**FINAL**

# PROPOSED PLAN FOR NO FURTHER ACTION FOR THE INACCESSIBLE SOIL OPERABLE UNIT ASSOCIATED WITH GROUP 1 PROPERTIES AT THE ST. LOUIS DOWNTOWN SITE

**ST. LOUIS, MISSOURI**

**JANUARY 3, 2014**

**U.S. Army Corps of Engineers**
**St. Louis District Office**
**Formerly Utilized Sites Remedial Action Program**

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## ST. LOUIS, MISSOURI

**JANUARY 3, 2014**

*prepared by*
U.S. Army Corps of Engineers, St. Louis District Office,
Formerly Utilized Sites Remedial Action Program

*with assistance from*
Leidos, formerly part of Science Applications International Corporation
under Contract No. W912QR-12-D-0020

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## ACRONYMS AND ABBREVIATIONS

Both English and metric units are used in this report. The units used in a specific situation are based on common unit usage or regulatory language (e.g., depths are given in feet and meters, and areas are given in square feet and square meters). Acres are given for area when applicable.

| | |
|---|---|
| $^{o}$F | degrees Fahrenheit |
| 1993 BRA | *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site* |
| 1998 ROD | *Record of Decision for the St. Louis Downtown Site* |
| Ac | actinium |
| AEC | U.S. Atomic Energy Commission |
| amsl | above mean sea level |
| ARAR | applicable or relevant and appropriate requirement |
| bgs | below ground surface |
| BNSF | Burlington Northern Santa Fe |
| BRA | baseline risk assessment |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| *CFR* | *Code of Federal Regulations* |
| cm | centimeters |
| COC | contaminant of concern |
| COPC | contaminant of potential concern |
| CSM | conceptual site model |
| C-T | Columbium-Tantalum |
| DOE | U.S. Department of Energy |
| DT | Downtown |
| FFA | Federal Facility Agreement |
| FSSE | Final Status Survey Evaluation |
| ft | foot/feet |
| $ft^2$ | square foot/feet |
| FUSRAP | Formerly Utilized Sites Remedial Action Program |
| GWS | gamma walkover survey |
| HHRA | human health risk assessment |
| HU | hydrostratigraphic unit |
| IDOT | Illinois Department of Transportation |
| ISOU | Inaccessible Soil Operable Unit |
| m | meter(s) |
| $m^2$ | square meter(s) |
| $m^3$ | cubic meter(s) |
| Mallinckrodt | Mallinckrodt LLC |
| MDNR | Missouri Department of Natural Resources |
| MED | Manhattan Engineer District |
| MoDOT | Missouri Department of Transportation |
| mrem/yr | millirem per year |
| MSD | Metropolitan St. Louis Sewer District |
| NCP | National Oil and Hazardous Substances Contingency Plan |
| NFS | Norfolk Southern |

## ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| NRC | U.S. Nuclear Regulatory Commission |
| OU | Operable Unit |
| Pa | protactinium |
| PCOC | potential contaminant of concern |
| pCi/g | picocuries per gram |
| PDI | pre-design investigation |
| PP | Proposed Plan |
| PRG | preliminary remediation goal |
| Ra | radium |
| RA | remedial action |
| RCRA | Resource Conservation and Recovery Act |
| RG | remediation goal |
| RI | remedial investigation |
| RI/BRA | *Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site* |
| RI WP | *Remedial Investigation Work Plan for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site* |
| RR | railroad |
| ROD | Record of Decision |
| ROW | right-of-way |
| SARA | Superfund Amendments and Reauthorization Act |
| SLDS | St. Louis Downtown Site |
| SLERA | Screening Level Ecological Risk Assessment |
| Th | thorium |
| TRRA | Terminal Railroad Association |
| U | uranium |
| USACE | U.S. Army Corps of Engineers |
| USEPA | U.S. Environmental Protection Agency |
| UUUE | Unlimited Use Unrestricted Exposure |
| VP | vicinity property |
| $yd^3$ | cubic yards |

# 1.0 INTRODUCTION

This Proposed Plan (PP) identifies the preferred remedy for the Inaccessible Soil Operable Unit (ISOU) associated with selected properties at the Formerly Utilized Sites Remedial Action Program (FUSRAP) St. Louis Downtown Site (SLDS). The selected properties addressed by this PP require "No Further Action" in order to be protective of human health and the environment and are hereafter referred to as the "Group 1 Properties." This document is issued by the U.S. Army Corps of Engineers (USACE), which is the lead agency for site activities being conducted subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The USACE, in coordination with the U.S. Environmental Protection Agency (USEPA), will select a final remedy for the Group 1 Properties after reviewing and considering all comments submitted during the public comment period.

The public is encouraged to comment on the preferred remedy presented in this PP. The preferred remedy can change in response to public comment or new information. At the close of the comment period, the USACE and the USEPA will either choose to take no action and issue a Record of Decision (ROD) documenting that decision, or choose to address the properties through additional CERCLA actions. The box below serves as an announcement that highlights important information relevant to the beginning and end dates of the public comment period, as well as the date scheduled for a public meeting during which the USACE will explain this PP and accept oral and written comments directly from members of the public.

This PP provides the rationale for No Further Action for ISOU media at the Group 1 Properties and includes a summary of the Baseline Risk Assessment (BRA) used as the primary basis for the selection of No Further Action. Specifically, the Group 1 Properties are those properties that are the subject of this PP. To briefly summarize, the rationale for the selection of No Further Action is twofold: (1) the determination that some of the Group 1 Properties were not impacted by past Manhattan Engineer District/Atomic Energy Commission (MED/AEC) operations and therefore, required no evaluations in the BRA, and (2) the determination of no complete exposure pathways and/or no unacceptable risks to human health and the environment for impacted Group 1 Properties that were evaluated in the BRA.

**MARK YOUR CALENDAR**

**PUBLIC COMMENT PERIOD:**
**January 13, 2014 to February 13, 2014**
The USACE will accept written comments on the Proposed Plan during the public comment period, which begins **January 13, 2014.**

**PUBLIC MEETING:**
**January 30, 2014**
The USACE will hold a public meeting to explain the Proposed Plan and to accept comments and concerns. Oral and written comments will also be accepted at the meeting. The meeting will be held at **4:30 pm at Clay Elementary School, 3820 North 14th Street, St. Louis, MO 63107.**

**For more information, see the Administrative Record File at the following locations:**

USACE FUSRAP Project Office
8945 Latty Avenue
Berkeley, Missouri 63134
Phone: (314) 260-3905

St. Louis Public Library
Government Information Room
1301 Olive Street
St. Louis, Missouri 63103
Phone: (314) 539-0376

This PP is specific to ISOU media at the following properties that are collectively identified as the Group 1 Properties:

- Mallinckrodt Security Gate 49,
- Downtown (DT)-4 South,
- DT-8,
- DT-9 Levee,
- DT-15,
- DT-29,
- DT-34,
- the South of Angelrodt Property Group (i.e., DT-5, DT-13, DT-14, DT-16, DT-17, and DT-18), and
- West of Broadway Property Group (i.e., Plants 3, 8, 9, and 11 and DT-20, DT-21, DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-30, DT-35, and DT-36).

The Group 1 Properties are shown on Figure 1 and are a subset of all the properties associated with the ISOU, which in turn, are a subset of all the properties at the SLDS. The BRA conducted as part of the *Remedial Investigation and Baseline Risk Assessment Report for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site* (hereafter referred to as the RI/BRA) evaluated risks to human health and the environment at the ISOU properties. No Further Action is recommended for the Group 1 Properties. For the remaining SLDS ISOU properties, the results of the BRA indicate that they may pose unacceptable risks and could require further action or analysis. Therefore, the remaining properties will continue through the CERCLA process on a separate path that will ultimately lead to further action or analysis. Section 4.0 presents the scope and role of this PP and includes Table 4-1, which shows a full breakout of the Group 1 Properties that are the subject of this PP, as well as the remaining SLDS properties associated with the ISOU (i.e., not included in this PP) and all other SLDS properties that are not included in the ISOU or this PP. Table 4-1 also shows a breakout of all properties into the two operable units (OUs) that have been established at the SLDS and described in Section 2.2.1.

The USACE plans to issue this PP for public comment. This PP summarizes information that can be found in greater detail in the RI/BRA, as well as other documents contained in the Administrative Record File for the SLDS ISOU. The USACE and the USEPA encourage the public to review these documents, available at the locations specified previously, to gain a more comprehensive understanding of the SLDS ISOU and FUSRAP activities that have been conducted at the site.

## 1.1 PURPOSE

The purpose of this PP is to describe the USACE's preferred remedy for the Group 1 Properties associated with the SLDS. This PP is being used to solicit public and agency comments, as specified in the CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Contingency Plan (NCP). The USACE, in conjunction with the USEPA, is requesting input from the public to select a final remedy. The remedy preferred by the USACE for ISOU media at the Group 1 Properties is No Further Action. However, the final remedy will not be selected until after full consideration of all public

comments submitted during the comment period and will be documented in a ROD for the ISOU associated with the Group 1 Properties within the SLDS.

## 1.2 AUTHORITY

In 1997, Public Law 105-62 transferred responsibility for the execution of FUSRAP from the U.S. Department of Energy (DOE) to the USACE under the Fiscal Year 1998 Energy and Water Development Appropriations Act. Consistent with this transfer, the USACE is conducting response actions at the SLDS under the legislative authority contained in the Energy and Water Development Appropriations Act for Fiscal Year 2000, Public Law 106-60, §611 (1999). This law establishes the authority of the USACE to conduct response actions for releases related to the nation's early atomic energy program as the lead federal agency, subject to the CERCLA and the NCP. This PP is being submitted as part of the USACE's public participation responsibilities under Section 117(a) of the CERCLA.

The FUSRAP was initiated to identify, clean up or otherwise control sites at which residual radioactive material remains because of uranium manufacturing and processing activities conducted during the nation's early atomic energy program.

The scope of this PP is limited to FUSRAP wastes. As defined by the Federal Facility Agreement (FFA), these wastes include the following types of materials:

- all wastes, including but not limited to radiologically contaminated wastes, resulting from or associated with uranium manufacturing or processing activities conducted at the SLDS; and,
- other chemical or non-radiological wastes that have been mixed or commingled with radiologically contaminated wastes resulting from or associated with uranium manufacturing or processing activities conducted by the MED/AEC at the SLDS.

Other contaminants present at the SLDS that are not a result of past MED/AEC-related activities or are not commingled, are beyond the scope of this PP.

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# 2.0 SITE BACKGROUND

## 2.1 SITE DESCRIPTION

The SLDS is located in an industrial area in the eastern portion of the City of St. Louis, Missouri, just west of the Mississippi River, as shown on Figure 2. The SLDS consists of approximately 44.5 acres (180,000 square meters [$m^2$]) of land currently owned by Mallinckrodt LLC (Mallinckrodt) and more than 165 acres (670,000 $m^2$) of surrounding land that is owned by various private and government entities. The properties that are not owned by Mallinckrodt are referred to as vicinity properties (VPs).

The SLDS VPs consist of 38 properties surrounding the Mallinckrodt property. These properties have the potential to be contaminated as a result of the historical MED/AEC operations and/or subsequent transportation, storage, or migration of MED/AEC-related residues. The VPs are identified using the prefix of "DT" to represent the "downtown" site and are followed by a number for consistent identification regardless of changing property ownership. Various industrial and commercial processes have been conducted throughout the SLDS vicinity for more than 150 years. The area is primarily industrial with the exception of one mixed use property (DT-22) where a person resides within the business location. This residential use was grandfathered and future residential use is prohibited. The long-term plans for the area are to retain industrial uses, encourage a wholesale produce district, prohibit residential use, and phase out junk yards, truck storage lots.

## 2.2 SITE HISTORY

Since 1867, Mallinckrodt Inc. (now Mallinckrodt LLC) has used blended, and/or manufactured chemicals at this facility, including organics and inorganics. Mallinckrodt Chemical Works (now Mallinckrodt LLC), from 1942 until 1957, was contracted by MED and AEC to process uranium ore for the production of uranium metal. Residuals of the process, including spent pitchblende ore, process chemicals, and radium, thorium, and uranium, were inadvertently released from the Mallinckrodt Property and into the environment through handling and disposal practices. Residuals from the uranium process had elevated levels of radioactive radium, thorium, and uranium. From 1942 to 1945, Plants 1, 2, and 4 (now Plant 10) (Figure 3) were involved in the development of uranium-processing techniques, uranium compounds and metal production, and uranium metal recovery from residues and scrap.

A radiological survey conducted in 1977 at the SLDS found that alpha and beta-gamma contamination levels exceeded guidelines for release of the property for use without radiological restrictions. The radiological survey was documented by Oak Ridge National Laboratory in a 1981 report entitled: *Radiological Survey of the Mallinckrodt Chemical Works, St. Louis, Missouri*. Elevated gamma radiation levels were measured at some outdoor locations and in some of the buildings formerly used to process uranium ore. Elevated radium (Ra)-226 and uranium (U)-238 concentrations were above background in subsurface soil. Additionally, radon and radon daughter activity levels in two buildings exceeded guidelines for non-occupational radiation exposure. In response to this survey, it was determined that further investigation was necessary to characterize the nature and extent of contamination, and to evaluate possible remedial actions to mitigate threats to human health and the environment.

### 2.2.1 St. Louis Downtown Site Operable Units

To facilitate environmental investigations and remedial activities, the SLDS was divided into two OUs: the accessible soil and ground-water OU and the SLDS ISOU.

#### *2.2.1.1 Accessible Soil and Ground-Water Operable Unit*

Remediation of wastes in accessible soil at the SLDS has been ongoing for years under a separate ROD, the *Record of Decision for the St. Louis Downtown Site*, which was signed in 1998 (hereafter referred to as the 1998 ROD). The 1998 ROD addresses contamination related to the MED/AED activities in accessible soil and ground water. Accessible soil is defined as MED/AEC impacted soil that is not inaccessible due to the presence of buildings, active rail lines, roadways and the levee and that can be remediated without impacting the activities critical to the continued operation of the Mallinckrodt Facility. As stated in "The Selected Remedy" section (Section 9) of the 1998 ROD, the cleanup criteria for radiological contaminants within the OU are:

- "Excavation of accessible soil according to the applicable or relevant and appropriate requirement (ARAR)-based composite criteria of 5/15 picocuries per gram (pCi/g) above background for Ra-226, Ra-228, thorium (Th)-232, and Th-230, and 50 pCi/g above background for U-238 in the uppermost 4 to 6 feet (ft) (1.2 or 1.8 meters [m]) throughout the OU and at the perimeter VPs…;" and,
- "On the portion of the Mallinckrodt property addressed in the OU, site-specific target removal levels of 50 pCi/g above background for Ra-226, 100 pCi/g above background for Th-230, and 150 pCi/g above background for U-238 will be used as the deep-soil cleanup guidelines below 4 to 6 ft (1.2 or 1.8 m)."

#### *2.2.1.2 Inaccessible Soil Operable Unit*

The scope of the ISOU includes all media at the SLDS not covered by the 1998 ROD that may have become contaminated as a result of the deposition or migration of MED/AEC-related contaminated media.

Media within the scope of the ISOU include:

- Soil that is inaccessible due to the presence of buildings and other permanent structures, including the subsoil within the footprint of a structure of which remediation would reasonably be expected to affect the stability of the structure.
- Soil located under active railroads (RRs), including the supporting soil in the associated right-of-way (ROW).
- Soil located under roadways, including the supporting soil in the associated ROW. Roadways are defined as the public and private streets. Inaccessible soil does not include soil beneath driveways, parking lots, or other paved surfaces located at plant or VP areas that were addressed as accessible soil areas.
- Soil on the exteriors and interiors of buildings and permanent structures (e.g., tanks, bridges, sheds, loading docks, utility poles, traffic signals, piping, rail tracks, and equipment boxes).
- Sewers (e.g., structures and interior sediment) not directly encountered within an excavation area during the remedial action conducted under the 1998 ROD.
- Soil adjacent to sewers located beneath buildings, permanent structures, RRs, and/or roads.

The following properties are excluded from the scope of the ISOU:

- Plant 7E and three VPs (DT-1, DT-7, and DT-32) are excluded because they do not contain inaccessible soil areas and there are no sewers, buildings, or structures impacted by MED/AEC operations present at these properties. Accessible soil contamination has been remediated at Plant 7E and DT-7 to standards specified in the 1998 ROD. DT-1 and DT-32 did not require remediation.
- The inaccessible soil and structures at Plant 10 have been excluded because Plant 10 was remediated by the DOE. The sewers used for MED/AEC operations at Plant 10 were included and evaluated in the *Remedial Investigation Work Plan for the Inaccessible Soil Operable Unit at the St. Louis Downtown Site* (hereafter referred to as the RI WP) and were determined to be non-impacted.
- Plant 5 is excluded because residual contamination is reasonably attributable to the Columbium-Tantalum (C-T) processing activities that were conducted at these areas by Mallinckrodt. C-T ores were processed by Mallinckrodt at Plant 5 under a separate U.S. Nuclear Regulatory Commission (NRC) Source-Material License and, therefore, remediation of this radiologically contaminated soil is not within the scope of the FUSRAP. These ores contain natural uranium, thorium, and actinium decay series radionuclides.
- Plant 7W is currently excluded from the ISOU, because historical sources of contamination have not been determined. If historical sources of contamination are determined to be from MED/AEC activities, FUSRAP will take necessary action consistent with CERCLA.

The status of the following properties has changed since the publication of the RI WP and, therefore, the inclusion of the specific property areas within the scope of the ISOU has also changed. These areas are now being addressed under the 1998 ROD.

- A sewer line at the northern edge of the 50-series excavation area in Plant 2 was characterized during the remedial investigation (RI). Results of the soil sampling indicated subsurface soil adjacent to the sewer line was radiologically contaminated. In calendar year 2011, this area was made available for remediation for a short time by the owner and the contaminated soil above the sewer line was removed. The sewer and surrounding soil will be remediated under the 1998 ROD. Consequently, the soil and sewer line at the northern edge of the 50-series excavation area are no longer included in the scope of the ISOU.
- Soil beneath Building 101 was made available by the property owner for remediation under the 1998 ROD. Plant 6 Building 101 has been demolished. Soil within the footprint of Building 101 is now accessible soil and outside the scope of the ISOU.
- Soil at the northeastern corner of Plant 7N was defined in the RI WP as an “inaccessible area of detected contamination” and was proposed for sampling. The subsurface soil beneath this area was found to be radiologically contaminated. Soil beneath Destrehan Street has been made available by the property owner for remediation under the 1998 ROD.
- The Hazardous Waste Storage Area at Plant 7N was razed in 2010, and the associated soil and sewer lines were remediated. Therefore, soil and sewer lines beneath this building are no longer defined as inaccessible and are outside the scope of the ISOU.
- ROW soil along DT-12, was characterized during the RI, found to be radiologically contaminated, and then made available by the owner for remediation under the

1998 ROD. Remedial actions have been conducted in this area and the remaining inaccessible soil is being evaluated as part of the ISOU. The DT-12 ROW soil remediation activities are documented in the USACE's (2012) *Remedial Action Summary for Burlington Northern Santa Fe Railroad Vicinity Property (DT-12), FUSRAP St. Louis Downtown Site, St. Louis, Missouri*. However, the post-remedial data have yet to be fully evaluated and documented in a future Post-Remedial Action Report.

- Soil beneath Destrehan Street, between Hall Street and DT-12, was characterized during the RI, found to be radiologically contaminated, and then made available by the owner for remediation under the 1998 ROD. This area has not yet been remediated.

The purpose of the RI/BRA was to define the nature and extent of MED/AEC soil contamination present in the ISOU and to assess the associated risk to human health and the environment under the current and reasonable anticipated future land use for the SLDS. As part of the RI/BRA, "property-wide" evaluations were conducted to reflect the fact that remediation had been conducted in accessible soil areas under the authority of the 1998 ROD and to reflect that in reality, individuals move randomly through all portions of each property. Table 2-1 includes a list of the properties that are included in the ISOU and an indication of whether the property is included in this PP. The remaining properties associated with the SLDS ISOU that are not included in this PP are being separately evaluated under CERCLA. This is because the BRA results indicate that the remaining properties may pose unacceptable risks and could therefore, require further action or analysis.

#### *2.2.1.3 Group 1 Inaccessible Soil Operable Unit Properties included in this Proposed Plan*

The Group 1 Properties included in this PP are presented in Table 2-1 and discussed in further detail within Section 3 of this PP.

## 2.3 REGULATORY AND COMMUNITY INVOLVEMENT

Since 1997, the USACE has involved the regulators and the public in the CERCLA process for the St. Louis Sites. USEPA Region VII has been involved in FUSRAP activities pursuant to the DOE's FFA. The Missouri Department of Natural Resources (MDNR) has a local office focused on the FUSRAP efforts and interacts regularly with the USACE staff.

The USACE provides regular briefings at the St. Louis Oversight Committee meetings, which are open to the public. The USACE maintains a website (www.mvs.usace.army.mil) with current information about the status of the St. Louis FUSRAP Sites and historical documentation. Newsletters are distributed to the community twice per year.

## 2.4 PREVIOUS ACTIONS

The following paragraphs describe the prior actions that have occurred at the properties in an effort to give a complete picture of the current conditions. This section discusses the interim actions conducted across the SLDS by the DOE, actions taken by Mallinckrodt pursuant to its Decommission Plan and Resource Conservation and Recovery Act (RCRA) Permit, the remedial actions taken under the 1998 ROD by the USACE at accessible areas associated with the properties recommended for No Further Action, and a description of the RI/BRA activities that focused on the ISOU.

## Table 2-1. Summary of Group 1 Properties Associated with the Inaccessible Soil Operable Unit at the St. Louis Downtown Site

| Property | Current Property Name | Group 1 Property | Comments |
|---|---|---|---|
| ***Mallinckrodt Plant Properties*** | | | |
| Plant 1 | Mallinckrodt LLC | | |
| Plant 2 | Mallinckrodt LLC | | |
| Plant 6 | Mallinckrodt LLC | | |
| Plant 7N | Mallinckrodt LLC | | |
| Mallinckrodt Security Gate 49 | Mallinckrodt LLC | ✓ | |
| ***Industrial/Commercial Vicinity Properties*** | | | |
| DT-1 | Kiesel (formerly Archer Daniels Midland and PVO Foods | | *c* |
| DT-2 | City Property | | |
| DT-4 North | Gunther Salt North | | |
| DT-4 South | Gunther Salt South | ✓ | *a* |
| DT-6 | Heintz Steel and Manufacturing | | |
| DT-7 | Midwest Waste | | *c* |
| DT-8 | PSC Metals Inc. | ✓ | |
| DT-10 | Thomas and Proetz Lumber Company | | |
| DT-15 | St. Louis Metropolitan Sewer District Lift Station | ✓ | |
| DT-29 | Midtown Garage | ✓ | |
| DT-34 | Hjersted | ✓ | |
| ***South of Angelrodt Property Group*** [b] | | | |
| DT-5 | Ameren UE | ✓ | *a,b* |
| DT-13 | Cash Scrap Metals | ✓ | *b* |
| DT-14 | Cotto-Waxo | ✓ | *b* |
| DT-16 | Star Bedding Company | ✓ | *b* |
| DT-17 | Christiana Court LLC | ✓ | *b* |
| DT-18 | City of St. Louis | ✓ | *a,b* |
| ***West of Broadway Property Group*** [b] | | | |
| Plant 3 | Mallinckrodt LLC | ✓ | *b* |
| Plant 8 | Mallinckrodt LLC | ✓ | *b* |
| Plant 9 | Mallinckrodt LLC | ✓ | *b* |
| Plant 11 | Mallinckrodt LLC | ✓ | *b* |
| DT-20 | Richey | ✓ | *b* |
| DT-21 | Farve | ✓ | *a,b* |
| DT-22 | Tobin Electric | ✓ | *a,b* |
| DT-23 | Worth Industries | ✓ | *b* |
| DT-24 | Bremen Bank | ✓ | *a,b* |
| DT-25 | Eirten's Parlors | ✓ | *a,b* |
| DT-26 | UAAA Local 1887 | ✓ | *a,b* |
| DT-32 | Westerhide Tobacco | | *c* |

## Table 2-1. Summary of Group 1 Properties Associated with the Inaccessible Soil Operable Unit at the St. Louis Downtown Site

| Property | Current Property Name | Group 1 Property | Comments |
|---|---|---|---|
| ***West of Broadway Property Group [b] (Continued)*** | | | |
| DT-27 | Dillion | ✓ | [b] |
| DT-28 | Challenge Enterprises | ✓ | [a,b] |
| DT-30 | Zamzow Manufacturing | ✓ | [a,b] |
| DT-31 | Porter Poultry | | [c] |
| DT-35 | Factory Tire Outlet | ✓ | [b] |
| DT-36 | OJM Inc. | ✓ | [b] |
| DT-37 | Lange-Stegmann | | [c] |
| ***Railroad Vicinity Properties*** | | | |
| DT-3 | Norfolk Southern Railroad | | |
| DT-9 Main Line | Terminal Railroad | | |
| DT-9 Rail Yard | Terminal Railroad | | |
| DT-9 Levee | Terminal Railroad | ✓ | |
| Terminal Railroad Soil Spoils Area | Terminal Railroad | | |
| DT-12 | BNSF Railroad | | |
| ***Roadway Vicinity Properities*** | | | |
| DT-11 | McKinley Bridge (Jointly Owned by the Missouri Department of Transportation [MoDOT] and the Illinois Department of Transportation [IDOT]) | | |
| DT-19 | City of St. Louis-Owned Roads | | |
| DT-33 | MoDOT-Owned Roads | | |

[a] Property has been determined to be non-impacted during previous investigations.

[b] Property group was evaluated collectively in the RI Nature and Extent evaluation and in the BRA. Therefore, although individual properties belonging to the group are indicated as being included in this PP, it is the property group itself that is retained for the PP.

[c] These properties are not included in the scope of the ISOU due to the absence of inaccessible soil areas and buildings/structures.

Notes:

Check mark indicates that the property is a Group 1 property included in this PP.

### 2.4.1 Interim Actions at St. Louis Downtown Site

Prior to the 1998 ROD, four interim actions were performed at the SLDS. These actions were conducted by the DOE prior to the transfer of responsibility to the USACE. The interim actions are summarized below:

- Decontamination, demolition and crushing of the 50 Series Buildings (Buildings 50, 51, 51A, 52, and 52A). Approximately 1,000 cubic yards ($yd^3$) (764.6 cubic meters [$m^3$]) of material were shipped offsite;
- Asbestos abatement, decontamination, demolition to floor elevation grade, crushing of Plant 6 and 7 Buildings (100, 116, 116B, 117, 700, 704, 705, 706, 707, and 708). Approximately 2,670 $yd^3$ (2,041 $m^3$) of material shipped offsite;
- Excavation of Plant 10 subsurface area. Approximately 15,000 $yd^3$ (11,468 $m^3$) of material shipped offsite; and
- Excavation of City Property (Riverfront Trail). Approximately 750 $yd^3$ (573.4 $m^3$) shipped offsite.

### 2.4.2 Actions Taken By Mallinckrodt Inc. (Property Owner)

Mallinckrodt Inc. has obtained a RCRA Part B permit from the State of Missouri for the entire facility. This permit defines the manufacture, use and handling of hazardous wastes at the facility, including any remediation of hazardous wastes that were deemed necessary by the State.

In addition, a Decommissioning Plan was approved by the NRC to terminate the license for the C-T process that was conducted in the Plant 5 area. In the Plan, Mallinckrodt agreed to decommission the land affected by C-T processing so that it may be used without restriction for continued industrial productivity. Soil and debris containing residual regulated radionuclides in greater concentrations than release criteria by NRC-authorized transfer was shipped to a disposal facility. At the conclusion of decommissioning, Mallinckrodt anticipates that the potential radiological dose to people on the site will be less than the dose limit of 25 millirem per year (mrem/yr), indicating that post-remediation activity is not necessary. The dose limit of 25 mrem/yr is a health-protective standard established by the NRC under 10 *Code of Federal Regulations (CFR)* 20 Subpart E, which pertains to the decommissioning of NRC licensed facilities. This is the minimum standard that must be attained before decommissioning of a site can be considered complete and the license terminated.

### 2.4.3 Remedial Actions Pursuant to the 1998 Record of Decision at No Further Action Properties

The 1998 ROD presented the selected remedial action for the clean-up of waste related to the accessible soil and ground water OU at the SLDS. Pursuant to the 1998 ROD, accessible portions of some properties have been addressed either through a Final Status Survey Evaluation (FSSE) or through a remedial action (RA) followed by an FSSE. More information on RA at the Group 1 Properties can be found in Section 3.8.

### 2.4.4 St. Louis Downtown Site Inaccessible Soil Operable Unit Remedial Investigation Activities

The following RI field activities were conducted for the SLDS ISOU between May 2009 and August 2010 to evaluate the nature of radionuclides and metals contamination within the ISOU:

- soil sampling of inaccessible soil beneath or immediately adjacent to buildings and other permanent structures (including the levee, RRs, and roadways);
- gamma walkover surveys (GWSs);
- radiological surveys of interior and exterior building surfaces and structural components;
- sewer sediment sampling of manholes and surface grates; and
- subsurface soil sampling adjacent to sewer lines.

The results of the field investigations were analyzed and documented in the RI/BRA, which is available online at www.mvs.usace.army.mil and included in the Administrative Record File for the ISOU.

# 3.0 SITE CHARACTERISTICS

## 3.1 LOCATION

The SLDS is located within the city of St. Louis in an area that has been industrialized for more than 150 years. The SLDS includes the property owned by Mallinckrodt and the 38 VPs that are operated and/or maintained by individual owners.

The Mallinckrodt property encompasses an area of approximately 12 city blocks, roughly bounded by the McKinley Bridge on the north, Angelrodt Street on the south, North Broadway on the west, and the Burlington Northern Santa Fe (BNSF) RR VP (DT-12) on the east (Figure 1). The Mallinckrodt property currently includes a chemical manufacturing plant, support facilities, and administrative buildings that cover a large portion of the property. The remainder of the complex is covered, mostly with asphalt or concrete pavement. The surrounding properties that are owned by various private and government entities are referred to as VPs. Most of the VPs that surround the Mallinckrodt property are small parcels of land owned by individuals conducting industrial, commercial, manufacturing, or retail businesses, including a lumber distributor, a scrap metal recycler, a bedding manufacturer, and a bank. These properties have the potential to be contaminated as a result of the historical MED/AEC operations and/or subsequent transportation, storage, or migration of MED/AEC-related residues.

## 3.2 CLIMATE

The SLDS experiences climate typical of the Midwest where winters are cold and wet followed by hot and humid summers. National Weather Service records show the mean annual temperature for this area is 56.2 degrees Fahrenheit ($^{o}$F) with a minimum recorded temperature of -22$^{o}$F and a maximum recorded temperature of 115$^{o}$F. Annual average precipitation is 37.5 inches (95.25 centimeters [cm]) and is generally well-distributed throughout the year.

## 3.3 SITE GEOLOGY AND HYDROGEOLOGY

Surficial fill, consisting of brick, concrete, organic material, and coal slag with minor sand, coal ash, coal cinders, and silt, is present over most of the property with an average thickness of 13 ft (4 m). There are two depositional units that underlie the fill and are identified based on differences in their geologic properties: an upper unit, consisting of clay and silty clay with interbedded clay, silt, and sandy silt, ranging in thickness from 10 to 17 ft (3.1 to 5.2 m); and a lower unit, comprised of sandy silt, silty sand, and gravelly sand deposits ranging in thickness from 0 to 60 ft (0 to 18.3 m).

The uppermost bedrock unit at the SLDS is the Mississippian-age Ste. Genevieve Formation, which consists of moderately fractured limestone with some dolomite. The erosional surface of the bedrock dips eastward from a depth of approximately 19 ft (6 m) below ground surface (bgs) at the western edge of the SLDS to a depth of approximately 80 ft (24.4 m) bgs near the Mississippi River.

Ground water at the SLDS is found within three hydrostratigraphic units (HUs). These units are, in order of increasing depth, HU-A, which consists of fill overlying clay and silt; HU-B, also referred to as the Mississippi Alluvial Aquifer, consisting of sandy silts and silty sands; and the Limestone Bedrock Unit, referred to as HU-C. Monitoring activities associated with the SLDS ground water are covered in the 1998 ROD.

There are no known drinking water wells in the vicinity of the SLDS. The City of St. Louis has Ordinance 66777 which explicitly forbids the installation of wells into the subsurface for the purposes of using the ground water as a potable water supply.

## 3.4 TOPOGRAPHY, DRAINAGE, AND SURFACE WATER

At the SLDS, surface elevations range from approximately 430 ft (131.1 m) above mean sea level (amsl) in the southwestern part of the site to 420 ft (128 m) amsl near the Mississippi River. The SLDS ground surface slopes at an average of 0.4 percent eastward toward the Mississippi River. Portions of the SLDS lie within the original floodplain of the Mississippi River. Such areas are now separated from the river by a levee and floodwall system identified as the St. Louis Flood Protection system. This system includes the Mississippi River levee, an earthen levee, and a concrete floodwall that protect St. Louis from Mississippi River floodwaters. The top of the Mississippi River levee is approximately 438 ft (133.5 m) amsl and is designed to protect against a 500-year flood event.

Surface drainage is directed through ditches and catchment basins into an extensive storm drainage system that discharges to the Metropolitan St. Louis Sewer District (MSD) Bissell Point Treatment Plant. The surface water is treated at the plant prior to discharge to the Mississippi River. Much of the SLDS area is covered with concrete or asphalt, which interferes with natural surface-water runoff and ground-water recharge mechanisms. No permanent surface-water bodies exist within the boundaries of the SLDS.

The Mississippi and Missouri Rivers are the major water supply sources for the St. Louis area. All of the St. Louis area municipal water intakes are located upstream of the SLDS except for the Illinois-American Water Plant, which supplies a small percentage of the water required by the city of East St. Louis, Illinois. The Illinois-American Water Plant intake is located approximately 8 miles downstream of the SLDS on the opposite (east) bank of the Mississippi River.

## 3.5 ECOLOGICAL AND CULTURAL RESOURCES

The SLDS is located in the Oak-Hickory-Bluestem Parkland section of the Prairie Parkland Province. Pre-settlement vegetation was characterized by deciduous woodlands intermixed with open prairie. Today, the ecological resources at the SLDS are limited because of the site's location within an urban area of concentrated industrial and commercial developments. Site vegetation consists of a mixture of prairie species, disturbance-related aggressive species, and species typical to old fields including wild carrot, aster, clover, dandelion, milkweed, ragweed, and various grasses.

Vertebrate fauna of the St. Louis area consist of species that have adapted to urban encroachment, including mammals (e.g., mice, opossum, eastern cottontail rabbit, gray squirrel, and eastern mole). Birds that inhabit the urban environment include the Canada goose, rock dove, mourning dove, American crow, American robin, and Northern cardinal.

Available data indicate that no archaeological sites or historic buildings lie within the SLDS boundaries. Due to the intensive industrial use of the site, it is unlikely that any significant archeological sites exist at the SLDS. Two sites listed in the March 1992 edition of the National Register of Historic Places for the state of Missouri exist within 1 mile of the SLDS. The first site is the Bissell Street Water Tower, located northwest of the SLDS, and the second is the Murphy-Blair Historic District, located 0.5 mile southwest from the SLDS. Additionally, an official historic

district (Hyde Park) is located about 0.2 miles west of the SLDS, near the intersection of Ninth Street and the McKinley Bridge.

## 3.6 LAND USE

The Mallinckrodt site is in an urban industrial area in the northeastern section of the City of St. Louis. Manufacturing and support buildings cover a large portion of the site, and the remainder of the area is typically paved with asphalt or concrete. Mallinckrodt grants access to its facilities to employees, subcontracting construction workers, and authorized visitors and maintains 24-hour security at the property. Three RRs cross, serve, or are adjacent to the site: BNSF; Norfolk Southern (NFS); and the St. Louis Terminal Railroad Association (TRRA). This industrial zone allows all uses except new or converted dwellings. Some uses allowed within this zone under conditional use permits are acid manufacture, petroleum refining, and stockyards.

Land use within a 1-mile radius of the SLDS includes a mixture of commercial, industrial, and residential uses. According to the City of St. Louis Zoning District Map, the SLDS properties are currently zoned as either "J Industrial District" or "K Unrestricted District."

According to the City of St. Louis Strategic Land Use Map, which was adopted by the City of St. Louis' Planning Commission on January 5, 2005, all SLDS properties are listed as "Business and Industrial Preservation and Development Area" or "Business and Industrial Development Area." As stated previously, the SLDS properties are currently zoned for industrial uses, which do not allow new or converted dwellings (residential use). However, a resident is currently located on North Broadway (DT-22), approximately 200 ft (61 m) southwest of the Mallinckrodt Plant 10 property. This residential use was grandfathered but future residential use is prohibited. The long-term plans for the area are to retain industrial uses, encourage a wholesale produce district, and phase out junkyards, truck storage lots, and the remaining residential use.

Property owned by the City of St. Louis is located between Mallinckrodt and the Mississippi River. The Mississippi River levee is located on this city property. The Riverfront Trail hiking and bicycle trail runs along the top of the levee, but the property is otherwise undeveloped and unfenced.

## 3.7 POTENTIAL CONTAMINANTS OF CONCERN EVALUATION

The ISOU potential contaminants of concern (PCOCs) selected as the starting point for the RI/BRA at the SLDS ISOU were the same radionuclides and metals identified as contaminants of concern (COCs) in the 1998 ROD. A COC is a MED/AEC-related contaminant identified in the 1998 ROD as requiring response action for accessible soil for protection of human health or welfare of the environment. The COCs in the 1998 ROD are: actinium (Ac)-227, protactinium (Pa)-231, Ra-226, Ra-228, Th-228, Th-230, Th-232, U-235, and U-238 site-wide, and the metal contaminants including arsenic, cadmium, and uranium metal in historical ore processing areas.

Regarding the Group 1 Properties that are the subject of this PP, and that were previously identified in Table 2-1, radiological COCs were not identified at the accessible portions of the following properties because these portions were found to meet the requirements of the 1998 ROD without the need for remedial actions: DT-15, DT-34, most of the South of Angelrodt properties (DT-5, DT-13, DT-14, DT-16, and DT-18), and most of the West of Broadway properties (DT-20, DT-21, DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-30, DT-35, DT-36, Plant 3, Plant 8, Plant 11 and the parking lots). Accessible soil areas that were

found to be impacted by COCs have been remediated and now meet the requirements of the 1998 ROD, as discussed in Section 3.8.

PCOCs were identified in ISOU media at the Group 1 Properties that are the subject of this PP. Consequently, these properties were further evaluated in the RI/BRA. The results of the RI/BRA were used to evaluate risks associated with ISOU media at all properties and property groups included in this PP. As discussed later in Section 5.2, the BRA concluded that the combined ISOU and accessible media within each of the Group 1 Properties do not contain MED/AEC-related contaminants at levels requiring a response action (i.e., they do not pose an unacceptable risk to human health or the environment) and therefore, there are no COCs for the Group 1 Properties.

No source materials or principal threat wastes are present at the SLDS ISOU.

## 3.8 CHARACTERISTICS OF THE SELECTED PROPERTIES

The following sections present a property by property discussion of the physical location, features, land use, prior accessible soil OU RA, and a discussion of the inaccessible portions addressed by this PP.

Some of the Group 1 Properties in this PP were previously identified in the RI/BRA to be non-impacted by MED/AEC operations. Other Group 1 Properties do not present complete exposure pathways or pose an unacceptable risk to human health and the environment based on investigations undertaken as part of the RI/BRA. These determinations are documented in the RI/BRA.

The determination of whether soil associated with inaccessible areas was non-impacted is based on historical site use and the extent of MED/AEC contamination in adjacent areas. Soil beneath structures in MED/AEC processing areas is considered non-impacted if the structure was constructed prior to MED/AEC operations and data indicates contamination levels in adjacent soil are below background or the 1998 ROD remediation goals (RGs). Soil adhered to structures in MED/AEC processing areas is considered non-impacted if the structure was constructed after MED/AEC operation ceased and data indicates contamination levels in adjacent soil are below background or the 1998 ROD RG. Inaccessible soil outside MED/AEC processing areas is considered non-impacted if data indicates contamination levels in adjacent soil are below background or the 1998 ROD RGs. The following properties addressed by this PP were found to be non-impacted: DT-4 South, DT-5, DT-18, DT-21, DT-22, DT-24, DT-25, DT-26, DT-28, and DT-30.

The determination that areas associated with inaccessible soil do not present complete exposure pathways or pose an unacceptable risk to human health and the environment was made based upon property-wide risk assessments documented in the RI/BRA. The following properties are included in the Group 1 Properties for this PP based on this analysis: Security Gate 49, DT-8, DT-9, DT-15, DT-29, DT-34, South of Angelrodt Property Group, and West of Broadway Property Group.

### 3.8.1 Mallinckrodt Security Gate 49

The Mallinckrodt Security Gate Number 49 (hereafter referred to in this discussion as Security Gate 49) is located east of Plant 10 just north of the intersection of the North Second Street corridor and Angelrodt Street. The triangular-shaped property has a frontage of approximately

60 ft (18.3 m) extending east to west along Angelrodt Street and is approximately 250 ft (76.2 m) extending north to south along Plant 10.

A large area at Security Gate 49 consists of asphalt cover over North Second Street. A small building serves as a guard shack. The Mallinckrodt Security Gate 49 area is not within the defined uranium-ore processing area; therefore, only radiological PCOCs were evaluated.

Land use at Security Gate 49 is industrial.

An accessible soil area of approximately 603 square feet ($ft^2$) (56 $m^2$) at Security Gate 49 was remediated in 2006 pursuant to the 1998 ROD. During the remediation of accessible soil at the Security Gate 49 area, approximately 16 bank cubic yards (12.2 $m^3$) were excavated, loaded into rail cars and shipped to a properly licensed, out-of-state disposal facility. The RA and compliance with 1998 ROD requirements are documented in the USACE (2010) document entitled: *Post-Remedial Action Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Northeast Corner of Plant 9 and Security Gate Number 49 Area*, Revision 0. The Post-Remedial Action Report and FSSE for the Accessible Soils at this property indicate that the accessible areas meet the 1998 ROD remediation goals and achieve an acceptable risk.

Inaccessible soil areas (i.e. areas addressed by the ISOU) associated with Security Gate 49 are located beneath the asphalt cover of North Second Street and beneath the guard shack. To support the RI/BRA, a GWS was conducted and two inaccessible soil samples were collected at the Mallinckrodt Security Gate 49 area. In addition, because this area is also associated with North Second Street, two systematic soil samples were collected in this area as part of the roadway characterization for the RI/BRA. The sample results were evaluated in the RI/BRA for human health risks, the results of which are discussed in Section 5.2.

### 3.8.2 DT-4 South – Gunther Salt

DT-4 is essentially comprised of two city blocks diagonal from each other at the intersection of Buchanan and Hall Streets. DT-4 South is bordered to the north by Buchanan Street, to the east by the BNSF RR, to the south by Dock Street, and to the west by Hall Street. DT-4 South is located approximately 400 ft (122 m) south of the southern border of Plant 7 South. DT-4 South has an area of approximately 8.9 acres (36,017 $m^2$) and is one of two parcels (i.e., DT-4 North and DT-4 South) owned by the Gunther Salt Company.

The Gunther Salt Company is a family-owned and operated supplier of rock, solar, and evaporated salt for a variety of water softening, ice control, agricultural, food processing, and industrial uses.

The area surrounding DT-4 South consists of primarily industrial and commercial facilities.

Prior to 1964, DT-4 South was an unpaved lot used for parking. Between 1964 and 1968 a large building was constructed in the center of this property, and the remainder of the property was paved. Between 1996 and 1998 the DT-4 South building was extended to the current configuration with a 22,000-$ft^2$ (2,043.9-$m^2$) addition. DT-4 South is currently used for the bulk storage and staging of salt and water conditioning materials by the Gunther Salt Company. The building is used to store packaged salt products. The property also includes open storage areas. DT-4 South is fenced/access-controlled on all sides and paved with asphalt.

The DT-4 South property was not included in the RI activities at the SLDS during the 1990s, though pre-design investigation (PDI) characterization activities were conducted between 2001 and 2004. Data from radiological analyses indicated that remediation would be required in two

isolated accessible areas on the very eastern edge of the property and a third area at the northern edge of the property. Remediation was completed in June 2006, which included the excavation of the two small areas located adjacent to the eastern property boundary as well as the third area adjacent to the northern property boundary. However, excavation of the northern area also included removal of soil from beneath Buchannan Street, between DT-4 South and DT-7 (Midwest Waste). An estimated 380 $yd^3$ (290.5 $m^3$) of radiologically contaminated soil were removed from the property and adjacent areas. The RA and compliance with 1998 ROD requirements are documented in the USACE (2012) document entitled: *Post-Remedial Action Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Property Gunther Salt (DT-4)*, Revision 0. The Post-Remedial Action Report and FSSE for the Accessible Soils at this property indicate that the accessible areas meet the 1998 ROD remediation goals and achieve an acceptable risk.

The inaccessible areas that remain at DT-4 South include the soil beneath the footprint of the sole building that exists on the property and the building's surfaces. The soil beneath the footprint of the building was identified as non-impacted. The basis for this identification is: (1) the GWS at the property found no areas of elevated radiological activity in the soil adjacent to the building, (2) the systematic soil sampling to characterize accessible soil found no contamination requiring removal (with the exception of the northern areas discussed above), and (3) the accessible areas (with the exception of the northern area) were deemed non-impacted. The only building on the DT-4 South property was constructed after MED/AEC operations ceased and no accessible soil remediation was conducted directly adjacent to the building. Therefore, the building surfaces were determined to be non-impacted. Therefore, neither the soil nor building surfaces were retained for further evaluation in the RI/BRA.

### 3.8.3 DT-8 – PSC Metals Inc.

The property is located within the City of St. Louis in an area generally bounded by Bremen Avenue on the north, the Mallinckrodt Chemical Plant on the south, the Mississippi River Flood Protection Levee on the east, and North Second Avenue on the west. DT-8 consists of approximately 23.5 acres (95,100 $m^2$) owned by McKinley Iron Inc. DT-8 is comprised of seven tracts of property located within the general area.

PSC Metals Inc. a recycler and broker of scrap metal, is the company residing on the property. A significant portion of DT-8 is open ground used for segregating and stockpiling scrap metal prior to processing. Several buildings are located within the overall property, and these buildings include an administration building, warehouses, a shredder/welding shop, and a scale house. DT-8 also includes a small undeveloped tract owned by the City of St. Louis.

The area surrounding DT-8 consists of industrial and commercial facilities.

Accessible soil at these locations was remediated pursuant to the 1998 ROD. During the remediation of accessible soil, approximately 8,071 bank cubic yards (6,071 $m^3$) of soil were excavated from and shipped via rail to a properly permitted, out-of-state disposal facility between September 2006 and March 2008. The RA and compliance with the 1998 ROD requirements are documented in the USACE (2013) document entitled: *Post-Remedial Action Report and Final Status Survey Evaluation for Accessible Soils within the St. Louis Downtown Site Vicinity Property PSC Metals Inc. (DT-8)*, Revision 0. The Post-Remedial Action Report and FSSE for the Accessible Soils at this property indicate that the accessible areas meet the 1998 ROD remediation goals and achieve an acceptable risk.

The inaccessible soil areas remaining at DT-8 include the soil within the footprint of six remaining buildings and the RR tracks. Because this VP is outside of the uranium-ore processing area, only radiological PCOCs were evaluated. RI activities for the ISOU included the collection of 49 inaccessible soil samples and the performance of nine GWSs at DT-8. The radiological results for the inaccessible soil samples and the results of the GWSs were analyzed in the BRA, the results of which are discussed in Section 5.2.

### 3.8.4 DT-9 Levee – Terminal Railroad Association

The DT-9 levee area is owned by the TRRA. It consists of two non-contiguous parcels (i.e., a northern parcel and a southern parcel) that are undeveloped and includes a segment of the St. Louis Flood Protection levee system for the Mississippi River. (The St. Louis Riverfront Trail which runs along the DT-9 Levee property is used for walking, jogging and biking.) Both parcels are located to the east of the DT-9 RR and west of the Mississippi River. More specifically, the northern DT-9 levee parcel is located to the east of the DT-9 rail yard, and the southern parcel is located to the east of DT-8 and DT-34. In total, the DT-9 levee area covers approximately 67 acres (273,078 $m^2$).

The area is currently used for industrial and recreational purposes.

In early 2009, RAs adjacent to the levee area and subsequent FSSE were conducted as part of a larger accessible soil remediation effort at DT-9. The RA and compliance results are being documented by the USACE in a *Post-Remedial Action Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Property Terminal Railroad Association (DT-9)*. (At this time, the document has not been finalized.)

The ISOU at the DT-9 Levee Property (i.e., both north and south areas) is the area beneath the footprint of the levee. At the SLDS, inaccessible soil has been categorized into three depth profiles based upon their historical placement relative to the levee:

- Levee Depth A soil includes the soil used to construct the levee beginning at the top of the levee (approximately 13 ft [4 m]) above the original grade) to the base of the levee.
- Levee Depth B soil is the soil located between the base of the levee and 25 ft (7.6 m) bgs. Soil at these depths is urban fill material, which replaced the previous fill which was excavated to a depth of approximately 25 ft (7.6 m) bgs prior to construction of the levee.
- Levee Depth C soil is the original soil located beneath the Levee Depth B soil at a depth of greater than 25 ft (7.6 m) bgs. This soil was sampled to a depth of 37 ft (11.3 m) bgs.

Radiological sampling of the inaccessible areas was conducted in 2007 and 2009. The sample results were evaluated in the RI/BRA for human health risks, the results of which are discussed in Section 5.2.

### 3.8.5 DT-15 – Metropolitan St. Louis Sewer District Lift Station

DT-15 (The MSD Lift Station) is located in the northeastern portion of the SLDS. DT-15 is bounded on the east by the Mississippi River and City Property (DT-2), on the west by BNSF RR (DT-12), on the south by McKinley Bridge (DT-11), and on the north by the TRRA property (DT-9). The DT-15 property covers approximately 2.3 acres (9,259 $m^2$).

DT-15 contains the Salisbury Pumping Station (which is part of the City of St. Louis Flood Protection System), a paved equipment yard and part of the St. Louis Flood Protection Levee for the Mississippi River. The DT-15 pumping station consists of a two story brick structure and

inlet chamber. Adjacent to the pumping station, to the south, is a paved equipment yard. The St. Louis Riverfront Trail which runs along the levee is used for walking, jogging and biking. The remaining property area is covered with vegetation.

Land use at DT-15 is industrial and recreational.

No RA was required on this property to meet the 1998 ROD for accessible soil and groundwater. These findings are documented by the USACE (2012) in the *Pre-Design Investigation Summary Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Property Metropolitan St. Louis Sewer District Lift Station (DT-15),* Revision 0.

The inaccessible areas at DT-15 include the area beneath the footprint of the levee, the area beneath the footprint of the pump house station and surfaces of the pump house station. Sampling of inaccessible soil beneath the levee was conducted in December 2009 and January 2010, the results of which were used to support the RI/BRA, the risk results of which are discussed in Section 5.2. The pump house building was deemed to be non-impacted. This determination was based on the fact that the building was constructed after MED/AEC processing operations ceased and that the surrounding areas were not found to be contaminated or impacted. Therefore, the pump house building was not further evaluated in the RI/BRA.

### 3.8.6 DT-29 – Midtown Garage

DT-29 is located at 3227 North Broadway Street and covers approximately 0.47 acres (1,900 $m^2$).

The property includes two adjoining buildings with a covered bay and a hoist along the western side of the property. More than 90 percent of the property is paved with asphalt and the remainder, a 20-ft-by-80-ft (6.1-m-by-24.4-m) section on the north, is covered with gravel. Outdoor areas are used for parking and storage, and the property slopes gently from northwest to southeast.

Land use at DT-29 is commercial/industrial.

Accessible soil at DT-29 was remediated pursuant to the 1998 ROD. During the remediation of accessible soil, approximately 51 bank cubic yards (approximately 40 $m^3$) of contaminated soil were excavated from the southeast corner of the property and loaded into rail cars and shipped to a properly permitted out-of-state disposal facility. The remedial actions conducted at DT-29, along with the subsequent evaluations and findings are documented by the USACE (2005) in the *Post-Remedial Action Report for the Accessible Soils within the St. Louis Downtown Site Midtown Garage Vicinity Property (DT-29),* Revision 0. The Post-Remedial Action Report and FSSE for the Accessible Soils at this property indicate that the accessible areas meet the 1998 ROD remediation goals and achieve an acceptable risk.

The inaccessible soil areas remaining at DT-29 are located beneath the buildings at the property. Of the two buildings and the covered bay, only one was constructed prior to MED/AEC activities. GWSs conducted as part of the FSSE in 2004 showed most areas of DT-29 to be at background levels except for the isolated area in the southeastern corner of the property which was subsequently remediated. Because the property was not used for MED/AEC operations and the available inaccessible soil data showed no concentrations above radiological screening criteria, the inaccessible soil and structures at DT-29 were classified as non-impacted in the RI WP. However, a later comparison of inaccessible soil data with the USEPA's risk-based radiological PRGs during the RI/BRA indicated exceedances of the PRGs, and the property was further evaluated for human health risks. These RI/BRA risk results are presented in Section 5.2.

### 3.8.7 DT-34 – Hjersted

DT-34 is located northeast of the Mallinckrodt facility in the northeast corner of the SLDS. The property is bordered by Bremen Avenue to the north, an active rail line to the east, and DT-8 to the west and south.

DT-34 is occupied by numerous buildings and tanks that encompass approximately 0.32 acres (1,300 $m^2$) of the total property area of 3.7 acres (15,158 $m^2$). The remainder of the property is primarily covered by gravel, with some small areas of asphalt or concrete. RR tracks from the adjacent DT-8 extend into the property to the eastern edge. Based on a review of aerial photographs, the southern part of the property near the RR tracks was developed before 1941, and steady development of the remainder of the property has occurred since 1975. The property was not used for MED/AEC activities.

No RA was required on this property to meet the 1998 ROD for accessible soils and groundwater. This was documented by the USACE (2012) in the *Pre-Design Investigation Summary Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Property DT-34,* Revision 0.

The inaccessible soil at DT-34 is underlying the structures and RR tracks at the property. Soil samples were collected from accessible soil locations and inaccessible locations in close proximity to the RR tracks and beneath one of the large buildings in the northern portion of the property. Average and maximum soil concentrations were below RI screening level criteria. Based on these factors, inaccessible soil and structures at DT-34 were classified as non-impacted. However, a later comparison of inaccessible soil data with the USEPA's risk-based radiological PRGs during the RI/BRA indicated exceedances of the PRGs, and the property was further evaluated for human health risks. These RI/BRA risk results are presented in Section 5.2.

### 3.8.8 South of Angelrodt Property Group (DT-5, DT-13, DT-14, DT-16, DT-17, and DT-18)

The South of Angelrodt Property Group includes properties owned by Ameren UE (DT-5), Cash Scrap Metals Company (DT-13), Cotto-Waxo Company (DT-14), Star Bedding Company (DT-16), Christiana Court LLC (DT-17), and City of St. Louis Land Reutilization Authority (formerly owned by Curley Collins Recycling) (DT-18). The properties lie south of Angelrodt Street, north of Dock Street, east of North Broadway, and west of a major RR corridor.

These properties contain several buildings. Roads and RRs are not present on these properties.

Land use for these properties is commercial/industrial.

Under the 1998 ROD, no soil removal was required at any of the properties, except for approximately 72 $yd^3$ (55 $m^3$) of soil, which was removed from DT-17 in accordance with 1998 ROD requirements. The highest residual risk calculated for these properties was below the USEPA's acceptable risk value; therefore, the accessible soil at DT-5, DT-13, DT-14, DT-16, DT-17 and DT-18 met the 1998 ROD RGs. The PDI-FSSE activities and findings for DT-5, DT-13, DT-14, DT-16, and DT-18 are documented by the USACE (2010) in the *Pre-Design Investigation Summary Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Properties DT-5, DT-13, DT-14, DT-16, and DT-18 and the Second Street Corridor,* Revision 0. The soil removal action conducted at DT-17 and the subsequent FSSE are documented by the USACE (2011) in the *Post-Remedial Action Report for the Accessible Soils within the St. Louis Downtown Site Vicinity Property Christiana Court, LLC (DT-17),* Revision 0.

Inaccessible areas at the South of Angelrodt Property Group are areas beneath buildings present at the sites (Figure 4). Some of the buildings pre-date MED/AEC activities but not all. No MED/AEC activities are known to have occurred at these VPs. Based on the history of the buildings and the accessible soil data in adjacent areas indicating levels below PRGs, the inaccessible soil beneath the buildings was categorized as non-impacted. Although determined to be non-impacted, existing inaccessible soil sampling results were available for DT-13, DT-14, DT-16, and DT-17, which were used for comparisons with risk-based preliminary remediation goals (PRGs) in the RI/BRA Report and subsequently analyzed in the BRA. The soil risk results are presented in Section 5.2. Two buildings at the South of Angelrodt Properties (the L-shaped building and the brick warehouse at DT-14) were categorized as potentially impacted due to their close proximity to MED/AEC operations. These buildings were investigated during the ISOU RI via a scoping survey of the exterior and roofs. The results of the surveys were used to support the BRA, the results of which are presented in Section 5.2.

### 3.8.9 West of Broadway Property Group (DT-20, DT-21, DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-30, DT-35, and DT-36, and Mallinckrodt Plants 3, 8, 9, and 11 and Parking Lots)

The 12 West of Broadway VPs lie south of McKinley Bridge, north of Dock Street, and are between Ninth Street to the west and Broadway to the east. Mallinckrodt Plants 3, 8, 9, and 11 and Parking Lots are bounded on the north by the City of Venice VP (DT-11) and PSC Metals VP (DT-8); on the east by the TRRA VP (DT-9), PSC Metals VP (DT-8), and Mallinckrodt Plants 1 and 2; on the south by Mallinckrodt Plant 10; and on the west by Broadway, as shown on Figure 1.

The surrounding area is largely a mixture of public, industrial, and commercial facilities with limited residential usage.

Of all the properties within the West of Broadway Property Group, only the northeast corner of Plant 9 required remediation. The northeast corner of Plant 9 covers approximately 538 $ft^2$ (50 $m^2$) and is located adjacent to the City of Venice, Illinois, VP (DT-11) on the north and the NFS RR VP (DT-3) on the east. An accessible soil area of approximately 118 $ft^2$ (11 $m^2$) within the northeast corner of Plant 9 was remediated in 2006, pursuant to the 1998 ROD. During the remediation of accessible soil at the northeast corner of Plant 9, approximately 6 bank cubic yards (4.6 $m^3$) were excavated, loaded into rail cars and shipped to a properly licensed, out-of-state disposal facility. The remedial action and compliance with 1998 ROD requirements is documented in the USACE (2010) *Post-Remedial Action Report and Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Northeast Corner of Plant 9 and Security Gate Number 49 Area,* Revision 0. No RA was required on the remaining West of Broadway Property Group to meet the 1998 ROD for accessible soil and groundwater The findings for the remaining properties in this group are documented in the USACE (2006) *Final Status Survey Evaluation for the Accessible Soils within the St. Louis Downtown Site Vicinity Properties West of Broadway, Mallinckrodt Plants 3, 8, 9, 11, and Parking Lots,* Revision 0.

The inaccessible areas at the West of Broadway Property Group include areas beneath buildings and other permanent structures (Figure 4). The parking lots at each of the properties, including the Mallinckrodt parking lots, were evaluated as part of the PDI/FSSE for accessible soil. Based on the evaluation presented in the RI/BRA, inaccessible soil beneath the buildings and other structures at the West of Broadway Property Group was categorized as non-impacted. Although determined to be non-impacted, existing inaccessible soil data from the following properties

were compared to the USEPA's risk-based radiological PRGs in the RI/BRA Report, and were later used as the basis for conducting the BRA for inaccessible soil: Plants 3, 8, 9, and 11, and DT-20, DT-23, DT-27, DT-35 and DT-36. The risk results of the RI/BRA are discussed in Section 5.2.

The buildings on DT-20, DT-21, DT-22, DT-24, DT-25, and DT-26 were constructed prior to MED/AEC activities and are adjacent to MED/AEC processing areas. During the ISOU RI, the exteriors and roofs of these buildings were investigated via building scoping surveys and the results of the surveys have been used to support the RI/BRA. The structures at the remaining properties (DT-23, DT-27, DT-28, DT-29, DT-30, DT-35, and DT-36) were classified as non-impacted because they are not adjacent to the MED/AEC processing areas, the structures were built after MED/AEC operations ceased, and the accessible soil on the property did not require remediation. Therefore, none of the building/structural surfaces at these properties were evaluated for human health risks in the RI/BRA.

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# 4.0 SCOPE AND ROLE

This section is intended to discuss how this recommended remedy fits into the overall SLDS strategy. The actions proposed by this document, when coupled with the other actions at the SLDS, will result in complete coverage of the SLDS with respect to addressing MED/AEC contamination.

The SLDS is divided into two operable units: (1) the Accessible Soil and Groundwater Operable Unit and (2) the ISOU. The 1998 ROD addresses the Accessible Soils and Groundwater Operable Unit. It did not address contamination in inaccessible areas. Inaccessible media (i.e., inaccessible soil, soil on building/structure surfaces, sediment inside of sewer lines and soil adjacent to sewers) were excluded from the scope of the 1998 ROD because they did not present a significant threat in their current configuration and because activities critical to the continued operation of the Mallinckrodt facility prevented excavation beneath encumbrances. In general, the encumbrances consisted of permanent buildings, structures, sewers, roads and RRs. These excluded media comprise the ISOU.

To expedite and simplify the CERCLA planning process, the ISOU media will be addressed under two sets of CERCLA documents. This PP is the first of the two sets of documents. It addresses the following properties/areas: DT-4 South, DT-5, DT-8, DT-9 Levee, DT-13, DT-14, DT-15, DT-16, DT-17, DT-18, DT-20, DT-21, DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-29, DT-30, DT-34, DT-35, DT-36, Mallinckrodt Security Gate 49, Plant 3, Plant 8, Plant 9, and Plant 11. The remaining properties associated with the ISOU (i.e. those not addressed by this PP) will be addressed in a second set of documents. Identification of specific operable units with respect to individual SLDS properties is presented in Table 4-1.

## Table 4-1. St. Louis Downtown Site Mallinckrodt Plant and Vicinity Property Operable Unit Matrix

| Property | Current Property Name | Accessible Soil Operable Unit | Inaccessible Soil Operable Unit | | Comments |
|---|---|---|---|---|---|
| | | | Group 1 Property Included in this PP for No Further Action for ISOU Media | Property Not Included in this PP (Retained for Separate Evaluation for Further Action for ISOU Media) | |
| ***Mallinckrodt Plant Properties*** | | | | | |
| Plant 1 | Mallinckrodt LLC | ✓ | | ✓ | |
| Plant 2 | Mallinckrodt LLC | ✓ | | ✓ | |
| Plant 6 | Mallinckrodt LLC | ✓ | | ✓ | |
| Plant 7N | Mallinckrodt LLC | ✓ | | ✓ | |
| Mallinckrodt Security Gate 49 | Mallinckrodt LLC | ✓ | ✓ | | |
| ***Industrial/Commercial Vicinity Properties*** | | | | | |
| DT-2 | City Property | ✓ | | ✓ | |
| DT-4 North | Gunther Salt North | ✓ | | ✓ | |
| DT-4 South | Gunther Salt South | ✓ | ✓ | | [a] |
| DT-6 | Heintz Steel and Manufacturing | ✓ | | ✓ | |
| DT-8 | PSC Metals Inc. | ✓ | ✓ | | |
| DT-10 | Thomas and Proetz Lumber Company | ✓ | | ✓ | |
| DT-15 | St. Louis Metropolitan Sewer District Lift Station | ✓ | ✓ | | |
| DT-29 | Midtown Garage | ✓ | ✓ | | |
| DT-34 | Hjersted | ✓ | ✓ | | |
| ***South of Angelrodt Property Group*** | | | | | |
| DT-5 | Ameren UE | ✓ | ✓ | | [a,b] |
| DT-13 | Cash Scrap Metals | ✓ | ✓ | | [b] |
| DT-14 | Cotto-Waxo | ✓ | ✓ | | [b] |
| DT-16 | Star Bedding Company | ✓ | ✓ | | [b] |
| DT-17 | Christiana Court LLC | ✓ | ✓ | | [b] |
| DT-18 | City of St. Louis | ✓ | ✓ | | [a,b] |
| ***West of Broadway Property Group*** | | | | | |
| Plant 3 | Mallinckrodt LLC | ✓ | ✓ | | [b] |
| Plant 8 | Mallinckrodt LLC | ✓ | ✓ | | [b] |
| Plant 9 | Mallinckrodt LLC | ✓ | ✓ | | [b] |
| Plant 11 | Mallinckrodt LLC | ✓ | ✓ | | [b] |
| DT-20 | Richey | ✓ | ✓ | | [b] |
| DT-21 | Farve | ✓ | ✓ | | [a,b] |
| DT-22 | Tobin Electric | ✓ | ✓ | | [a,b] |
| DT-23 | Worth Industries | ✓ | ✓ | | [b] |
| DT-24 | Bremen Bank | ✓ | ✓ | | [a,b] |
| DT-25 | Eirten's Parlors | ✓ | ✓ | | [a,b] |
| DT-26 | UAAA Local 1887 | ✓ | ✓ | | [a,b] |
| DT-27 | Dillion | ✓ | ✓ | | [b] |
| DT-28 | Challenge Enterprises | ✓ | ✓ | | [a,b] |
| DT-30 | Zamzow Manufacturing | ✓ | ✓ | | [a,b] |
| DT-35 | Factory Tire Outlet | ✓ | ✓ | | [b] |
| DT-36 | OJM Inc. | ✓ | ✓ | | [b] |

## Table 4-1. St. Louis Downtown Site Mallinckrodt Plant and Vicinity Property Operable Unit Matrix

| Property | Current Property Name | Accessible Soil Operable Unit | Inaccessible Soil Operable Unit | | Comments |
|---|---|---|---|---|---|
| | | | Group 1 Property Included in this PP for No Further Action for ISOU Media | Property Not Included in this PP (Retained for Separate Evaluation for Further Action for ISOU Media) | |
| ***Railroad Vicinity Properties*** | | | | | |
| DT-3 | Norfolk Southern Railroad | ✓ | | ✓ | |
| DT-9 Main Line | Terminal Railroad | ✓ | | ✓ | |
| DT-9 Rail Yard | Terminal Railroad | ✓ | | ✓ | |
| DT-9 Levee | Terminal Railroad | ✓ | ✓ | | |
| Terminal Railroad Soil Spoils Area | Terminal Railroad | ✓ | | ✓ | |
| DT-12 | BNSF Railroad | ✓ | | ✓ | |
| ***Roadway Vicinity Properties*** | | | | | |
| DT-11 | McKinley Bridge (Jointly Owned by MoDOT and IDOT) | ✓ | | ✓ | |
| DT-19 | City of St. Louis-Owned Roads | ✓ | | ✓ | |
| DT-33 | MoDOT-Owned Roads | ✓ | | ✓ | |

[a] Property has been determined to be non-impacted during previous investigations. Although no risk assessment was conducted for the property in the ISOU RI/BRA, the property is retained for inclusion in the PP for No Further Action.

[b] Property group was evaluated collectively in the RI Nature and Extent evaluation and in the BRA. Therefore, although individual properties belonging to the group are indicated as being included in this PP, it is the property group itself that is retained for the PP.

Notes:
Check mark indicates that the property is included in the operable unit category indicated by the column header and subheader.

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# 5.0 SUMMARY OF SITE RISKS

## 5.1 CONCEPTUAL SITE MODEL

In the RI/BRA, a conceptual site model (CSM) was developed that identified complete and potentially significant pathways by which human exposure could occur for contaminants of potential concern (COPCs) in ISOU media under industrial land use. These pathways were retained for further quantitative evaluations in the BRA. Generally, a complete exposure pathway is comprised of the following elements:

- a contaminant source,
- a release/transport mechanism,
- an exposure medium (or point) at which humans could contact the contaminated medium, and
- an exposure route.

The CSM identified main categories of potential sources of contamination and exposure through the initial screening of ISOU media analytical results against the USEPA risk-based PRGs for soil and site-specific PRGs developed for building surfaces. The results of the screening identified all ISOU media as defined in Section 2.2.1.2 at individual properties to be potential sources that warranted evaluations in the BRA.

Release and environmental transport of contaminants away from a source can occur such that downgradient or downwind human and/or environmental receptors could also be adversely affected or contaminated. For all ISOU source media, the potentially significant transport pathways include air transport, subsurface water transport, and surface runoff transport. Contaminant transport usually results in increasing dilution, dispersion, and attenuation of contaminant concentrations with increasing distances away from the source. In other words, the effects of environmental transport cause contaminant concentrations to decrease with increasing distances away from the source. Therefore, the BRA conservatively focused on estimating risks at the source, which are typically higher than those estimated at downgradient or downwind locations. Additionally, risk estimates calculated at the source have less uncertainty than those estimated using environmental fate and transport modeling to determine risks at downgradient or downwind locations. This is because of the additional layers of uncertainty introduced by assumptions applied in modeling that are absent when estimating risks at the source.

Contamination in the ISOU source media may or may not be available for human and ecological exposures, depending on whether or not a physical barrier to exposure exists. At the SLDS, these physical barriers are present at inaccessible soil areas in the forms of various types of ground cover. Examples of ground cover at the SLDS include asphalt and concrete pavement, gravel, and buildings/structural surfaces (including the RR). These barriers minimize or prevent horizontal migration of contaminants by inhibiting the water and air transport mechanisms that typically facilitate most types of migration in the environment. This in turn, minimizes or prevents contamination of other areas located downgradient or downwind of the ISOU source media, as well as exposures in those areas. However, once the barrier is removed, eroded, or damaged, contaminants in the exposure medium could become available for migration and exposure.

Exposures to humans and ecological receptors typically occur through similar routes. Under the industrial land use that is predominant at the SLDS, these exposure routes may include incidental

ingestion of soil, dermal (skin) contact with soil, soil inhalation via windblown dusts, and external radiation.

## 5.2 BASELINE RISK ASSESSMENT

A BRA was performed to estimate potential risks to human and ecological receptors that could result from exposures to MED/AEC-related radiological and metal COPCs identified in ISOU media as defined in Section 2.2.1.2. Therefore, the BRA consisted primarily of two components: a human health risk assessment (HHRA) and a screening-level ecological risk assessment (SLERA). The evaluations and results of the HHRA and SLERA portions of the BRA are summarized in Sections 5.2.1 and 5.2.2.

Prior to conducting the BRA, some properties associated with the ISOU were determined to be non-impacted by past MED/AEC operations at the SLDS. This determination is documented in the USACE's RI/BRA. Because the properties were determined to be non-impacted, there are no unacceptable health risks associated with them; therefore, they were not retained for further investigation and evaluation in the RI/BRA, but are included in this PP for No Further Action. These non-impacted properties include the following:

- DT-4 South,
- South of Angelrodt Properties DT-5 and DT-18, and
- West of Broadway Properties DT-21, DT-22, DT-24, DT-25, DT-26, DT-28, and DT-30.

### 5.2.1 Human Health Risk Assessment

Human health risks estimated in the HHRA represent current and expected future land use of properties associated with the SLDS ISOU. The types of individuals identified for evaluations in the HHRA, along with the manner in which they are assumed to become exposed, are referred to as receptor exposure scenarios. The predominant current and future land use of the SLDS is industrial. For each of the receptor scenarios, reasonable maximum exposure assumptions were incorporated into risk calculations regarding the magnitude, frequency, and duration of exposures, among others. These conservative assumptions ensure that the calculations do not underestimate actual risks posed by MED/AEC-related COPCs in ISOU media. Although the focus of the RI/BRA was determining risks associated with exposures to COPCs in the ISOU media at each property, in reality, individuals are assumed to move randomly throughout all portions of the property. Therefore, the final assessment of risks reflects a high-end estimate of the potential for an individual to become exposed to COPCs anywhere across a given property. This type of property-wide risk assessment forms the basis for determining a no-action remedy for each impacted property in this PP.

In the HHRA, all of the Group 1 Properties in this PP were evaluated for cancer risks associated with exposures to radiological COPCs. However, in order to comply with the authority of the 1998 ROD, and for consistency with all subsequent work conducted under the 1998 ROD, as well as with the RI WP, metals were not evaluated at any of the Group 1 Properties because none of the Group 1 Properties are within the historical MED/AEC uranium ore processing boundary. Additionally, there are no concerns for metals migrating from inaccessible soil areas within the former uranium ore processing boundary to areas outside of the boundary. This is because inaccessible soils are generally beneath ground cover (asphalt and concrete pavement, gravel, and buildings/structural surfaces [including the RR]), which inhibits water infiltration and wind erosion mechanisms that facilitate migration to locations that are downgradient or downwind of

the former uranium ore processing boundary. This in turn, prevents contamination of areas outside of the former uranium ore processing boundary, as well as subsequent exposures in those areas (see also Section 5.1).

A cancer risk is defined by the USEPA to be the "incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen." A cancer risk is expressed as the potential number of additional cancer cases estimated to occur above baseline within a given population (with baseline being the number of cases that is considered statistically normal for the population), over the course of a lifetime. The USEPA has established an acceptable (i.e., not to exceed) cancer risk range of $1x10^{-6}$ to $1x10^{-4}$. The minimum cancer risk or lower boundary of $1x10^{-6}$ is equal to the probability of the occurrence of one additional cancer case above the statistical baseline for a population of 1,000,000 people. The maximum acceptable cancer risk or upper boundary of $1x10^{-4}$ is equal to the probability of the occurrence of one additional cancer case above the statistical baseline for a population of 10,000 people. As another example, a cancer risk of $1x10^{-5}$, which is in the middle of the USEPA's acceptable risk range, is equal to the probability of the occurrence of one additional cancer case above the statistical baseline for a population of 100,000 people. The upper boundary of the risk range is not a discrete line at $1x10^{-4}$, although USEPA generally uses $1x10^{-4}$ in making risk management decisions. A specific risk estimate around $1x10^{-4}$ may be considered acceptable if justified based on site specific reasons. Cancer risks that are below or within the acceptable risk range indicate that there is little or no likelihood for the occurrence of adverse health effects. In this PP, the cancer risks estimated for each evaluated property associated with the ISOU were compared to the acceptable risk range. In contrast, data from the American Cancer Society (http://www.cancer.org/cancer/cancerbasics/lifetime-probability-of-developing-or-dying-from-cancer) indicates that Americans have a 1 in 2 risk of developing cancer in their lifetime. This probability is orders of magnitude greater than the USEPA's acceptable cancer risk range and demonstrates the health-protective nature of the risk assessment process.

Since different agencies have used different terminology for the principle of unrestricted use unlimited exposure (UUUE), the rationale for UUUE was not developed in this Proposed Plan. Instead the risk range data was presented so that each agency could label the risk accordingly.

Although the HHRA evaluated radiological cancer risks from exposures to MED/AEC-related contaminants, radiological risk can also come from naturally occurring radionuclides in the environment around SLDS. Additionally, radionuclides can be present in the SLDS environment from manmade (anthropogenic) processes not related to past MED/AEC operations. Radiological cancer risks that exist as a result of naturally occurring and anthropogenic conditions are referred to as background radiological risk (or background risk). Although the scope of the RI/BRA is limited to determining property risks from MED/AEC-related contamination, site-specific background contributions to risk were also evaluated as part of the total risk estimated for each individual property. Inclusion of site-specific background risk contributions in the risk assessment is consistent with the CERCLA process and is a recommended methodology for the purposes of risk characterization in the USEPA's 1989 *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual* (Part A). This allows for a more complete characterization of overall risk at a site. However, as actions move beyond the risk assessment phase of the CERCLA process, risk contributions from background become more scrutinized when making determinations of the need for action versus No Further Action. This process of evaluating site-specific background has been implemented at the SLDS during all work completed under the authority of the 1998 ROD and has been instrumental in meeting the requirements of the ROD.

#### *5.2.1.1 Land Use and Receptor Scenarios*

The general categories of land use scenarios evaluated in the HHRA include industrial, recreational, and hypothetical residential gardener land uses. Each of these land use categories was evaluated in the HHRA by estimating risks to population groups that are considered to be receptors to exposures. The following paragraphs desribe the land use and receptor scenarios evaluated in the HHRA.

##### 5.2.1.1.1 Industrial Land Use Scenarios

As stated previously, the predominant current and future land use of all former Mallinckrodt plant properties, industrial/commercial VPs, RR properties, and roadways within the SLDS study area is industrial. The following bulleted items identify and describe each receptor evaluated in the HHRA using industrial land use exposure scenarios:

- ***Industrial Worker*** **–** The industrial worker scenario includes individuals working mainly indoors with some outdoor activities at the plants, industrial/commercial VPs, RRs, and roadways. Some of the outdoor activities could infrequently include light excavation and construction work. This group includes site workers performing daily job activities specific to the property at which they are employed (e.g., working at various plant processes and industrial/commercial work activities at the SLDS and VPs, office workers, and building maintenance employees). Because the land use at the SLDS has been established as being industrial, the industrial worker is assumed to be the receptor that has the greatest opportunity for exposure at the SLDS properties, over the other evaluated receptors; therefore, this receptor is evaluated at all properties. The current industrial worker evaluation assumes that the existing ground cover (for example, in the form of asphalt or concrete pavement, gravel cover, and buildings/structures) is present to act as a physical barrier to most routes of soil exposure evaluated in the BRA (soil ingestion, direct contact, and inhalation of soil as dust). With ground cover in place, the only potential route for exposure from underlying soil is external radiation. In the future, ground cover is assumed to be absent or degraded sufficiently so that a future industrial worker could be exposed via external radiation, soil ingestion, direct contact with soil, and dust inhalation. Industrial workers performing indoor work may also be exposed to contaminated soil on interior building surfaces.
- ***Construction Worker*** **–** The construction worker is assumed to be a contractor (i.e., not a SLDS/VP employee) who performs one-time, deep excavation and construction activities. This receptor group is assumed to be exposed at all SLDS plants, industrial/commercial VPs, RRs, and roadways. Because this scenario assumes work in excavations, soil exposures can occur via external radiation, soil ingestion, direct contact with soil, and dust inhalation.
- ***Utility Worker*** **–** In a manner consistent with the 1998 ROD, a utility worker is assumed to perform one-time work on utilities (i.e., repairing, maintaining, and replacing subsurface utilities), within a deep excavation, for a short time duration with an equal probability of performing this work at any location across each individual property, as well as across all of the SLDS. Similar to the construction worker, this scenario assumes work in excavations so that soil exposures can occur via external radiation, soil ingestion, direct contact with soil, and dust inhalation. However, exposures to this receptor occur for a much shorter duration than to the construction worker.

- ***Building Maintenance Worker*** **–** Building maintenance employees are SLDS/VP employees who may become exposed to contaminated soil on exterior building surfaces during exterior building or structural maintenance work. Exposures to contaminated soil on surfaces are assumed to be specific to the building to which the exposures occur.
- ***Sewer Maintenance Worker*** **–** Sewer maintenance workers are assumed to perform infrequent work inside of sewers and manholes; therefore, ingestion, direct contact, and inhalation exposures to sewer sediment were evaluated in the HHRA for this receptor. Although this receptor was evaluated in the HHRA, no sewer lines ever existed at the Group 1 Properties that facilitated the flow of MED/AEC-related contaminants.
- ***Sewer Utility Worker*** **–** This receptor is assumed to perform work specifically on the outside of lines, usually within a deep excavation and for a short duration. During this time, exposures are likely to occur to the soil adjacent to the outside of the sewer lines. In an effort to evaluate possible contamination specifically from the sewers, this receptor was evaluated separately from the utility worker receptor described in a previous bullet. Similar to the previous utility worker, this scenario assumes work in excavations so that soil exposures can occur via external radiation, soil ingestion, direct contact with soil, and dust inhalation. Although this receptor was evaluated in the HHRA, no sewer lines ever existed at the Group 1 Properties that facilitated the flow of MED/AEC-related contaminants.

#### 5.2.1.1.2 Recreational Land Use Scenario

In addition to industrial land use, recreational use occurs at two of the Group 1 Properties containing portions of the Mississippi levee system, upon which the St. Louis Riverfront Trail has been developed. Therefore, recreational users were evaluated in the BRA as individuals assumed to use the St. Louis Riverfront Trail along DT-9 Levee and DT-15 for walking, jogging, and biking. Exposures are assumed to occur via external radiation from contaminated soil around and beneath the levee. Individuals are prohibited from engaging in recreational activities at the remaining selected properties due to owner restrictions.

#### 5.2.1.1.3 Hypothetical Residential Gardener Land Use Scenarios

The HHRA demonstrates that there are no unacceptable risks to any receptors evaluated under the predominant current and future land use of the SLDS (i.e. industrial land use), as well as for recreational land use for the Group 1 Properties. In response to stakeholder interest, a hypothetical resident gardener scenario was also evaluated in the HHRA.

Because current land use is predominantly industrial, and land use is expected to remain as such for the foreseeable future, scenarios assuming industrial land are appropriate as the basis for determining future actions at the ISOU. However, it is noteworthy that the hypothetical resident gardener, which is a more health-conservative scenario, further supports the preferred remedy of No Further Action for the Group 1 Properties in this PP. Since the resident gardener is a hypothetical scenario, it was evaluated in the HHRA for only informational purposes.

The hypothetical resident gardener is an individual assumed to be living at a property, who is only exposed to soil at that property via incidental ingestion, direct contact, inhalation of dusts, external radiation, and the consumption of homegrown fruits and vegetables. In the HHRA, resident gardener exposures were assumed to occur at plant properties and industrial/commercial VPs. Resident gardener exposures to soil are not expected to occur at the RR properties, roadways, levee, or adjacent to sewer lines. This is because a resident gardener is not likely to construct a house and live on a RR, roadway or levee property under the industrial land use conditions that is

currently prevalent at the SLDS, which is expected to remain as such into the foreseeable future. For the levee properties (DT-9 Levee and DT-15), this means that resident gardener exposure pathways are incomplete because it is highly unlikely that a house will ever be constructed upon or adjacent to the levee. Exposures to soil adjacent to sewer lines are also unlikely for the resident gardener because the depth of the sewer lines makes the adjacent soil unavailable for residential exposures. Additionally, no exposures are assumed to occur to sediment inside of sewer lines. Since all existing buildings are assumed to have been razed prior to land redevelopment, no resident gardener exposures were assumed to occur as a result of soil on building surfaces.

#### *5.2.1.2 Summary of Human Health Risks*

Radiological cancer risks were estimated in the HHRA for exposures to ISOU media assumed to occur for each of the above-described receptor scenarios, at each of the Group 1 Properties. The risks are summarized in Tables 5-1, 5-2, and 5-3, by ISOU media of concern (i.e., for soil, soil on buildings/structures, and sediment inside of sewer lines, respectively). The first column on the left side of each of the medium-specific tables presents the Group 1 Properties for which the risks are summarized, for each of the receptor scenarios indicated in the "Receptor" row of the table header. In addition to the Group 1 Properties, risks are also presented in each table for SLDS background receptor scenarios, where applicable (see gray-shaded rows). SLDS background risks were estimated for soil (Table 5-1) and sediment inside of sewer lines (Table 5-3). No background data were collected for soil on buildings/structures; therefore, background risks were not estimated for this medium (Table 5-2).

Also included in all tables, under each of the receptor headings, are three columns containing the following subheadings: "Property-Specific Risk," "Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)," and "Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)." Each of these columns and the applicable entries are described below.

The "Property Specific Risk" column presents numerical cancer risk results, where applicable, for each designated property/receptor scenario. The risk estimates in this column are total risk estimates attributable to MED/AEC-related cancer risk and SLDS background risk combined. In some cases, a risk calculation was not applicable, so no risk value is presented. In these cases, descriptors were added that explain the reason for no risk calculation having been conducted for the property/medium/receptor scenario. Generally, when no risk calculation is conducted, it is because of the absence of a complete exposure pathway, which is in turn due to the absence of contamination, a source medium, or exposure, all of which must be present in order to have a complete exposure pathway. The absence of a complete exposure pathway leads to the conclusion of no unacceptable risks being posed by the designated property for the subject medium/receptor scenario. The descriptors applied across Tables 5-1 through 5-3 include the following:

- *"No Exposures"* – The calculation of risk is not necessary for the recreational user at the subject property because the receptor is not likely to be on the property, thereby eliminating the possibility of exposures (i.e., there are no exposure pathways). Since there are no exposures, there are no unacceptable risks from MED/AEC-related COCs at the property.
- *"Non-Impacted"* – No risk calculations were necessary in the RI/BRA because the subject property was previously determined in the RI WP as being non-impacted from past MED/AEC processes; therefore, there are no unacceptable risks from MED/AEC-related COCs at the property.

- *"No MED/AEC Sewer Lines"* – No sewer lines exist or ever existed on the subject property that facilitated the flow of MED/AEC-related COCs. Therefore, there are no unacceptable risks from MED/AEC-related COCs in sewer sediment or soil adjacent to sewer lines at the property.
- *"No Buildings"* – No buildings or structural surfaces associated with buildings exist at the property; therefore, there are no unacceptable risks from MED/AEC-related COCs from soil on building/structural surfaces at the property.

The column entitled "Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)" compares the property-specific risk estimated for each property/medium/receptor scenario (including both the MED/AEC-related cancer risk and SLDS background risk combined) to each of the SLDS property/medium/receptor background risk. If the property-specific risk is below the corresponding background risk, a "Yes" is indicated. If the property-specific risk is above the corresponding background risk, a "No" is presented.

The column entitled "Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)" assumes that theoretically, the risk due to the MED/AEC-related contamination is the difference between the property-specific risk (including both the MED/AEC-related cancer risk and SLDS background risk combined) and the background risk. If the difference does not exceed the USEPA's acceptable risk range of $1x10^{-6}$ to $1x10^{-4}$, then a "No" is presented. However, if the difference between the property-specific risk and the background risk exceeds the USEPA's acceptable risk range, then a "Yes" is indicated. The absence of a complete exposure pathway, as indicated by one of the above descriptors, indicates that the risk due to MED/AEC-related contamination does not exceed the USEPA's acceptable risk range; therefore, a "No" is presented.

#### 5.2.1.2.1 Risks Associated with Soil

Table 5-1 shows that three types of soil exposure scenarios were evaluated in the HHRA for each of the Group 1 Properties: property-wide soil, inaccessible soil, and inaccessible soil adjacent to sewer lines. Each of these is briefly described below.

- Risks due to property-wide exposures to soil were estimated for selected receptors (industrial workers, recreational users, and hypothetical residential gardeners) assumed to be the most frequently exposed individuals, under each of the evaluated land use types, and include combined risks estimated for both inaccessible soil and accessible soil areas at each property.
- Risks due to exposures to contaminants in only the inaccessible soil areas of each property were estimated for the construction worker and utility worker.
- Risks due to exposures to soil adjacent to sewer lines were estimated for sewer utility workers.

Property-wide soil risks were estimated for the industrial worker and resident gardener at all properties, except for DT-4 South. No risks were estimated for the industrial worker and resident gardener at DT-4 South because inaccessible soil on that property (beneath the building) is considered to be non-impacted; therefore, no MED/AEC-related contamination is present and the associated radiological cancer risk does not exceed the USEPA's acceptable risk range. The property-specific risks for the industrial worker and resident gardener at all of the remaining properties exceed the USEPA's acceptable risk range. However, because the SLDS background risks for the industrial worker ($1.8x10^{-4}$) and resident gardener ($7.8x10^{-4}$) are greater than all of the property-specific risks for those receptors, the corresponding risks due to MED/AEC-related contamination for all properties are less than the USEPA's acceptable risk range.

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## Table 5-1. Risk Summary for Soil at Group 1 St. Louis Downtown Site Properties

| ISOU Medium: | Property-Wide Soil (Combined Inaccessible and Accessible Soil) | | | | | | | | | Inaccessible Soil | | | | | | Inaccessible Soil Adjacent to Sewer Lines | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Receptor:** | **Industrial Worker** [a] | | | **Recreational User** | | | **Hypothetical Resident Gardener** | | | **Construction Worker** | | | **Utility Worker** | | | **Sewer Utility Worker** | | |
| **Risk Results/ Comments:** | **Property-Specific Risk** [b] | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)** [c] | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)** [d] | **Property-Specific Risk** [b] | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)** [c] | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)** [d] | **Property-Specific Risk** [b] | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)** [c] | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)** [d] | **Property-Specific Risk** [b] | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)** [c] | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)** [d] | **Property-Specific Risk** [b] | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)** [c] | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)** [d] | **Property-Specific Risk** [b] | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No)** [c] | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No)** [d] |
| ***SLDS Background*** | | | | | | | | | | | | | | | | | | |
| **SLDS Background** | **$1.8x10^{-4}$** | **NA** | **NA** | **$1.5x10^{-6}$** | **NA** | **NA** | **$7.9x10^{-4}$** | **NA** | **NA** | **$3.4x10^{-4}$** | **NA** | **NA** | **$3.7x10^{-7}$** | **NA** | **NA** | **$2.6x10^{-7}$** | **NA** | **NA** |
| ***Group 1 Properties*** | | | | | | | | | | | | | | | | | | |
| Mallinckrodt Security Gate 49 | $1.5x10^{-4}$ | Yes | No | No Exposures | Yes | No | $6.1x10^{-4}$ | Yes | No | $1.5x10^{-6}$ | Yes | No | $1.7x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| DT-4 South | ISOU Non-Impacted | Yes | No | ISOU Non-Impacted/No Exposures | Yes | No | ISOU Non-Impacted | Yes | No | ISOU Non-Impacted | Yes | No | ISOU Non-Impacted | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| DT-8 | $1.7x10^{-4}$ | Yes | No | No Exposures | Yes | No | $7.8x10^{-4}$ | Yes | No | $2.8x10^{-6}$ | Yes | No | $3.1x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| DT-9 Levee | $1.1x10^{-4}$ | Yes | No | $1.9x10^{-6}$ | No | No | $6.7x10^{-4}$ | Yes | No | $2.1x10^{-6}$ | Yes | No | $2.4x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| DT-15 | $4.4x10^{-5}$ | Yes | No | $7.2x10^{-7}$ | Yes | No | $5.8x10^{-4}$ | Yes | No | $2.7x10^{-6}$ | Yes | No | $3.0x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| DT-29 | $1.2x10^{-4}$ | Yes | No | No Exposures | Yes | No | $7.0x10^{-4}$ | Yes | No | $1.7x10^{-6}$ | Yes | No | $1.9x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| DT-34 | $1.3x10^{-4}$ | Yes | No | No Exposures | Yes | No | $6.0x10^{-4}$ | Yes | No | $3.1x10^{-6}$ | Yes | No | $3.4x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| South of Angelrodt Property Group [e] | $1.5x10^{-4}$ | Yes | No | No Exposures | Yes | No | $6.8x10^{-4}$ | Yes | No | $3.0x10^{-6}$ | Yes | No | $3.3x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |
| West of Broadway Property Group [f] | $1.4x10^{-4}$ | Yes | No | No Exposures | Yes | No | $6.4x10^{-4}$ | Yes | No | $2.5x10^{-6}$ | Yes | No | $2.8x10^{-7}$ | Yes | No | No MED/AEC Sewer Lines | Yes | No |

[a] Cancer risks presented for industrial worker exposures to soil were estimated under a future worst case scenario in which the absence of protective ground cover was assumed.

[b] The property-specific risk includes MED/AEC-related risk and background risk combined. All cancer risks presented are radiological. Metals risks were not calculated for any of the properties in the above table because no MED/AEC-related metals contamination is present. Also, the following qualifiers are presented when a property-specific cancer risk was not calculated:

- *ISOU Non-Impacted* - No risk calculations were necessary for DT-4 South in the ISOU RI because the ISOU portion of the property was previously determined to be non-impacted from past MED/AEC processes (according to USACE's 2009 RI WP); therefore, there no ISOU data were collected for performing a risk assesssment. Also, accessible areas of contamination at DT-4 South have been remediated under the 1998 ROD. Therefore, there are no unacceptable risks from MED/AEC-related COCs at the property.
- *No Exposures* - Calculation of risk is not necessary for the receptor at the property because the receptor is not likely to be exposed to COCs at the property (i.e., no complete exposure pathways); therefore, there are no unacceptable risks from MED/AEC-related COCs at the property. Therefore, because there are no complete exposure pathways, there is no unacceptable risks from MED/AEC-related contamination.
- *No MED/AEC Sewer Lines* - No sewer lines exist on the property that facilitated flow of MED/AEC-related COCs; therefore, there are no unacceptable risks from MED/AEC-related COCs in sewer sediment or soil adjacent to sewer lines at the property.

[c] A "Yes" response indicates that the calculated property-specific risk is indistinguishable from SLDS background. This is also true for properties for which risk is not calculated due to the following designations: *ISOU Non-Impacted* , *No Exposures* , and *No MED/AEC Sewer Lines.*

[d] A "No" response indicates that the calculated property-specific risk is either within or less than USEPA's acceptable risk range. This is also true for properties for which risk is not calculated due to the following designations: *ISOU Non-Impacted* , *No Exposures* , and *No MED/AEC Sewer Lines.*

[e] Although inaccessible soil areas at the South of Angelrodt Property Group were determined to be non-impacted (per USACE's 2009 RI WP), inaccessible soil data are available for the following VPs that were used in the ISOU RI/BRA: DT-13, DT-14, DT-16, and DT-17. No inaccessible soil data were available for the following South of Angelrodt properties: DT-5 and DT-18.

[f] Although inaccessible soil areas at the West of Broadway Property Group were determined to be non-impacted (per USACE's 2009 RI WP), inaccessible soil data from the following properties were available and used in the RI/BRA risk calculations: Plants 3, 8, 9, and 11, and DT-20, DT-23, DT-27, DT-35, and DT-36. No inaccessible soil data were available for the following properties for use in risk calculations: DT-21, DT-22, DT-24, DT-25, DT-26, DT-28, and DT-30.

Notes:

NA - For the column with header reading "Is Property-Specific Risk SLDS Background Risk (Yes/No)?", SLDS background is not compared to itself; therefore, the comparison is not applicable (NA). For the column with the header reading "Does Risk Due to MED/AEC-related Contamination Exceed USEPA's Acceptable Risk Range (Yes/No)?", the comparison to the acceptable risk range is not applicable because by definition, SLDS background locations were selected in areas not impacted by past MED/AEC releases.

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Property-wide soil risks for the recreational user were only estimated for DT9-Levee and DT-15, which contain portions of the Mississippi levee system, upon which the St. Louis Riverfront Trail has been developed. The property-specific risk for the recreational user at DT-9 Levee ($1.9x10^{-6}$) is slightly greater than the corresponding SLDS recreational user background risk ($1.5x10^{-6}$), whereas the property-specific risk for DT-15 ($7.2x10^{-7}$) is less than the SLDS recreational user background risk. However, at both properties, the risks due to recreational user exposures to MED/AEC-related contamination in property-wide soil are less than the USEPA's acceptable risk range. Risk were not estimated for the recreational user at the remaining properties due to no complete exposure pathways; therefore, associated radiological cancer risks for those properties do not exceed the USEPA's acceptable risk range.

Construction workers and utility workers were evaluated for risks due to exposures to inaccessible soil at all properties, except for DT-4 South. No risks were estimated for the construction worker and utility worker at DT-4 South because inaccessible soil on that property (beneath the building) is considered to be non-impacted; therefore, no MED/AEC-related contamination is present and the associated radiological cancer risk does not exceed the USEPA's acceptable risk range. The property-specific risks for these receptors at all of the remaining properties are less than the corresponding SLDS background risks; therefore, the risks due to MED/AEC-related contamination are less than the USEPA's acceptable risk range.

Sewer utility workers were considered for evaluations of risks due to exposures to inaccessible soil adjacent to sewer lines. However, because there are no sewer lines that facilitated the flow of MED/AEC-related contaminants at any of the Group 1 Properties, there is no source medium present and there are no complete exposure pathways. Therefore, the MED/AEC-related risk from soil adjacent to sewer lines does not exceed the USEPA's acceptable risk range at any Group 1 Property.

#### 5.2.1.2.2 Risks Associated with Soil on Building/Structural Surfaces

Table 5-2 shows that industrial worker and building maintenance worker risks due to soil on interior and exterior building/structural surfaces, respectively, were evaluated in the HHRA for each of the Group 1 Properties. As previously stated, no SLDS background data were collected for building/structural surfaces; therefore, no background risks were estimated for this ISOU medium. DT-9 Levee is the only property at which no buildings exist. Because there is no source medium and no exposure pathways at DT-9 Levee, the radiological cancer risks from building/structural surfaces do not exceed the USEPA's acceptable risk range at DT-9 Levee. All existing surfaces at the remaining properties, except for an exterior surface at the South of Angelrodt Property Group (i.e., the horizontal beam between the L-shaped and brick buildings at DT-14) were determined to be non-impacted. The risk estimated for the exterior surface at the South of Angelrodt Property Group is less than the USEPA's acceptable risk range. The determination that building/structural surfaces at the remaining properties are non-impacted leads to the conclusion that there is no MED/AEC-related surface contamination; therefore, MED/AEC-related risk at those properties is less than the USEPA's acceptable risk range.

#### 5.2.1.2.3 Risks Associated with Sediment Inside of Sewer Lines

Table 5-3 shows that sewer utility workers were considered for evaluations of risks associated with sediment inside of sewer lines. However, because there are no sewer lines that facilitated the flow of MED/AEC-related contaminants at any of the Group 1 Properties, there is no source medium present and there are no complete exposure pathways. Therefore, the associated MED/AEC-related risk from sediment inside of sewer lines does not exceed the USEPA's acceptable risk range at any Group 1 Property.

## Table 5-2. Risk Summary for Soil on Building/Structural Surfaces at Group 1 St. Louis Downtown Site Properties

| ISOU Medium: | Soil on Interior Building Surfaces | | | Soil on Exterior Building/ Structural Surfaces | | |
|---|---|---|---|---|---|---|
| Receptor: | Industrial Worker | | | Building Maintenance Worker | | |
| Risk Results/ Comments: | Property-Specific Risk [a] | Is Property-Specific Risk Below SLDS Background Risk? (Yes/No) [b] | Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No) [c] | Property-Specific Risk [a] | Is Property-Specific Risk Below SLDS Background Risk? (Yes/No) [b] | Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No) [c] |
| ***SLDS Background*** | | | | | | |
| **SLDS Background** | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |
| ***Group 1 Properties*** | | | | | | |
| Mallinckrodt Security Gate 49 | Non-Impacted | NA | No | Non-Impacted | NA | No |
| DT-4 South | Non-Impacted | NA | No | Non-Impacted | NA | No |
| DT-8 | Non-Impacted | NA | No | Non-Impacted | NA | No |
| DT-9 Levee | No Buildings | NA | No | No Buildings | NA | No |
| DT-15 | Non-Impacted | NA | No | Non-Impacted | NA | No |
| DT-29 | Non-Impacted | NA | No | Non-Impacted | NA | No |
| DT-34 | Non-Impacted | NA | No | Non-Impacted | NA | No |
| South of Angelrodt Property Group [d] | Non-Impacted | NA | No | $2x10^{-7}$ | NA | No |
| West of Broadway Property Group | Non-Impacted | NA | No | Non-Impacted | NA | No |

[a] The property-specific risk includes MED/AEC-related risk across all building surfaces on the property. All risks presented are radiological. Also, the following qualifiers are presented when a property-specific risk was not calculated:

- *Non-Impacted* - No risk calculations were necessary in the ISOU RI because property was previously determined to be non-impacted from past MED/AEC processes; therefore, there are no unacceptable risks from MED/AEC-related COCs at the property.
- *No Buildings* - No buildings or structural surfaces associated with buildings exist at the property; therefore, there are no unacceptable risks from MED/AEC-related COCs from soil on building surfaces at the property.

[b] No SLDS background data are available for building/structural surfaces.

[c] A "No" response indicates that the calculated property-specific risk is either within or less than USEPA's acceptable risk range. This is also true for properties for which risk is not calculated due to the following designations: *Non-Impacted* and *No Buildings.*

[d] DT-14 was the only South of Angelrodt property evaluated for risks associated with soil on interior and exterior building/structural surfaces.

Notes:

NA - No background data were available for for estimating risks due to background.

## Table 5-3. Risk Summary for Sediment Inside of Sewer Lines at Group 1 St. Louis Downtown Site Properties

| **ISOU Medium:** | **Sediment Inside of Sewer Lines** | | |
|---|---|---|---|
| **Receptor:** | **Sewer Maintenance Worker** | | |
| **Risk Results/ Comments:** | **Property-Specific Risk [a]** | **Is Property-Specific Risk Below SLDS Background Risk? (Yes/No) [b]** | **Does Risk Due to MED/AEC-Related Contamination Exceed USEPA's Acceptable Risk Range? (Yes/No) [c]** |
| ***SLDS Background*** | | | |
| **SLDS Background** | **$9.2 \times 10^{-9}$** | **NA** | **NA** |
| ***Group 1 Properties*** | | | |
| Mallinckrodt Security Gate 49 | No MED/AEC Sewer Lines | Yes | No |
| DT-4 South | No MED/AEC Sewer Lines | Yes | No |
| DT-8 | No MED/AEC Sewer Lines | Yes | No |
| DT-9 Levee | No MED/AEC Sewer Lines | Yes | No |
| DT-15 | No MED/AEC Sewer Lines | Yes | No |
| DT-29 | No MED/AEC Sewer Lines | Yes | No |
| DT-34 | No MED/AEC Sewer Lines | Yes | No |
| South of Angelrodt Property Group [d,e] | No MED/AEC Sewer Lines | Yes | No |
| West of Broadway Property Group [f] | No MED/AEC Sewer Lines | Yes | No |

[a] Applies to all MED/AEC sewer lines on the subject property.

[b] *No MED/AEC Sewer Lines* - No sewer lines exist on the property that facilitated flow of MED/AEC-related COCs; therefore, there are no unacceptable risks from MED/AEC-related COCs in sewer sediment or soil adjacent to sewer lines at the property.

[c] "No" is entered because there are no unacceptable risks due to no sewer lines existing on the property that facilitated flow of MED/AEC related COCs.

Notes:

NA - For the column with header reading "Is Property-Specific Risk SLDS Background Risk (Yes/No)?", SLDS background is not compared to itself; therefore, the comparison is not applicable (NA). For the column with the header reading "Does Risk Due to MED/AEC-related Contamination Exceed USEPA's Acceptable Risk Range (Yes/No)?", the comparison to the acceptable risk range is not applicable because by definition, SLDS background locations were selected in areas not impacted by past MED/AEC releases.

### 5.2.2 Ecological Risks

The SLERA conducted as part of the RI/BRA agrees with the result of the ecological evaluation in the *Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site* (hereafter referred to as the 1993 BRA), which determined that potential impacts to ecological receptors from accessible environmental media at the SLDS are likely to be insignificant. This is because the SLDS is a heavily urbanized area not suitable for habitation of sensitive and threatened and endangered species. In comparison to the accessible media evaluated in the 1993 BRA, the potential for impacts to ecological receptors from ISOU media evaluated in this SLERA is significantly less for the following reasons. First, based on the lack of suitable habitat, the potential for direct contact exposures to ISOU media is reduced for terrestrial or aquatic ecological receptors. Second, the presence of buildings and consolidated cover (e.g. asphalt and concrete pavement) over inaccessible soil acts as a physical barrier to direct contact exposures by terrestrial receptors. Third, the potential for subsurface migration to sensitive terrestrial or aquatic habitats (although no sensitive habitats have been found to exist, per the Ecological Checklist in Appendix R of the RI/BRA) from inaccessible soil is not significant. Thus, it is concluded that there are no complete or significant exposure pathways for ecological receptors at the ISOU.

Finally, remedial actions conducted at the SLDS under the 1998 ROD have reduced the likelihood that ISOU media will be impacted by accessible soil contamination. It is for the aforementioned reasons that contaminant screening was not conducted in the SLERA and no further action was recommended from an ecological perspective. Therefore, the potential for significant ecological impacts to occur is small for any of the SLDS properties associated with ISOU media that were evaluated in the RI/BRA.

### 5.2.3 Summary

In summary, ISOU media at the following Group 1 Properties are recommended for No Further Action as a result of either the determination of properties as non-impacted or posing no unacceptable risks to human health and the environment, per the RI/BRA.

- Mallinckrodt Security Gate 49,
- DT-4 South,
- DT-8,
- DT-9 Levee,
- DT-15,
- DT-29,
- DT-34,
- South of Angelrodt Property Group (includes DT-5, DT-13, DT-14, DT-16, DT-17 and DT-18), and
- West of Broadway Property Group (includes Plants 3, 8, 9, and 11 and DT-20, DT-21, DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-30, DT-35, and DT-36).

# 6.0 PREFERRED REMEDY

Under CERCLA, if no unacceptable risks to human health or the environment are identified, then No Further Action is the appropriate remedy. Based on the findings of the RI/BRA, No Further Action is recommended for ISOU media at the Group 1 Properties associated with the SLDS ISOU. The properties included in this preferred remedy are:

- Mallinckrodt Security Gate 49,
- DT-4 South,
- DT-8,
- DT-9 Levee,
- DT-15,
- DT-29,
- DT-34,
- South of Angelrodt Property Group (includes DT-5, DT-13, DT-14, DT-16, DT-17 and DT-18), and
- West of Broadway Property Group (includes Plants 3, 8, 9, and 11 and DT-20, DT-21, DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-30, DT-35, and DT-36).

For areas at which contamination was present in the accessible soil, previously implemented RAs have eliminated potential risk to human health and the environment. Sampling of both the accessible and inaccessible soil has demonstrated that the properties do not pose an unacceptable threat to human health or the environment.

Based on the current site conditions, the risk characterization results of the BRA, exposure pathways and the determination of no impacts from past MED/AEC operations, No Further Action is appropriate for the Group 1 Properties. This final proposed remedy is protective of human health and the environment and is considered cost effective. Because No Further Action is warranted to address concentrations of COPCs present in ISOU media at the Group 1 Properties, five-year reviews of these properties will not be necessary per CERCLA Section 121 (c) and NCP Section 300.430(f)(4)(ii).

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# 7.0 COMMUNITY PARTICIPATION

The USACE encourages public input to ensure that the remedy selected for the SLDS ISOU meets the needs of the local community. The documentation used to support the preferred remedy is available at the following locations:

USACE Public Information Center
FUSRAP Office
8945 Latty Avenue
Berkeley, Missouri 63134

St. Louis Public Library
Government Information Room
1301 Olive Street
St. Louis, Missouri 63103

The public is encouraged to review and comment on the remedy described in this PP. Additional information about the site (including the RI/BRA) can be found at the St. Louis District Website (www.mvs.usace.army.mil) or in the Administrative Record Files at the locations listed above.

Comments on the proposed RA for the SLDS ISOU will be accepted during the comment period following issuance of the PP. A public meeting will be held during the comment period to receive any oral comments from the public. Written comments regarding the preferred remedy will be received either at the meeting or during the comment period.

The USACE will respond to all comments submitted during the comment period in a Responsiveness Summary. After considering these comments, the USACE, in coordination with the USEPA, will make a final decision on the cleanup remedy for the Group 1 Properties, which will be outlined in the ROD. The Responsiveness Summary will be included in a ROD.

All written comments should be addressed to:

Ms. Sharon Cotner, Program Manager
U.S. Army Corps of Engineers
St. Louis District
8945 Latty Avenue
Berkeley, Missouri 63134

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## GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan (PP) are defined below.

**Administrative Record** – the collection of all relevant documents produced to support decisions regarding actions at the site. The documents in the Administrative Record are available for review.

**Applicable or Relevant and Appropriate Requirements (ARARs)** – those federal environmental or more stringent state environmental or facility siting laws that establish cleanup goals, requirements, or limitations that specially address hazardous substances, pollutants, contaminants, remedial actions (RAs), locations, or other circumstances at a site or are considered sufficiently similar to circumstances at the site such that they are relevant and appropriate. ARARs must be met by the selected remedial action for a site unless waived.

**Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Risk Range** – the acceptable lifetime risk range for carcinogens of $10^{-6}$ to $10^{-4}$ for site cleanups under the CERCLA. It corresponds to a predicted statistical increase in the cancer incidence rate in the range of about one case for every million people to about one case for every 10,000 people exposed to the carcinogen.

**Chronic Reference Dose Values** – the lifetime average daily level of exposure below which no harmful health effects are expected.

**Contaminants of Concern (COC)** – those hazardous substances or pollutants or contaminants that are established in this PP as having been released on this site and requiring response action for protection of human health or welfare of the environment. Related terms are potential chemical of concern (PCOC) and contaminants of potential concern (COPC).

**Dose** – the amount of energy from ionizing radiation that is absorbed per unit mass of matter.

**Exposure Pathway** – the path from sources of pollutants via soil, water, or food to man and other organisms including intermediate pathways e.g., soil to plant to animal to man.

**Formerly Utilized Sites Remedial Action Program (FUSRAP)** – a federal government program with the authority to address properties where residual radioactive material remains because of activities conducted during the early years of the nation's atomic energy program or other sites assigned as a result of U.S. Congressional action.

**Ground Water** – underground water that fills interstitial spaces between soil and rock to the point of saturation.

**Group 1 Properties** – properties within the St. Louis Downtown Site (SLDS) Inaccessible Soil Operable Unit (ISOU) that are addressed by this PP.

**Monitoring** – ongoing collection of information about the environment that helps gauge the effectiveness of a clean-up action, determine potential exposures to workers, and establish potential risks to workers or members of the public.

**Property Groups** – groupings of related properties at the SLDS (i.e., South of Angelrodt and West of Broadway property groups).

**Proposed Plan** – CERCLA decision document that presents the Preferred Remedial Alternative for a site. This PP, in conjunction with the Remedial Investigation/Baseline Risk Assessment RI/BRA Report, forms the basis for the United States Army Corps of Engineers (USACE's) response selection, and is being made available for public comment.

**Radioactivity** – the emission of energy in the form of particles or waves resulting as a consequence of a nuclear decay including alpha particles, beta particles, and gamma rays.

**Remediation** – the activities conducted to address environmental risk and hazards.

**Risk-Based Preliminary Remediation Goal (PRGs)** – risk-based concentration levels established for individual radiological and metal contaminants that were used for initial data comparisons to characterize the nature and extent of contamination present at a property, as well as to determine if the property should be further evaluated in the BRA. The PRGs correspond to a specific cancer risk level of $1x10^{-6}$ or a non-cancer hazard quotient/hazard index of 1. In accordance with CERCLA, risk-based PRGs are generally applied at the beginning of an investigation, and can be modified based on site-specific considerations as the investigation progresses through the CERCLA process.

# FIGURES

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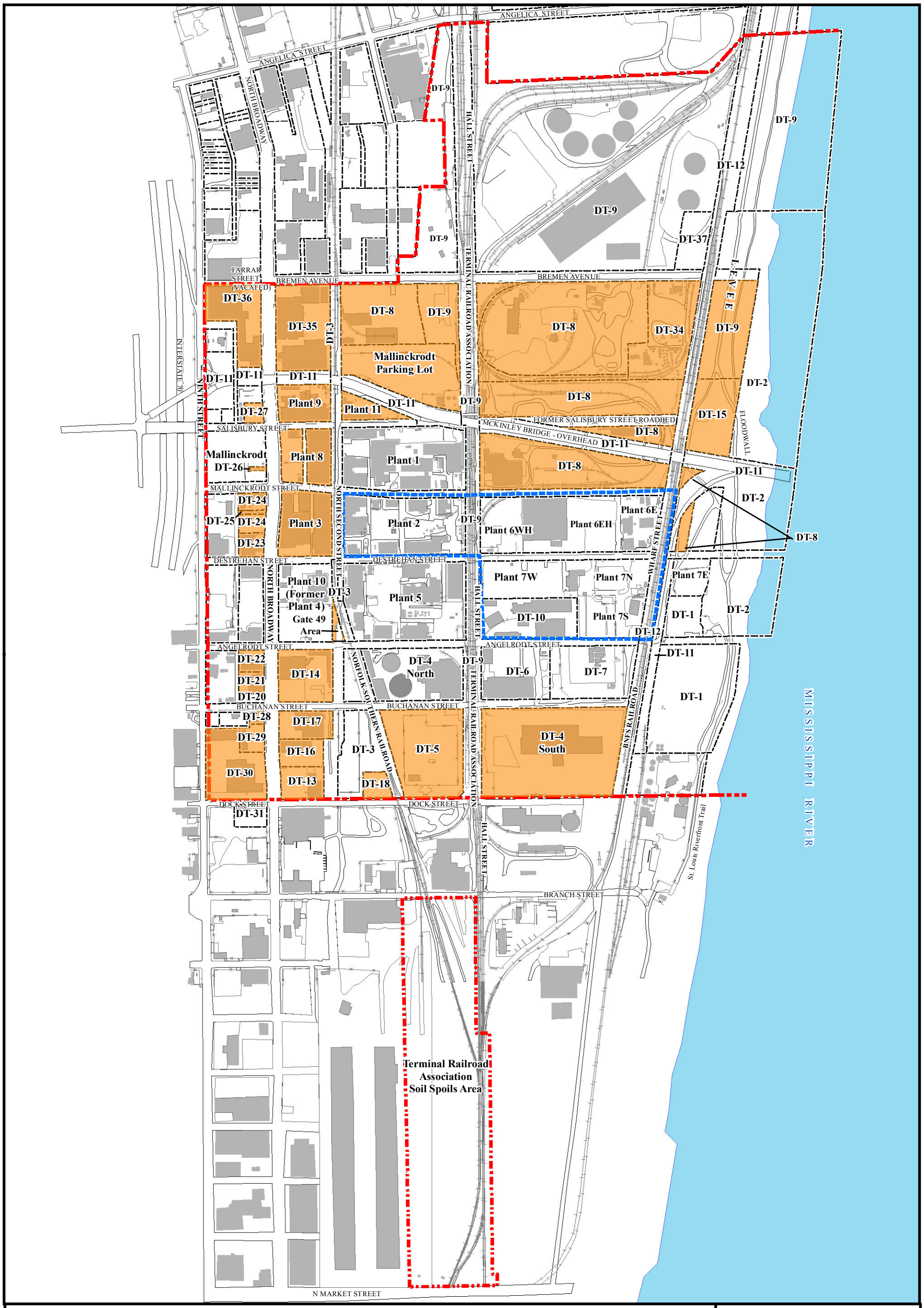
Path: U:\GPS\SLDS\Inaccessible Areas\Projects\ISOU RI Report\RevB\Figure 1 Selected Properties Recommended for No Further Action.mxd




**LEGEND**

- Property Boundary
- Uranium-Ore Processing Areas as Defined by the 1998 ROD
- SLDS Boundary
- Building or Tank
- River/Stream
- Fence
- Railroad
- No Further Action Properties

MO-East State Plane
(NAD 83, Feet)

0 250 500 1,000 Feet

St. Louis Downtown Site (SLDS)
St. Louis, Missouri

FUSRAP

| DRAWN BY: | REV: | DATE: |
|---|---|---|
| KLP, DJH, DLL | 3 | 09/03/2013 |

Figure 1. Group 1 Properties Recommended for No Further Action

Path: U:\GPS\SLDS\Inaccessible Areas\Projects\Figure 1-1 Location Map of the St.mxd

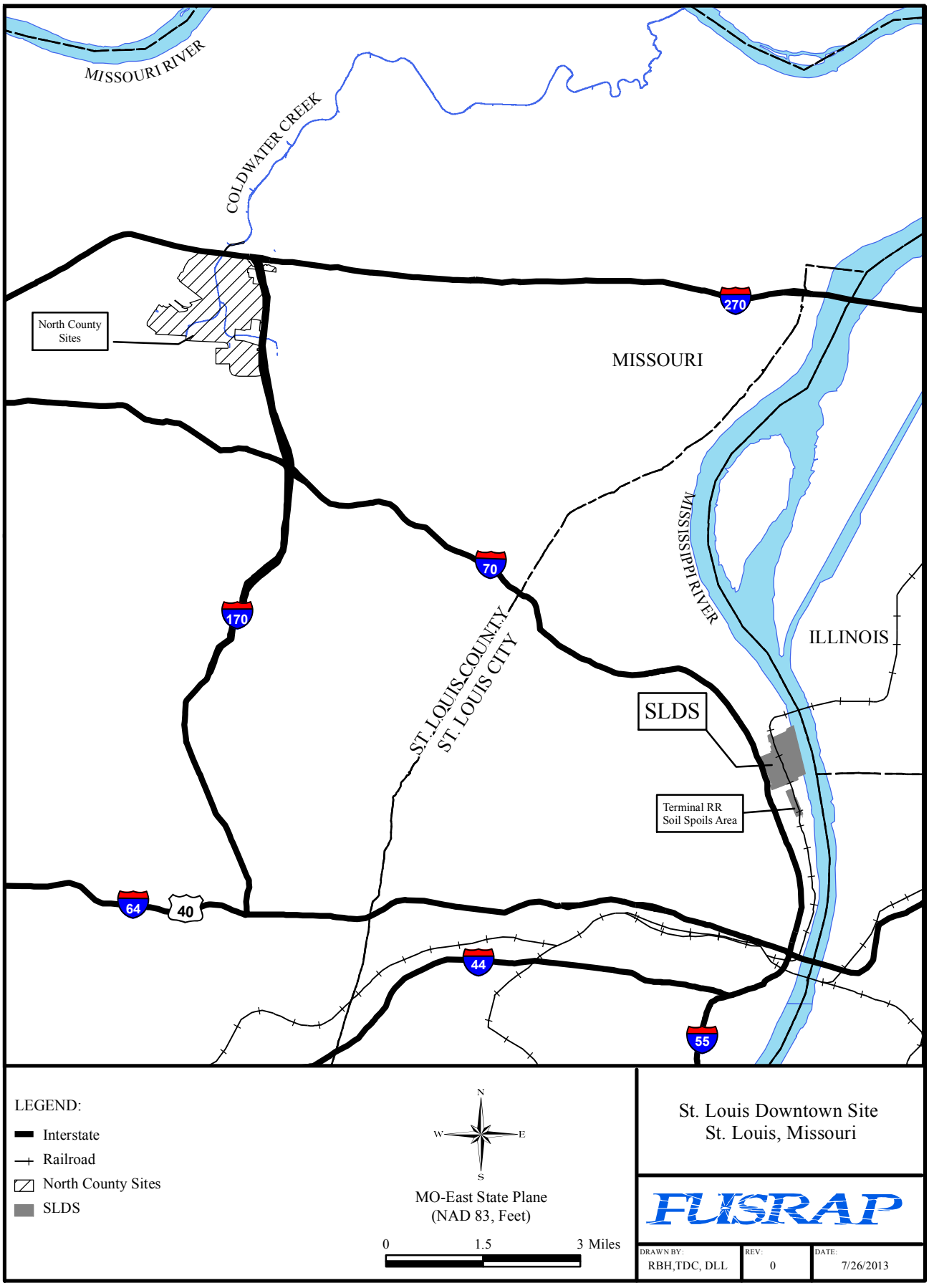
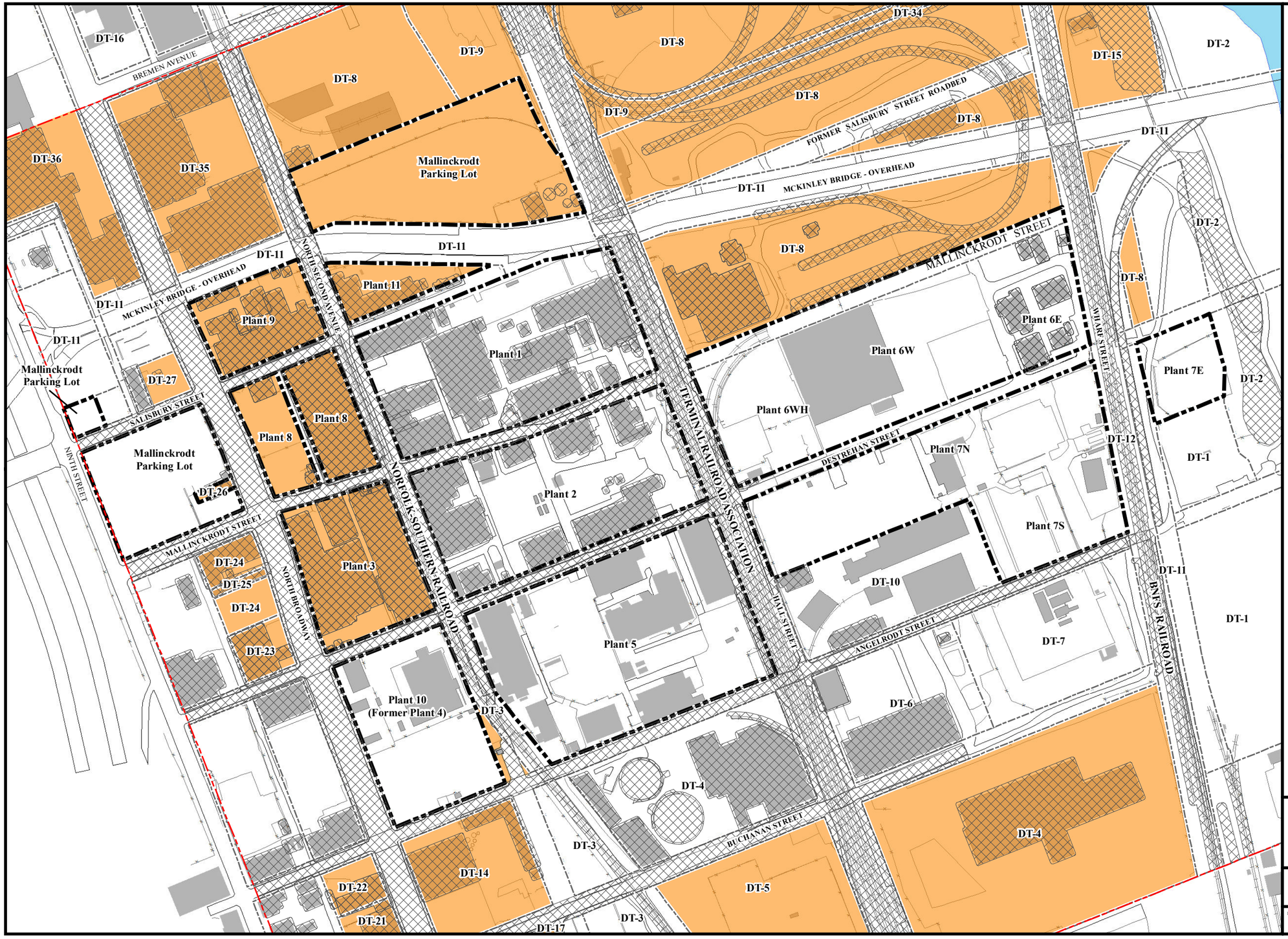



Figure 2. Location Map of the St. Louis Sites




LEGEND:

- Mallinckrodt Property
- Inaccessible Areas
- Property Boundary
- No Further Action Properties
- Building or Tank
- Fence
- Railroad
- Surface Feature (Road, Parking Lot)
- SLDS Boundary

MO-East State Plane
(NAD 83, Feet)

0 100 200 300 Feet

St. Louis Downtown Site (SLDS)
St. Louis, Missouri

FUSRAP

| DRAWN BY: | REV: | DATE: |
|---|---|---|
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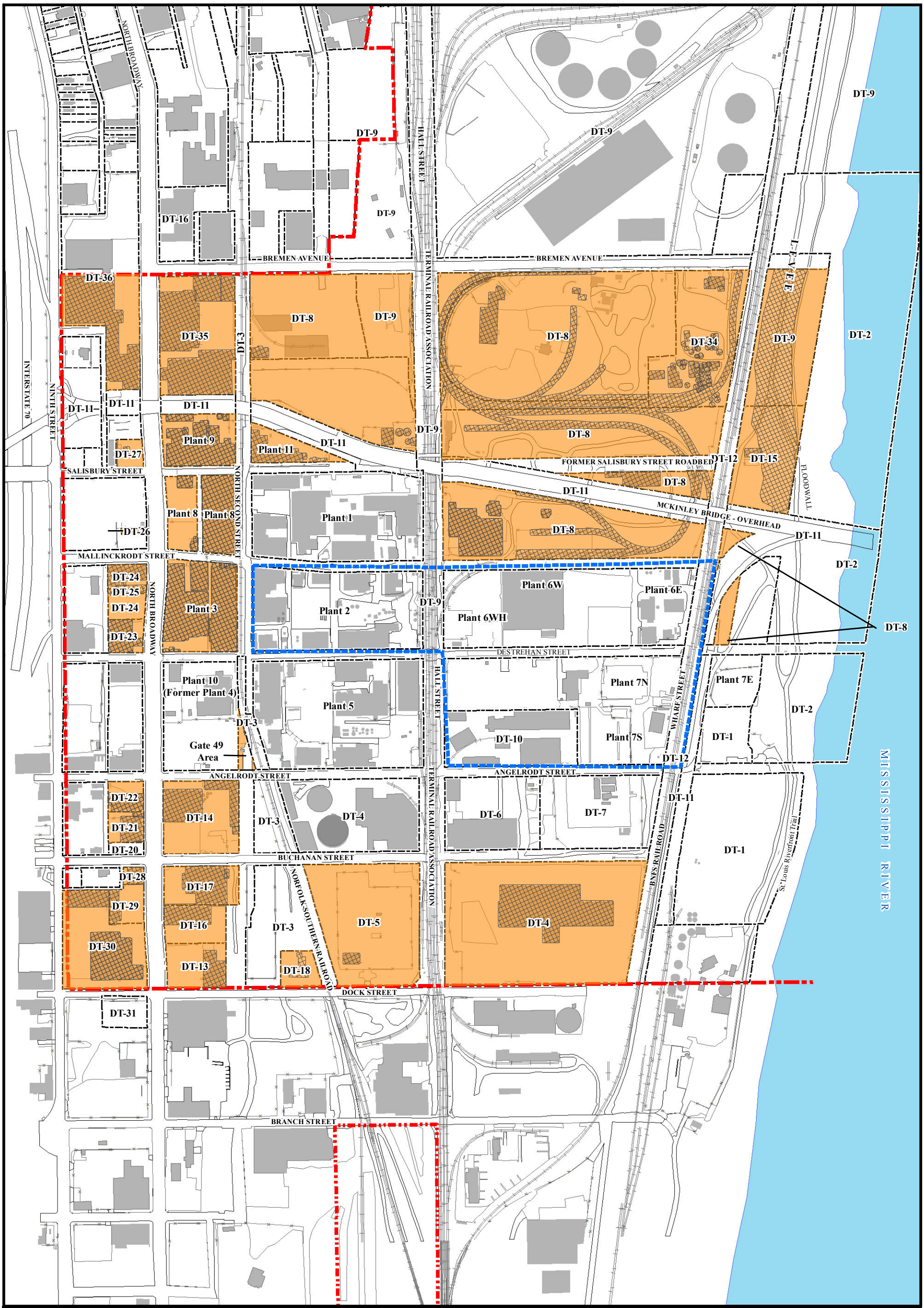
Figure 3. Mallinckrodt Plant Designations

Path: U:\GPS\SLDS\Inaccessible Areas\Projects\ISOU RI Report\RevB\Figure 4 Inaccessible Areas within selected properties.mxd




**LEGEND**

- Inaccessible Areas
- Property Boundary
- Uranium-Ore Processing Areas as Defined by the 1998 ROD
- SLDS Boundary
- Building or Tank
- River/Stream
- Fence
- Railroad
- No Further Action Properties

MO-East State Plane
(NAD 83, Feet)

0 185 370 740 Feet

St. Louis Downtown Site (SLDS)
St. Louis, Missouri

FUSRAP

| DRAWN BY: | REV: | DATE: |
|---|---|---|
| KLP, DJH, DLL | 2 | 09/03/2013 |

Figure 4. Inaccessible Areas within Group 1 Properties

# APPENDIX A

# COMMENT FORM

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## USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the *Proposed Plan for No Further Action for Group 1 Properties Associated with the Inaccessible Soil Operable Unit at the St. Louis Downtown Site* is important to the USACE and the USEPA. Your comments are valuable in helping select a final cleanup remedy for the site.

You may use either the space below to record your comments or a separate sheet of paper. When you have finished, please return your comments to the USACE Public Information Center at 8945 Latty Avenue in Berkeley, Missouri 63134, by mail or by fax to (314) 260-3941 no later than February 13, 2014. Comments may also be submitted by email to USACE Project Manager Mr. Steve Hamm at Steve.Hamm@usace.army.mil. If you have any questions about the comment period, please contact Mr. Hamm at (314) 260-3905.

Name:_____
Address:_____
City:_____
State:_____ Zip:_____

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