IV. ST. LOUIS SITES RESPONSE ACTIONS

SLS response actions consisted of a remedial action performed at a non-NPL site known as the SLDS (Mallinckrodt property and VPs) in accordance with the SLDS ROD (USACE 1998c), and removal actions at the North St. Louis County sites (SLAPS, HISS/Futura, and VPs) performed in accordance with their corresponding Action Memoranda (DOE 1997b and USACE 1999a; USACE 1998b; DOE 1995). The respective action and the implementation of the action at each site is presented in subsequent paragraphs.

ST. LOUIS DOWNTOWN SITE

As stated previously, this five-year review concerns the remedial action conducted at the SLDS Accessible Soil and Ground-Water OU from September 1998 through August 2003. The remedial action for the SLDS Accessible Soil and Ground-Water OU presented in the SLDS ROD (USACE 1998c) is expected to be protective of human health and the environment, will meet applicable or relevant and appropriate requirements (ARARs), and was developed to provide the best balance of effectiveness, cost, and implementability. The scope and role of the remedial action set forth in the SLDS ROD (USACE 1998c) is to remediate accessible soil and ground-water contamination that resulted from MED/AEC uranium manufacturing and processing activities conducted at the Mallinckrodt plant.

The SLDS ROD (USACE 1998c) was signed on August 3, 1998, by Russell L. Fuhrman, Major General, U.S. Army Director of Civil Works and on August 27, 1998 by Dennis Grams, P.E. Regional Administrator, USEPA Region VII.

The other OU at the SLDS is the Inaccessible Soil OU. The Inaccessible Soil OU is comprised of buildings and soil that is inaccessible due to the presence of Buildings 25 and 101, active rail lines, roads, the levee, and other buildings and encumbrances (e.g., Building 8). The buildings and inaccessible soil that compose the Inaccessible Soil OU will be addressed in accordance with a future CERCLA action. USACE is currently developing the approach to issuance of a ROD for the Inaccessible Soil OU. MDNR and EPA will be invited to participate in this process.

Prior to selection of the remedial action for the SLDS, several properties were addressed under removal action authority. These properties include Plant 10 (City Block 1201, a.k.a. former Plant 4), the land east of the levee (Riverfront Trail), and several buildings at the Mallinckrodt Property. These areas are to be included in the post-remedial action risk assessment to reconfirm the protectiveness of the removal action.

SLDS Remedial Action Selection

Characterization activities conducted at the SLDS determined that contamination related to MED/AEC activities is present in accessible soil at the Mallinckrodt property and VPs at levels that require remedial action. The remedial action ultimately selected was identified as Selective Excavation and Disposal, although treatment to cost-effectively reduce the mobility and toxicity of the radioactivity to acceptable risk levels was initially retained as a conditional part of the remedy. Treatment was further evaluated during the design phase and was subsequently not

identified as a cost-effective remedy that reduced the contaminant's volume, toxicity, or mobility. Therefore treatment was not included in the remedial action.

Implementation of a long-term ground-water monitoring strategy for the Mississippi Alluvial Aquifer (HU-B) is also being implemented under the SLDS ROD. The need for ground-water remediation is being investigated as part of Phase II of the Ground-water Remedial Action Alternatives Assessment (GRAAA).

Well sampling is conducted for two purposes: 1) to assure that protection of human health and the environment is being preserved; and, 2) to design and conduct the best management for treatment, if necessary, and disposition of excavation waters. Well sampling is conducted in both the shallow and deep water horizons. The deeper water (HU-B) needs to be protected and the GRAAA will evaluate any contaminants in the deeper water and determine if additional response actions are required. The protective sampling is to assure that the environment is not being degraded by the site's remedial action. The monitoring also provides information to determine issues that may influence the management / disposition of excavation water.

The remedial action objectives for the SLDS Accessible Soil and Ground-Water OU as set forth in the SLDS ROD (USACE 1998c) are to:

Soil

- prevent exposures from surface residual contamination in soil greater than the criteria prescribed in 40 CFR 192;
- eliminate or minimize the potential for humans or biota to contact, ingest, or inhale soil containing COCs;
- eliminate or minimize volume, toxicity, and mobility of affected soil;
- eliminate or minimize the potential for migration of radioactive materials off-site;
- comply with ARARs; and
- eliminate or minimize potential exposure to external gamma radiation.

Ground Water

- remove sources of COCs in the A Unit (HU-A); and
- continue to maintain low concentrations of OU COCs in the B Unit (HU-B).

The major components of the remedial action presented in the ROD include:

- excavation of accessible soil to composite criteria (ARAR based) on perimeter VPs and Mallinckrodt Plant 7;

- excavation of accessible soil on the Mallinckrodt Property (except Plant 7) to composite criteria (ARAR based) in the top 4 or 6 feet and to depth to deep-soil criteria (risk-based); and

- control of potential ground-water degradation by removal of sources of soil contamination; removal, treatment, and disposal of ground water from excavations within the A Unit (HU-A); implementing institutional controls, when applicable; and perimeter ground-water monitoring in the B Unit (HU-B) to assure post-remediation compliance.

The remediation goals for the SLDS Accessible Soil and Ground-Water OU as set forth in the SLDS ROD (USACE 1998c) consist of the following general components:

Soil

- Excavation of accessible surface soil according to the ARAR-based composite criteria of 5 picocuries per gram (pCi/g) above background for the greater of Ra-226 or Th-230, 5 pCi/g above background for the greater of Ra-228 or Th-232, and 50 pCi/g above background for U-238 in the uppermost 6 inches (in.) below ground surface (bgs) (5/5/50 criteria). To concurrently address each of the major radionuclides of interest, a sum of the ratios calculation is applied.

- Excavation of accessible subsurface soil (below 6 in. bgs) according to the ARAR-based subsurface criteria of 15 pCi/g above background for the greater of Ra-226 or Th-230, 15 pCi/g above background for for the greater of Ra-228 or Th-232, and 50 pCi/g above background for U-238 to a depth of 4 or 6 feet bgs of the SLDS (15/15/50 criteria). These criteria will be met to a depth of 6 feet bgs in areas of Mallinckrodt located west of the St. Louis Terminal Railroad Association tracks (DT-9) and at the former locations of Buildings 116 and 117 in Plant 6EH. These criteria will be met at the remaining areas of the SLDS to a depth of 4 feet bgs except at the Plant 7 area and VPs, where these criteria are applied to depth.

- Excavation of accessible deep subsurface soil [below 4 or 6 feet bgs] to the risk-based criteria 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 in the Mallinckrodt property portion of the SLDS (50/100/150 criteria). To concurrently address each of the major radionuclides of interest, a sum of the ratios calculation is applied, subject to achieving the 25 mrem/yr ARAR (i.e., 10 CFR 20, Subpart E).

- For arsenic and cadmium: (1) excavation of accessible soil to the criteria of greater than 60 milligrams per kilogram (mg/kg) of arsenic and/or greater than 17 mg/kg of cadmium to a depth of 4 or 6 feet bgs and (2) excavation of accessible soil to the criteria of greater than 2,500 mg/kg of arsenic and/or greater than 400 mg/kg of cadmium from 4 or 6 feet bgs to depth. Arsenic and cadmium are COCs only in Plants 2, 6, 7N, 7S, and 7W and DT-10.

Ground Water

- Perimeter monitoring of the ground water in the HU-B during and after source-term removal will be implemented. The need for ground-water remediation will be evaluated as part of the periodic

reviews performed for the SLDS. The ground-water monitoring will also establish the effectiveness of the source removal. The goal of the monitoring will be to determine if COCs are present above ILs and to provide sufficient sampling data to support an evaluation of the fate and transport of MED/AEC residual contaminants through and following the remedial action.

The remedial action for the SLDS includes the excavation and off-site disposal of accessible contaminated soil to remediation goals established in the SLDS ROD (USACE 1998c). Accessible contaminated sediment in sewers and drains considered to be accessible is removed along with the accessible soil. Only approved off-site borrow would be used to fill excavations at the perimeter VPs and in the top 4 to 6 feet across the Mallinckrodt Property. A post-remedial action risk assessment will be performed upon completion of excavation and restoration [i.e., backfilling and placement of cover (asphalt, concrete, crushed rock, etc.)] to describe the level of risk remaining from MED/AEC COCs following completion of remedial activities. Material that does not exceed the deep soil (risk-based) criteria and is not a characteristically hazardous waste may be used, with prior notification to MDNR, as backfill below 4 or 6 feet bgs, as appropriate, on the Mallinckrodt Property of the SLDS except in Plant 7.

Final determinations as to whether institutional controls and land-use restrictions are necessary at the remediated areas will be based on calculations of post-remedial action risk derived from actual residual conditions. Institutional controls may include land use restrictions for those areas having residual concentrations of contaminants unsuitable for unrestricted use. This determination will be made based on a risk analysis of the actual post-remedial action conditions. For residual conditions requiring land-use restrictions after the period of active remediation, coordination with property owners and local land use planning authorities will be necessary to implement deed restrictions or other mechanisms to maintain industrial/commercial land use.

Evaluation of the Mississippi River bed in the vicinity of the SLDS is a component of the SLDS remedial action. During the RI (BNI 1994) of the SLDS, sediments containing radioactivity were found in a small area of the Mississippi River bed. A subsequent investigation as part of the RI addendum (SAIC 1995) could not relocate radioactivity on the riverbed. Presumably it was carried downstream during high flows. The location of the riverbed where radiological contamination was detected during the RI will be revisited and characterized. If the remediation goals established in the SLDS ROD (USACE 1998c) are exceeded, the remediation of the riverbed will be addressed under a subsequent response action. If no contamination is present, the existing remedy will be considered the final remedy for this portion of the SLDS.

Because the removal action conducted along the Riverfront Trail on the strip of land east of the levee and west of the Mississippi River was subject to different exposure and land use assumptions than those used in the SLDS ROD (USACE 1998c), a post-remedial action risk assessment will be conducted as a component of the SLDS remedy to determine whether restrictions will be required on this portion of the SLDS.

Another component of the SLDS remedy is the performance of a post-remedial action risk assessment to reconfirm the protectiveness of the removal action conducted at Mallinckrodt Plant 10.

SLDS Remedial Action Implementation

As part of the remedial action implementation for the SLDS, pre-design investigations were conducted on the various SLDS properties to obtain the information necessary to develop the remedial design documents. Common to remedial action implementation at each Mallinckrodt Property or VP is the coordination with the property owner; establishment of a central support facility, water treatment facility, and soil storage and loading facility; implementation of air monitoring, access controls, and security measures; and sequencing of excavation, confirmation, and final status survey activities. Support facilities include personnel and equipment decontamination facilities.

The central support facility was established on the eastern portion of Plant 7N at the initiation of FUSRAP field activities. In order to accommodate characterization of Plant 7N, the support facility was moved to DT-7, Midwest Waste in 2002.

The purpose of the central wastewater treatment facility is to store and treat ground water removed during excavation activities. All potentially contaminated waters are processed through the wastewater treatment system and the treated water is discharged to the Metropolitan St. Louis Sewer District (MSD) sewer line in accordance with an MSD authorization letter, dated October 30, 1998. The discharge is directed to the Bissell Point Treatment Plant through underground mains. Each discharge is monitored, and the results reported to MSD.

Two soil storage and railroad car loading facilities are currently established at the SLDS: (1) the Plant 7S Loadout Area on the eastern edge of the Mallinckrodt Plant and (2) the Plant 6EH Loadout Area on the northern edge of the Mallinckrodt Plant. Although the physical loadout pad has switched from the south side of the rail spur (Plant 6EH) to the north side (PSC Metals), the name for this loadout area has not changed. Once loaded into the railcars, the excavated material is covered and sent out of state for disposal. Material is disposed, depending on the concentration of the contamination, at either U.S. Ecology Idaho, Inc. in Idaho or Envirocare in Utah, which are low-level radioactive waste disposal facilities.

Excavation perimeter air monitoring is conducted during excavation activities. Monitoring consists of both real-time (continuous readout) and time-integrated sampling. Real-time monitoring is conducted for lower exposure limit, oxygen level, particulates, and organic compounds. Time-integrated sampling consists of mid-volume and low-volume samplers for total alpha and total beta measurements. Radon monitoring is conducted to determine whether radon releases are occurring.

The primary means of access control is provided by security fencing surrounding each excavation area. Prior to the commencement of work, temporary chain-link fences, gates, and/or other barriers are installed around the remediation work area. Additional safety fencing is also installed at specific excavation locations as determined by site conditions. All non-remediation personnel pedestrian traffic is excluded from construction zones. Access exclusion is established through the use of temporary chain-link fences, barricades, orange construction fencing, and radiation rope. Appropriate warning signs are posted on or adjacent to contaminated areas.

Once verification sampling demonstrates that the contamination has been removed, final status survey confirmation sampling is conducted. The USACE evaluates the results to ensure that the residual concentrations in the excavation meet the SLDS ROD (USACE 1998c) remediation goals and the excavation can be backfilled. Following the completion of backfilling, the excavated areas are regraded, compacted, and resurfaced with the same type of material initially present (e.g., asphalt, concrete, gravel). Following resurfacing, a topographic survey of the excavation areas is completed to document backfill volumes and final conditions.

The required remedial action at the SLDS and VPs is not complete as of August 2003; however, remediation has been completed at a portion of the Mallinckrodt Property and VPs.

A summary of the remedial activities conducted at the SLDS through August 2003 is presented in the following Table IV-1 below.

Table IV-1. St. Louis Downtown Site Remedial Activities Summary

Loc.	Property	Start	Complete	CY Removed
DT-2	City Property VP	October 1998	July 1999	4,260
MP	Plant 2	October 1998	August 2000	9,660
MP	Plant 1	July 2000	March 2002	2,490
DT-7	Midwest Waste VP	May 2001	February 2003	3,910
MP	Plant 6 East Half (EH) and East (E)	November 2000	July 2003	18,880
DT-6	Heintz Steel VP	April 2003	In Progress	1,660
MP	Plant 7E	July 2003	In Progress	1,775
			Total Volume =	42,635

CY = cubic yards (In-Situ)

The specifics of these remedial activities are presented in the following sections.

City Property VP (DT-2)

The USACE completed remedial design activities for this VP between August and September 1998. The remedial design partitioned the City Property Work Area into six separate excavation areas, Areas A through F. Excavation of contaminated soil began on October 14, 1998 and site restoration activities (i.e., grading and revegetation) were completed on July 8, 1999. No unexpected events of note occurred during remedial activities at DT-2.

Contaminated soil was transported to the Plant 7S soil storage and loadout facility and loaded into lined railcars for transport to the Envirocare facility in Utah, a low-level radioactive waste disposal facility. Approximately 4,260 in situ yd^3 of contaminated material were removed from DT-2.

The remedial action summary and post-remedial action evaluation are presented in the *Final Post-Remedial Action Report for the St. Louis Downtown Site City-Owned Vicinity Property, St. Louis, Missouri* (USACE 1999b). The analytical results for the final status survey samples indicated that the residual radioactivity on DT-2 met the requirements of the remedial design and was below the SLDS ROD (USACE 1998c) remediation criteria. Thus, the remediated areas can

be used without restriction. By definition, the area beneath the levee on DT-2 is considered to be an inaccessible soil area and therefore is not included in the scope of the SLDS ROD (USACE 1998c).

Mallinckrodt Plant 2

Prior to development of the remedial design for Plant 2, a pre-design investigation was implemented to gather additional subsurface data to support the design of the remedial action at Plant 2. During pre-design planning, the SAIC three-dimensional model (based on EarthVision Software) of radionuclide distribution was evaluated to determine whether the soil contamination boundaries in Plant 2 were adequately defined. In addition, the RI data were reviewed to determine whether sufficient data existed for evaluation of excavation support requirements. Several data gaps were identified, including a lack of soil geotechnical data; uncertainty in the vertical and horizontal contamination boundaries and shallow distribution of contamination; and lack of radiological and chemical waste characteristic data. To address the data gaps, two wells were completed in the fill material to measure hydraulic properties. In addition, sampling was conducted to further delineate three areas of radiological activity exceeding the SLDS ROD (USACE 1998c) remediation criteria identified during the Class 2 sampling in Plant 2. The pre-design investigation data showed that the radionuclide contamination was within the fill material. However, there were occurrences of radionuclide contamination within the underlying clay/silt layer (IT 1999a).

Remedial activities at Plant 2 (i.e., design through backfilling and site restoration) were conducted between October 1998 and August 2000.

Two changes to the initial design for Plant 2 occurred. The first change involved an alteration in the excavation limits based on newly acquired pre-design investigation data and a process change to allow the excavation to proceed incrementally once the gross excavation boundary was reached. The second change involved an update in the utility locations and the incorporation of fieldwork variances issued subsequent to the previous design change.

The following activities were major components of the remedial activities implemented at Plant 2. The foundations of Buildings 50, 51, 51A, 52, and 52A were demolished. Several water and fire suppression lines were temporarily capped and removed. Manholes and catch basins exposed during excavation were supported or replaced. On-site stockpiled crushed concrete, brick, and/or cinder block from previously demolished Mallinckrodt buildings, foundations, or other consolidated material having radionuclide concentrations below the composite criteria of the SLDS ROD (USACE 1998a) and exhibiting no hazardous characteristics, as determined by the Toxicity Characteristic Leaching Procedure, were used for backfilling excavations to levels below 6 feet bgs on Mallinckrodt property. Clean off-site borrow material was used to backfill excavations from 6 feet bgs to the surface.

A total of approximately 9,660 in-situ yd^3 of contaminated material was removed from Plant 2. Excavated soil was transported to a soil storage and loadout facility and loaded into lined railcars for transport to and disposal at Envirocare of Utah, a low-level radioactive waste disposal facility.

A few unexpected events of note occurred during remedial activities at Plant 2. These included the interception of previously unknown underground active and inactive utility lines, accumulation and required collection of greater-than-anticipated quantities of ground water, and the discovery of ordnance. During remediation of the main excavation area in Plant 2, multiple utility lines were encountered that were not previously identified by any Missouri utility company or Mallinckrodt, Inc. Leaking sewer lines as well as potable water and fire-suppression-system water line ruptures resulted in excessive water accumulation in the main excavation. During soil removal at the main excavation, ordnance was unexpectedly discovered within the excavation boundaries. Work was halted, and safety specialists from USACE and the St. Louis Police Department's Bomb and Arson Squad were called in to safely extract the nearly 150-year-old ordnance. Over a five-month period, 58 pieces of ordnance were eventually removed and disposed of by the Bomb and Arson Squad. A permanent brass marker was placed on the pavement surface to identify the location of the ordnance left in place beyond the excavation limits.

Portions of stockpiled crushed concrete, brick, and/or cinder block from previously demolished Mallinckrodt buildings, foundations, or other consolidated material were determined to meet the composite criteria stated in the SLDS ROD (USACE 1998a) and exhibit no hazardous characteristics, as determined by the Toxicity Characteristic Leaching Procedure. Approximately 5,700 yd^3 of crushate were placed as deep backfill in the Plant 2 main excavation from total depth to no higher than 6 feet bgs. Clean off-site borrow material or commercially available crushed aggregate was placed from 6 feet bgs to the level of the crushed aggregate base course for a new pavement. Commercially available crushed aggregate was also used as deep backfill material.

The remedial action summary and post-remedial action evaluation are presented in the *Post-Remedial Action Report for the Accessible Soils Within the St. Louis Downtown Site Plant 2 Property* (USACE 2002a). The analytical results for the final status survey samples indicated that the residual radioactivity in the accessible areas in Plant 2 met the requirements of the remedial design and was below the 15/15/50 SLDS ROD remediation criteria. In addition, analytical results for arsenic and cadmium were below the SLDS ROD remediation criteria. Thus, the accessible areas of Plant 2 were released for use without restriction. There are several areas of inaccessible soil present in Plant 2. These areas include soil beneath the buildings in Plant 2, a small area on the north end of the main excavation, and a small area on the south end of the main excavation.

Mallinckrodt Plant 1

The Plant 1 pre-design investigation activities described in the *Pre-Design Investigation Summary Report, Plant 1, FUSRAP St. Louis Downtown Site, St. Louis, Missouri* (IT 1999b) identified one large and 11 isolated locations of elevated radiological activity. The large area of contamination was located near the northwest corner of Plant 1 in the former Building K foundation (K-Pad) area. The 11 isolated locations, numbered 1 through 11, were located north and southeast of the K-Pad area.

The original Plant 1 design included the installation of sheet piling around the K-Pad area. However, the bids received to build/construct this design were significantly greater than the estimated costs. USACE, along with its remedial action contractor, IT, began to explore other

means of shoring. It was determined that excavation of the K-Pad area in strips using a slide rail shoring system would be a more cost-effective approach. During the remediation, unexpected subsurface obstructions were encountered (e.g., remnants of building foundations and streets) that would not have allowed sheet piling to be driven to the desired depth. Use of the slide rail shoring system enabled the excavating subcontractor to work around these obstructions.

Plant 1 remedial activities began in July 2000 and were completed in September 2003. As remediation progressed, the 12 contamination locations (including the K-Pad) were further subdivided into individual excavation areas. This subdivision was implemented as an adjustment to changing field conditions and to facilitate remedial activities while allowing continuous Mallinckrodt operations. Approximately 2,490 in-situ yd^3 of contaminated material were removed. Ten areas of inaccessible soil have been identified in Plant 1, owned by Mallinckrodt, Inc. These areas could not be excavated without jeopardizing the integrity of nearby structures (e.g., building, substation) or impacting daily business operations of the owner.

The use of slide rail shoring at the K-Pad area excavation in lieu of the sheet pile system originally scoped was instrumental in controlling the volume of water accumulating in the excavation. Use of the slide rail shoring system facilitated the progress of excavation in a controlled manner by limiting the excavation area that was open at any given time. By using the slide rail shoring system, sheet-pile-driving vibrations which could have adversely affected Mallinckrodt operations in adjacent buildings were eliminated.

On-site stockpiled crushed concrete, brick, and/or cinder block from previously demolished Mallinckrodt buildings, foundations, or other consolidated material having radionuclide concentrations below the composite criteria of the SLDS ROD (USACE 1998a) and exhibiting no hazardous characteristics, as determined by the Toxicity Characteristic Leaching Procedure, were used for backfilling excavations to levels below 6 feet bgs on Mallinckrodt property. Approximately 450 yd^3 of crushate were placed as deep backfill in the K-Pad area from total depth to no deeper than 6 feet bgs. Clean off-site borrow material or commercially available crushed aggregate was placed from 6 feet bgs to the level of the crushed aggregate base course for the new pavement.

Many challenges were encountered during Plant 1 remedial activities because the work areas were in the most active part of an operating chemical plant complex. However, the only unexpected event of note was the encountering of subsurface remnants of a building foundation and brick street pavement. Use of the slide rail shoring system in the K-Pad area enabled the excavation subcontractor to work around these obstructions and therefore limit possible schedule delays.

The USACE most recently addressed contaminated soil near the former Buildings T, V, and W and the rail spur area south of Building X. Upon completion of remedial activities in these areas, a remedial action summary and post-remedial action evaluation will be presented in a post-remedial action report.

Midwest Waste VP (DT-7)

Prior to development of the remedial design for DT-7, a pre-design investigation was conducted to gather additional subsurface data to support the design of remedial action. The data collected

during pre-design investigation activities identified 15 locations of shallow (less than 4 feet bgs) contamination [*Pre-Design Investigation Data Summary Report, Midwest Waste Vicinity Property (DT-7), St. Louis Downtown Site, St. Louis, Missouri* (IT 2001a)].

DT-7 remedial operations began in May 2001 and concluded in February 2003. After remediation activities began, it became apparent that more contamination was present than originally anticipated based on the pre-design investigation sampling. A geologic examination of the soil/fill horizons exposed by the excavations, along with further evaluation of historical land elevations and aerial photographs, indicated that the subsurface zone of contamination encountered appeared to coincide with the horizon that was the land surface at the time MED/AEC activities began (i.e., 1941). This horizon was present 4 to 5 feet bgs. The pre-design investigation sampling conducted on DT- 7 did not encounter this zone of contamination. A total of approximately 3,910 in-situ yd^3 of contaminated material was excavated from DT-7.

Other than the increased quantity of contaminated soil volumes discussed above, no unexpected events of note occurred during remedial activities at DT-7. The remedial action summary and post-remedial action evaluation will be presented in a post-remedial action report and will be submitted to MDNR and EPA for review and comment prior to finalization.

Mallinckrodt Plants 6 East (6E) and 6 East Half (6EH)

Prior to development of the remedial design for Plants 6E and 6EH, a pre-design investigation was conducted to gather additional subsurface data to support the design of remedial actions. The pre-design investigation data showed that radionuclide contamination was confined to two isolated areas in Plant 6E, but was extensive in Plant 6EH [*Pre-Design Investigation Data Summary Report, Plants 6 East Half and 6E* (IT 2000)]. The majority of the contamination appeared to be present within the fill material to a depth of 4 feet bgs. Contamination was present in two deep areas at 12 and 20 feet bgs.

Remedial activities consisting of the excavation of contaminated soils in Plant 6EH and Plant 6E began in November 2000 and were completed in July 2003. After remedial operations began, it became apparent that the contamination was more extensive, both vertically and horizontally, than originally anticipated based on the pre-design investigation sampling. Approximately 18,880 in-situ yd^3 of contaminated material were excavated from Plants 6EH and 6E. The post remedial action report for this area is being developed and will be submitted as part of the Post Remedial Action Report for Plant 6 to MDNR and EPA for review and comment prior to finalization. A more complete discussion of the remedial activities conducted at Plants 6EH and 6E will be provided in the next five-year review report.

Heintz Steel and Manufacturing VP (DT-6)

The Heintz Steel and Manufacturing VP (DT-6) was investigated to 2 feet bgs during pre-design investigation activities. The pre-design data indicated three areas of shallow (0.5 feet bgs) radiological contamination in the fill material [*Pre-Design Investigation Data Summary Report, Heintz Steel and Manufacturing Vicinity Property (DT-6)* (IT 2001b)]. The three areas of radiological contamination appeared to be randomly located, with no specifically identifiable source.

Due to the degree and extent of contaminated soil encountered at DT-7 during excavation activities, further evaluation of historical land elevations and aerial photographs was conducted for DT-6. The results of this evaluation indicated that the same subsurface zone of contamination present at DT-7, which coincides with the horizon that was the land surface at the time MED/AEC activities, which began in 1941, may be present at DT-6. This horizon is expected to be present 4 to 5 feet bgs. The pre-design investigation sampling conducted on DT-6 did not encounter this zone of contamination.

Remedial activities began in April 2003 and are ongoing. As part of these remediation activities, sampling of several trenches excavated to a depth of approximately four feet, was conducted to determine if the deeper zone of contamination encountered on DT-7 is present on DT-6, and to what extent. A more complete discussion of the remedial activities conducted at DT-6 will be provided in the next five-year review report.

Mallinckrodt Plant 7E

The Plant 7E property is located in the eastern portion of the SLDS, south of Destrehan Street and east of the Burlington Northern Railroad tracks (DT-12) and Plant 7 North (N). The northern portion of the Plant 7E property was previously remediated along with DT-2 because property ownership information available at that time indicated that it was part of DT-2 and not Plant 7E. The fenced portion of the Plant 7E property is surfaced with gravel placed over geotextile and was most recently used for storage of MI roll-offs and small FUSRAP stockpiles of miscellaneous materials. These stored items were removed.

The availability of data from Plant 7E obtained during remediation of DT-2 and the characterization of DT-1 precluded a pre-design investigation for the remedial design of Plant 7E. These data have been augmented by the sampling of several investigational trenches that delineated required areas of remediation in more detail. Data from samples collected during the digging of the trenches were used to aid in the determination of the proposed limits of gross excavation for Plant 7E and are presented in *Mallinckrodt Plant 7E Remediation Activity Work Description* (IT 2003).

Remedial activities began in July 2003 and are currently ongoing. A more complete discussion of the remedial activities conducted at Plant 7E will be provided in the next five-year review report.

General Remediation Matters

As stated previously, authority under the SLDS ROD (USACE 1998c) for the remediation of MED/AEC-related wastes is limited to those wastes in accessible soil and ground water. The SLDS ROD (USACE 1998c) defines accessible soil as soil that are not beneath buildings or other permanent structures. The SLDS ROD (USACE 1998c) also provides examples of soil considered to be inaccessible and excluded from remedial action under the SLDS ROD. Soil that is inaccessible due to the presence of buildings, active roads, active rail lines, and the levee is specifically excluded from remediation. Because the scope of the remedial action authorized by the SLDS ROD (USACE 1998c) is limited to accessible soil and ground water, the definition of accessible soil controls the determination of whether remediation of a particular area is

authorized. The discussion of inaccessible soil in the SLDS ROD (USACE 1998c) provides examples of areas excluded, but not a complete list. Therefore, the determination of whether an area is accessible or inaccessible is made on a case-by-case basis by applying the SLDS ROD (USACE 1998c) definition of accessible soil. Because the determination of whether soil is accessible is directly related to the permanent nature of structures built upon soil, USACE has concluded that areas surrounding buildings or other permanent structures where the volume of soil underlying the areas is required for structural stability of the adjacent building or other permanent structure are also inaccessible. Each area excluded from remediation as inaccessible is documented, presented in the appropriate post-remedial action report, and will be included in the final site closeout report and will be submitted to MDNR and EPA for review and comment prior to finalization. A separate ROD will be developed for inaccessible areas at the SLDS. MDNR and EPA will be invited to participate in this process.

The SLDS remedy also includes implementation of a long-term ground-water monitoring strategy for the Mississippi Alluvial Aquifer (HU-B). As specified in the SLDS ROD (USACE 1998c), if long-term monitoring of HU-B shows significant exceedances of maximum contaminant levels (MCLs) or the thresholds established in 40 CFR 192 by the COCs specified in the SLDS ROD, then a GRAAA is to be initiated. The ROD-specified investigative levels (ILs) for each of the ground-water COCs are 50 micrograms per liter (µg/L) for arsenic, 5 µg/L for cadmium, and 20 µg/L for total uranium. Samples from three HU-B (Mississippi Alluvial Aquifer) monitoring wells exceeded the ILs for one or more of the COCs established in the SLDS ROD. Monitoring wells DW14 and DW15 exceeded the IL for arsenic. Significant exceedance of the total uranium IL in DW19 for an extended period initiated Phase 1 of the GRAAA. Therefore, a Phase I GRAAA was initiated in 2001 (USACE 2003a).

Final status surveys compatible with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) are performed subsequent to remediation at the SLDS. These surveys document achievement of remedial goals. Results of final status surveys are documented in Post-Remedial Action Reports (PRARs) for properties requiring remediation and in Final Status Survey Evaluation Reports (FSSERs) for those properties not requiring remedial action. Each of these reports includes a summary of the detailed documentation that confirms that the areas involved achieve remediation goals. This documentation specifically includes residual concentrations of contaminants of concern (e.g., exposure point concentrations) and assessment of residual site risks to confirm protectiveness.

System Operation/Operation and Maintenance

Thus far, the remedial activities completed for accessible soils have allowed for unlimited use and unrestricted exposure at the particular property. Therefore no operations and maintenance documents have been required. USACE is currently in the process of developing the CERCLA documentation necessary to address inaccessible soil at the SLDS. MDNR and EPA will be invited to participate in this process.

NORTH ST. LOUIS COUNTY SITES

During the period of this review (September 1998 through August 2003), North St. Louis County sites removal actions were conducted pursuant to the following EE/CAs and their corresponding Action Memoranda:

(1) *Engineering Evaluation/Cost Analysis – Environmental Assessment for the Proposed Decontamination of Properties in the Vicinity of the Hazelwood Interim Storage Site, Hazelwood, Missouri,* DOE/EA-0489, Rev. 1, March 1992 (DOE 1992) and *St. Louis Site Action Memorandum for Vicinity Property Cleanups,* June 1995 (DOE 1995).

(2) *St. Louis Airport Site (SLAPS) Interim Action Engineering Evaluation/Cost Analysis (EE/CA) St. Louis, Missouri,* DOE/OR-21950-1026, September 1997 (DOE 1997a) and *SLAPS Action Memorandum for the Removal of Radioactively Contaminated Material*, September 1997 (DOE 1997b).

(3) *Engineering Evaluation/Cost Analysis for the Hazelwood Interim Storage Site (HISS), St. Louis, Missouri,* October 1998 (USACE 1998a) and *Action Memorandum for the Removal of Radioactively Contaminated Material at the Hazelwood Interim Storage Site and Latty Avenue Vicinity Properties,* June 1998 (USACE 1998b).

(4) *Engineering Evaluation/Cost Analysis (EE/CA) and Responsiveness Summary for the St. Louis Airport Site (SLAPS) and Action Memorandum, St. Louis, Missouri,* March 1999 (USACE 1999a).

North St. Louis County Sites Removal Action Selection

Up to August 2003, removal actions have been conducted pursuant to Action Memoranda adopting recommendations set forth in the EE/CAs while a ROD was being developed to identify the final remedial action.

Four separate EE/CAs govern the removal actions conducted at the North St. Louis County sites. As noted, two of these EE/CAs were developed by DOE and two were developed by the USACE.

The first EE/CA (DOE 1992) developed for the North St. Louis County sites addresses vicinity properties in the Hazelwood and Berkeley, Missouri, area that were affected by operations at the SLAPS and the HISS. The selected response action for these vicinity properties presented in the EE/CA is the excavation of affected materials and the transportation of the affected materials to an interim storage area, the HISS. Subsequently, a DOE memorandum, "*St. Louis Site – Action Memorandum for Vicinity Property Cleanups,* June 1995", authorized the removal actions recommended in the EE/CA and amended the original proposal to replace the interim storage of contaminated soil at the HISS with shipment to an out-of-state commercial disposal facility.

The second EE/CA (DOE 1997a) addresses the presence of residual radioactive material in the soil at the SLAPS. The objectives of the selected alternative are to remove fill material immediately adjacent to Coldwater Creek and to provide a buffer zone between the creek and the remainder of the SLAPS. Specifically, all excavated soil that exceeded the DOE standard referred to as the 5/15/50 guideline would be shipped out of state to a licensed disposal facility. This removal action was authorized in the *SLAPS Action Memorandum for the Removal of Radioactively Contaminated Material* (DOE 1997b).

The third EE/CA (USACE 1998a) developed for the North St. Louis County sites addresses two interim storage piles at the HISS, two interim storage piles at Latty Avenue VP-2(L), accessible

subsurface soil at two Latty Avenue VPs, and one contiguous property. The USACE determined that an expedited response action to address affected materials located on these properties was appropriate to ensure protection of human health and the environment. The approved removal action required soil from the four interim storage piles, and accessible subsurface soil from the two Latty Avenue VPs and the contiguous property that exceed the selected criteria of 5/15/50 pCi/g for Ra-226, Th-230, and U-238, respectively, to be excavated and disposed at a licensed or permitted disposal facility. This removal action was authorized in the *Action Memorandum for the Removal of Radioactively Contaminated Material at the Hazelwood Interim Storage Site and Latty Avenue Vicinity Properties* (USACE 1998b).

The fourth EE/CA and Action Memorandum **(**USACE 1999a) addresses the SLAPS and the Ballfields (a SLAPS-VP area) and identifies the excavation and disposal of affected fill materials from the SLAPS and the Ballfields as the selected removal action. Specifically, soil within the top 6-inch layer from the SLAPS and the Ballfields (excluding the north ditch) that exceeds the selected criteria of 5/5/50 pCi/g (Ra-226/Th-230/U-238, respectively) above background [as determined by sum of ratios (SOR)] is to be excavated and disposed at a licensed or permitted disposal facility. Soil below 6-inch bgs that exceeds 15/15/50 pCi/g (Ra-226/Th-230/U-238, respectively) above background (as determined by SOR) is also to be excavated and disposed at a licensed or permitted disposal facility. This EE/CA allows that, if an effective treatment is identified subsequent to approval of the EE/CA, the USACE will consider implementation of such treatment on any remaining soil.

North St. Louis County Sites Removal Action Implementation

As part of the removal actions for the North St. Louis County sites, pre-design investigations were conducted on the various North St. Louis County sites' properties in order to obtain the information necessary to develop the remedial design documents.

The pre-design investigations conducted to date have either refined information obtained during the RI and/or provided new information regarding the degree and extent of contamination on the North St. Louis County sites' properties.

The ground-water monitoring is to assure that the environment is not being degraded by the sites' response actions. The monitoring also provides information to determine issues that may influence the management / disposition of excavation water.

Presented below is the history of the removal action implementation at the North St. Louis County sites. Information regarding initial plans, implementation history, removal measures (including monitoring, fencing, and institutional controls), and current status of the removal actions is presented. Also presented are discussions regarding any changes to or problems with removal action components.

SLAPS

At the start of the five-year review reporting period in August 1998, the North Ditch Removal Action and Sedimentation Basin Installation were in progress at the SLAPS under a *Construction Work Plan* (CWP) (USACE 1998d) developed pursuant to the initial EE/CA at the SLAPS (DOE

1997) and the subsequent EE/CA and Action Memorandum (USACE 1999a). The CWP was implemented in three phases:

Phase 1: Excavation and disposal of radiologically affected soil from the North Ditch (the area between McDonnell Boulevard and the former ballfields).

Phase 2: Construction of a sedimentation basin on the western portion of the site.

Phase 3: Removal of radiologically affected soil from the East End Area of the site.

Each of these three phases was initiated as part of the site stabilization effort to prevent surface water run-off from carrying radioactive affected materials from the site. The SLAPS work areas and the status of the removal actions are shown in Figure IV-1.

Approximately 6,550 in-situ yd^3 of affected material were excavated from the North Ditch area. The soil excavated during each of the three phases that exceeded the removal action criteria was loaded into railcars, in accordance with governing transportation requirements, and shipped out of state to a licensed disposal facility.

In 1998, USACE performed additional characterization to provide data to support ongoing removal actions, to provide information on contaminant transport and limits of migration of contaminants, and to support contaminant boundary delineation (USACE 2001a). Soil samples from the investigation areas (IAs 1 to 13) were collected and analyzed for radionuclides and various chemicals. TCLP analyses were performed on selected soil samples. Some monitoring wells were added and some were abandoned as part of the characterization activities. Geophysical investigations were performed to determine the locations of subsurface features such as utilities, buried metal, and other objects that may be of concern during drilling and remediation activities. The USACE investigation reconfirmed the presence of the radionuclides of interest including Ra-226, Th-230, and U-238. The *SLAPS Implementation Report* documents the results of this investigation (USACE 2001a).

A pre-design investigation was conducted at the SLAPS East End and in the right-of-way (ROW) along McDonnell Boulevard in 2000 to supplement the historical data. The radiological sampling results of the pre-design investigation borings supported the historical data indicating the maximum depth of affected material to be 10 to 12 feet bgs in the East End. The radiological sampling results of the pre-design investigation borings along the McDonnell Boulevard ROW supported the historical data indicating the maximum depth of affected materials to be 3 to 4 feet bgs. In addition, the borings indicated no disturbed soil below this depth interval that may be affected as a result of past construction activities. The pre-design investigation results are presented in the *Pre-Design Investigation Summary Report, East End and Right of Way Work Areas* (Stone & Webster 2000).

In early 2000, a decision was made to temporarily suspend removal activities in the East End work area and to initiate removal of affected materials from the Radium Pits work area. The *Radium Pits Removal Action Work Plan* (USACE 2000a), developed pursuant to the EE/CA and Action Memorandum (USACE 1999a), implemented this removal action. Of note was that the Radium Pits area was believed to contain the highest radiological concentrations of affected material on the site. The Radium Pits work area was completed in November 2000.

Later in 2000, removal activities at the SLAPS resumed at the re-designated East End Extension/ROW work area (basically the area between the original East End and the Radium Pits, including the site drainage ditch along the ROW). The original work plan for this area included sheetpile shoring along portions of the ROW. However, field operations were conducted without the need for the sheetpile shoring, while still providing protection to workers and the public and stability to the roadway and shoulder area.

Current removal activities at the SLAPS are being implemented under the *Site Wide Removal Action Work Plan* (the SLAPS-RAWP)(USACE 2000b) and conducted pursuant to the EE/CA and Action Memorandum (USACE 1999a). The document includes or incorporates by reference the following:

- ARARs identified in the EE/CA (USACE 1999a);
- other related site-wide removal action plans (site safety and health plan, quality control plan, etc.);
- requirements for site-wide activities such as security, work zone access control, methods of excavation, decontamination, erosion and dust control, water management and treatment, final status surveys, backfill, site grading, and site restoration; and
- individual SLAPS area removal action work plans as appendices to the SLAPS-RAWP.

A 2.3-acre area located south of the Radium Pits, west of the East End, and north of the rail spur loadout facility has been designated as the Phase 1 Work Area. A pre-design investigation was performed during September–October 2000 in the Phase 1 Work Area. Results of historical RIs did not adequately cover the extent of the Phase 1 Work Area. Additional sampling resulted in the pre-design investigation borings supporting the historical data indicating the depth of contamination to be 12 feet bgs. The pre-design investigation results are presented in the *Pre-Design Investigation Summary Report, Phase 1 Work Area* (Stone & Webster 2001a).

Excavation of the Phase 1 Work Area was implemented under the *Phase 1 Work Description* (USACE 2001b) developed pursuant to the EE/CA and Action Memorandum (USACE 1999a). Excavation of the Phase 1 Work Area was begun in December 2001 and completed in May 2003. Approximately 65,120 in-situ yd^3 of affected material were removed from the Phase 1 Work Area. A post-remedial action report will be developed and submitted to MDNR and EPA for review and comment prior to finalization. The report will include the Radium Pits, East End, East End Extension/ROW, and Phase 1 Work Area. A complete discussion of the removal activities conducted at the Phase 1 Work Area will be provided in the next five-year review report.

Currently, removal activities are in progress in the Phase 2 and 3 Work Areas, a 5.5-acre portion of the SLAPS located west of the Radium Pits and Phase 1 Work Area. Pre-design investigation activities were performed during June 2000 through January 2001 in the Phase 2 and Phase 3 Work Areas. The purpose of this investigation was to characterize the vertical extent of, and more accurately delineate, affected materials in the Phases 2 and 3 Work Areas prior to initiation of removal activities. The analytical results indicated that the deepest contamination was present

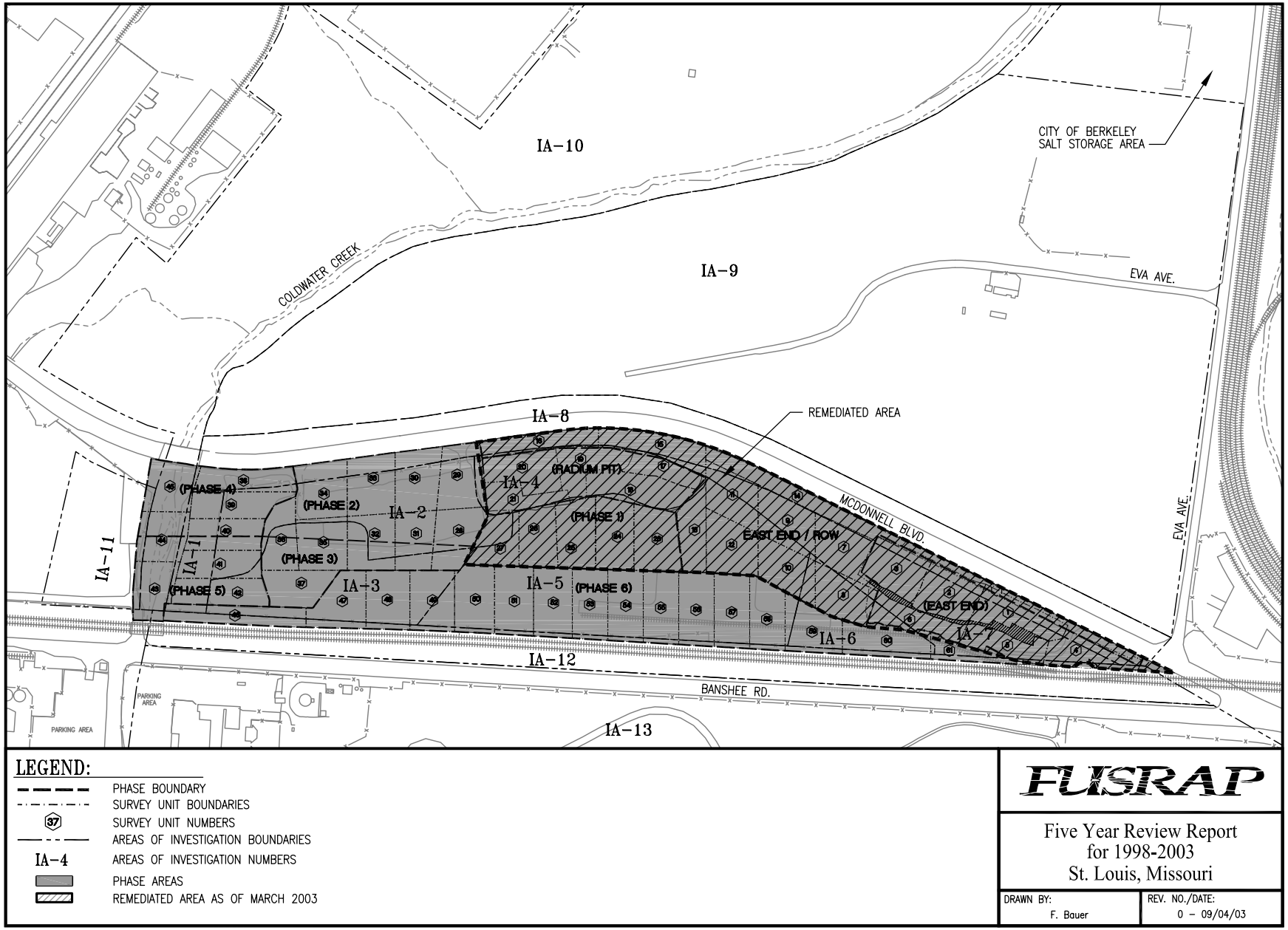

Figure IV-1. St. Louis Airport Site

at a depth of 18.4 feet bgs. The pre-design investigation results are presented in the *Pre-Design Investigation Summary Report, Phases 2 and 3 Work Areas* (Stone & Webster 2001b). The removal activity at the Phase 2 and 3 Work Areas was implemented in December 2002 under Appendix L to the SLAPS-RAWP, *Phase 2 and Phase 3 Work Description* (USACE 2001c). A complete discussion of the removal activities conducted at the Phase 2 and Phase 3 Work Areas will be provided in the next five-year review report.

At the SLAPS, the entire site is enclosed by chain-link fence, with vehicle access through a gated entrance. Non-work hour security is conducted site-wide. Environmental monitoring is conducted at the site boundaries. Thermoluminescent dosimeters (TLDs), radon alpha track detectors (ATDs) and particulate air filters are used in various combinations to monitor gamma exposure levels, radon emissions, and airborne radionuclide emissions. A ground-water monitoring well network is used to sample and evaluate ground-water constituent concentrations and potential effects on ground-water quality. Stormwater sampling and monitoring are conducted to meet National Pollutant Discharge Elimination System (NPDES)-equivalent and 120 CFR 20 Appendix B requirements for the site. In addition, monitoring to meet MSD discharge requirements is conducted.

Drainage and water control are integral to the removal actions conducted at the SLAPS during the period of this report (September 1998 through August 2003). Stabilized drainage ways have been constructed along the northern and southern boundaries of the site to convey run-off into the sedimentation basin located at the west end of the site. In 2000, monitoring of ground-water intrusion into active work areas indicated levels of selenium exceeding guidelines. A de-nitrification treatment is now utilized to lower selenium concentrations in the water removed from the excavations to levels below guidelines. A series of water storage tanks, having a capacity of over 600,000 gallons, are used to store water prior to treatment and/or discharge.

The removal action at the SLAPS is not complete as of August 2003; however, removal has been completed at a portion of the SLAPS.

Start and completion dates, as well as excavated (in-situ) volumes of the SLAPS removal actions performed during this reporting period, are summarized in the following table:

Table IV-2. SLAPS Removal Action Summary

Designation	Start	Complete	CY Removed
Sedimentation Basin	September 1998	May 1999	10,530
East End/East End Extension/ROW	October 1998	May 2003	65,120
Radium Pits	March 2000	November 2000	36,910
Phase 1	December 2001	May 2003	74,670
Phases 2 and 3	December 2002	In Progress	24,630
		Total Volume =	211,860

CY = cubic yards (In-Situ)

Latty Avenue Properties

For the Latty Avenue properties, the removal actions conducted during the five-year review period (September 1998 through August 2003) occurred primarily at the HISS/Futura site. The construction of the HISS railroad spur line and loading facility commenced in October 1998, pursuant to the EE/CA and Action Memorandum (USACE 1998a, b), and was completed by the

spring of 1999. Two stockpiles of affected material were created from this construction and subsequently removed.

The HISS stockpile removal was implemented pursuant to the EE/CA and Action Memorandum (USACE 1998a, b), under several firm-fixed price service contracts. The stockpiled affected material at the HISS has been removed and shipped by railcar to out-of-state licensed disposal facilities. A Post-Remedial-Action Report for the HISS will be developed and submitted to MDNR and EPA for review and comment prior to finalization. The start and completion dates, as well as the excavated (in-situ) volumes for the HISS removal actions conducted during the five-year review period, are summarized in the following table:

Table IV-3. HISS Stockpiles Removal Summary

Stockpile Designation	Start	Complete	CY Removed
East Piles 1 and 2	April 2000	June 2000	6,880
Railroad Spur Spoil Piles A and B	March 2000	June 2000	5,590
Supplemental Pile	September 2000	October 2000	4,710
Main Pile – Northern Portion	November 2000	January 2001	4,440
Main Pile – Phase 1 – South Half	March 2001	May 2001	11,950
Main Pile – Phase 2 – North Half	September 2001	October 2001	5,905
		Total Volume =	39,475

CY = cubic yards

At the HISS, disturbed areas have been covered with topsoil and hydro-seeded, or covered with reinforced poly with granular ballast, pending final selection of a remedial action for the HISS subsurface contamination. Currently, the rail spur is not used but remains operational. The entire site is enclosed by chain-link fence, with vehicle access through a gated entrance. Environmental monitoring is conducted at the site boundaries for radioactive air particulates, external gamma radiation and radon levels. A ground-water monitoring well network is used to sample and evaluate ground-water constituent concentrations and potential effects on ground-water quality. Storm-water sampling and monitoring are conducted to meet NPDES permit requirements for the site.

SLAPS VPs

The first SLAPS VPs removal action performed during the five-year review period (September 1998 through August 2003) was in conjunction with the replacement of the St. Denis Street Bridge over Coldwater Creek located in Florissant, Missouri. The DOE, the predecessor of USACE, was contacted by the City of Florissant, Missouri regarding the planned bridge replacement and conducted sampling activities in the area of the pending construction. The results of the sampling activity identified levels exceeding DOE guidelines, and the area was designated for removal prior to construction in order to protect worker health and safety during construction. The removal action was conducted on the east and west banks of Coldwater Creek from October 21, 1998, through November 12, 1998, pursuant to the EE/CA and Action Memorandum (DOE 1992, DOE 1995). About 450 in-situ yd^3 of radioactively affected soil and sediment were excavated. The affected material was transported by dump truck to the Eva Road loading area, then transferred to railroad cars for shipment to Envirocare disposal facility in Utah. No portion of the removal action for this property required an on-going treatment of affected soil or water. The areas where removal of affected material had taken place were released to the City of Florissant to begin preparations for the bridge replacement. The

excavated areas were released to the City of Florissant to begin preparations for the bridge replacement. On November 23, 1998, the USACE informed the City of Florissant that the soil with residual radioactive contamination above the EE/CA criteria (DOE 1992) in the areas impacted by the new bridge installation had been removed, as documented in the *Post-Remedial Action Report for the St. Denis Bridge Area* (USACE 1999c). Note that this document incorrectly cites the DOE 1997 as the governing document for the removal action. A correction will be issued to this document.

In March 2000, excavation of affected materials from a portion of the SLAPS VP-38 on SuperValu, Inc. property commenced pursuant to the EE/CA and Action Memorandum (DOE 1992, DOE 1995). Approximately 5,000 in-situ yd^3 of radioactively affected material were excavated and transported out of state for disposal at EnviroSafe in Idaho. The entire floor of the excavation was confirmed clean and released. However, only the west and northwest walls of the excavation were released. Residual soil concentrations in the other walls were in excess of the removal action goals and excluded from the removal area. Areas of the wall that were not included in the removal area were covered with geotextile material. Placement of clean backfill in the excavation and against the geotextile material was completed in June 2000. The VP-38 removal action is documented in the *Vicinity Property 38 Removal Action Summary*, Revision 0, dated April 9, 2001 (USACE 2001d). The post-remedial action report will be developed upon completion of the remaining response actions on this property and will be submitted to MDNR and EPA for review and comment prior to finalization. Currently, the USACE field project office complex and on-site laboratory facility are located on the remediated portion of VP-38.

Characterization activities consisting of gamma radiation walkovers and soil sampling were conducted across VP-24c in the Summer of 2002. Contaminated soil was identified on VP-24c. The contaminated soil was excavated in April 2002 and the area sampled in accordance with MARSSIM. The sample data showed that soil remaining on this parcel were below the criteria specified in the EE/CA and Action Memorandum (DOE 1992, DOE 1995).

Though no removal actions were required to be conducted on the property, a final status survey was performed on the northeast portion of the former ballfield area designated as the City of Berkeley Salt Storage Area. This area represents the first final status survey unit [Survey Unit (SU) 1] of IA-9. The final status survey and resulting conclusions are presented in *St. Louis Airport Site Investigation Area 9 Final Status Survey Evaluation, Berkeley Salt Storage Area (IA-9 Survey Unit 1)* (USACE 2000c).

Surface-water and sediment samples are collected from fixed locations along Coldwater Creek on a scheduled, periodic basis. Sample data are analyzed and evaluated against water quality criteria as part of the SLS environmental monitoring program.

Final status surveys compatible with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) are performed subsequent to removal at the North St. Louis County sites. These surveys document achievement of the removal action criteria identified in applicable Engineering Evaluations/ Cost Analyses (EE/CAs). Results of final status surveys are documented in Post-Remedial Action Reports (PRARs) for properties requiring a response action or in Final Status Survey Evaluation Reports (FSSERs) for those properties not requiring a response action. Each of these reports will include a summary of the detailed documentation that confirms that the areas involved achieve relevant criteria. This documentation will specifically

include residual concentrations of COCs (e.g., exposure point concentrations) and assessment of residual site risks and doses to confirm protectiveness.

System Operation/Operation and Maintenance

Thus far, the removal actions completed at the North St. Louis County sites have allowed unlimited use and unrestricted exposure at the particular properties. Therefore, no O&M documents have been required.

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