
DRAFT 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

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prepared by

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

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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.

°F	degrees Fahrenheit
1993 BRA	<i>Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site</i>
1998 ROD	<i>Record of Decision for the St. Louis Downtown Site</i>
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	<i>Code of Federal Regulations</i>
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)

1		
2	NRC	U.S. Nuclear Regulatory Commission
3	OU	Operable Unit
4	Pa	protactinium
5	PCOC	potential contaminant of concern
6	pCi/g	picocuries per gram
7	PDI	pre-design investigation
8	PP	Proposed Plan
9	PRG	preliminary remediation goal
10	Ra	radium
11	RA	remedial action
12	RCRA	Resource Conservation and Recovery Act
13	RG	remediation goal
14	RI	remedial investigation
15	RI/BRA	<i>Remedial Investigation and Baseline Risk Assessment Report for</i>
16		<i>the Inaccessible Soil Operable Unit at the St. Louis Downtown Site</i>
17	RI WP	<i>Remedial Investigation Work Plan for the Inaccessible Soil</i>
18		<i>Operable Unit at the St. Louis Downtown Site</i>
19	RR	railroad
20	ROD	Record of Decision
21	ROW	right-of-way
22	SARA	Superfund Amendments and Reauthorization Act
23	SLDS	St. Louis Downtown Site
24	SLERA	Screening Level Ecological Risk Assessment
25	Th	thorium
26	TRRA	Terminal Railroad Association
27	U	uranium
28	UMTRCA	Uranium Mill Tailings Radiation Control Act
29	USACE	United States Army Corps of Engineers
30	USEPA	U.S. Environmental Protection Agency
31	VP	vicinity property
32	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 United States 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 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 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 for impacted Group 1 properties that were evaluated in the BRA.

MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:

TBD, 2013 to TBD, 2013

The USACE will accept written comments on the Proposed Plan during the public comment period, which begins **TBD, 2013**.

PUBLIC MEETING:

TBD, 2013

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 **To Be Determined**.

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-31, 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 these Group 1 Properties. The remaining properties associated with the SLDS ISOU were evaluated in the BRA, the results of which indicate that they may pose unacceptable risks and could therefore, require further action. Therefore, the remaining properties will continue through the CERCLA process on a separate path that will ultimately lead to further action. 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 significant 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, USACE is conducting response actions at 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 [m²]) of land currently owned by Mallinckrodt LLC (Mallinckrodt) and more than 165 acres (670,000 m²) 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)."

The authority for the cleanup criteria in the first bullet above is established by 40 *Code of Federal Regulations (CFR)* Part 192 Subpart B, in combination with 10 *CFR* 40 Appendix A Criterion 6(6) (the latter of which is referred to hereafter as "Criterion 6(6)"). The 40 *CFR* Part 192 standards were promulgated to manage mill tailings and residual radioactive material from uranium and thorium processing activities. 40 *CFR* Part 192 Subpart B applies to inactive sites designated either in Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) or by the DOE. The SLDS is not designated in Title I or by the DOE, and the SLDS is not an active uranium and thorium processing facility; however, the standards in 40 *CFR* 192 Subpart B are considered relevant and appropriate to the SLDS. 40 *CFR* 192 Subpart B identifies USEPA's standards for remedial actions of land and buildings contaminated with residual radioactive materials at inactive uranium processing sites and provides cleanup standards for Ra-226 in soil. Section 192.12(a) specifies that Ra-226 concentrations shall not exceed 5 pCi/g above background in top 15 centimeters (cm) (6 inches) and 15 pCi/g above background in lower 15 cm layers averaged over 100 m² (1076 square feet [ft²]) areas.

Like 40 *CFR* Part 192, Criterion 6(6) provides standards for the remediation of uranium and thorium mill tailings sites, but includes criteria for non-radium radiological contaminants in soils and radiological contaminants in buildings. The standards contained within Criterion 6(6) are potentially applicable only for the Title II sites designated under Section 206 of UMTRCA, which do not include the SLDS. However, criterion 6(6) is relevant and appropriate for the SLDS because non-radium contaminants such as thorium and uranium derived from the processing of uranium ores are COCs for the ISOU.

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, RR's, 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.

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

- 4 • A sewer line at the northern edge of the 50-series excavation area in Plant 2 was
5 characterized during the remedial investigation (RI). Results of the soil sampling
6 indicated subsurface soil adjacent to the sewer line was radiologically contaminated. In
7 calendar year 2011, this area was made available for remediation for a short time by the
8 owner and the contaminated soil above the sewer line was removed. The sewer and
9 surrounding soil will be remediated under the 1998 ROD. Consequently, the soil and
10 sewer line at the northern edge of the 50-series excavation area are no longer included in
11 the scope of the ISOU.
- 12 • Soil beneath Building 101 was made available by the property owner for remediation under
13 the 1998 ROD. Plant 6 Building 101 has been demolished. Soil within the footprint of
14 Building 101 is now accessible soil and outside the scope of the ISOU.
- 15 • Soil at the northeastern corner of Plant 7N was defined in the RI WP as an “inaccessible
16 area of detected contamination” and was proposed for sampling. The subsurface soil
17 beneath this area was found to be radiologically contaminated. Soil beneath Destrehan
18 Street has been made available by the property owner for remediation under the 1998
19 ROD.
- 20 • The Hazardous Waste Storage Area at Plant 7N was razed in 2010, and the associated
21 soil and sewer lines were remediated. Therefore, soil and sewer lines beneath this
22 building are no longer defined as inaccessible and are outside the scope of the ISOU.
- 23 • ROW soil along DT-12, was characterized during the RI, found to be radiologically
24 contaminated, and then made available by the owner for remediation under the
25 1998 ROD. Remedial actions have been conducted in this area and the remaining
26 inaccessible soil is being evaluated as part of the ISOU. The DT-12 ROW soil
27 remediation activities are documented in USACE’s (2012) *Remedial Action Summary for*
28 *Burlington Northern Santa Fe Railroad Vicinity Property (DT-12)*, *FUSRAP St. Louis*
29 *Downtown Site, St. Louis, Missouri*. However, the post-remedial data have yet to be fully
30 evaluated and documented in a future Post-Remedial Action Report.
- 31 • Soil beneath Destrehan Street, between Hall Street and DT-12, was characterized during
32 the RI, found to be radiologically contaminated, and then made available by the owner
33 for remediation under the 1998 ROD. This area has not yet been remediated.

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

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 USACE at accessible areas associated with the properties recommended for No Further Action, and a description of the RI/BKA 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
<i>Mallinckrodt Plant Properties</i>			
Plant 1	Mallinckrodt LLC		
Plant 2	Mallinckrodt LLC		
Plant 6	Mallinckrodt LLC		
Plant 7N	Mallinckrodt LLC		
Mallinckrodt Security Gate 49	Mallinckrodt LLC	✓	
<i>Industrial/Commercial Vicinity Properties</i>			
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	✓	
<i>South of Angelford Property Group^b</i>			
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}
<i>West of Broadway Property Group^b</i>			
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
<i>West of Broadway Property Group^b (Continued)</i>			
DT-27	Dillion	✓	<i>b</i>
DT-28	Challenge Enterprises	✓	<i>a,b</i>
DT-30	Zamzow Manufacturing	✓	<i>a,b</i>
DT-31	Porter Poultry	✓	<i>a,b</i>
DT-35	Factory Tire Outlet	✓	<i>b</i>
DT-36	OJM Inc.	✓	<i>b</i>
DT-37	Lange-Stegmann		<i>c</i>
<i>Railroad Vicinity Properties</i>			
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		
<i>Roadway Vicinity Properties</i>			
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 VPs are not included in the scope of the ISOU because no inaccessible soil areas or buildings and structures remain at the property.

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 SLDS. These actions were conducted by the DOE prior to the transfer of responsibility to 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 (yd³) (764.6 cubic meters [m³]) 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 yd³ (2,041 m³) of material shipped offsite;
- Excavation of Plant 10 subsurface area. Approximately 15,000 yd³ (11,468 m³) of material shipped offsite; and
- Excavation of City Property (Riverfront Trail). Approximately 750 yd³ (573.4 m³) 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 *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:

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

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

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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 (°F) with a minimum recorded temperature of -22°F and a maximum recorded temperature of 115°F. Annual average precipitation is 37.5 inches 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. The expected future use of SLDS ground water is not anticipated to change from its current use.

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 many of the accessible portions of the properties because these portions were found to be non-impacted by past MED/AEC-related contamination. In other words, accessible portions of the following properties were determined 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-31, DT-35, DT-36, Plant 1, 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 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, DT-30, and DT-31.

The determination that areas associated with inaccessible soil does not 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 ft² (56 m²) 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 m³) 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 Final Status Survey Evaluation 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 south of the southern border of Plant 7 South. DT-4 South has an area of approximately 8.9 acres (36,017 m²) 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-ft² (2,043.9-m²) 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 Buchanan Street, between DT-4 South and DT-7 (Midwest Waste). An estimated 380 yd³ (290.5 m³) 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 Final Status Survey Evaluation 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 m²) 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 m³) 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 Final Status Survey Evaluation 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 m²).

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 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 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 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 m²).

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 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 m²).

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 m³) 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 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 Final Status Survey Evaluation 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 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 m²) of the total property area of 3.7 acres (15,158 m²). 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 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 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 yd³ (55 m³) 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 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 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-31, DT-35, and DT-36, and Mallinckrodt Plants 3, 8, 9, and 11 and Parking Lots)

The 13 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 ft² (50 m²) 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 ft² (11 m²) 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 m³) 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

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

4 The buildings on DT-20, DT-21, DT-22, DT-24, DT-25, and DT-26 were constructed prior to
5 MED/AEC activities and are adjacent to MED/AEC processing areas. During the ISOU RI, the
6 exteriors and roofs of these buildings were investigated via building scoping surveys and the
7 results of the surveys have been used to support the RI/BRA. The structures at the remaining
8 properties (DT-23, DT-27, DT-28, DT-29, DT-30, DT-31, DT-35, and DT-36) were classified as
9 non-impacted because they are not adjacent to the MED/AEC processing areas, the structures
10 were built after MED/AEC operations ceased, and the accessible soil on the property did not
11 require remediation. Therefore, none of the building/structural surfaces at these properties were
12 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-31, 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-1	Kiesel (formerly Archer Daniels Midland and PVO Foods)	✓			No Inaccessible Areas
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	✓			No Inaccessible Areas
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-32	Westerhide Tobacco	✓			No Inaccessible Areas
DT-27	Dillion	✓	✓		b
DT-28	Challenge Enterprises	✓	✓		a,b
DT-30	Zamzow Manufacturing	✓	✓		a,b
DT-31	Porter Poultry	✓	✓		a,b
DT-35	Factory Tire Outlet	✓	✓		b
DT-36	OJM Inc.	✓	✓		b
DT-37	Lange-Stegmann	✓		✓	No Inaccessible Areas

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.

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 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

1 ingestion of soil, dermal [skin] contact with soil, soil inhalation via windblown dusts, and
2 external radiation.

3 **5.2 BASELINE RISK ASSESSMENT**

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

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

- 16 • DT-4 South,
- 17 • South of Angelrodt Properties DT-5 and DT-18, and
- 18 • West of Broadway Properties DT-21, DT-22, DT-24, DT-25, DT-26, DT-28, DT-30, and
19 DT-31.

20 **5.2.1 Human Health Risk Assessment**

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

35 In the HHRA, all of the Group 1 Properties in this PP were evaluated for cancer risks associated
36 with exposures to radiological COPCs. However, in order to comply with the authority of the
37 1998 SLDS ROD, and for consistency with all subsequent work conducted under the 1998 ROD,
38 as well as with the RI WP, metals were not evaluated at any of the Group 1 Properties because
39 none of the Group 1 Properties are within the historical MED/AEC uranium ore processing
40 boundary. Additionally, there are no concerns for metals migrating from inaccessible soil areas
41 within the former uranium ore processing boundary to areas outside of the boundary. This is
42 because inaccessible soils are generally beneath ground cover (asphalt and concrete pavement,
43 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 1×10^{-6} to 1×10^{-4} . The minimum cancer risk of 1×10^{-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 of 1×10^{-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 1×10^{-5} , which is in the middle of 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. 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 USEPA’s acceptable cancer risk range and demonstrates the health-protective nature of the risk assessment process.

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, background contributions to risk were also evaluated as part of the total risk estimated for each individual property. Inclusion of 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 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 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.

The following subsections discuss the land use scenarios evaluated in the HHRA and the results of the respective risk characterizations.

5.2.1.1 Industrial Land Use

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.

Table 5-1 presents a risk summary for each of the industrial land use receptors evaluated at all of the Group 1 Properties included in this PP for No Further Action. The receptor scenarios are presented by the environmental medium to which they are most likely to be exposed, as evaluated in the RI/BRA:

- Soil – Industrial and Construction Workers,
- Soil on Interior Building Surfaces – Industrial Worker,
- Soil on Exterior Building Surfaces – Building Maintenance Worker,
- Sediment Inside of Sewers – Sewer Maintenance Worker, and
- Soil Adjacent to Sewer Lines – Sewer Utility Worker.

Under each of the main headings for the media, risk results are presented within three columns for each receptor (“Total Property Cancer Risk,” “Is Total Property Cancer Risk Above or Below Background Cancer Risk?”, and “No Unacceptable MED/AEC-Related Risk”). The Group 1 Properties are listed in the first column on the left-hand side of the table, with SLDS Background presented in bold font and gray shading as the top row beneath the main column headers.

The “Total Property Cancer Risk” column presents numerical cancer risk results for scenarios that represent the total property cancer risk, which includes the MED/AEC-related cancer risk and background risk combined, across inaccessible and accessible soil areas. Table 5-1 shows that for the industrial worker (assuming no ground cover), the SLDS background risk, as well as the total cancer risks estimated for each property evaluated in the BRA, exceed USEPA’s acceptable risk range. The SLDS background risk estimated for the construction worker also exceeds the acceptable risk range, though total cancer risks estimated for the properties are all within the acceptable risk range. The background and total property cancer risks estimated for the remaining receptor scenarios in Table 5-1 are below USEPA’s acceptable risk range.

If a risk calculation was not applicable, then the descriptors presented in the subsequent bullets are used to explain the reason for no risk calculation, which ultimately have led to the determination of no unacceptable risks being posed by the property for the subject medium/receptor scenario.

- “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 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.

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Table 5-1. Risk Summary for Industrial Land Use at Group 1 St. Louis Downtown Site Properties Associated with the Inaccessible Soil Operable Unit

ISOU Medium:	Soil									Soil on Interior Building Surfaces			Soil on Exterior Building/ Structural Surfaces			Sediment Inside of Sewer Lines			Soil Adjacent to Sewer Lines		
Receptor:	Industrial Worker ^a			Construction Worker			Utility Worker			Industrial Worker			Building Maintenance Worker			Sewer Maintenance Worker			Sewer Utility Worker		
Risk Results/ Comments:	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c	Total Property Cancer Risk ^b	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC- Related Risk ^c
SLDS Background	1.8x10 ⁻⁴	---	---	3.4x10 ⁻⁴	---	---	3.7x10 ⁻⁷	---	---	NA	---	---	NA	---	---	9.2x10 ⁻⁹	---	---	2.6x10 ⁻⁷	---	---
Mallinckrodt Security Gate 49	1.5x10 ⁻⁴	Below	✓	1.5x10 ⁻⁶	Below	✓	1.7x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
DT-4 South	Non-Impacted	NA	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
DT-8	1.7x10 ⁻⁴	Below	✓	2.8x10 ⁻⁶	Below	✓	3.1x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
DT-9 Levee	1.1x10 ⁻⁴	Below	✓	2.1x10 ⁻⁶	Below	✓	2.4x10 ⁻⁷	Below	✓	No Buildings	NA	✓	No Buildings	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
DT-15	4.4x10 ⁻⁵	Below	✓	2.7x10 ⁻⁶	Below	✓	3.0x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
DT-29	1.2x10 ⁻⁴	Below	✓	1.7x10 ⁻⁶	Below	✓	1.9x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
DT-34	1.3x10 ⁻⁴	Below	✓	3.1x10 ⁻⁶	Below	✓	3.4x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
South of Angelrodt Property Group ^{d,e}	1.5x10 ⁻⁴	Below	✓	3.0x10 ⁻⁶	Below	✓	3.3x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	2x10 ⁻⁷	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓
West of Broadway Property Group ^f	1.4x10 ⁻⁴	Below	✓	2.5x10 ⁻⁶	Below	✓	2.8x10 ⁻⁷	Below	✓	Non-Impacted	NA	✓	Non-Impacted	NA	✓	No MED/AEC Sewer Lines	NA	✓	No MED/AEC Sewer Lines	NA	✓

^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 total property cancer risk includes MED/AEC-related risk and background risk combined, across inaccessible and accessible soil areas. 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 total property cancer risk was not calculated:

- "Non-Impacted" - No risk calculations were necessary in the ISOU RJ 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.
- "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 checkmark in the column indicates that there is no unacceptable risk from MED/AEC-related COCs at the property. MED/AEC cancer risks that are less than or within USEPA's acceptable risk range 1x10⁻⁶ to 1x10⁻⁴ are considered to be acceptable risks that are protective of human health. When the total property risk is less than the background risk, then all of the cancer risk is due to background and none of the cancer risk is due to MED/AEC-related contamination.

^d South of Angelrodt Property Group risks are based on data available from the following VPs: DT-13, DT-14, DT-16, and DT-17. The following non-impacted properties were not included in risk calculations for the property group: DT-5 and DT-18.

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

^f West of Broadway Property Group risks are based on data available from the following properties: Plants 3, 8, 9, and 11, and DT-20, DT-23, DT-27, DT-35, and DT-36. The following non-impacted properties were not included in risk calculations for the property group: DT-21, DT-22, DT-24, DT-25, DT-26, DT-28, DT-30, and DT-31.

NA - Soil background risk comparisons with property risks are Not Applicable for non-impacted properties. Background risk comparisons with property risks associated with sewer sediment and soil adjacent to sewer lines are Not Applicable for properties with no sewer lines that facilitated flow of MED/AEC-related contaminants.

Background data for soil on building/structural surfaces are Not Available for estimating background risk.

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- "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.

The column with the header "Is Total Property Cancer Risk Above or Below Background Cancer Risk?" indicates whether the total property risks for the medium/receptor scenario (in the previous column to the left) are "Above" or "Below" the corresponding background cancer risk. Where applicable, all of the estimated total property cancer risks in Table 5-1 are indicated as being below the corresponding background risk.

Under the "No Unacceptable MED/AEC-Related Risk" columns, a check mark is used to indicate that there is no unacceptable risk from MED/AEC-related COCs at the property for the subject receptor. Cancer risks that are less than or within USEPA's acceptable risk range of 1×10^{-6} to 1×10^{-4} are considered to be acceptable risks that are protective of human health. Also, when the total property cancer risk is less than the background risk, then the total property cancer risk is considered to be due solely to background contributions, with negligible contributions being attributed to MED/AEC-related contamination. Therefore, in this situation, there is a determination of no unacceptable MED/AEC-related risk for the property (i.e., a checkmark is applied).

In summary, Table 5-1 shows that there are no unacceptable risks to any of the evaluated receptors at the Group 1 Properties under industrial land use (as indicated by check marks added for all property/receptor scenarios under the "No Unacceptable MED/AEC-Related Risk" column).

5.2.1.2 Recreational Land Use

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 from soil around and beneath the levee from external radiation. Individuals are not likely to engage in recreational activities at the remaining selected properties due to owner restrictions.

Table 5-2 presents a risk summary for the recreational user evaluated at the Group 1 Properties. Under the "Total Property Cancer Risk" column, the total property cancer risks are presented for the recreational user at the DT-9 Levee and DT-15 properties, which includes the MED/AEC-related cancer risk and background risk combined, across inaccessible and accessible soil areas. Risk values were not calculated for the remaining properties because the properties are either non-impacted and/or are associated with no exposure pathways for a recreational user. In the absence of a risk value for each of these situations, the appropriate descriptor was presented to explain the rationale for no risk calculations, which ultimately have led to the determination of no unacceptable risks being posed by those properties for the recreational user. The descriptors are presented below.

- "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 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.

Table 5-2 shows that the results for the total property cancer risks for the DT-9 Levee and DT-15 properties are slightly above and below the corresponding background risk, respectively. For the DT-9 Levee, the MED/AEC-related risk (4.0×10^{-7}), which is the difference between the total property and background cancer risks, is less than the USEPA's acceptable risk range. The total property cancer risk for DT-15 is below background risk, indicating that the MED/AEC-related risk is also less than the USEPA acceptable risk range. Therefore, in summary, there are no unacceptable MED/AEC-related cancer risks to the recreational user at either of the levee properties.

5.2.1.3 Hypothetical Residential Gardener Land Use

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. In response to stakeholder interest, a hypothetical resident gardener scenario was also evaluated in the HHRA.

Table 5-2. Risk Summary for Recreational Land Use at Group 1 St. Louis Downtown Site Properties Associated with the Inaccessible Soil Operable Unit

ISOU Medium:	Soil		
Receptor:	Recreational User		
Risk Results/Comments:	Total Property Cancer Risk ^a	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC-Related Risk ^b
SLDS Background	1.5x10 ⁻⁶	---	---
Mallinckrodt Security Gate 49	No Exposures	NA	✓
DT-4 South	Non-Impacted/No Exposures	NA	✓
DT-8	No Exposures	NA	✓
DT-9 Levee	1.9x10 ⁻⁶	Above ^c	✓
DT-15	7.2x10 ⁻⁷	Below	✓
DT-29	No Exposures	NA	✓
DT-34	No Exposures	NA	✓
South of Angelrodt Property Group	No Exposures	NA	✓
West of Broadway Property Group	No Exposures	NA	✓

^a The total property cancer risk includes MED/AEC-related risk and background risk combined, across inaccessible and accessible soil areas. 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 total property cancer risk was not calculated:

- "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.
- "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.

^b A checkmark in the column indicates that there is no unacceptable risk from MED/AEC-related COCs at the property. MED/AEC cancer risks that are less than or within USEPA's acceptable risk range 1x10⁻⁶ to 1x10⁻⁴ are considered to be acceptable risks that are protective of human health. When the total property risk is less than the background risk, then all of the cancer risk is due to background and none of the cancer risk is due to MED/AEC-related contamination.

^c Because the total property cancer risk is above the background cancer risk, the MED/AEC-related cancer risk is estimated to be the difference, or 4.0x10⁻⁷. Therefore, the MED/AEC-related risk is less than the acceptable risk range.

NA - Soil background risk comparisons with property risks are Not Applicable for non-impacted properties and properties with no complete exposure pathways for the recreational user.

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. Because 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.

Table 5-3 presents a risk summary for the hypothetical resident gardener evaluated at the Group 1 Properties included in this PP for No Further Action. Total property cancer risks are presented for the resident gardener at the Mallinckrodt Security Gate 49, DT-8, DT-29, and DT-34 properties, as well as the South of Angelrodt and West of Broadway property groups. Risk values were not calculated for the remaining properties because the properties are either non-impacted (DT-4 South) or are associated with no exposure pathways for a resident gardener (DT-9 Levee and DT-15). In the absence of a risk value for each of these situations, the appropriate descriptor (i.e., "*Non-Impacted*" or "*No Exposures*," as defined in the previous section) was presented to explain the rationale for no risk calculations, which ultimately have led to the determination of no unacceptable risks being posed by those properties for the resident gardener user.

Table 5-3 shows that for the Group 1 Properties evaluated in the HHRA, there are no unacceptable soil risks to the resident gardener. This is because the total property risks are below the background risk, indicating that the MED/AEC-related risk is less than USEPA's acceptable risk range. For the properties not evaluated in the HHRA, there are no unacceptable risks associated with DT-4 South, which was previously determined to be non-impacted, and there are no unacceptable risks associated with the two levee properties (DT-9 Levee and DT-15) due to incomplete exposure pathways.

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

1 endangered species. In comparison to the accessible media evaluated in the 1993 BRA, the
2 potential for impacts to ecological receptors from ISOU media evaluated in this SLERA is
3 significantly less for the following reasons. First, based on the lack of suitable habitat, the potential
4 for direct contact exposures to ISOU media is reduced for terrestrial or aquatic ecological
5 receptors. Second, the presence of buildings and consolidated cover (e.g. asphalt and concrete
6 pavement) over inaccessible soil acts as a physical barrier to direct contact exposures by terrestrial
7 receptors. Third, the potential for subsurface migration to sensitive terrestrial or aquatic habitats
8 (although no sensitive habitats have been found to exist, per the Ecological Checklist in Appendix
9 R of the RI/BRA) from inaccessible soil is not significant. Thus, it is concluded that there are no
10 complete or significant exposure pathways for ecological receptors at the ISOU.

Table 5-3. Risk Summary for Hypothetical Residential Gardener Land Use at Group 1 St. Louis Downtown Site Properties Associated with the Inaccessible Soil Operable Unit

ISOU Medium:	Soil		
Receptor:	Resident Gardener		
Risk Results/Comments:	Total Property Cancer Risk ^a	Is Total Property Cancer Risk Above or Below Background Cancer Risk?	No Unacceptable MED/AEC-Related Risk ^b
SLDS Background	7.9×10^{-4}	---	---
Mallinckrodt Security Gate 49	6.1×10^{-4}	Below	✓
DT-4 South	Non-Impacted	NA	✓
DT-8	7.8×10^{-4}	Below	✓
DT-9 Levee	No Exposures	NA	✓
DT-15	No Exposures	NA	✓
DT-29	7.0×10^{-4}	Below	✓
DT-34	6.0×10^{-4}	Below	✓
South of Angelrodt Property Group	6.8×10^{-4}	Below	✓
West of Broadway Property Group	6.4×10^{-4}	Below	✓

^a The total property cancer risk includes MED/AEC-related risk and background risk combined, across inaccessible and accessible soil areas. 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 total property cancer risk was not calculated:

- "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. There are no exposures assumed for a resident gardener at the levee properties (DT-9 Levee or DT-15) because it is highly unlikely that a house will ever be constructed upon or adjacent to the levee.
- "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.

^b A checkmark in the column indicates that there is no unacceptable risk from MED/AEC-related COCs at the property. MED/AEC cancer risks that are less than or within USEPA's acceptable risk range 1×10^{-6} to 1×10^{-4} are considered to be acceptable risks that are protective of human health. When the total property risk is less than the background risk, then all of the cancer risk is due to background and none of the cancer risk is due to MED/AEC-related contamination.

NA - Soil background risk comparisons with property risks are Not Applicable for non-impacted properties and properties with no complete exposure pathways for the recreational user.

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

7 **5.2.3 Summary**

8 In summary, ISOU media at the following Group 1 properties are recommended for No Further
9 Action due to no unacceptable risks determined as a result of properties being non-impacted, as
10 well as from the results of exposure and risk evaluations conducted in the HHRA and SLERA.

- 11 • Mallinckrodt Security Gate 49,
- 12 • DT-4 South,
- 13 • DT-8,
- 14 • DT-9 Levee,
- 15 • DT-15,
- 16 • DT-29,
- 17 • DT-34,
- 18 • South of Angelrodt Property Group (includes DT-5, DT-13, DT-14, DT-16, DT-17 and
19 DT-18), and
- 20 • West of Broadway Property Group (includes Plants 3, 8, 9, and 11 and DT-20, DT-21,
21 DT-22, DT-23, DT-24, DT-25, DT-26, DT-27, DT-28, DT-30, DT-31, DT-35, and DT-36).

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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-31, 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 results of the BRA, 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 SUMMARY OF COMMENTS RECEIVED FROM THE USEPA AND THE
STATE OF MISSOURI**

[This section will be completed at the conclusion of the Comment Period]

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8.0 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 public use.

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 Angelrod 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.

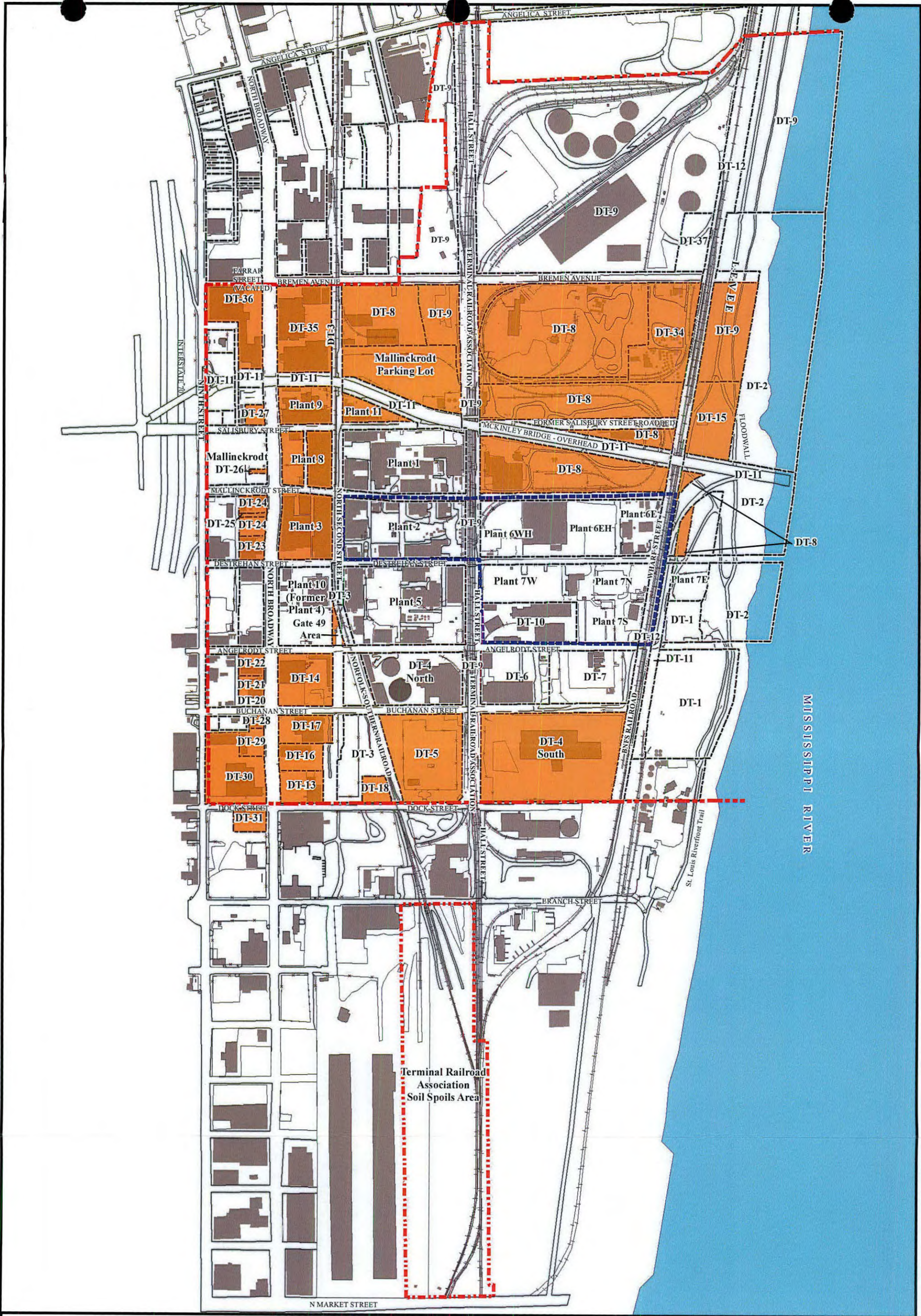
Radioactivity – the emission of energy in the form of particles or waves resulting as a consequence of a nuclear decay including alpha particles, beta particles, and gamma rays.

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 1×10^{-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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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: KLP, DJH, DLL	REV: 3	DATE: 09/03/2013
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Figure 1. Group 1 Properties Recommended for No Further Action

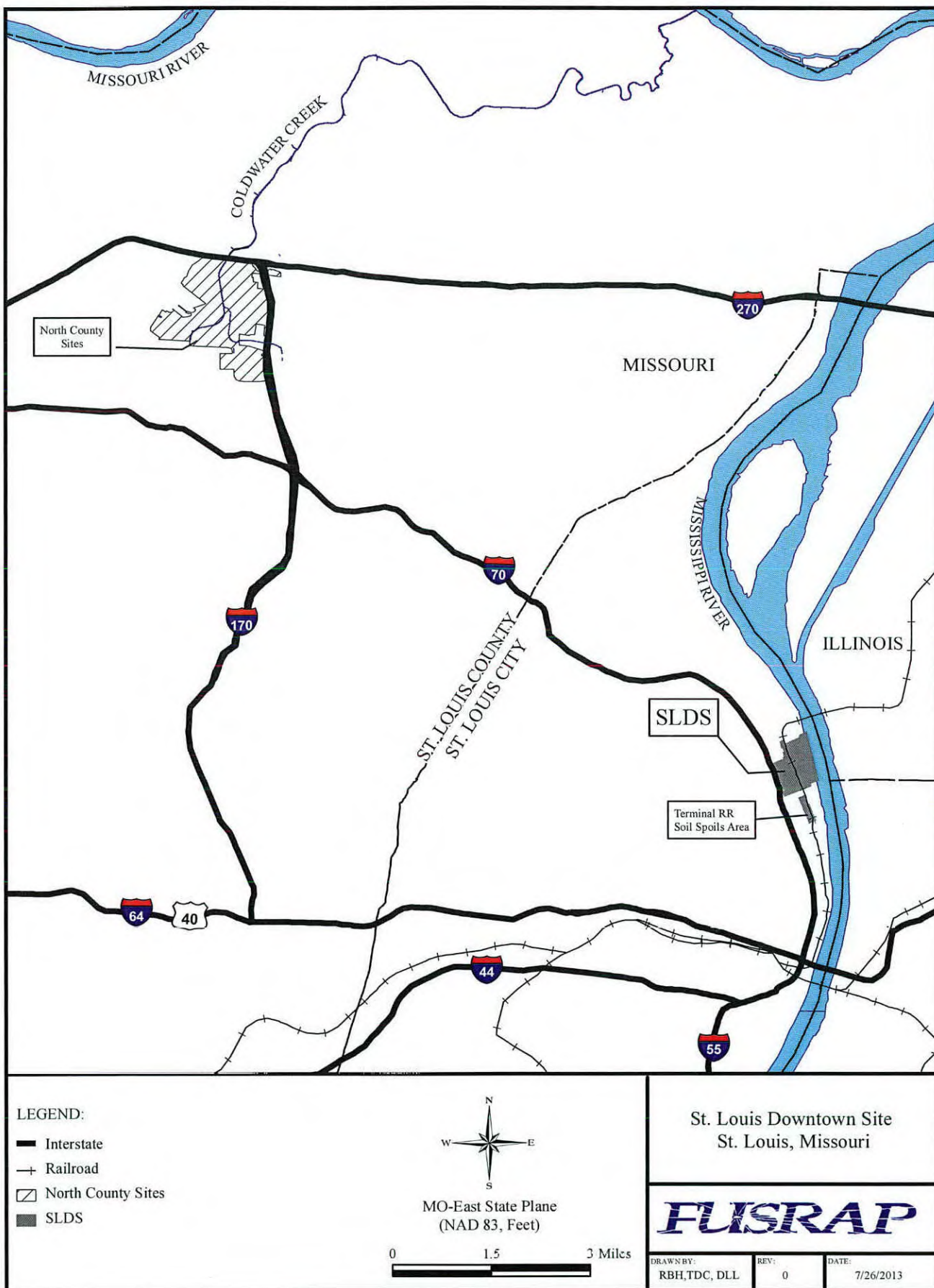


Figure 2. Location Map of the St. Louis Sites

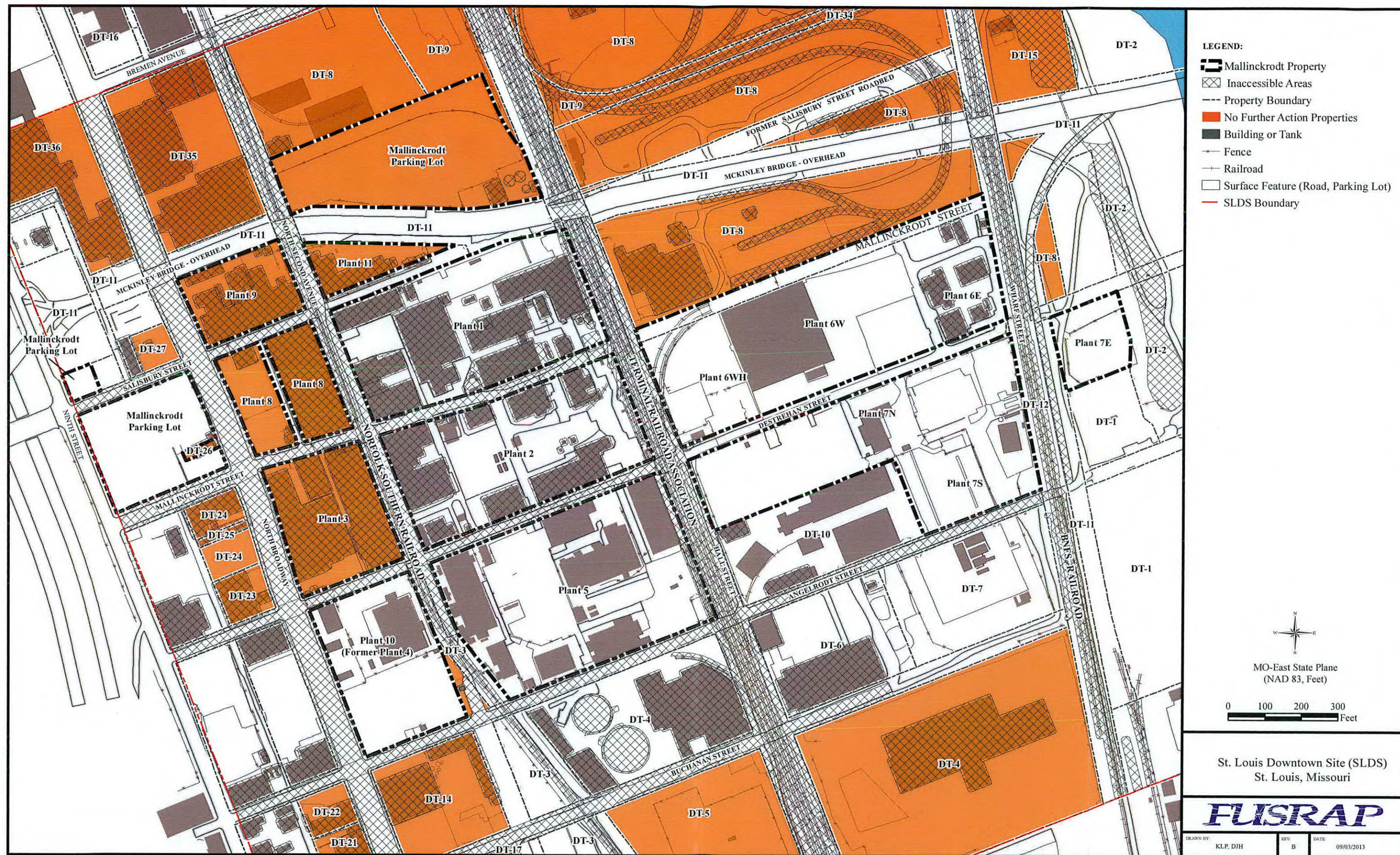


Figure 3. Mallinckrodt Plant Designations

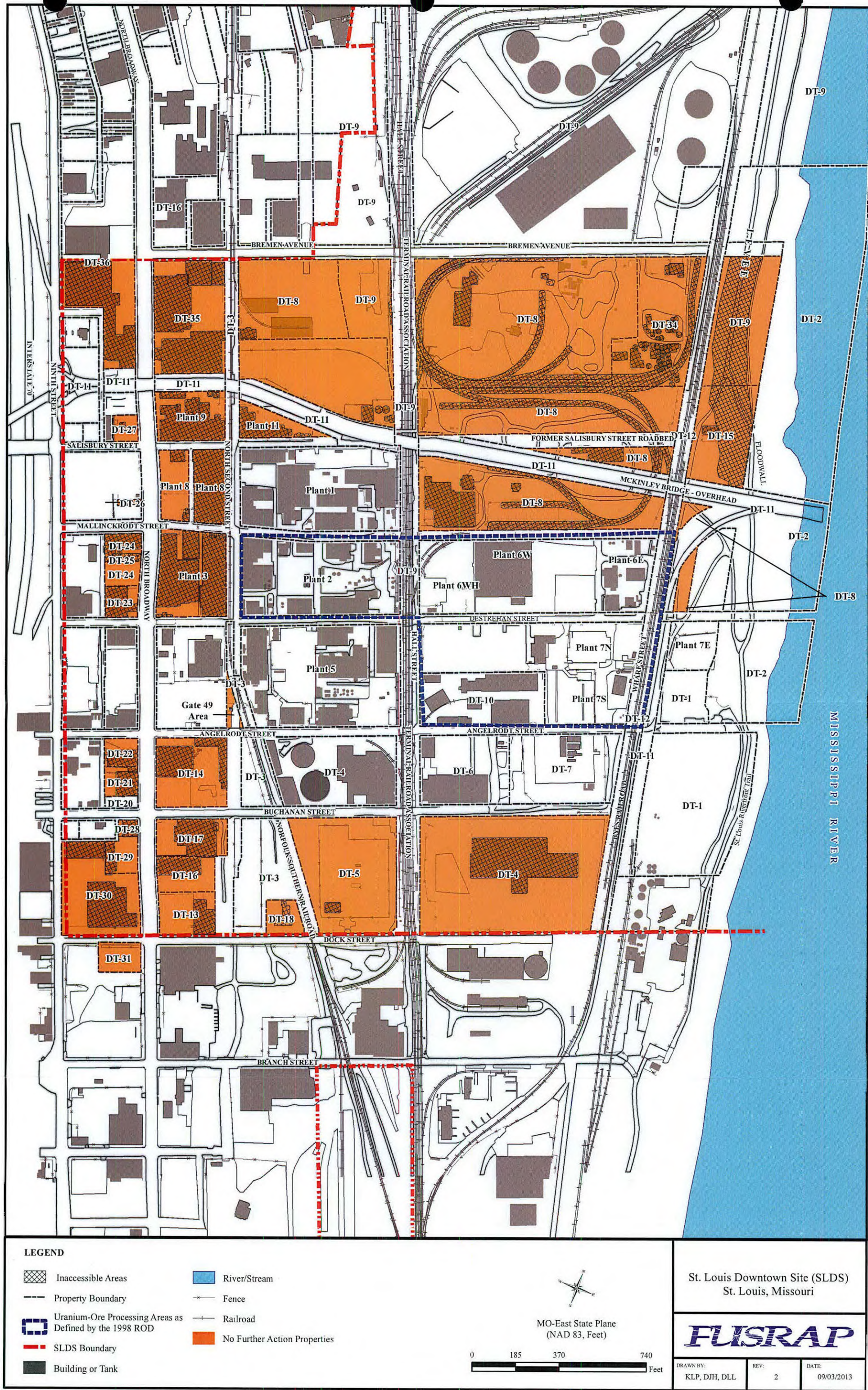


Figure 4. Inaccessible Areas within Group 1 Properties

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 _____. Comments may also be submitted by email to USACE Program Manager Ms. Sharon Cotner at _____. If you have any questions about the comment period, please contact Ms. Cotner at 314-260-3905.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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

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