waste will be transported to a disposal site "mostly" by railroad. What other way will be used to transport waste? Has Mallinckrodt written a plan for an alternative way to transport waste? Has the proper regulatory agencies been notified that this may be a possibility?

NRC Response

The NRC staff believes this section is clearly written. NRC staff does not believe additional information is required in the DP.

39. MDNR Comment 31

Section 7, page 7-1, **ALARA Analysis** - The department has concerns with the DCGLs presented in Section 5 to achieve the NRC's 25 mrem dose-based standard. The department holds that the criteria presented in Table I of the *Memorandum of Understanding between the Environmental Protection Agency and the Nuclear Regulatory Commission* (MOU) is more appropriate than the criteria in Section 5 of the Plan. The department is also concerned that Plan does not discuss remediation to depth. (See Comment 29.) The economics of this section has not considered the environmental damage caused by the C-T processes. Groundwater must be considered. See Comment 16 and 22.

NRC Response

The NRC staff has reviewed the DCGL's presented in Chapter 5 of the DP and find them to be acceptable. Per the NRC/EPA Memorandum of Understanding (MOU) for sites that trigger the criteria in Table 1 of the MOU, the NRC will consult with EPA at two points in the decommissioning process: (1) prior to NRC's approval of the DP; and (2) following completion of the final status survey.

In addition, see responses to Comments 24, 30, and 37.

40. MDNR Comment 32

Section 7.4.7, page 7-6, **Environmental Impacts** - A re-evaluation needs to be made to address the groundwater contamination caused by the C-T activities. (Comment 16).

NRC Response

See response to Comment 24.

41. MDNR Comment 33

Section 8, page 8-1, **Planned Decommissioning Activities** - The work plan states that Building 91 sewers will be remediated if contamination is identified in Phase I. Chemical constituents should be included as part of this evaluation as leaking sewers have always been a potential source for contamination other than radiological.

NRC Response

See response to Comment 2.

42. MDNR Comment 34

Section 8.3.3, page 8-3, **Wastewater Neutralization Basins** - Sub-surface sampling under the neutralization basins should be performed.

NRC Response

Soil under the neutralization basins will be addressed in the Plant 7 delineation agreement between Mallinckrodt and USACE. NRC staff does not believe additional information is required in the DP.

43. MDNR Comment 35

Section 8.4.1, page 8-4, **Description and History,** third paragraph - The plan states that the U.S. Corps of Engineers (USACE) is addressing radioactive contamination in the sewer system under the FUSRAP program. It is the department's understanding that the USACE is not presently addressing radioactive contamination in the sewer system. USACE has stated that funding for the sewer study is not yet available and Mallinckrodt has not consented to the sewer study thus far.

NRC Response

The DP says that USACE is addressing the MSD Salisbury Street Sewer and the Destrehan Street outfall since these sewers were used to discharge wastewater from the MED/AEC Destrehan Street Plant. The NRC is not responsible for USACE's sewer remediation schedule.

44. MDNR Comment 36

Section 8.4.2, page 8-4, **Drains and Subsurface Sewerage that Served C-T Process Buildings,** last paragraph, second sentence - Any sludge found in the sewers necessitates inclusion of characterization of chemical hazardous substances in addition to radioactive wastes. If other hazardous wastes are found, then the waste must be shipped as mixed waste and the department's Hazardous Waste Program will need to be involved.

NRC Response

See response to Comment 2.

45. MDNR Comment 37

Section 8.4.3, page 8-5, **Drains and Subsurface Sewerage that Served C-T Support Buildings,** second sentence - Again, downstream sewers need to be surveyed for chemical hazardous wastes in addition to radioactivity.

NRC Response

See response to Comment 2.

46. MDNR Comment 38

Section 8.5, page 8-6, **Soil Remediation,** second sentence - At what depth was the contaminated soil that exceeded the DCGL found in the areas below and adjacent to Building 238?
First bullet - What are the depths that used/will be used to model the subsurface areas?
Second bullet - Is the criteria in Tables 5.1 and 5.2, the soil cleanup criteria in pCi/g and to what depth will the soil be remediated?
Fourth bullet - What disposal facility will be used? Is "state-regulated" a generic term? The state of Missouri does not allow radioactive materials to be disposed of in licensed landfills within the state.
Fifth bullet - How will the Final Status Survey (FSS) be calculated using the mrem/year per pCi/g established? If each survey unit is cleaned up to a dose of 25 mrem/year, the site may still be greater than 25 mrem/year if contaminated inaccessible soils are left in place, contaminated soils are not remediated to depth, and the groundwater is not monitored and remediated if necessary.

NRC Response

The NRC staff believes Section 8.5.1 is clear. Modeling will be used to determine the general areas of contamination. Mallinckrodt will remove all soil (to any depth necessary) which exceeds the DCGL's. Soil above the DCGL will be disposed of in accordance with an NRC-authorized transfer to a state-regulated (RCRA) disposal facility. Finals status surveys will demonstrate that no material with concentrations above the DCGLs remain on-site. If the DCGLs are not exceeded, then the dose will be less than 25 mrem/yr.

NRC staff does not believe additional information is required in the DP.

47. MDNR Comment 39

Section 8.6, page 8-7, **Surface and Groundwater** - The department disagrees with this section. See Comments 16 on groundwater, comment 22 on the use of backfill and comment 44 on storm water.

NRC Response

See responses to Comments 24, 30, and 52.

48. MDNR Comment 40

Section 9.1.2, page 9-2, **Mallinckrodt C-T Project** Manager, second paragraph, second sentence - The sentence should include "all local, state, and federal regulations" and NRC requirements, if the goal of the remediation is to achieve "unrestricted release".

NRC Response

Suggested revision will not affect the staff's expectation of the project manager. NRC staff does not believe additional information is required in the DP.

49. MDNR Comment 41

Section 9.4.1, page 9-6, **Industrial Safety Training** - Because of potential chemical contaminants, please include the OSHA 29 CFR 1910.120 (e)(3) - General site worker training (HAZWOPER) and 8-hour refresher.

NRC Response

NRC staff agrees that the 29 CFR 1910.120 Hazardous Waste Operations and Emergency Response requirements appear to be applicable to the remediation efforts at Mallinckrodt. The staff will request that Mallinckrodt implement the applicable elements of this OSHA HazWoper Standard.

50. MDNR Comment 42

Section 9.5, page 9-8, **Adjustments to the Decommissioning Process** - Will these adjustments to the decommissioning process be addressed in a "Field Work Variance"?

NRC Response

The staff believes Section 9.5 is addressing the need to make “general” adjustments to the decommissioning process as decommissioning progresses. Section 9.2 states that work plans are required for all decommissioning activities. General changes to the decommissioning process will not affect the requirement for work plans. NRC staff does not believe additional information is required in the DP.

51. MDNR Comment 43

Section 10.1.1.1, page 10-1, **Air Sampling Program** - To protect workers and the public, air sampling should be implemented 24/7 at the excavation sites and the property perimeters.

NRC Response

See Section 11.2.5.2 of DP. Section 11.2.5.2, Environmental Air Monitoring, commits to verification by air sampling, as required by 10 CFR 20, that demolition and decommissioning activities do not adversely impact on-site workers and the public. NRC staff does not believe additional information is required in the DP.

52. MDNR Comment 44

Section 11.2.5.3, page 11-3, **Storm Water Monitoring** - This plan does not consider water collected in the excavations. How will water (groundwater or storm water) collected in the excavations be sampled, treated, and released? Has Mallinckrodt set up a special water treatment area to treat this water for radioactive and chemical hazardous wastes? Where will this water be released? Does Mallinckrodt have a permit from MSD to release this water to the MSD sewer system?

NRC Response

Section 12.2 of the DP discusses Mallinckrodt's plan for the storage, sampling and disposal of water collected in the excavations. The staff finds this section to adequately address the issues associated with storm water and excavation water. NRC staff does not believe additional information is required in the DP.

53. MDNR Comment 45

Section 11.3.1.2, page 11-5, **Erosion and Sediment Control,** second bulleted area, **Structural Features to Control Erosion and Sedimentation,** last bullet - There is no mention that stockpiles will be covered or managed to control dust. Please provide information on this aspect.

NRC Response

Section 12.1.3 of the DP discusses the management of excavated material. It states that soils and materials will be stored in covered containers or piles. It states that covers, surface coatings or functionally similar techniques will be used to control dust. The staff is satisfied that this issue is adequately addressed. NRC staff does not believe additional information is required in the DP.

54. MDNR Comment 46

Section 12.1.3, page 12-3, **Material Management Area** - second paragraph, bulleted section:
A. Second bullet - soils and material that are <DCGL for soil. See Comment 22 concerning the use of this material as backfill.
B. Third bullet - "soils and materials that contain unimportant quantities of radioactive material....NRC-authorized transfer to a state-regulated disposal facility" - Missouri's Solid Waste Laws prohibit any radioactive material to be deposited in landfills within the state.

NRC Response

See responses to Comments 2 and 4.

55. MDNR Comment 47

Section 12.1.4, page 12-3, **Waste Packaging and Transportation,** second paragraph - State, local, and federal regulations must be considered if the decision is made to transport radioactive waste by truck. What about the potential for mixed wastes?

NRC Response

The first sentence of Section 12.1.4 states, “Wastes will be packaged, placarded and/or labeled, and transported in accordance with the requirements of the disposal site, and applicable state and federal waste transportation regulations.” The staff believes Mallinckrodt’s commitment is adequate. NRC staff does not believe additional information is required in the DP.

56. MDNR Comment 48

Section 12.1.6, page 124, **Waste Disposition,** fourth paragraph - See Comment 22 concerning the use of <DCGL material as backfill in excavations deeper that 4 ft. The Decommissioning Plan does not specify which "excavations" this material will be deposited in at the Mallinckrodt site. Does the Plan refer to excavations created during the Decommissioning activities or to other unrelated excavations at the Mallinckrodt site? What institutional controls and long-term stewardship provisions will accompany this action?

NRC Response

See response to Comment 4.

57. MDNR Comment 49

Section 12.2, page 12-4, **Liquid Radwaste,** second paragraph, fifth sentence - Does this sentence mean that collected water will be used for dust control only on contaminated areas? What controls will be employed if collected water is used on contaminated areas for dust control? Will this water be sampled? Will the water be used for dust control if it is contaminated? The mist from the water may spread to non-contaminated areas and the runoff may also drain to non-contaminated areas. The water may accidentally be sprayed on workers or members of the public.

NRC Response

The staff believes the content of this section is clear. Section 12.2 says that stormwater will be contained, collected, stored and transported to the water treatment system for sampling. NRC staff does not believe additional information is required in the DP.

58. MDNR Comment 50

Section 12-3, page 12-5, **Mixed Waste** - Has Mallinckrodt characterized the all sub-surface material in the decommissioning areas? If so, please give a report of the analyses performed and where the samples were taken. To save time and money, Mallinckrodt should characterize the area for decommissioning for chemical contaminants in addition to radiological. Characterization, identification, handling, storage, disposal methods and costs, etc. of the all the hazardous wastes (chemical and radiological) at the site should be included in this Plan.

NRC Response

See response to Comment 2.

59. MDNR Comment 51

Section 13.6.2.1, page 13-6, **Laboratory Data,** second paragraph - Laboratory data should be given an independent review other than laboratory personnel to verify quality of the data. Who will analyze the radiological samples? What criteria will be used to determine if the remediation is complete at a survey unit? Will the criteria in picocuries per gram be converted to dose? Will all the contaminants be added together to determine total dose? Who will determine that the final status survey is complete to release a survey unit?

NRC Response

Section 13.6 is a discussion about quality assurance records. This section is not intended to be a detailed discussion of data management. Please see Section 14.4.3.8 of the DP for a complete discussion of data analysis. NRC staff does not believe additional information is required in the DP.

60. MDNR Comment 51

Appendix A, section 1.3, page A-5, **Groundwater Sampling and Analytical Results** - See Comment 16 concerning groundwater. Groundwater at the site should be characterized for C-T process contaminants (chemical and radiological). The groundwater should be monitored during the decommissioning activities and afterwards.

NRC Response

See response to Comment 24.