REVISION 0

ENVIRONMENTAL MONITORING IMPLEMENTATION PLAN FOR THE ST. LOUIS DOWNTOWN SITE FOR CALENDAR YEAR 2020

ST. LOUIS, MISSOURI

DECEMBER 23, 2019

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

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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

Ac	actinium
AEC	U.S. Atomic Energy Commission
AOC	area of contamination
ARAR	applicable or relevant and appropriate requirement
ATD	alpha track detector
BMP	best management practice
C-T	columbium and tantalum
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COD	chemical oxygen demand
CWC	Coldwater Creek
CY	calendar year
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
ELAP	Environmental Laboratory Accreditation Program
EMDAR	Environmental Monitoring Data and Analysis Report
EMG	*Environmental Monitoring Guide for the St. Louis Sites*
EMICY	Environmental Monitoring Implementation Calendar Year
EMP	Environmental Monitoring Program
Futura	Futura Coatings Company
FUSRAP	Formerly Utilized Sites Remedial Action Program
GASP	Ground-Water Algorithm Sampling Protocol
HISS	Hazelwood Interim Storage Site
HU	hydrostratigraphic unit
IA	investigation area
IDW	investigation-derived waste
IL	investigative limit
ISOU	Inaccessible Soil Operable Unit
KPA	kinetic phosphorescence analysis
Mallinckrodt	Mallinckrodt LLC
MDNR	Missouri Department of Natural Resources
MED	Manhattan Engineer District
MSD	Metropolitan St. Louis Sewer District
NC	North St. Louis County
NCP	National Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NRC	U.S. Nuclear Regulatory Commission
Pa	protactinium
PCB	polychlorinated biphenyl
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
Ra	radium

ACRONYMS AND ABBREVIATIONS (Continued)

RA	remedial action
RAC	remedial action contractor
RCRA	Resource Conservation and Recovery Act
Rn	radon
ROD	*Record of Decision for the St. Louis Downtown Site*
SAG	*Sampling and Analysis Guide for the St. Louis Sites*
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
SLS	St. Louis Sites
SOR	sum of ratios
SVOC	semi-volatile organic compound
TEDE	total effective dose equivalent
Th	thorium
TLD	thermoluminescent dosimeter
TRRA	Terminal Railroad Association
TSS	total suspended solids
U	uranium
UMTRCA	Uranium Mill Tailings Radiation Control Act
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
VP	vicinity property

UNIT 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 areas are given in square meters). Units included in the following list are not defined at first use in this report.

µCi/mL	microcurie(s) per milliliter
µg/L	microgram(s) per liter
ft	foot/feet
mCi	millicurie(s)
mrem	millirem
NTU	nephelometric turbidity unit(s)
pCi/g	picocurie(s) per gram
pCi/L	picocurie(s) per liter
pCi/m^2	picocurie(s) per square meter
WL	working level(s)

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1.0 INTRODUCTION

This Environmental Monitoring Implementation Calendar Year (EMICY) plan for calendar year (CY) 2020 applies to the St. Louis Downtown Site (SLDS) within the Formerly Utilized Sites Remedial Action Program (FUSRAP). Figure 1-1 depicts a schematic representation of the FUSRAP St. Louis Sites (SLS). Figure 1-2 depicts the SLDS, which consists of the Mallinckrodt LLC (Mallinckrodt) property and vicinity properties (VPs).

The FUSRAP was initiated in 1974 by the U.S. Atomic Energy Commission (AEC), the predecessor to the U.S. Department of Energy (DOE). The FUSRAP was transferred to the U.S. Army Corps of Engineers (USACE) on October 13, 1997. The USACE is responsible for the management and execution of the FUSRAP to clean up sites used in the nation's early atomic energy program. One element of the FUSRAP mission is the environmental monitoring of sites at which response actions either are being implemented or have been completed, but at which contaminants remain onsite above levels that allow for unrestricted use.

Environmental monitoring is conducted to support assessment of the effectiveness of the remedial action (RA) in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 5-year reviews. Five-year reviews are required under the National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan (NCP), at sites where hazardous substances, pollutants, or contaminants remain above levels that allow for unrestricted use. Environmental monitoring serves as a critical tool to evaluate potential future migration of residual contaminants, whether as a component of RAs or as a best management practice (BMP).

This document serves as a component of an integrated approach to collecting environmental data at the SLDS. These data are collected to ensure compliance with the *Record of Decision for the St. Louis Downtown Site* (ROD) (USACE 1998a) applicable or relevant and appropriate requirements (ARARs). As a result of promulgation of new regulations, issuance of permits, meeting of substantive requirements, and/or the implementation of RAs, monitoring requirements and data objectives for the SLDS may change. Accordingly, program-level requirements with respect to field sampling procedures, sample management requirements, analytical protocols, and quality assurance (QA)/quality control (QC) activities that are unlikely to change are specified in an upper-tier document titled *Sampling and Analysis Guide for the St. Louis Sites* (SAG) (USACE 2000). The *Environmental Monitoring Guide for the St. Louis Sites* (EMG) (USACE 1999) describes the overall objectives, program structure, media to be monitored, and program requirements of the Environmental Monitoring Program (EMP).

Annual EMICY plans are issued under the EMG to address changing monitoring objectives and specifically identify sampling locations, frequencies, monitoring parameters, and criteria for evaluation of the resultant data specific for periodic sampling activities for the subject year. Non-periodic sampling activities such as soil sampling to define contamination extent for design purposes or to verify compliance with cleanup objectives or other special studies are specified in other implementation plans throughout the year. Excavation-water data obtained from the monitoring described in the EMICY are reported to the U.S. Environmental Protection Agency (USEPA) Region 7 and the Missouri Department of Natural Resources (MDNR) in quarterly reports. The remaining data along with an evaluation of the data obtained from monitoring under each EMICY during a CY is provided in an annual Environmental Monitoring Data and Analysis Report (EMDAR) for each CY.

Since the completion of the EMICY for CY 2019 (USACE 2018), two groundwater monitoring well (DW19RD and DW19RS) were installed to replace the previously decommissioned DW19. Additionally, three outdoor thermoluminescent dosimeter (TLD) and alpha track detector (ATD) monitoring locations (DA-10, DA-11, and DA-12) were added and two (DA-2 and DA-7) were removed. There were no other changes to the EMP or environmental monitoring planned for CY 2020.

The remainder of this section contains a summary description of the contents of this document. Section 2.0 contains guidelines derived from the ROD and various environmental regulations that will be used for assessment of the data obtained under this EMICY. Section 3.0 contains the various types and locations of monitoring to be conducted at the SLDS, along with supporting QA/QC requirements. Section 4.0 references the SAG procedures necessary to fulfill the requirements of this EMICY, including field-sampling procedures, sample management requirements, sample packaging and shipping requirements, management of investigation-derived waste (IDW), and analytical protocols.

2.0 OBJECTIVES AND EVALUATION GUIDELINES FOR THE ENVIRONMENTAL MONITORING PROGRAM FOR CY 2020

2.1 PROGRAM OBJECTIVES FOR CY 2020

The objectives for the EMP during CY 2020 are identified as follows.

- Conduct BMP monitoring to obtain data for impact evaluations relative to guidelines derived from environmental regulations.
- Conduct periodic monitoring, as required, to meet substantive requirements, permit, or ARAR conditions for the SLDS.
- Perform trend analyses, as required, to determine effects of RAs on ground water.

To fulfill these objectives, Section 3.0 identifies sampling locations and frequencies for various environmental media based on ARARs, permit conditions, site characteristics, risk assessment considerations, and other site factors. Such sampling locations can include the area of contamination (AOC), points of compliance at the AOC boundary, receptor areas, off-site unaffected areas, critical receptors, or migration pathways. Similarly, the monitoring parameters identified in Section 3.0 were selected from permit conditions, best professional judgment based on historical site studies, and the ROD (USACE 1998a).

2.2 EVALUATION GUIDELINES FOR ENVIRONMENTAL MONITORING DATA

Data acquired during CY 2020 will be evaluated with respect to ARARs, permit conditions, guidelines derived from environmental regulations, and environmental documents (i.e., the ROD).

2.2.1 Guidelines for Site Radiological Data

Outdoor and indoor air monitoring will be conducted under this EMICY as a BMP to meet substantive requirements or ARAR commitments. Site outdoor radiological monitoring is appropriate at site perimeters (e.g., Mallinckrodt), in the vicinity of excavation areas, and/or at areas accessible to members of the public. Indoor air monitoring (i.e., radon) will be proactively conducted at Plant 1 Building 26 and the DT-4 North-South Storage Building at which radium (Ra)-226 levels beneath the buildings exceed the 40 *Code of Federal Regulations* (*CFR*) 192.12(a) level (15 pCi/g, subsurface). The following subsections describe the monitoring that will be conducted to demonstrate compliance.

Title 40 CFR 61, Subpart I

Sampling results from outdoor airborne particulate monitoring will be evaluated with respect to regulatory guidelines from 40 *CFR* 61. In accordance with 40 *CFR* 61, the dose from radioactive airborne particulates (excluding radon) to the hypothetical maximally exposed member of the public is not to exceed 10 mrem per year. This value applies to the critical receptor receiving the highest dose as determined by modeling and/or monitoring that considers inputs such as wind direction and duration of human occupancy.

Title 10 CFR 20.1301

Sampling results from outdoor airborne particulate, external gamma, and outdoor radon monitoring conducted at the SLDS will be evaluated with respect to the regulatory guideline from 10 *CFR* 20. Although this is not an ARAR, the evaluation is conducted as a BMP to provide assurance that actions conducted in accordance with the ROD are protective of the

public. Exposure to the public from FUSRAP RA operating activities is limited to 100 mrem per year, excluding background, from all pathways by 10 *CFR* 20. Guidance on the use of monitoring data to demonstrate compliance with the 100 mrem per year standard when considering all pathways is contained in 10 *CFR* 20.

Title 40 CFR 192.02(b)

Sampling results from outdoor radon monitoring will be evaluated with respect to the regulatory guideline from 40 *CFR* 192.02(b). In accordance with 40 *CFR* 192, control of residual radioactive materials and constituents shall be designed to provide reasonable assurance that release of radon (Rn)-222 from residual radioactive material to the atmosphere will not exceed an average release rate of 20 pCi/m^2 per second or increase the annual average concentration of Rn-222 in air at or above any location outside the site by more than 0.5 pCi/L.

Title 40 CFR 192.12(b)

Based upon soil sampling results obtained during the SLDS Inaccessible Soil Operable Unit (ISOU) remedial investigation, only two occupied or habitable buildings, Plant 1 Building 26 and the DT-4 North-South Storage Building, were determined to have average Ra-226 subsurface soil concentrations that exceeded the 40 *CFR* 192.12(a) level of 15 pCi/g. When Ra-226 concentrations beneath occupied or habitable buildings exceed the 40 *CFR* 192.12(a) level (15 pCi/g, subsurface), there is a potential for Rn-222 to accumulate inside of the buildings. Therefore, indoor air (i.e., radon) will be monitored in Plant 1 Building 26 and the DT-4 North-South Storage Building, and sampling results will be evaluated with respect to the regulatory guideline from 40 *CFR* 192.12(b). In accordance with 40 *CFR* 192.12(b), reasonable effort shall be made to achieve an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL in occupied or habitable buildings. Although this is not an ARAR at this time, the monitoring will be proactively conducted as a BMP in lieu of a signed record of decision for the SLDS ISOU Group 2 Properties.

Lists of regulatory commitments and general descriptions of how those commitments will be implemented are provided in Tables 2-1 through 2-4.

Table 2-1. Guidelines for Outdoor Air, Indoor Air, and Direct Radiation Monitoring Data at the SLDS

Media	Parameter	Regulatory Based Guideline	Type of Monitoring
Outdoor Air	Radiation Dose to Public	Total dose to a member of the public from all pathways ≤100 mrem/year. Airborne particulate dose to a member of the public ≤10 mrem/year (exclusive of radon).	Radon concentrations (ATDs), and direct gamma radiation dose rates (TLDs) in the vicinity of excavation areas accessible to members of the public. Air particulate concentrations (filtered air samples) at active excavations and loadout area perimeters accessible to members of the public at Mallinckrodt and the VPs.
Indoor Air	Radon	Radon progeny concentration (or equivalent) ≤0.02 WL.	Radon measurements (ATDs) within Plant 1 Building 26 and the DT-4 North-South Storage Building.

Table 2-2. Summary of National Emission Standards for Hazardous Air Pollutants (NESHAP) Air Emissions at the SLDS

Regulation: NESHAP Air Emissions		
Regulation	**Description/Standard**	**Implementation**
40 *CFR* 61, Subpart I (ARAR in ROD [USACE 1998a])	Radionuclide emissions of ambient air particulates from federal facilities other than U.S. Nuclear Regulatory Commission (NRC) licensees shall not exceed those amounts that would cause any member of the public to receive an effective dose equivalent in excess of 10 mrem/year exclusive of radon.	Compliance with this standard will be demonstrated through measurement of radionuclide air particulate concentrations at site or excavation area perimeters and through the use of the USEPA computer code CAP88PC and/or measurement of radionuclide air concentrations at critical receptor locations in accordance with 40 *CFR* 61.107(b). USEPA concurrence is required to use environmental measurements to show compliance at receptor locations.

Table 2-3. Summary of Uranium Mill Tailings Radiation Control Act (UMTRCA) Radon Emissions Regulation

Regulation: UMTRCA Radon Emissions		
Regulation	**Description/Standard**	**Implementation**
40 *CFR* 192.02 (b) (ARAR in ROD [USACE 1998a])	Standards for control of residual radioactive materials from inactive uranium processing sites. Outdoor radon measurements to ensure the average annual concentration is ≤0.5 pCi/L at, or in, the air above the site.	Outdoor radon monitoring will be performed at locations in the vicinity of excavation areas accessible to members of the public using radon ATDs as described in 40 *CFR* 61, Appendix B, Method 114, Method A-7.
40 *CFR* 192.12(b) (Proactive Action)	Indoor radon measurements to ensure the average annual (or equivalent) radon decay product concentration (including background) does not exceed 0.02 WL.	Indoor radon monitoring will be conducted in Plant 1 Building 26 and the DT-4 North-South Storage Building using radon ATDs as described in 40 *CFR* 61, Appendix B, Method 114, Method A-7.

Table 2-4. Summary of Regulation for Dose Limits to Individual Members of the Public

Regulation: 10 *CFR* 20.1301 Dose Limits to Individual Members of the Public		
Regulation	**Description/Standard**	**Implementation**
10 *CFR* 20.1301 (BMP)	Total dose limits for individual members of the public shall not exceed 100 mrem/year, exclusive of the dose contributions from background radiation.	Compliance with this standard will be demonstrated using a combination of TLDs, ATDs, and air samples for particulate radionuclides. At Mallinckrodt and the VPs, air particulate monitoring will be conducted at excavation perimeters in areas accessible to members of the public. The summation of the doses calculated from the results of monitoring with TLDs, ATDs, and particulate air samples will be used to demonstrate compliance with the 100 mrem/year criterion. The dose contribution from water pathways is negligible and is not considered when calculating total effective dose equivalent (TEDE) to the critical receptor. Dose from the fence line (boundary of unrestricted area) or other monitoring locations to critical receptors will be modeled to maximally exposed receptor locations in accordance with 10 *CFR* 20.1302(b)(1) to demonstrate compliance with the dose limit in 10 *CFR* 20.1301.

2.2.2 Guidelines for Excavation-Water Data

The Metropolitan St. Louis Sewer District (MSD) has issued discharge authorization letters for the SLDS that establish discharge-limit-based criteria (MSD 1998, 2001, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018). The pollutants addressed for the SLDS are identified in Table 2-5. These discharge limits will be used as a guideline for storm-water and excavation-water monitoring data obtained under this EMICY and reported in the annual EMDAR. For cases in which the governing authorities have not provided discharge limits for SLDS radiological contaminants of concern (COCs), the 10 *CFR* 20, Appendix B, water effluent values have been provided. These values are used as a basis to improve water management and calculate the sum of ratios (SOR) value. Copies of the MSD discharge authorization letters are included in Appendix A of this EMICY.

Table 2-5. SLDS MSD Discharge Limits and 10 *CFR* 20, Appendix B, Values

Constituent	SLDS Discharge-Limit-Based Criteria MSD[a]	10 *CFR* 20, Appendix B, Table 3, Sewer Release Values
Radiochemical Parameters		
Ra-226[b]	10 pCi/L	600 pCi/L
Ra-228[b]	30 pCi/L	600 pCi/L
Thorium (Th)-228[b]	2,000 pCi/L	2,000 pCi/L
Th-230[b]	1,000 pCi/L	1,000 pCi/L
Th-232[b]	Not Required	300 pCi/L
Uranium (U)-234	3,000 pCi/L	3,000 pCi/L
U-235	3,000 pCi/L	3,000 pCi/L
U-238	3,000 pCi/L	3,000 pCi/L
Total U (kinetic phosphorescence analysis ([KPA])[b]	Not Required	3,000 pCi/L
Gross Alpha (raw water)	3,000 pCi/L	No Value Listed
Gross Beta	No Value Listed	No Value Listed
SOR	1.0	1.0
Total Activity	25 mCi per year	No Value Listed
Other Parameters		
Total Suspended Solids (TSS)	No Value Listed	No Value Listed
Total Volume Discharged	100,000 gallons/24-hour period	No Value Listed

[a] SLDS – MSD Discharge authorization letter dated 10/30/98 from the MSD to IT Corporation, as modified in MSD letter issued 07/23/01. The first two batches in each new investigation/plant area will require a full suite analysis. Subsequent batches require total U KPA, gross alpha, gross beta, and TSS (MSD 1998, 2001).

[b] These evaluation parameters are used to calculate the SOR value when sampling for discharge and aid in establishing water management protocols.

2.2.3 Guidelines for Ground-Water Data

The ROD states that the goal of the ground-water portion of the selected remedy is to maintain protection of the potentially usable ground water (hydrostratigraphic unit [HU]-B, referred to as the Mississippi Alluvial Aquifer) and that HU-A is not considered a potentially usable ground-water source. The ROD further states that sources of soil contamination within HU-A will be removed and water that must be managed as part of the excavation will be treated and appropriately disposed. HU-A is the upper HU that consists of fill and naturally deposited clays and silts.

Monitoring of HU-A ground water will be conducted to ensure protectiveness of the final remedy and to verify that ground-water conditions do not degrade. A trend analysis will be performed on select wells based on their historical data to determine if any significant effects to ground water result from the RA.

Monitoring of HU-B ground water will be conducted to verify COCs have no significant impacts on the Mississippi Alluvial Aquifer (HU-B). Monitoring will be conducted during and after soil removal. Ground-water sampling results will be compared to the investigative limits (ILs) established in the ROD (Table 2-6). A trend analysis, such as the Mann-Kendall Trend Test, will be performed on wells that meet certain conditions based on their historical data to determine if the soil RA has any significant effects on ground water. The data and results of the trend analyses for both HU-A and HU-B will be reported in the annual EMDAR.

Table 2-6. Guidelines for Ground Water at the SLDS

Analyte Type	COC[a]	ILs[b]
Inorganics (µg/L)	Arsenic	50
	Cadmium	5
Radionuclides	Ra-226	5 pCi/L[c]
	Total U	20 µg/L

[a] Based on the ground-water COCs as listed in the ROD (USACE 1998a).

[b] Source: ROD (USACE 1998a).

[c] The 5 pCi/L combined Ra-226/Ra-228 concentration limit from 40 *CFR* 192.02, Subpart A, Table 1, which is for comparative evaluation.

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3.0 ENVIRONMENTAL MONITORING ACTIVITIES FOR CY 2020

This section describes the periodic sampling and analysis selected for CY 2020 to achieve the objectives of the EMP, including the monitoring locations, frequencies, and analytes of concern. These activities will be implemented in conjunction with the program objectives defined in the EMG and program protocols described in the SAG. Details of the specific monitoring and analytical protocols necessary for field implementation are provided in the SAG. Characterization efforts, monitoring to support treatability studies, and RA confirmation sampling are considered non-periodic monitoring activities. Non-periodic monitoring activities are outside the scope of the EMICY and are implemented through issuance of work descriptions or other implementation plans and are not described herein.

3.1 AIR MONITORING AND DIRECT GAMMA RADIATION MONITORING

3.1.1 Rationales and Objectives for Air and Direct Gamma Radiation Monitoring

Objectives for air and direct gamma radiation monitoring are identified as follows:

- provide surveillance of public exposure routes through sampling and analysis;
- verify compliance with regulations;
- provide indication and methods to quantify release of radioactive materials from the site; and
- characterize trends in environmental radiation measurements, especially as they are affected by site RAs.

Measurement objectives to meet regulatory requirements are identified as follows:

- calculate the total effective dose equivalent (TEDE) to hypothetical maximally exposed members of the public from all complete and applicable pathways;
- calculate the effective dose equivalent from airborne particulate emissions (exclusive of radon) to the hypothetical maximally exposed member of the public;
- calculate outdoor radon concentrations at the fence line and/or at locations in the vicinity of excavation areas accessible to members of the public;
- proactively monitor indoor air for radon progeny concentrations (or equivalent) in occupied or habitable buildings where Ra-226 subsurface concentrations exceed 15 pCi/g; and
- determine background values for the parameters of concern at off-site locations.

TLDs, ATDs, and particulate air filters will be used in various combinations at the SLDS to monitor gamma exposure levels, radon, and airborne particulate radionuclide emissions (exclusive of radon). Data from these measurements will be converted into an effective dose equivalent. In compliance with regulatory requirements, an annual NESHAP report will be submitted to the USEPA.

3.1.2 Monitoring Locations

Monitoring locations for TLDs and ATDs at the SLDS are shown on Figure 3-1. Three new outdoor TLD and ATD monitoring locations (DA-10, DA-11, and DA-12) were established and two (DA-2 and DA-7) were removed for CY 2020. Figure 3-2 provides the location of the SLS background gamma radiation, radon, and particulate air sampling stations. The type, frequency, and location of air particulate, radon, and gamma radiation monitoring are identified in Table 3-1.

The SLS background sampling results are assumed to be representative of the entire St. Louis metropolitan area, including the SLDS.

Table 3-1. Air Particulate, Radon, and Gamma Radiation Monitoring

Site	Parameters	Media/ Sample Type	Number of Monitoring Locations	Frequency	Driver/Purpose[a]
Mallinckrodt and VPs	External gamma radiation	TLD	6	Quarterly	EMP – public exposure
	Radon and progeny	ATD	6	Semi-annually	EMP – public exposure
	Particulate radionuclides	Filter	Varies[b]	During active excavations and loadout	EMP – NESHAP/public exposure
ISOU Buildings[c]	Radon and progeny	ATD	2	Semi-annually	EMP – UMTRCA/public exposure
Background	External gamma radiation	TLD	1	Quarterly	EMP – public exposure
	Radon and progeny	ATD	1	Semi-annually	EMP – public exposure
	Particulate radionuclides	Filter	1	Weekly	EMP – NESHAP/public exposure

[a] Public exposure monitoring requirements: 40 *CFR* 61, Subpart I; 10 *CFR* 20.1301; and 40 *CFR* 192.02. Fence-line (or other appropriate monitoring location) levels and/or concentrations are used to calculate TEDE to the hypothetical maximally exposed critical receptor from the site.
[b] The environmental remedial action contractor (RAC) conducts particulate air sampling at appropriate locations around active excavations and at loadout areas. These data are used for NESHAP and public exposure evaluations.
[c] The monitored ISOU buildings include Plant 1 Building 26 and the DT-4 North-South Storage Building.

External Gamma Monitoring

The TLDs will be used to measure direct gamma exposure from background and residual radioactivity at the SLDS. TLD locations at the SLDS will be in the vicinity of excavation areas and/or representative of areas accessible to the public (including Mallinckrodt employees, who are not occupationally monitored for radiation exposure). Placement of TLDs in areas immediately surrounding Plant 5 will be avoided due to non-Manhattan Engineer District (MED)/AEC columbium and tantalum (C-T) processing. The QC TLDs will include transit control samples and duplicates. The purpose of the transit control samples will be to evaluate the exposure received during transit, while the duplicates will be used to evaluate measurement (field) precision.

A background monitoring location has been selected to measure the background gamma exposure rate. The background TLD monitoring station is currently located at the USACE Service Base on Arsenal Street (see Figure 3-2).

Outdoor Radon Monitoring

The ATDs will be used to measure alpha particle emissions from radon (primarily Rn-222) and its associated decay products. The radon emissions are expected to increase during RAs such as excavation of soil. The ATD results are reported as Rn-222 air concentrations in pCi/L and are then converted to dose equivalent.

Locations were chosen with consideration given to predominant wind direction and sources of contamination. Southerly winds predominate from March through November, and northwesterly winds predominate from December through February (Windfinder 2019). The locations were selected in the vicinity of excavations and areas accessible to members of the public at the SLDS. The ATDs will be co-located with the TLDs. The ATD background location is currently co-located with the background TLD at the USACE Service Base on Arsenal Street (see Figure 3-2).

Indoor Radon Monitoring

One ATD will be located in Plant 1 Building 26, and one ATD will be located in the southwestern corner of the DT-4 North-South Storage Building. The ATDs will be located in areas that represent the highest likely exposure from indoor radon. The indoor radon monitoring locations are shown on Figure 3-1. Locations have been identified with consideration given to known Ra-226 concentrations under the buildings and personnel occupancy time at any one location within each building. Background indoor radon monitors are not necessary because the regulatory standard of 0.02 WL includes background.

Particulate Air Monitoring

Particulate air samplers will be located around active excavation and loadout areas accessible to members of the public at the SLDS. Air samplers will be placed between the airborne source and areas accessible to members of the public during work activities that disturb soils and have the potential to generate airborne particulates. The locations of these air samplers will be downwind of the work activities. Airborne particulate radionuclide samples will be collected and subsequently analyzed for relevant radionuclides and/or gross alpha and gross beta activity.

The particulate air monitoring stations are expected to be affected mainly during periods of RA when the greatest potential for generation of airborne particulate radionuclide emissions exists. Additional particulate air samplers will be placed around the perimeters of active work zones during RAs. The background air particulate station is currently co-located with the background TLD and ATD stations at the USACE Service Base on Arsenal Street (see Figure 3-2).

3.1.3 Monitoring Frequency

Detectors will remain in place to continuously monitor the environment at the sample locations. The TLDs will be replaced and analyzed every quarter. Radon ATDs (indoor and outdoor) will be replaced and analyzed every 6 months. Particulate air samplers will operate continuously during active excavation and loadout, with samples typically being collected weekly but possibly more frequently because of operational considerations such as dust loading on the filters, which can reduce the sample flow. The number of samples/measurements and the frequency are identified in Table 3-1.

3.1.4 Field and Laboratory Analyses

Selection of the various monitoring parameters was based on the regulatory requirements with consideration of the radionuclides and their concentrations at the SLDS. The following sections summarize the rationales for analytes and the analysis methods.

Rationale for Analytes

The radionuclides found at the SLDS are mainly uranium (U)-series nuclides. Each SLDS property has radionuclides in the U-series that may be predominant (such as Ra-226, thorium [Th]-230, or U-238); thus, each radionuclide must be assessed separately. Some properties at the SLDS show higher concentrations of Ra-226, Th-230, or U-238. The relative concentration levels for individual radionuclides can be found in the *Feasibility Study for the St. Louis Downtown Site, St. Louis, Missouri* (USACE 1998b). Therefore, previous soil sampling results from each monitoring site have been used to determine source concentration ratios of the individual radionuclides for use in evaluating gross alpha and gross beta air particulate sampling results. Additionally, radon is a component of the U-series nuclides, and many radionuclides at the SLDS emit gamma radiation.

Analysis Methods

Details regarding the analytical testing methods to be used for analysis of TLDs, ATDs, and particulate radionuclide air samples are presented in the SAG. Analysis of the various media will be accomplished with qualified laboratories or through analysis at the U.S. Department of Defense (DOD) Environmental Laboratory Accreditation Program (ELAP)-accredited USACE St. Louis District FUSRAP Radioanalytical Laboratory using the laboratory QA plan and standard operating and analysis procedures.

A summary of the type of radiological samples, analysis methods, and target detection levels for the proposed radiological sampling in CY 2020 is provided in Table 3-2. Justification for the detection levels is based in part on the capabilities of the instrumentation and in part on meeting a lower value than the desired regulatory standard.

Table 3-2. Summary of Laboratory Analysis Methods and Target Detection Levels

Detector/Sample Medium	Analytes Measured	Analysis Method	Target Detection Levels
TLD	Direct external gamma exposure from residual contamination and background	Processed by a qualified vendor	0.1 mrem/quarter
ATD	Airborne Rn-222 and alpha-emitting progeny that originate from Ra-226	40 *CFR* 61, Appendix B, Method 114, Method A-7, Rn-222 ATDs detectors	0.2 pCi/L
Particulate Air Filter	Airborne particulate radionuclides: gross alpha and gross beta	40 *CFR* 61 Appendix B, Method 114, Method A-4, Direct Alpha Counting, and Method B-4, Gross Beta Counting	3E-15 μCi/mL (gross alpha)[a] 2E-11 μCi/mL (gross beta)[b]

[a] Based on 10 percent of the 10 CFR 20 Appendix B Air Effluent value for Class Y Th-230.

[b] Based on 10 percent of the 10 CFR 20 Appendix B Air Effluent value for Class Y Th-234 (Th-234 is a beta emitter in secular equilibrium with U-238).

The TLD target detection level of 0.1 mrem per quarter is approximately 0.3 percent of the annual background dose equivalent rate from external exposure and well below the regulatory limit for members of the public of 100 mrem per year.

The ATD target detection level of 0.2 pCi/L is the level achievable at a qualified vendor laboratory. This level is below the 0.5 pCi/L standard contained in 40 *CFR* 192, Subpart A, for locations outside a site.

A radon progeny level of 0.02 WL is equivalent to a radon concentration of 4.0 pCi/L when radon is in 50 percent equilibrium with its progeny. In an indoor environment, radon is expected to be in approximately 50 percent equilibrium with its progeny. Therefore, the 0.2 pCi/L target detection limit for indoor radon is adequate as compared to 4.0 pCi/L.

The detection level concentrations for uranium and thorium isotopes in particulate air samples are based on three analytical methods found in 40 *CFR* 61, Appendix B, Method 114. Because radionuclide-specific concentrations have already been established, Method A-4, direct alpha counting (gross alpha determination), and Method B-4, direct beta counting (gross beta determination), will be used to routinely evaluate activity levels of samples. These methods will determine alpha activity of the sample without extraction and separation of isotopes. Detection levels of 3E-15 μCi/mL for gross alpha and the detection level of 2E-11 μCi/mL for gross beta will provide adequate minimum detection levels for dose assessment estimates. Method G-1,

high-resolution gamma spectroscopy, will be used as needed to evaluate samples on a case-by-case basis at the qualified vendor laboratory.

3.1.5 Field Quality Control Samples

Two types of QC samples will be collected or used during direct gamma radiation monitoring and environmental radon air monitoring. The types of QC samples include duplicates and transit control samples.

QC Duplicates

Duplicate samples or measurements will be collected using the same protocol and procedures used for obtaining the initial samples and measurements. Duplicate samples/measurements are used to evaluate the field precision of the sampling and measurement process. Duplicate analysis of the same measurement device may be performed at the laboratory to evaluate the reproducibility of the counting technique.

At least one duplicate TLD will be designated at the SLDS for QC purposes. Duplicate TLDs will be installed, collected, and analyzed at the same time as the sample TLD at that location.

At least one duplicate radon ATD will be designated at the SLDS for QC purposes. Duplicate ATDs will be placed, collected, and analyzed at the same time as the actual sample at that location.

Transit Control Samples

TLD transit control samples will be used to evaluate the integrated dose to the dosimeter when the dosimeters are not in the monitoring locations. These transit control samples will measure the dose while the dosimeters are in storage and in transit to the processing laboratory.

3.1.6 Equipment and Sampling Methods

3.1.6.1 Equipment

The following sections describe the types of detectors that will be used to quantify radioactive emissions from the SLDS. The types of detectors and/or sample collection devices include TLDs, ATDs, and airborne particulate samplers.

External Gamma Monitoring

External gamma exposure rates are measured using environmental TLDs (aluminum oxide) housed in polyvinyl chloride (PVC) holders/shelters positioned in the vicinity of excavation areas accessible to members of the public at the SLDS. Each TLD measures a cumulative dose over the period of exposure and is expressed in mrem per quarter. The measurements must be corrected for shelter absorption, background, fading, and time of exposure to normalize the measurement to exactly one quarter of exposure.

When exposed to gamma radiation, the TLD stores a portion of the energy. When the TLD is heated, the stored energy is emitted as light that can be amplified, measured, and used to calculate dose equivalent. The TLD shelters are located approximately 3 ft above the ground surface at all monitoring locations.

Indoor and Outdoor Radon Monitoring

Rn-222 gas concentrations are measured using ATDs that are designed to record alpha emissions within the sensitive element of the detector. These detectors contain film that, when exposed to alpha particles from the radioactive decay of radon, create submicron damage tracks on the film. After exposure, the detectors are returned to the manufacturer for processing. The film is placed in

a caustic etching solution that amplifies the damage tracks, which are counted using a microscope or automated counting system. The number of tracks per unit area is correlated to the radon concentration in the air. ATDs are purchased from various USEPA-approved manufacturers.

Particulate Air Monitoring

Airborne particulate samplers provide a means to collect particulate radionuclides from the ambient air. Low-volume air pumps, with typical flow rates of 30 to 50 liters per minute draw ambient air through a 0.45-micron particulate filter. The filter has a high efficiency for removal of submicron particles. The air pumps are equipped with calibrated measurement devices (i.e., rotameters) to monitor air flow rates. Air flow rates can also be measured externally with portable rotameters. Average flow rates are calculated using before/after sample loading data. At the end of the sample period, the filters are removed from the housing and sent to a laboratory for analyses.

3.1.6.2 Sampling Methods

The following section describes the field sampling methods for direct gamma radiation and air monitoring at the SLDS. This description is not intended to replace the detailed guidance contained in project instruction guides. The chain-of-custody protocols, sample labeling, identification and shipment procedures, and field logbooks/documentation described in the SAG are applicable to each of the following sampling methods.

External Gamma Monitoring

TLDs will be placed in each ambient-air monitoring station at the beginning of each monitoring period. These TLDs will be replaced and analyzed after approximately 3 months. The location, date of installation, and date of removal for each detector will be logged. A control/background TLD will accompany the exposed dosimeter during shipment to detect any exposure incurred by the dosimeter during shipment.

Indoor and Outdoor Radon Monitoring

Unexposed, preassembled detectors packaged in sealed foil will remain sealed until they are placed in the detector housings. At the time of deployment, the location, date, and type of detector will be recorded. The new, unexposed detector will be placed in the detector housing with the air inlet holes unobstructed. At the end of the exposure period (approximately 6 months), a self-adhering circular seal (available from the manufacturer) will be placed on the exposed detector, covering the air inlet holes. The seals are used to prevent further exposure of the detector from radon or thoron during transport to the laboratory. The removal date will be logged. The exposed detectors will then be packaged in resealable plastic storage bags and submitted to the laboratory.

Particulate Air Monitoring

Siting of the particulate monitoring stations around active excavation and loadout areas accessible to the public is done carefully, so appropriate measurements of particulate concentrations in an area are collected. Typically, at least one air monitoring location should be located downwind of work activities.

Data collection will consist of logging the sample location, start date, time of sample filter deployment, and the initial flow rate of the air pump. At the end of the sampling period, the stop date, time of sample collection, and final flow rate of the air pump will be logged. If the initial air flow rate is different than the final flow rate, the average of the two values will be used to

determine the total flow volume over the sampling period. Calibrated rotameters will be used to establish initial and final flow rates. Rotameters will be calibrated on an annual basis.

As the filter is removed from the filter housing, care will be taken not to disturb the collected particulate. The filter will be placed in a suitable container such that sample integrity is not lost during transport to the laboratory.

The length of time between filter change-out can vary depending on the activities at the site. For example, if no RAs are being conducted, weekly filter change-out is recommended. However, during RAs, more dust could be generated, requiring more frequent filter change-out.

3.1.6.3 Field QC Sampling Procedures

Duplicate samples will be collected in association with the TLD and ATD measurements. Duplicates will be collected using the same equipment and sampling methods as defined in Section 3.1.6.2.

3.1.6.4 Field Decontamination

The sampling techniques described previously consist of one-time-use/dedicated sampling media. Therefore, field decontamination is not required for the samples obtained for direct radiation exposure and air (radon and air particulate) monitoring equipment.

3.2 EXCAVATION-WATER DISCHARGE MONITORING

Excavation-water monitoring is considered a principal component of the EMICY for the SLDS. RAs at the site could result in discharges that are covered under MSD discharge requirements. Monitoring will be conducted to meet permit or ROD conditions. Parameters for the SLDS are listed in Table 3-3, along with sampling locations and sampling frequencies. The purpose of excavation-water discharge sampling is to meet requirements set forth in the MSD discharge authorization letter dated October 30, 1998, and modified in letters dated July 23, 2001; October 13, 2004; June 19, 2006; May 22, 2008; May 10, 2010; May 24, 2012; June 23, 2014; July 18, 2016; and July 11, 2018, for the SLDS (MSD 1998, 2001, 2004, 2006, 2008, 2010, 2012, 2014, 2016, 2018). Copies of these letters are included in Appendix A.

Objectives for the SLDS

SLDS excavation-water discharge monitoring is conducted in accordance with the MSD authorization letter dated October 30, 1998, and revised in letters dated July 23, 2001; October 13, 2004; June 19, 2006; May 22, 2008; May 10, 2010; May 24, 2012; June 23, 2014; July 18, 2016; and July 11, 2018. The current MSD authorization letter will expire on July 23, 2020, and will be renewed prior to that date (MSD 2018). The excavation water is storm water and ground water that accumulates in excavations at the SLDS. Excavation-water discharge results from work-related RAs such as dewatering of soil excavations and equipment decontamination. The excavation-water discharge locations for the SLDS are shown on Figure 3-3.

Table 3-3. Excavation-Water Monitoring Locations, Frequencies, and Parameters

Site	Monitoring Location	Sample ID/Outfall	Media/ Sample Type	Frequency	Parameters	Driver/ Purpose	Status	Comments
SLDS	MSD Sewer	MSD Inlet 17D4-353C[a]	Runoff/ ground water, excavation water, or treated ground water	Per Batch	Various[b]	MSD	Active	Sampling is batch-dependent and, therefore, conducted on a non-routine basis. MSD discharge authorization letter dated October 30, 1998; and letters revised July 23, 2001; October 13, 2004; June 19, 2006; May 22, 2008; May 10, 2010; May 24, 2012; June 23, 2014; July 18, 2016; and July 11, 2018.

[a] MSD Inlet 17D4-353C is the primary discharge location; however, inlets 17D3-014S, 17D3-017C, 17D3-019C, 17D3-022C, 17D4-331C, 17D4-333C, 17D4-334C, 18D1-192C, 18D1-393C, 18D1-413C, 18D1-417C, and 18D1-657 may also be used.

[b] Per the 10/30/98 and 07/23/01 MSD letters, effluent must be tested for pH, suspended solids, chemical oxygen demand (COD) and total metal parameters having numeric limits in Ordinance 8472, Article V, Section 2B. Also identified are volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), gross alpha radioactivity, gross beta radioactivity, Ra-226, Ra-228, Th-230, Th-232, U-235, and U-238.

3.3 GROUND-WATER MONITORING

3.3.1 Objectives for Ground-Water Monitoring

Ground-water monitoring at the SLDS will be completed to meet various federal and state requirements. The primary objectives and a summary of the hydrogeology of the SLDS are briefly discussed in this section. A detailed description of the geology and hydrogeology of the SLDS can be found in prior environmental documents and the EMG (USACE 1999).

The ground-water monitoring objectives for the SLDS include the following:

- evaluate ground-water contaminant occurrence and migration within the lower HU (HU-B) beneath the SLDS and its downgradient perimeter;
- ensure compliance with ARARs;
- meet the commitments made in the ROD;
- evaluate potential effects on ground-water quality resulting from RA;
- provide data necessary for the CERCLA evaluation process; and
- monitor the potentiometric levels relative to that of the Mississippi River.

Ground water at the SLDS is found within three HUs: the upper soil unit, referred to as HU-A; the lower soil unit, referred to as HU-B; and the limestone bedrock, referred to as HU-C (see Figure 3-4). HU-A is not an aquifer and is not a potential source of drinking water because of insufficient yield, poor natural water quality, and susceptibility to surface-water contaminants because of the industrial setting.

The use of HU-B for a drinking-water resource is highly unlikely for several reasons: the industrial setting of the SLDS, the site's proximity to the Mississippi and Missouri Rivers (i.e., major drinking water supply sources), and the poor natural water quality of HU-B (USACE 1998a). However, HU-B does qualify as a potential source of drinking water under the *Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy* (USEPA 1988).

HU-C would also be an unlikely water supply source, as it is a deeper and less-productive HU (USACE 1998a).

No known drinking-water wells are located in the vicinity of the SLDS. Provisions of St. Louis City Revised Code, Chapter 11.81, explicitly forbid the installation of wells into the subsurface for the purposes of using the ground water as a potable water supply.

The ground-water monitoring well network for the SLDS is identified on Figure 3-5. Since the completion of the EMICY for CY 2019 (USACE 2018), two groundwater monitoring well (DW19RD and DW19RS) were installed to replace the previously decommissioned DW19.

The methodologies used to determine the parameters analyzed for each monitoring well and the appropriate sampling intervals are described on Figures 3-6 and 3-7, respectively. Ground-water sampling parameters for all of the SLDS are listed in Table 3-4. The parameters and intervals may be modified based on a review of data as specified on Figures 3-6 and 3-7. No wells are planned to be decommissioned in CY 2020. However, as the RA progresses, certain wells may require removal.

Table 3-4. Ground-Water Monitoring at the SLDS

Site	Parameter[a]	Driver/Purpose
Mallinckrodt and the VPs	Lists 1, 2, and 3	ROD (USACE 1998a)

[a] The methodologies used to determine the parameters analyzed and the appropriate sampling intervals for each monitoring well are described on Figures 3-6 and 3-7. In addition to the parameters listed here, the USACE may elect to add any parameters identified in the Quality Assurance Project Plan (QAPP) section of the SAG as part of the monitoring (USACE 2000).

Definition for Parameters:

List 1: Radiochemical parameters include actinium (Ac)-227, protactinium (Pa)-231, Ra-226, Ra-228, Th-228, Th-230, Th-232, U-234, U-235, and U-238.

List 2: Arsenic and cadmium are the only metals analyzed at the SLDS.

List 3: Field parameters include pH, specific conductance, oxidation reduction potential, temperature, dissolved oxygen, turbidity, and static water level.

3.3.2 Proposed New Ground-Water Monitoring Wells

No new ground-water monitoring wells are planned at the SLDS in CY 2020. As identified in Section 3.3.1, ground-water monitoring will be completed to meet various federal and state requirements. To accomplish these and other ground-water-related objectives, additional wells or well replacements may need to be installed during CY 2020, should conditions change. Specific objectives that may be considered at the site are:

- identify potential impacts to ground-water quality resulting from RA;
- ensure compliance with ARARs;
- obtain requisite data for CERCLA remedial performance evaluations;
- determine or monitor background water quality;
- ensure an adequate monitoring network is established for potentiometric and ground-water-quality monitoring at each key HU;
- evaluate ground-water contaminant occurrence and migration;
- evaluate the existing monitoring network; and
- replace a decommissioned well.

3.3.3 Rationale for Ground-Water Monitoring

The rationale for the sampling programs established for the SLDS is based on well-analyte history and site-specific requirements and conditions. The rationale for the ground-water monitoring plan correlates with the guidelines identified in Section 2.2.3. At the SLDS, analytes targeted for monitoring include COCs as identified in the ROD (USACE 1998a). Analytes may be added to this list at the discretion of the USACE.

3.3.4 Field and Laboratory Analyses

Based on the results of previous soil and ground-water sampling conducted at the SLDS, categories of known or potential ground-water contaminants have been identified for the site. Based on the identified categories, ground-water samples collected at the site will undergo laboratory analytical analysis for the parameters previously identified in Table 3-4. Details regarding the analytical testing methods to be used for chemical analysis of these ground-water samples are presented in the SAG.

Purging and sampling of ground-water monitoring wells will be accomplished using dedicated bladder-type pumps, non-dedicated electrical submersible or peristaltic pumps, bailers, or similar equipment. Field measurements of static water level, pH, specific conductance, oxidation-reduction potential, temperature, dissolved oxygen, and turbidity will be recorded during purging and sampling activities.

In cases where ground-water recharge into a monitoring well is rapid, ground-water samples will be collected immediately after completion of purging. However, in cases where recharge is slow, ground-water samples will be collected as soon as sufficient ground water is present in the well. If the volume of the ground-water sample collected from a slow-recharge well is not sufficient to perform both field parameter and laboratory analysis, the entire volume of the sample will be used for the laboratory analysis, and field parameter measurements will not be conducted. Ground-water samples collected for analysis of metal, radiological, and water-quality (new wells only) parameters will be collected as unfiltered. The USACE may elect to take both filtered and unfiltered samples at any ground-water monitoring well, particularly at new wells in which the turbidity is greater than 50 NTUs and at existing wells if adverse sampling conditions make it difficult to obtain samples free of sediment.

QA/QC Duplicate and Split Samples

In addition to the sampling conducted for the field measurements and laboratory analysis described previously, duplicate samples and QA split samples will be collected by the USACE during performance of ground-water sampling activities. The monitoring well locations selected for duplicate and split sampling will be random. The exact number of duplicate and split samples collected will depend on the total number of ground-water samples collected during each quarterly sampling event. One duplicate sample and one split sample will be collected for approximately every 20 ground-water samples collected at the SLDS. The duplicate and split samples will be analyzed for the same ground-water parameters as the samples collected in accordance with this EMICY. Additional information regarding field QA/QC sampling requirements and the analytical testing methods to be used for chemical analysis of QA/QC samples is presented in the SAG.

4.0 PROGRAM PROTOCOLS

4.1 ORGANIZATION

The USACE St. Louis District will issue an annual EMICY for each CY that defines the program monitoring requirements for the upcoming year with respect to sampling locations, frequencies, monitoring parameters, and the rationale for their selection. Organizational responsibilities for implementation of the EMICY will correspond to those delineated in the SAG (USACE 2000) or other implementation plans. If non-periodic environmental sampling activities are required to meet CERCLA objectives at the SLDS and if these activities are not discussed in an implementation plan, a work description or final status survey plan that describes the activity-specific requirements will be issued. Each work description or plan will describe responsibilities for its implementation to the extent those roles differ from those specified by the SAG or other implementation guide.

4.2 SAMPLING PROCEDURES

Field sampling procedures for the various media monitored under the EMICY will conform to the requirements specified in the SAG. No unique sampling procedures are required to meet the objectives defined in this annual EMICY.

4.3 SAMPLE MANAGEMENT

Samples collected under this EMICY will be managed in the field as specified in the SAG. Sample container, preservation, and holding-time requirements for samples collected under the EMICY are also specified in the SAG. Sample documentation requirements, which include the sample numbering system, logbook requirements, and sample labels that pertain to samples collected under the EMG, are presented in the SAG. Chain-of-custody requirements for EMICY samples are also specified in the SAG.

4.4 ANALYTICAL PROTOCOLS

Samples collected under this EMICY will be quantified by the methods specified in the SAG. No unique analytical protocols are necessary to meet the objectives identified in this EMICY.

4.5 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

IDW resulting from implementation of this EMICY will be managed in accordance with the requirements of the USEPA *Guide to Management of Investigation-Derived Wastes* (USEPA 1992). The management of IDW generated from various activities at FUSRAP is outlined in Table 4-1.

Table 4-1. Investigation-Derived Waste Management Options

Waste Type	IDW[a]	Generation Process	Management Option[b]
Water	Ground water	Well development Well sampling and/or purging Other characterization activities	Regulated or Suspect (i.e., Resource Conservation and Recovery Act [RCRA]): containerize and place in storage or treat onsite. Non-regulated or non-suspect: Purge water from wells at the SLDS will be disposed of by the RAC.
	Surface water	Characterization activities	Excess surface water is not anticipated from this activity.
	Decontamination water	Decontamination of equipment	Disposition in controlled area such that it will not pond or run offsite or through an outfall.
Soil	Soils and/or sediment	Drill cuttings Soil sampling	Known or suspect contaminated area: place soil in a contaminated soil pile or other designated location. Known or suspect uncontaminated area: backfill location or spread cuttings around sample location.
Waste	Containerized wastes	Sampling	Return unused portion to original source container.
Sample Equipment	Personal protective equipment	Sample activities Other miscellaneous activities	Reusable: decontaminate. Disposable: dispose of with other radiological trash. If used to sample suspect hazardous wastes, segregate and dispose of as directed by task manager or designee.
	Equipment	Sampling equipment Monitoring equipment (swipes, filters, etc.)	Reusable: decontaminate. Disposable: dispose of as radiological trash. If used to sample suspect hazardous wastes, segregate and dispose of as directed by task manager or designee.
Laboratory Wastes	Soil, filter papers, test tubes, other radiological trash, etc.	Analysis	Dispose of as radiological trash. If used to sample suspect hazardous wastes, segregate and dispose of as directed by task manager or designee.
	Acid wastes	Analysis	Neutralize with caustic soda at point of generation and store in a 55-gallon container.
	Other liquid wastes	Analysis Equipment decontamination	Regulated or suspect regulated: neutralize, containerize, and treat (solidify) radium analysis liquid waste (lead) at generation with Quikrete® or equivalent, rendering it non-hazardous. Dispose of as radiological trash. Non-regulated or non-suspect: containerize and store in designated storage area.

[a] Management and disposition of wastes not listed in this table will be evaluated on case-by-case basis following the referenced USEPA guidance.
[b] Options may be modified on case-by-case basis but will follow the USEPA guidance.

5.0 REFERENCES

MSD 1998. Letter dated October 30, 1998. From Bruce H. Litzsinger, Civil Engineer, to Ken Axetel, International Technology Corporation.

MSD 2001. Letter dated July 23, 2001. From Bruce H. Litzsinger, Civil Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: St. Louis Downtown Site, File: IU-Mallinckrodt 21120596-00.

MSD 2004. Letter dated October 13, 2004. From Roland A. Biehl, Environmental Associate Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: St. Louis Downtown Site, File: IU-Mallinckrodt 21120596-00.

MSD 2006. Letter dated June 19, 2006. From Roland A. Biehl, Environmental Associate Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt 21120596-00.

MSD 2008. Letter dated May 22, 2008. From Steven M. Grace, Environmental Assistant Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt 21120596-00.

MSD 2010. Letter dated May 10, 2010. From Steve Grace, Environmental Assistant Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt 21120596-00.

MSD 2012. Letter dated May 24, 2012. From Steve Grace, Environmental Assistant Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt 21120596-00, SP809.

MSD 2014. Letter dated June 23, 2014. From Steve Grace, Environmental Assistant Engineer, to Sharon Cotner, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt 1011728100, SP809.

MSD 2016. Letter dated July 18, 2016. From Steve Grace, Environmental Assistant Engineer, to Bruce Munholand, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt Inc. 1011728100, SP809.

MSD 2018. Letter dated July 11, 2018. From Steve Grace, Environmental Assistant Engineer, to Bruce Munholand, USACE FUSRAP Project Manager. Subject: FUSRAP St. Louis Downtown Site, File: IU-Mallinckrodt Inc. 1011728100, SP809.

USACE 1998a. *Record of Decision for the St. Louis Downtown Site, St. Louis, Missouri*, Final, October 1998.

USACE 1998b. *Feasibility Study for the St. Louis Downtown Site, St. Louis, Missouri*, April 1998.

USACE 1999. *Environmental Monitoring Guide for the St. Louis Sites, St. Louis, Missouri*, Final, December 1999.

USACE 2000. *Sampling and Analysis Guide for the St. Louis Sites, St. Louis, Missouri*, Final, September 2000.

USACE 2018. *Environmental Monitoring Implementation Plan for the St. Louis Downtown Site for Calendar Year 2019, St. Louis, Missouri,* Revision 0, December 20, 2018.

USEPA 1988. *Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy*, Office of Ground-Water Protection, 813R88001, Publication PB95-169603, June 1988.

USEPA 1992. *Guide to Management of Investigation-Derived Wastes*, Publication 9345.3-03FS, April 1992.

Windfinder 2019. https://www.windfinder.com/windstatistics/st_louis_lambert_airport. Accessed October 2019.

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FIGURES

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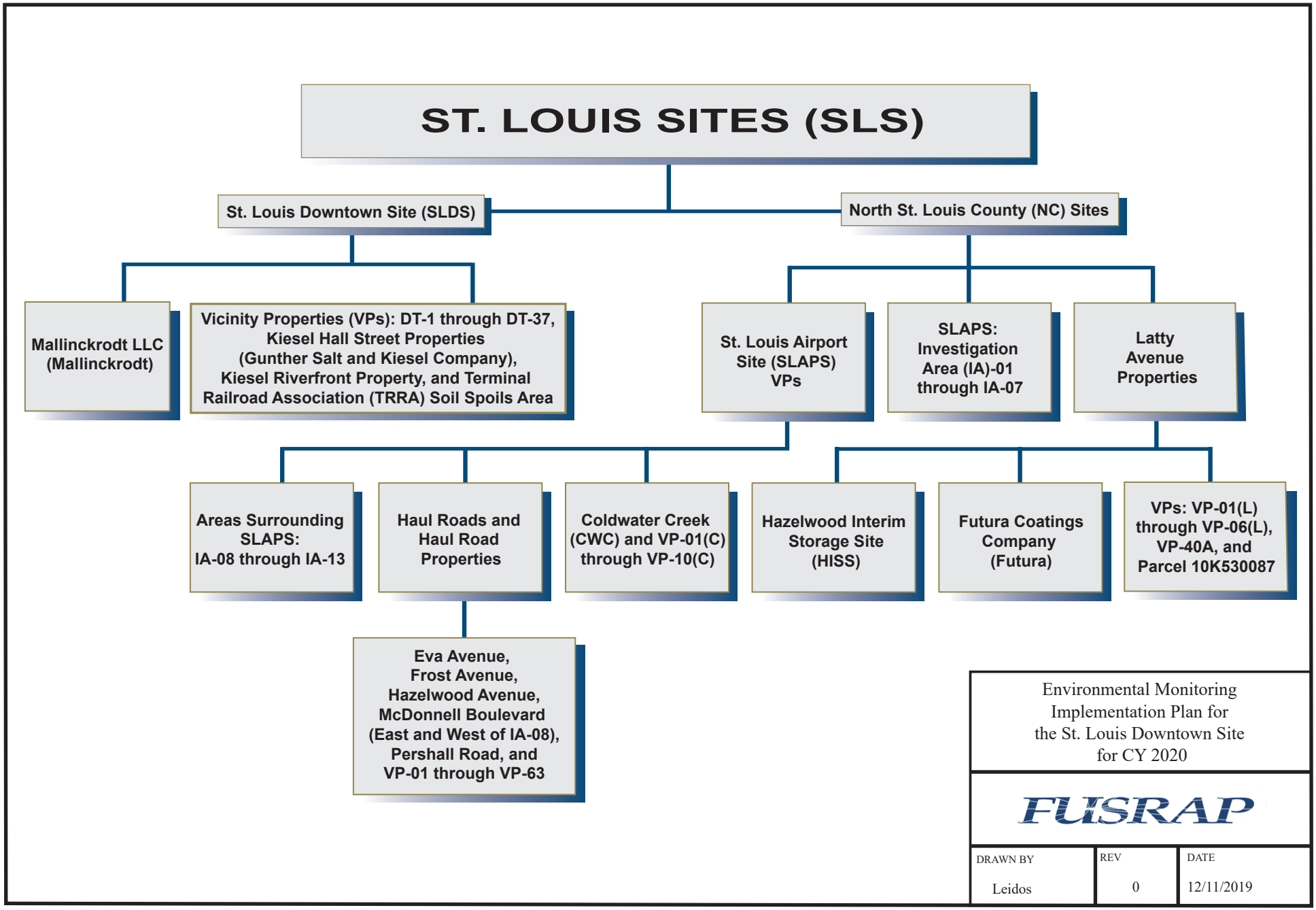


Figure 1-1 Schematic Representation of the FUSRAP SLS

Path: U:\GPS\EMICY\SLDS\CY20\Rev0\Figure 1-2 Plan View of the SLDS.mxd

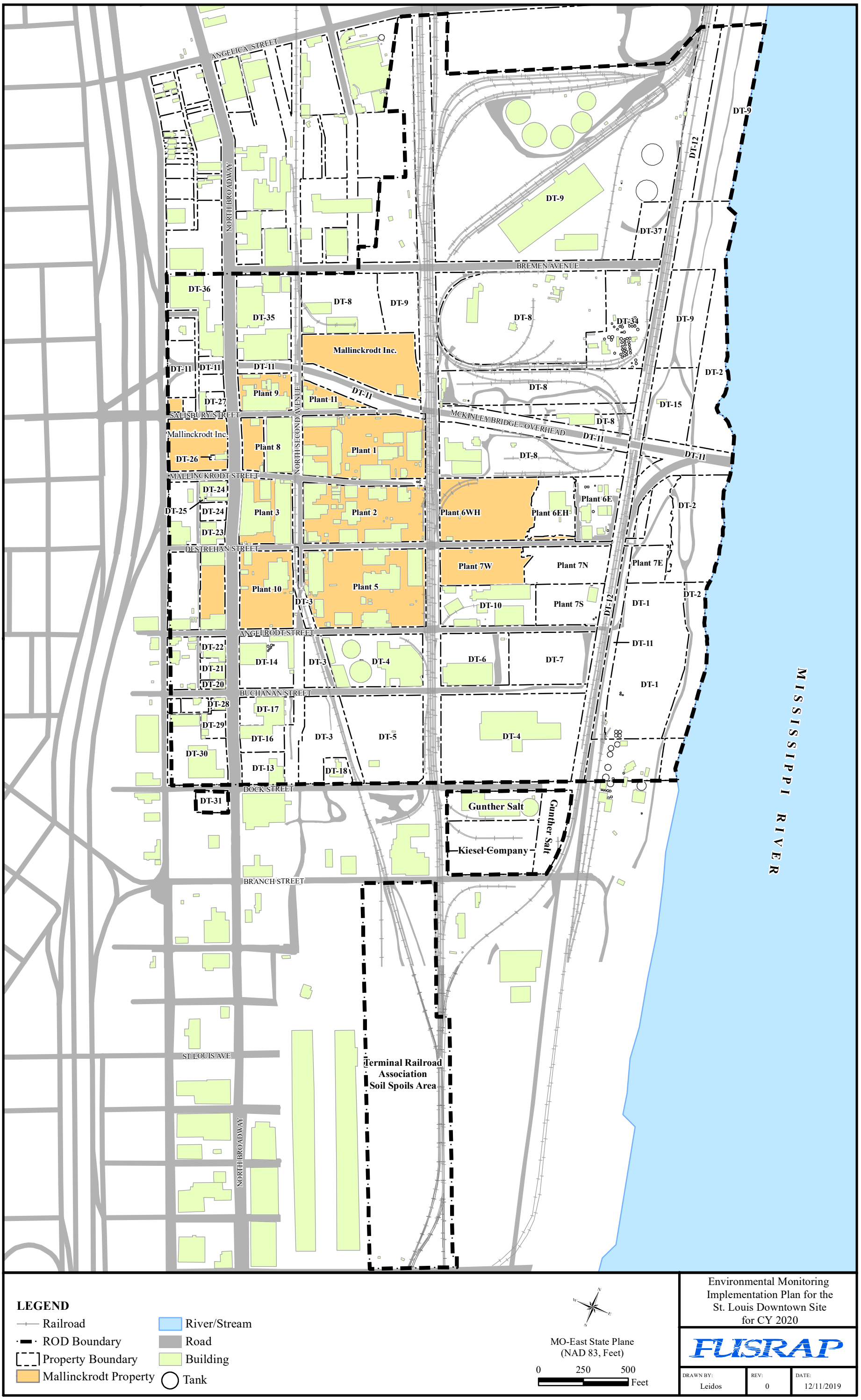


Figure 1-2. Plan View of the SLDS

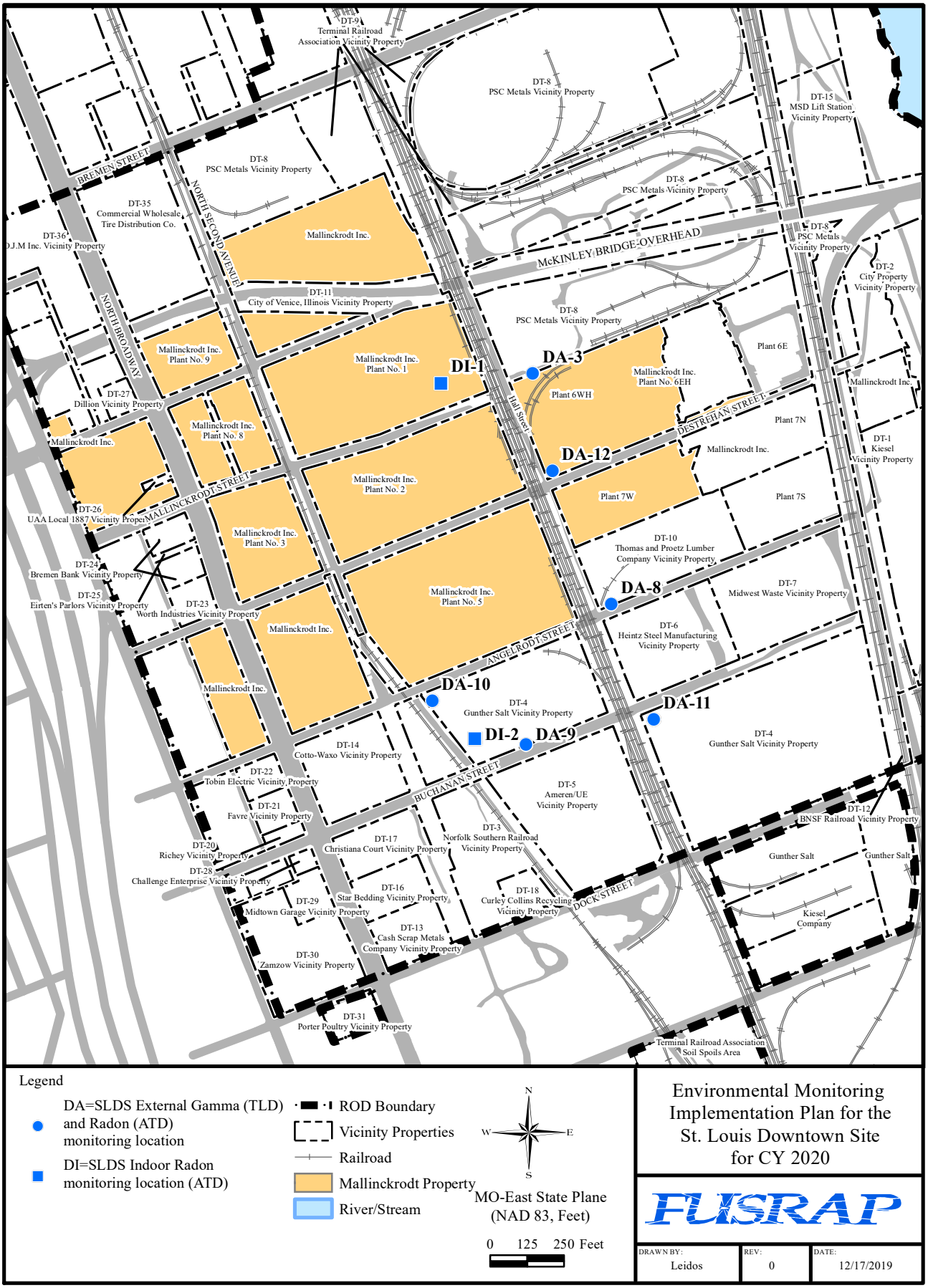


Figure 3-1. Gamma Radiation and Radon Monitoring Locations at the SLDS

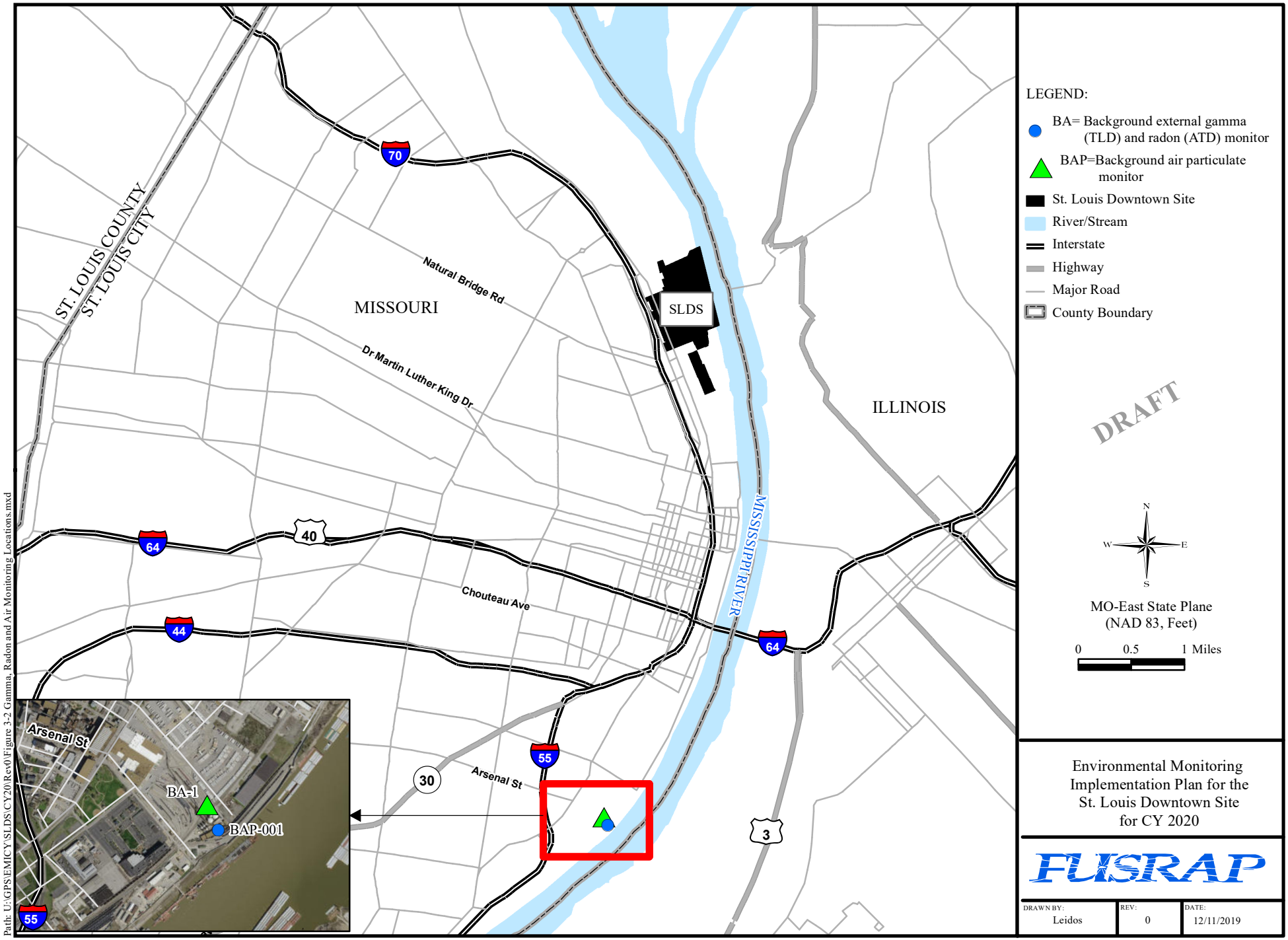


Figure 3-2. Gamma Radiation, Radon, and Particulate Air Monitoring at St. Louis Background Location - USACE Service Base

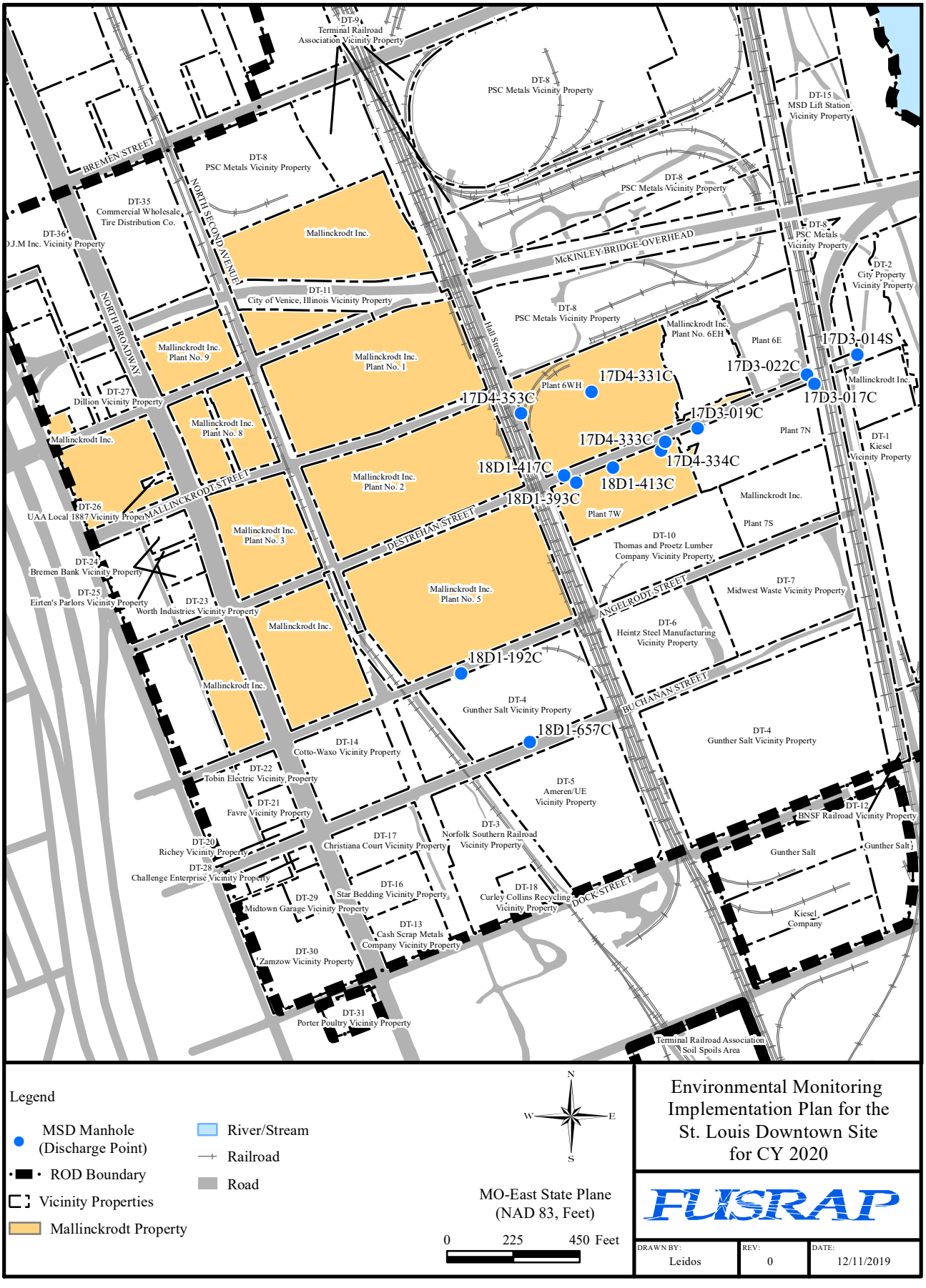
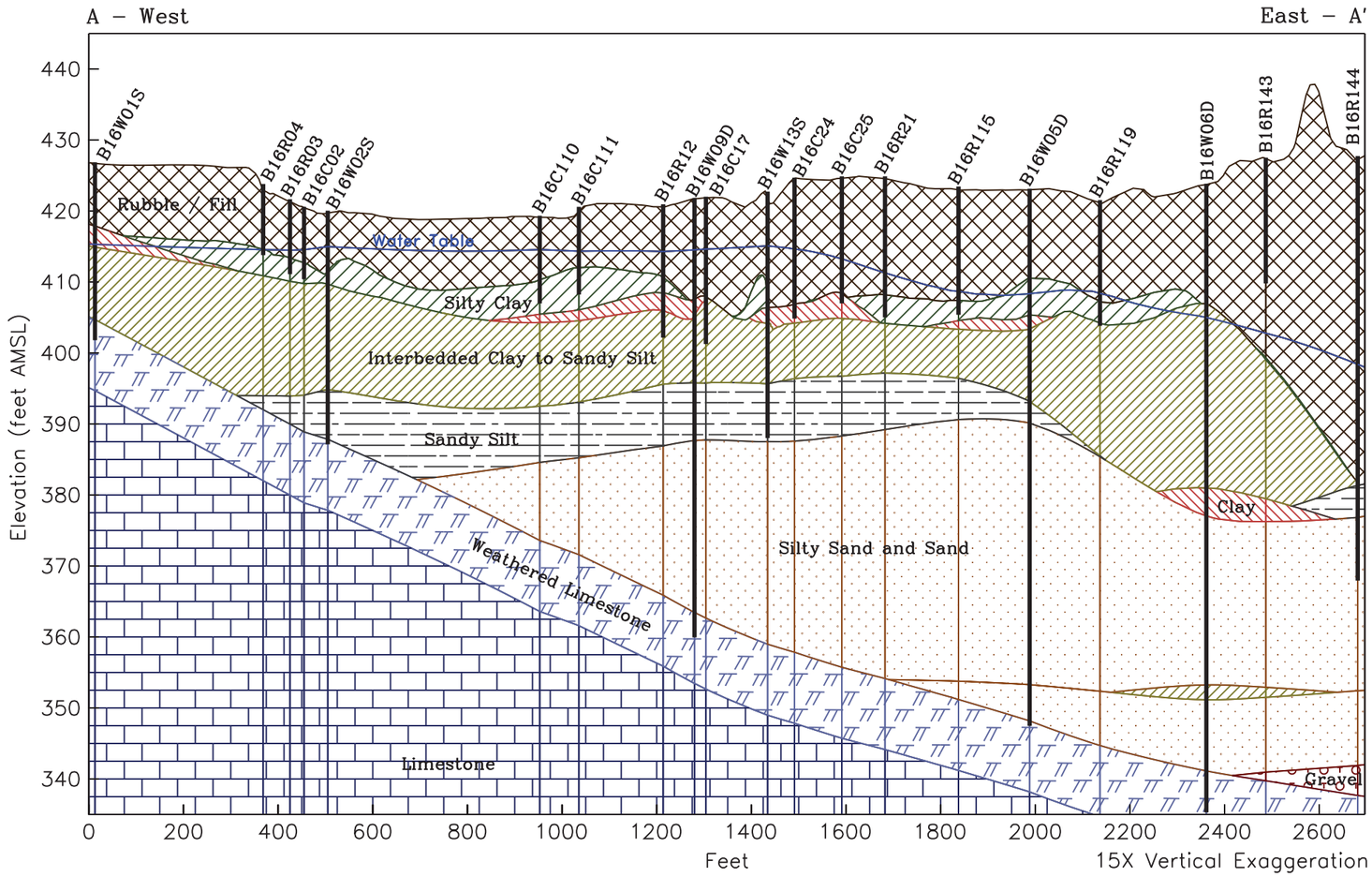


Figure 3-3. MSD Excavation-Water Discharge Points at the SLDS



SLDS Geologic
Cross-Section A-A'

Geologic data used in the cross section collected prior to 1998.

Cross Section Location Map

FUSRAP

Environmental Monitoring
Implementation Plan for the
St. Louis Downtown Site
for CY 2020

Drawn By: R. Smith

Rev. No. - Date: 0 - 11/08/2019

File: SLDSGlg01XSectA.ho

Figure 3-4. SLDS Geologic Cross-Section A-A'

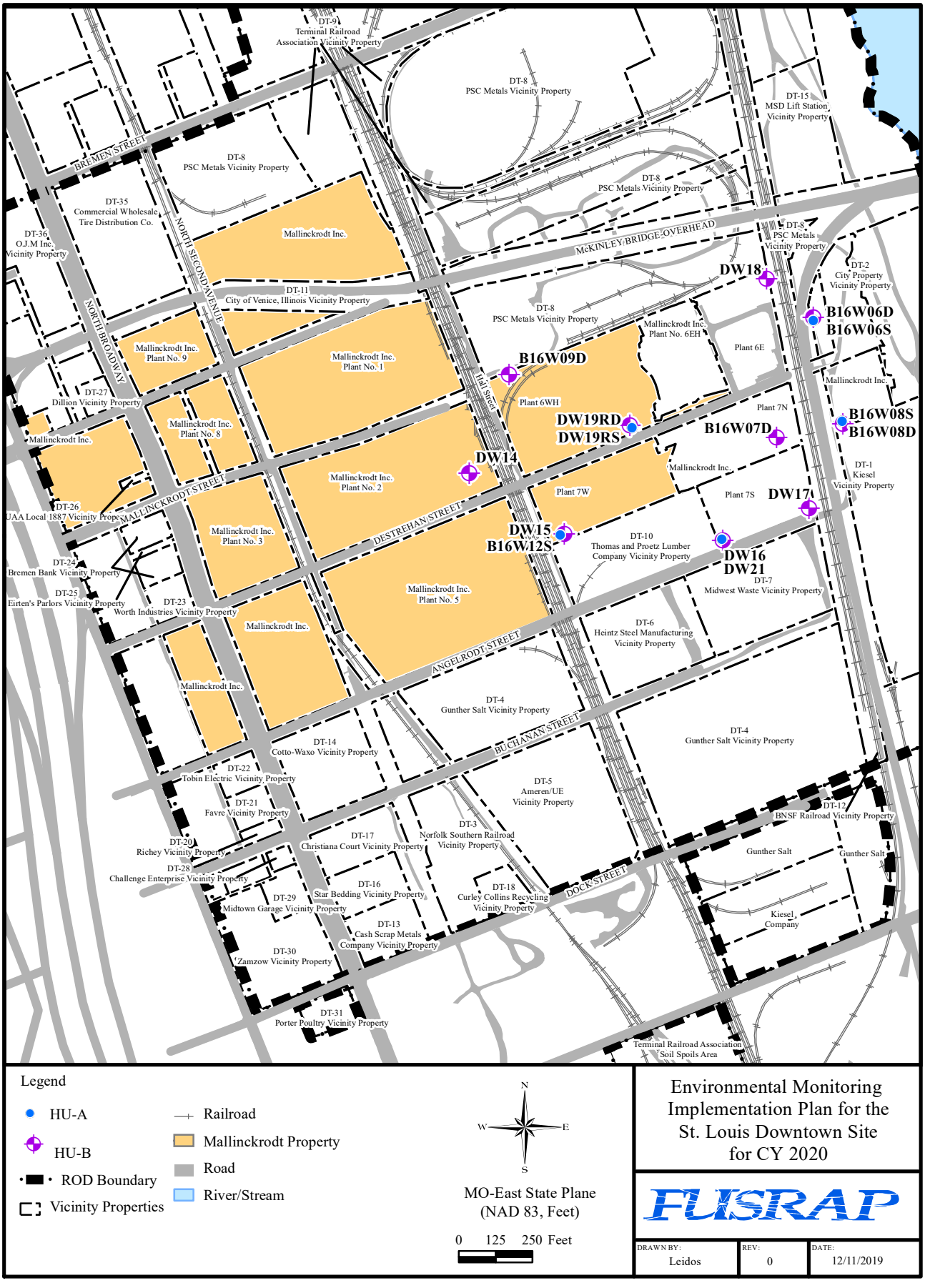
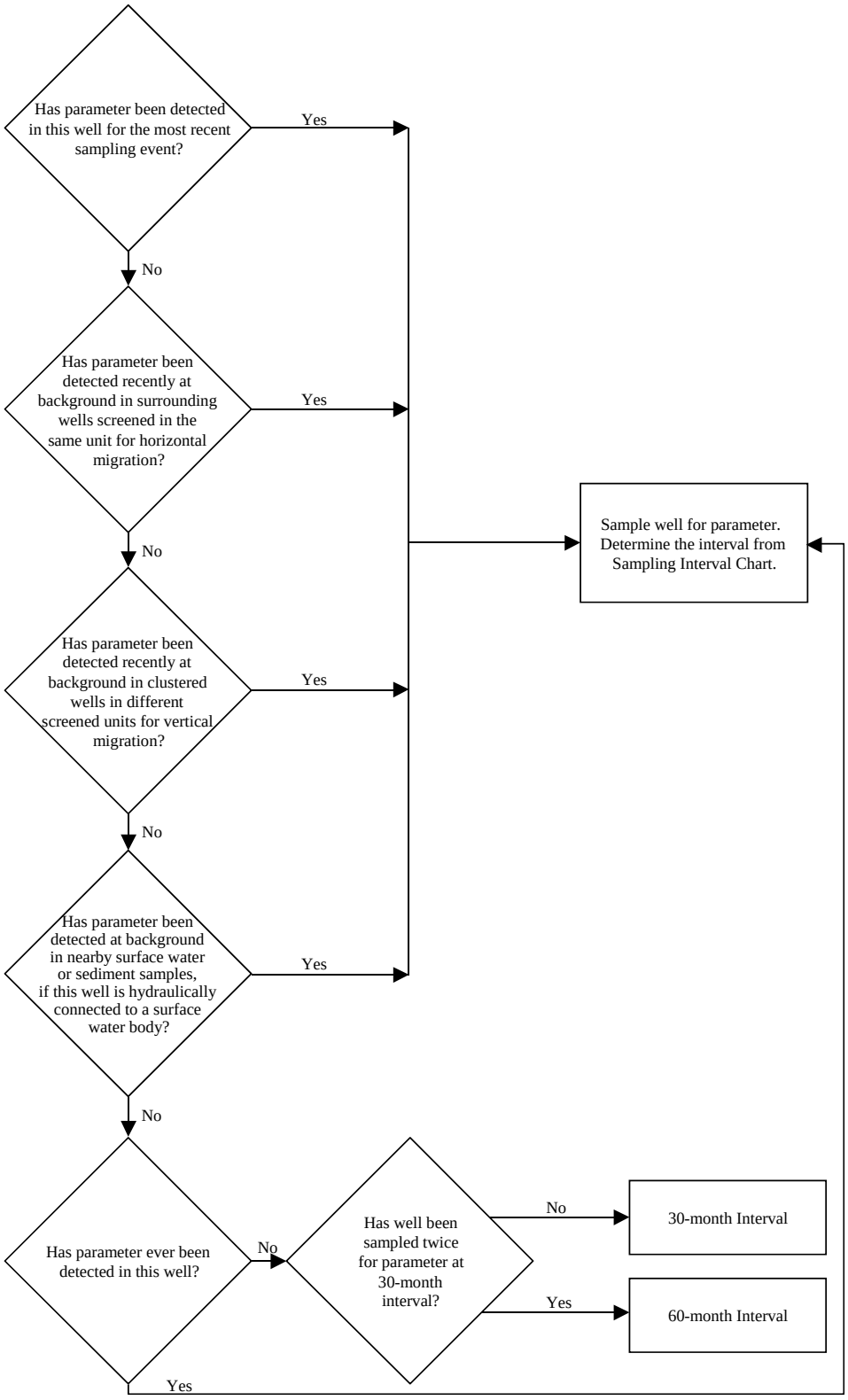
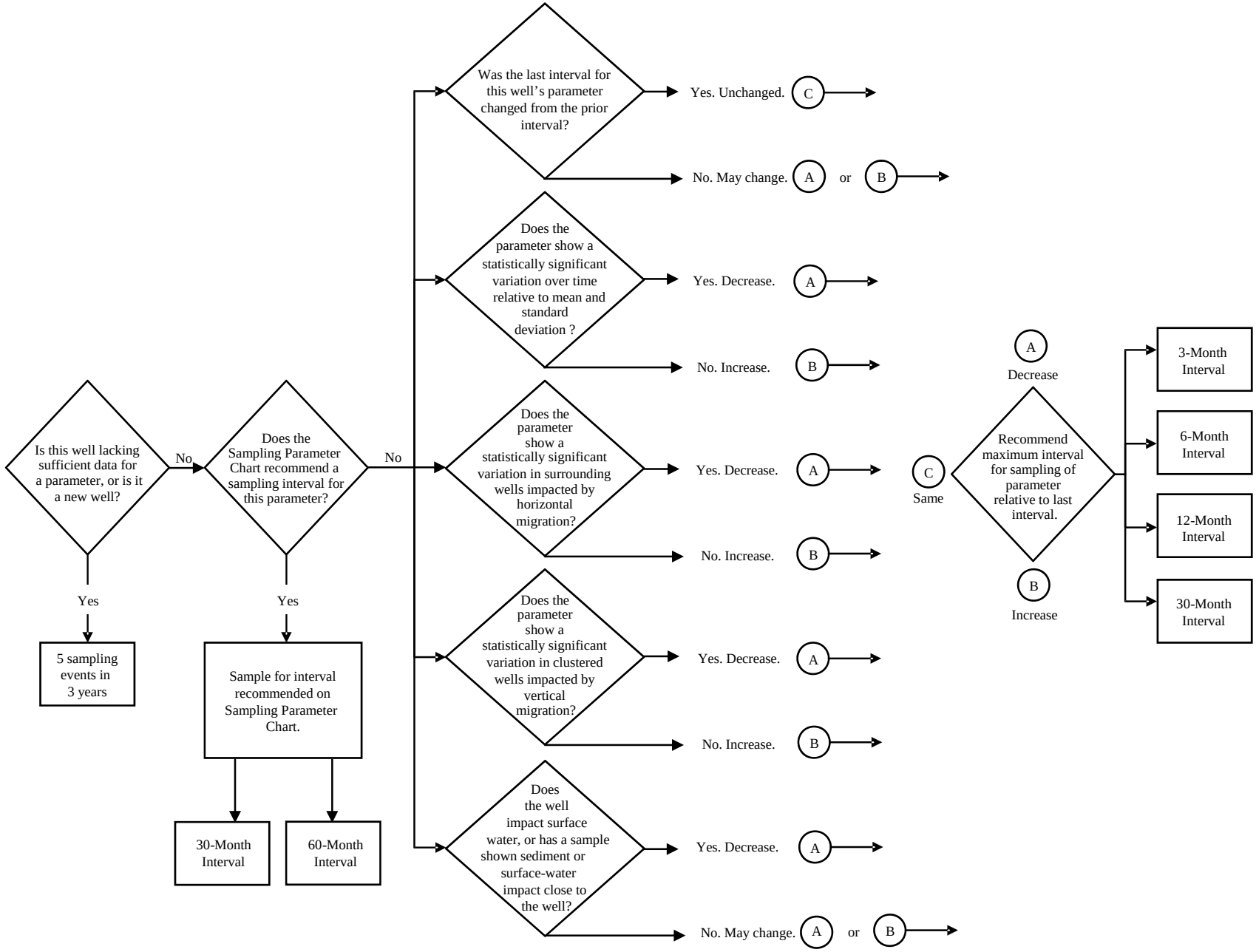


Figure 3-5. Ground-Water Monitoring Well Locations at the SLDS



Note: The recommended sampling frequency and dates may be adjusted to optimize sampling schedules or to monitor current RAs. Sampling results are compared to the SLDS ILs independent of the Ground-Water Algorithm Sampling Protocol (GASP). Exceedances are considered when evaluating the results of the GASP to ensure the recommended sampling frequencies are appropriate.

Figure 3-6. Sampling Parameter Chart



Note: The recommended sampling frequency and dates may be adjusted to optimize sampling schedules or to monitor current RAs. Sampling results are compared to the SLDS ILs independent of the GASP. Exceedances are considered when evaluating the results of the GASP to ensure the recommended sampling frequencies are appropriate.

Figure 3-7. Sampling Interval Chart

APPENDIX A

REGULATORY CORRESPONDENCE

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Metropolitan
St. Louis Sewer
D[illegible]ct
[illegible]partr[illegible]of Environmental Compliance
[illegible] East [illegible]d Avenue
St. Louis, [illegible]63147-2913
(314) 436 [illegible]10
FAX (314) [illegible]8753

October 30, 1998

Ken Axetel
INTERNATIONAL TECHNOLOGY CORPORATION
P.O. Box 5437
St. Louis, MO 63147

Dear Mr. Axetel:

We have reviewed your application dated October 2, 1998 requesting approval to discharge up to 120,000 gallons of wastewater per day to the Metropolitan St. Louis Sewer District for treatment. This wastewater is treated construction water from the contaminated soil removal project at the St. Louis Downtown Formerly Utilized Sites Remedial Action Program (FUSRAP) Site located at Mallinckrodt, Inc., 3600 N. Second Street, St. Louis, Missouri. The construction water will include groundwater and stormwater entering the excavations, and water used to decontaminate equipment. We understand the current scope of work is planned to take 4 years and will include excavating soil in the areas of Plant 7, Plant 2, and City Property between the levee and the river.

Based on the "Design Basis and General Description of the Construction Water Treatment System" and the "Radiological, Chemical, and Hydrogeological Characterization Report" submitted as part of the application, the proposed wastewater treatment system appears adequate to produce a wastewater effluent which meets MSD Ordinance 8472 standards. The system includes the use of granular activated carbon and a 1 to 5 micron filter to reduce the organic compounds, and radioactive and toxic metals in the discharge. The proposed system is approved for treatment of the wastewater when installed, maintained and operated to produce an effluent meeting the standards of Ordinance 8472. This approval is in effect for a period of five years from the date of this letter.

The wastewater from the system is approved for discharge to a combined sewer on site at the location identified on MSD's Base Map as Inlet 17D3-022C. To discharge at an alternate location, you will need to obtain prior written approval from us. The discharge into the sewer must be controlled at a rate that will not surcharge the lines in that area. This letter does not authorize any discharge to a separate storm sewer, or to any watercourse, as any such discharge must comply with the regulations of the Missouri Department of Natural Resources. This discharge authorization letter does not pertain to other wastes generated at the site including, but not limited to, spent filter media, or sludges or settled solids from wastewater treatment onsite.

Prior to discharging treated wastewater from each construction area, namely Plant 2, Plant 7 and the City Property, the analytical results of a representative sample of the first two batches from each area must be reviewed and approved, in writing, by MSD. The required analytical results include: pH, suspended solids, chemical oxygen demand, metal parameters (total values) which have numeric limits established in Ordinance 8472 Article V, Section Two, B., volatile organics by wastewater Method 624, semivolatile organics by Method 625, PCBs by Method 608, gross alpha radioactivity, gross beta radioactivity, Uranium 235 and 238, Radium 226 and 228, and Thorium 230 and 232.

Upon approval of the first two batches in each new construction area, each subsequent batch of treated wastewater must be analyzed for gross alpha radioactivity, gross beta radioactivity, and isotopes of uranium, radium and thorium. A grab sample at 90-100% completion of the batch is acceptable, as proposed in your application. In order to meet the regulatory requirements for this discharge, the following levels must be met for each batch prior to discharge:

Parameter	Limit (pCi/L)
Gross Alpha	15
Radium 226 plus 228	5
Thorium	Include in Gross Alpha
Uranium	Include in Gross Alpha
Gross Beta	50

MSD reserves the right to require additional parameters or sampling frequencies as necessary based upon our review of analytical results submitted. Gross beta radioactivity over 50 pCi/L will require the radioisotopes to be identified and a determination made as to whether they are subject to 10 CFR Part 20 or are exempt as "background radiation". The discharge of this wastewater must result in the facility's compliance with the limits for releases to sewers in 10 CFR Part 20, Appendix B, Table 3.

You must submit self-monitoring reports for the radioactivity analyzed in each batch for any month in which the wastewater was discharged. Please clearly identify each batch with a unique identifier. In addition to including the batch results for each required parameter, these reports must also list the total radioactivity discharged to date during the current calendar year. The reports are due 28 days after the end of the calendar month.

For billing purposes, you must also report the metered discharge volume. Wastewater originating from Mallinckrodt's metered water supply will be credited to the discharge volume, provided the supply water used by International Technology is metered and the meter readings are submitted to us. You will be billed for the volume discharged at the rate in effect at the time of discharge. The current rate, contained in MSD Ordinance 10177, is $1.05 per hundred cubic feet. The discharge volumes and the supply volumes should be included with the monthly self-monitoring reports.

This discharge has been approved based upon the information and sample analysis you provided, and is subject to the conditions stated above. This approval may be revoked by the District at any time if any of the information

s found to be incorrect, or if the conditions of this approval are violated. Also, if the discharge causes any operational or maintenance problem within the District's collection or treatment system, or results in violations of any conditions of the District's NPDES permit, International Technology Corporation and the U.S. Army Corps of Engineers will be considered responsible for damages.

If you have any questions, please call me at 436-8757. My fax number for analytical submittal is 436-8766.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Bruce H. Litzsinger, P.E.
Civil Engineer

ldl

pc: Mike Feldman, U.S. Army Corps of Engineers
Sharon Cotner, U.S. Army Corps of Engineers
Jeff Evers, Mallinckrodt, Inc.
John Lodderhose
Bernie Rains
Jeff Theerman

Metropolitan
St. Louis Sewer
District

Office of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
(314) 436-8710
FAX (314) 436-8753

July 23, 2001

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated April 10, 2001 requesting allocation of a portion of the one-Curie annual limit for the discharge of radionuclides to the Bissell Point Treatment Plant. This request concerns your current approval, originally granted by MSD on October 30, 1998, to discharge treated wastewater to the Metropolitan St. Louis Sewer District. The wastewater is stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP Site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. We have also reviewed your June 15, 2001 response to our request for additional information concerning the radioactive materials in the discharge.

Your request for allocation of a portion of the one-Curie limit into the Bissell Point Treatment Plant is granted. The St. Louis Downtown Site may discharge up to 60 milliCuries per calendar year of radioactivity to the Bissell Point Treatment Plant during the years 2001, 2002, and 2003. During subsequent years, the St. Louis Downtown Site may discharge up to 25 milliCuries per calendar year. This approval is in effect for a period of five years from the date of this letter.

The wastewater discharged to the sanitary sewer onsite, at MSD Manhole 17D3-022C, must meet the standards of MSD Ordinance 8472, the Nuclear Regulatory Commission in 10 CFR 20, and the Missouri Department of Health in 19 CSR 20-10. A maximum of 100,000 gallons of wastewater is allowed to be discharged in a 24-hour period. The applicable discharge standards are as follows:

Pollutant	Discharge Limit
Uranium-234	3,000 pCi/L
Uranium-235	3,000 pCi/L
Uranium-238	3,000 pCi/L
Thorium-228	2,000 pCi/L
Thorium-230	1,000 pCi/L
Radium-226	10 pCi/L
Radium-228	30 pCi/L
Gross Alpha	3,000 pCi/L

As required by the current approval letter, we will require submittal of analytical results for the isotopic radioactive materials listed above and that written approval be obtained for the first two batches from each investigation/plant area. Subsequent batches must be analyzed and shown to meet applicable limits for total Uranium (KPA), Gross Alpha, Gross Beta, and Total Suspended Solids prior to discharge. Gross Alpha results that are significantly higher than levels indicated by the total Uranium result will require the isotopic analytical results to be reviewed against applicable standards prior to the discharge for all radionuclides listed above. To demonstrate the solubility of the radioactive materials as required by 10 CFR 20, you will need to install a two micrometer (2 micron) filter in the treatment system, or provide the Gross Alpha results for the Suspended Solids portion of the wastewater at each new plant area.

The isotopic analysis of radioactive materials will continue to be required for each batch discharged. A monthly sum of the ratios (SOR) must be calculated for all radionuclides listed above, and the result must be less than 1.0 according to regulations in 10 CFR 20. The limit for Radium-226 and Radium-228 in the SOR calculation is 600 pCi/L.

You must submit quarterly self-monitoring reports that provide the analytical results and calculations required in this approval. In addition to including the batch results for each required parameter and the SOR calculations, the MSD Radioactive Materials Discharge Report (attached) must also be completed and signed. This report lists the total radioactivity discharged during the current calendar quarter to ensure compliance with the 50/25 milliCurie per year limit. For billing purposes, you must also report the metered discharge volume. The reports are due 28 days after the end of the calendar quarter. All other conditions of the existing approval shall remain in effect.

This discharge revision has been approved based upon the information you provided, and is subject to the conditions stated above. This approval may be revoked by the District at any time if any of the information is found to be incorrect, or if the conditions of this approval are violated. Also, if the discharge causes any operational or maintenance problem within the District's collection or treatment system, or results in violations of any conditions of the District's NPDES permit, the U.S. Army Corps of Engineers will be considered responsible for damages.

If you have any questions, please contact me at (314) 436-8757.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Bruce H. Litzsinger, P.E.
Civil Engineer

dh

Enclosure

Pc: Bernie Rains
Doug Mendoza
Fabian Grabski
Roland Biehl
Ed Cope

File: IU – Mallinckrodt, 21120596-00

Metropolitan
St. Louis Sewer
District

Office of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
(314) 436-8710
FAX (314) 436-8753

Recieved
10/18/04
am

October 13, 2004

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your letters dated August 12, 2004 and September 14, 2004 requesting a self-monitoring change and continuous volume discharge to the special discharge permit approved in our letter dated July 23, 2001. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP Site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. We understand that the continuous volume discharge request is for wastewater that is drained from previously remediated areas.

Based on the information you provided and historical analytical results, your request to remove the first two-batch discharge self-monitoring condition is granted. In addition, the continuous volume discharge is also approved. During the continuous discharge, we will require daily self-monitoring of wastewater for total suspended solids, total uranium radioactivity, gross alpha radioactivity, gross beta radioactivity and isotopes of uranium, radium, and thorium. In addition, we understand that this discharge will pass through a one micron bag filter to demonstrate the solubility of the radioactive materials. All other conditions of the above referenced approvals remain in effect.

Please contact me at (314) 436-8742 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Roland A. Biehl
Environmental Assistant Engineer

bv

File: IU – Mallinckrodt, 21120596-00

Metropolitan
St. Louis Sewer
District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
(314) 436-8710
FAX (314) 436-8753

June 19, 2006

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated May 17, 2006 for extension of a special discharge approved in our letters dated July 23, 2001 and October 13, 2004. The approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP Site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2008 . As a condition of this approval, you must notify us of any changes which would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above referenced approvals remain in effect.

Please contact me at (314) 436-8742 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Roland A. Biehl
Environmental Assistant Engineer

pc: Doug Mendoza
Jonathon Sprague

File: IU. MALLINCKRODT INC [2112059600]. SP809

Metropolitan St. Louis Sewer District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
Phone: 314.768.6200 www.stlmsd.com

May 22, 2008

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated May 16, 2008 for extension of a special discharge originally approved in our letters dated July 23, 2001 and October 13, 2004, and extended through July 23, 2008 in our letter dated June 19, 2006. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two-year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2010.

As a condition of this approval, you must notify us of any changes that would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above referenced approvals remain in effect.

Please contact me at (314) 436-8755 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Steven M. Grace

Steve Grace
Environmental Assistant Engineer

bv

File: IU – MALLINCKRODT INC [2112059600], SP809

Metropolitan St. Louis Sewer District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
Phone: 314.768.6200 www.stlmsd.com

May 10, 2010

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated March 16, 2010 for extension of a special discharge originally approved in our letters dated July 23, 2001 and October 13, 2004, and extended through July 23, 2010 in our letters dated June 19, 2006 and May 22, 2008. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two-year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2012.

As a condition of this approval, you must notify us of any changes that would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above referenced approvals remain in effect.

Please contact me at (314) 436-8755 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Steven M. Grace

Steve Grace
Environmental Assistant Engineer

bv

File: IU – MALLINCKRODT INC [2112059600], SP809

Metropolitan St. Louis Sewer District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
Phone: 314.768.6200 www.stlmsd.com

RECEIVED 6-1-12 CM

May 24, 2012

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated May 22, 2012 for extension of a special discharge originally approved in our letters dated July 23, 2001 and October 13, 2004, and extended through July 23, 2012 in our letters dated June 19, 2006, May 22, 2008, and May 10, 2010. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two-year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2014.

As a condition of this approval, you must notify us of any changes that would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above-referenced approvals remain in effect.

Please contact me at (314) 436-8755 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT
Steven M. Grace

Steve Grace
Environmental Assistant Engineer

bv

pc: Brian Gibson
Doug Mendoza

File: IU – MALLINCKRODT INC [2112059600], SP809

File, Cotner Frerker

Metropolitan St. Louis Sewer District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
Phone: 314.768.6200 www.stlmsd.com

June 23, 2014

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated May 1, 2014 for extension of a special discharge originally approved in our letters dated July 23, 2001 and October 13, 2004, and extended in our most recent letter dated May 24, 2012. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two-year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2016.

As a condition of this approval, you must notify us of any changes that would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above-referenced approvals remain in effect.

Please contact me at (314) 436-8755 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT
Steven M. Grace

Steve Grace
Environmental Assistant Engineer

bv

ec: Brian Gibson
Doug Mendoza

File: IU – MALLINCKRODT INC [1011728100], SP809

File - Adams, Wade

Metropolitan St. Louis Sewer District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
Phone: 314.768.6200 www.stlmsd.com

July 18, 2016

Bruce Munholand
DEPARTMENT OF THE ARMY,
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Mr. Munholand:

We have reviewed your request dated May 17, 2016 for extension of a special discharge originally approved in our letters dated July 23, 2001 and October 13, 2004, and extended in our most recent letter dated June 23, 2014. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two-year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2018.

As a condition of this approval, you must notify us of any changes that would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above-referenced approvals remain in effect.

Please contact me at (314) 436-8755 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Steve Grace
Environmental Assistant Engineer

bv

ec: Brian Gibson
Doug Mendoza

File: IU – MALLINCKRODT INC [1011728100], SP809

Metropolitan St. Louis Sewer District

Division of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
Phone: 314.768.6200 www.stlmsd.com

June 11, 2018

Bruce Munholand
DEPARTMENT OF THE ARMY,
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: FUSRAP St. Louis Downtown Site

Dear Mr. Munholand:

We have reviewed your request dated May 31, 2018 for extension of a special discharge originally approved in our letters dated July 23, 2001 and October 13, 2004, and extended in our most recent letter dated July 18, 2016. This approval was for stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. You have requested a two-year extension of your current approval.

Your request for an extension is granted. This approval will expire on July 23, 2020.

As a condition of this approval, you must notify us of any changes that would affect the characteristics of this discharge. The self-monitoring reporting requirements and all other conditions of the above-referenced approvals remain in effect.

Please contact me at (314) 436-8755 with questions or comments.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT

Steven M. Grace

Steve Grace
Environmental Assistant Engineer

bv

ec: Brian Gibson
Doug Mendoza

File: IU – MALLINCKRODT INC [1011728100], SP809

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