ENVIRONMENTAL MONITORING GUIDE FOR THE ST. LOUIS SITES

ST. LOUIS, MISSOURI

DECEMBER 1999

FINAL

ENVIRONMENTAL MONITORING GUIDE FOR THE ST. LOUIS SITES

ST. LOUIS, MISSOURI

DECEMBER 1999

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

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ADAR	Annual Data and Analyses Report
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	area of contamination
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirement
AS	accessible soils
ASL	any-use-source soil level
AWQC	Aquatic Water Quality Criteria
BMP	Best Management Practice
BNAE	base/neutral and acid extractable
BRA	baseline risk assessment
BS	buildings and structures
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
cfs	cubic feet per second
CFR	Code of Federal Regulations
CPOC	contaminant of potential concern
CWA	Clean Water Act
dBA	decibel
DCE	dichloroethene
DCG	derived concentration limit
DMR	discharge monitoring report
DOCHMC	Department of Community Health and Medical Care
DoD	U. S. Department of Defense
DOE	U. S. Department of Energy
DOI	U. S. Department of Interior
dpm	disintegration per minute
DQO	data quality objectives
EE/CA	Engineering Evaluation/Cost Analysis
EIS	Environmental Impact Statement
EMS	Emergency Medical Service
EPA	U. S. Environmental Protection Agency
EMG	Environmental Monitoring Guide
EMIFY	Environmental Monitoring Implementation for FY
ER	Engineer Regulation
ESA	Endangered Species Act
ESP	electrostatic precipitator
FFA	Federal Facilities Agreement
FR	Federal Register

ACRONYMS AND ABBREVIATIONS (cont'd)

RA	Remedial/ Removal Action
RCRA	Resource Conservation and Recovery Act
RESRAD	Residual Radiation computer modeling system
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
ROD	Record of Decision
IS	inaccessible soils
s	second
SAG	Sampling and Analysis Guide
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Office
SHRTSC-NCEA	Superfund Health Risk Technical Support Center- National Center for Environmental Assessment of EPA.
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
SLS	St. Louis Sites
SVOC	Semi-volatile organic compound
TBC	to be considered
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TOC	toxic organic compound
UMTRAP	Uranium Mill Tailings Remedial Action Project
UMTRCA	Uranium Mill Tailings Radiation Control Act
USACE	U. S. Army Corps of Engineers
USACE-SLD	U. S. Army Corps of Engineers- St. Louis District
USEPA	U. S. Environmental Protection Agency
VOC	volatile organic compound
VP	Vicinity Property
WD	work description
WL	working level
WQC	Water Quality Criteria

Table 1. Environmental Data Needs Requirements for the St. Louis Sites (Cont'd)

Media	ARAR Citation	Reporting Document	Applicable Area
Ground water	40 CFR 192.02 Table 1 to Subpart A - Uranium Mill Tailings Radiation Control Act (UMTRCA) (October 1992)	Reporting will be incorporated into the Annual Data Analyses Report for each Calendar Year.	1) SLDS ROD
Ground water	10 CSR 60- 4.060 (Missouri) - Primary Drinking Water Standards – Maximum Contaminant Levels (MCLs) for Radionuclides	Reporting will be incorporated into the Annual Data Analyses Report for each Calendar Year.	1) SLAPS EE/CA
Sediment	Executive Order No. 11990, May 24, 1977 – Protection of Wetlands (To Be Considered)	Reporting will be incorporated into the Annual Data Analyses Report for each Calendar Year.	1) SLAPS EE/CA 2) HISS EE/CA
Sediment	40 CFR Sections 192.12(a), 192.32(b)(2), and 192.41 - Uranium Mill Tailing Radiation Control Act (UMTRCA) (October 1992): Cleanup of Radioactively Contaminated Land and Contaminated Buildings	Reporting will be incorporated into the Annual Data Analyses Report for each Calendar Year.	1) SLAPS EE/CA 2) HISS EE/CA 3) SLDS ROD
Storm Water	10 CSR 20-6.060 - Water Quality Certification	Reporting will be incorporated in the Quarterly Discharge Monitoring Report, the Quarterly FFA Progress Report, and the Annual Data Analyses Report for each Calendar Year.	1) SLAPS EE/CA 2) HISS EE/CA
Storm Water	10 CSR 20-6.010 - State NPDES Permit Program	Reporting will be incorporated into the NPDES Permit.	1) SLAPS EE/CA 2) HISS EE/CA

Table 1. Environmental Data Needs for the St. Louis Sites (Cont'd)

Media	ARAR Citation	Reporting Document	Applicable Area
General	40 CFR 268.7 and 268.32 - RCRA Land Disposal Restrictions	To be determined as needed.	1) SLAPS EE/CA
General	10 CSR 25-5.262 - Standards Applicable to Generators of Hazardous Waste	To be determined as needed.	2) SLAPS EE/CA 3) HISS EE/CA
General	40 CFR 262 - RCRA Generator Requirements	To be determined as needed.	1) SLAPS EE/CA
Air/Waste	10 CFR 20 Appendix B, Table 2 – Annual Limits on Intake and Derived Air Concentrations of Radionuclides for Occupational Exposure	Reporting will be incorporated into the Annual Data Analyses Report for each Calendar Year.	

Note: All data collected from the St. Louis Sites will be reported in the Quarterly FFA Progress Reports.

1. SLAPS EE/CA = Engineering Evaluation/Cost Analysis (EE/CA) and Responsiveness Summary for the St. Louis Airport Site (SLAPS) – May 1998
2. HISS EE/CA = Engineering Evaluation/Cost Analysis (EE/CA) for the Hazelwood Interim Storage Site (HISS) – October 1998
3. SLDS ROD = Record of Decision for the St. Louis Downtown Site (ROD) – October 1998

- addresses periodic best management practice (BMP) monitoring, which is necessary at the SLS to obtain data relative to risk-based criteria or guidelines derived from environmental laws and regulation and access potential impact to environment.

1.2.2 Program Scope and Strategy

The EMG establishes an integrated monitoring network with sampling locations and frequencies defined on the basis of permit conditions, substantive requirements or best professional judgement, within the EMG structure. Such sampling locations include off-site unaffected areas, the area of contamination (AOC), points of compliance at the AOC boundaries, and potential off-site receptor areas. It should be noted that the sampling locations and activities indicated in the Annual Environmental Monitoring Implementation for each fiscal year (EMIFY) are not static because of the evolving nature of the CERCLA process at the sites. Accordingly, sampling activities may be deleted from subsequent versions of the EMIFY because the monitoring is no longer pertinent (i.e., radon monitoring within habitable buildings would not be pertinent once all relevant structures at a site were demolished). An increased sampling frequency may be incorporated into the program described to address changes elevated intensity of remedial or removal activities at the site. Frequencies will be driven by the sampling data collected, (i.e., if data is static-based on short time then no need to increase frequency; however, if data trends indicate changing data over short time the frequency may be increased).

The monitoring parameters identified in each year's EMIFY derive from permit conditions, and professional judgement to support the CERCLA re-evaluation process, risk-based criteria or guidelines from environmental laws. Parameters selected to support the CERCLA re-evaluation objective will be identified from historical characterization studies, potential constituents of concern (PCOCs) identified in the *North County Potential Constituents of Concern (PCOC) Assessment Memorandum (PAM)* (USACE, 1999a), PCOCs from the SLS ecological risk assessment, various environmental statutes and CERCLA decision documentation. It should be noted that in establishing parameters of concern, the EMIFY would consider potential transport pathways between media. For example, parameters of concern identified for storm water or surface water may include PCOCs identified from risk assessments.

Ground-water remedial action alternatives will be assessed, if long-term monitoring of the B unit shows that the MED/AEC COCs have statistically significant exceedances of the MCLs or thresholds established in 40 CFR 192. Monitoring will be conducted to meet CERCLA commitments to be protective of human health and the environment and demonstrate short-term effectiveness. For example, an increased level of air monitoring may be needed during excavation of soils at the sites. Incorporation of these types of monitoring efforts within the EMIFY allows that sampling effort to use existing monitoring capabilities and provides an integrated approach to data collection.

The fourth objective of the EMG is to identify the periodic environmental reporting requirements specified by site-related permits, decision documents, and the FFA. As indicated, substantive requirements of 10 CSR 20-6 are required to be met for the discharge of storm water

2.0 SITE HISTORY AND DESCRPITONS OF EACH SITE

2.1 DESCRIPTION AND OPERATING HISTORY FOR THE ST. LOUIS DOWNTOWN SITE

The St. Louis Downtown Site (SLDS) is a 45-acre industrial property within the eastern-most portion of St. Louis, approximately 300 feet west of the Mississippi River. The property is owned by Mallinckrodt, Inc., which produces various chemical products. The industrial facility consists of multiple separate former and current production complexes (plants) and ancillary support buildings and offices as depicted in Figure 2-1. The SLDS and vicinity properties have been used for industrial purposes for over a century. Between 1942 and 1957, the former Mallinckrodt Chemical Works (MCW) performed work under contract to the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC) at Plants 1, 2, 4, 6, 6E, 7, 7E, 7N, and 7S. The work included development of uranium processing techniques and producing uranium metal and metal compounds using various chemical processes and intermediates (nitric acid leaching, solvent extraction, fluorination using hydrofluoric acid and reduction using magnesium). In addition, some facilities were used for metallurgical processing of uranium, storage of reactor cores, and uranium recovery from slag (BNI, 1994).

Between 1948 and 1950, MCW decontaminated Plants 1 and 2 to meet the AEC criteria in effect at that time and the AEC released the buildings for further use without restrictions. The AEC managed decontamination efforts in Plants 6E, 7 and 10 between 1957 and 1962 to meet the release criteria in effect at that time. These plants were returned to MCW in 1962 without radiological restrictions. After the return of Plant 6 and 10 in 1962, MCW constructed new buildings in certain portions of these plant areas. However, a radiological survey conducted at SLDS in 1977 found radiological contamination that exceeded the guidelines in existence at that time. Elevated gamma radiation levels were measured at outdoor locations and within some of the historical processing buildings. Additionally, Radium-226 (Ra-226) and Uranium-238 (U-238) concentrations in certain soil samples significantly exceeded background concentrations. In response to this survey, it was determined that further investigation of the site was necessary to characterize the nature and extent of the contamination. In 1990, the U.S. Environmental Protection Agency (USEPA) Region VII and Department of Energy (DOE) entered into the Federal Facilities Agreement (FFA) that established schedules and deliverables for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at the St. Louis Sites (SLS). In 1994, DOE submitted the remedial investigation (RI) report for the SLS.

Vicinity properties that have been impacted by SLDS operations include McKinley Iron Company to the north; PVO Foods (defunct) and City of St. Louis properties to the east; Thomas and Proetz Lumber Company to the south; and North Broadway Avenue and small businesses to the west. The St. Louis Terminal Railroad Association; the Norfolk and Western Railroad; and the Chicago, Burlington, and Quincy Railroad all have active rail lines passing through the Mallinckrodt facility (Figure 2-2).

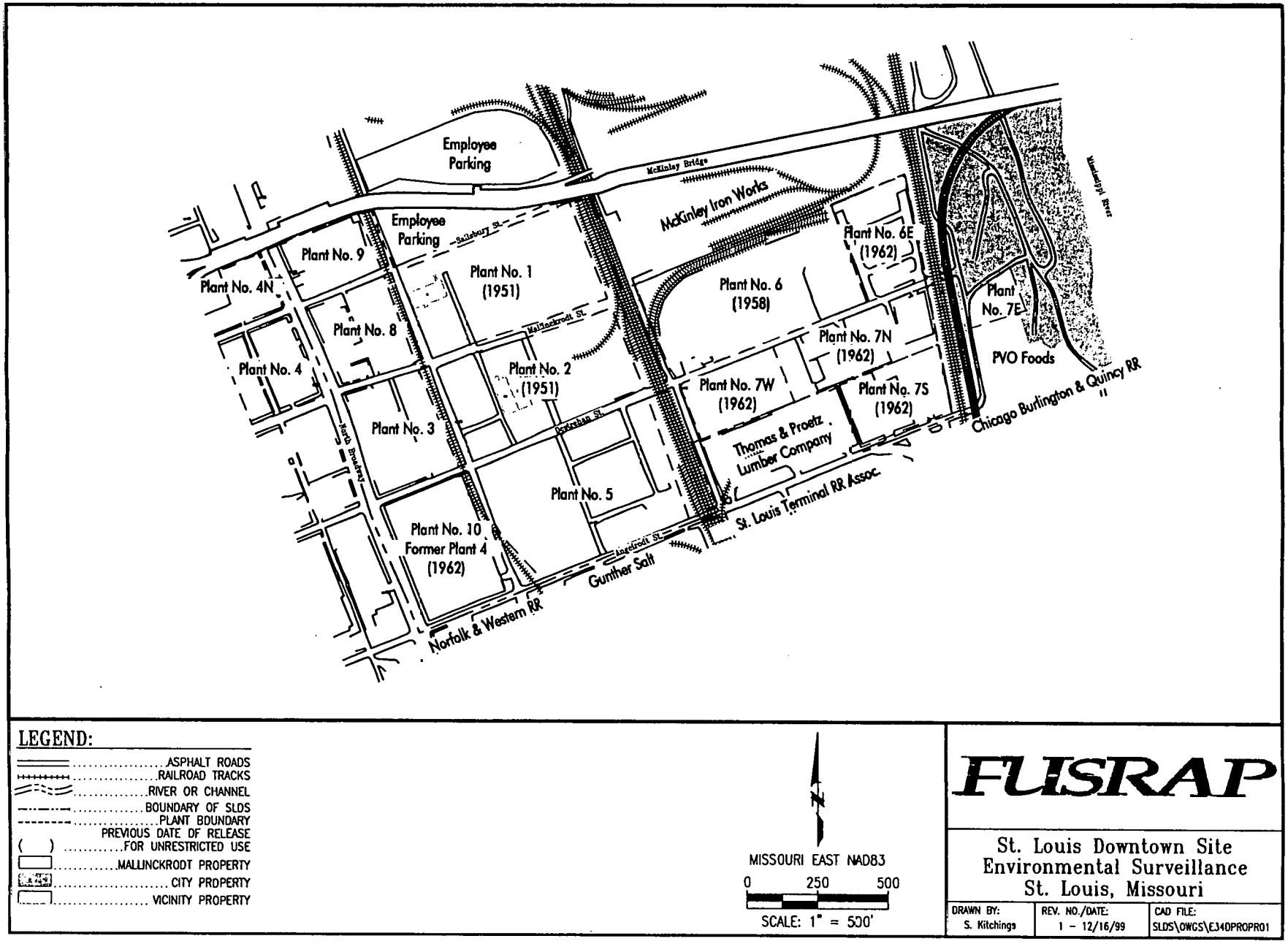


Figure 2-2. Location Map for the SLDS

of the SLDS, with the exception of the Illinois-American Water Plant intake, which serves East St. Louis and is located about 13 km (8 mi) downstream on the opposite bank of the river.

The geologic history of the St. Louis area is characterized by the cyclic deposition of 1,829 m (6,000 ft) of Paleozoic sandstones, shales, limestones, and dolomites. These layers thicken into the Illinois Basin to the east and toward the Ozark Dome to the southwest. They are nearly horizontal, dipping less than 1 degree to the northeast as a result of uplift of the Ozark Dome.

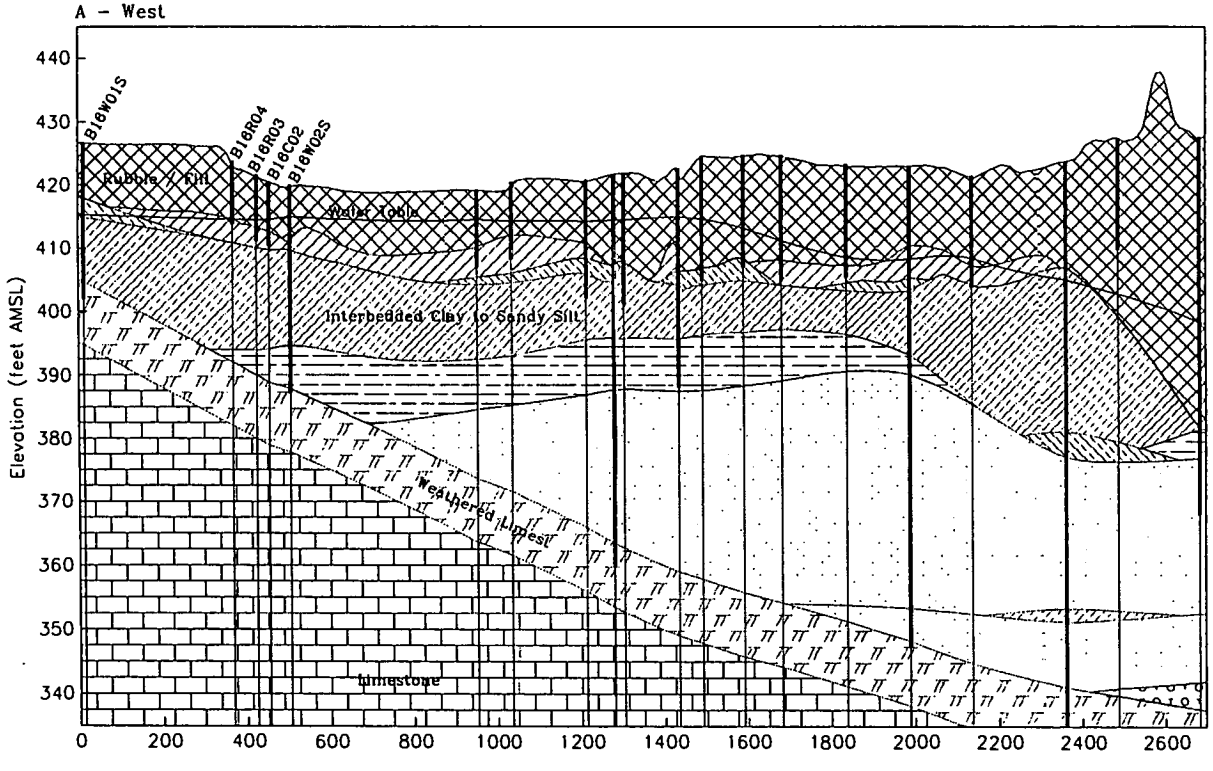
The stratigraphic section of interest for this site consists of limestone bedrock and the overlying Pleistocene and recent sediments and fill. The sediments consist of sand, silt, and clay that typically range from less than 2 m (5 ft) to more than 30 m (100 ft) thick.

The SLDS stratigraphy is shown on Figure 2-3. The fill consists of cinders, bricks, soil, and other debris and has been placed on top of the original floodplain to depths of up to 9 m (30 ft) as the area has been developed. The naturally occurring surficial deposits originated from multiple sources including: glacial outwash consisting of mixtures of clay, silt, and sand; wind-deposited loess; and deposits from the Mississippi and Missouri rivers.

Limestone bedrock of Mississippian age underlies the surficial sediments at depths ranging from 6 m (19 ft) on the western side of the SLDS to 24 m (80 ft) near the Mississippi River.

Ground water at the SLDS is found within three horizons (or hydrostratigraphic units): the upper unit, referred to as the A Unit; (consisting of fill on top of clay and silt), the lower, alluvial unit, referred to as either the Mississippi Alluvial Aquifer or the B Unit; and the bedrock, referred to as the C unit (Figure 2-4), (USACE, 1998c). The Mississippi Alluvial Aquifer is a principal aquifer in the St. Louis area, including the SLDS area. Aquifers in this region also exist in the bedrock formations underlying the alluvial deposits. Ground waters of the St. Louis area are generally of poor quality and do not meet drinking water standards without treatment. Expected future use of ground water at the SLDS is minimal, since the higher quality and large quantity of the Mississippi and Missouri Rivers is readily available.

The A Unit is heterogeneous and the youngest of the three hydrostratigraphic horizons. This young horizon overlies the B Unit on the east and bedrock on the west at the SLDS. The A Unit has the largest range of soil constituents and thus a great spread in hydraulic conductivities spatially. This uppermost unit does not have water levels or flow directly related to the river stage. The base of the A Unit consists of fine-grained deposits behind the Mississippi River's natural levee. The A Unit also had meandering creeks and swampy low topography prior to the introduction of fill material. In the 1800's the A Unit's surface was raised with the least expensive, most readily available fill materials: rubble and wood and coal combustion wastes, e.g., coal slag and cinders. The combustion products used for fill had inherently high metal concentrations. The infiltration and throughput of water in the A Unit is relatively minor, since the ground surface has large areas of buildings, road surfacing, and channeled surface water flow. This shallow unit is not a productive source of water due to poor yield and its multiple chemical



Geologic Cross Section A – A' at SLDS

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

Cross Section Location Map

FUSRAP

St. Louis, Missouri

Drawn By: R. Smith

Rev. No. / Date: 0 / 24 Mar 99

File: SLDSCfg01XSectA.sho

Figure 2–4. Hydrostratigraphic Cross–Section of the SLDS Area

Soil characterization results indicated that the areas associated with MED/AEC activities were principally contaminated with radionuclides, including Ra-226, Ra-228, Th-230, Th-232, U-234, U-235, and U-238, and associated daughter products (USACE, 1998c). Radiological constituents have also been identified on vicinity properties with the highest levels occurring at the City Property. The extent of contamination is limited mostly to shallow soils; however, contaminants may have migrated to depths of about 20 feet below ground surface at Plants 2 and 6, respectively. Metals and volatile organic compounds (VOCs) have also been detected across the site but generally occur in limited pockets (USACE, 1998c). The ROD for SLDS identified arsenic and cadmium as COCs in addition to the radionuclides indicated above.

Sediment samples were collected as part of the RI from 50 manholes and 23 storm drains or process pipelines as part of the initial RI completed in 1994. These samples indicated U-238, Ra-226, Th-232, and Th-230 contamination exceeding guidelines in 36 manholes and within 7 pipelines (DOE, 1995). Sampling of Mississippi River sediments along City of St. Louis property in 1987 and 1988 indicated Th-230 and Ra-226 contamination ranging from 1 to 160 pCi/g and 6 to 1,100 pCi/g, respectively. Subsequent confirmatory sampling conducted in 1992 indicated no levels of radioactivity above Minimum Detectable Activities (MDAs). Higher flows between the sampling events are suspected to have flushed the constituents downstream.

Groundwater at the SLDS has been impacted by historical operations related to MED/AEC activities and other site industrial uses. Radiological contamination is limited to the A Unit through sorption processes and is dominated by uranium activity. Other isotopes have historically been close to background levels. Ground-water monitoring wells in the vicinity of the former Building K1E have historically had consistently elevated levels of uranium activity in excess of background levels. Volatile organics detected in the A Unit include benzene, 1,2-dichloroethene (DCE), tetrachlorethylene (TCE), and vinyl chloride. Inorganic contaminants detected at significant concentrations in the A Unit include arsenic (As), cadmium (Cd), iron (Fe), manganese (Mn), chloride (Cl_2), and sulfate (SO_4).

Radiologic contaminants of concern (COCs), as identified by the ROD (Ac-227, Pa-231, Ra-226, Th-230, Th-232, and U-238), have not been found in the B Unit at concentrations exceeding their respective maximum contaminant levels. In general, historical concentrations of these isotopes in the B Unit have been near background levels (DOE 1995).

Non-radiological COCs as identified by the ROD (As, Cd, total uranium (U) have not been found in the B Unit at levels of significance. Organic contaminants, not that selected by the ROD as COCs, have been detected in the B Unit at significant levels include 1,2 DCE, vinyl chloride, methylene chloride, TCE and hexachlorobenzene. The primary inorganic contaminants found in the B Unit that are attributed non MED/AEC sources, and are not COCs under the ROD, are barium (Ba), Fe, Mn, and Cl_2.

The depth to ground water at SLDS ranged between approximately 5 to 34 feet bgs during the sampling event. The ground-water flow direction in the Upper Zone is generally eastward beneath the site (Figure 2-5). The lowest area of ground water elevation found in the center of the site occurs in an area where it could be influenced by the fill placed there or by man-made

drainage zones. The Lower Zone flow directions are defined at the northeastern quarter of the site and flow to the south and west towards an apparent ground-water surface depression near well B16W05D. Ground water in the Lower Zone is hydraulically connected to the Mississippi River. The potentiometric surface and ground-water flow directions of this zone vary and are influenced by river stage.

2.1.4 St. Louis Downtown Site Remedial Action Status Summary

The St. Louis Downtown Site (SLDS) is an active industrial site privately owned by Mallinckrodt, Inc. Four CERCLA interim actions have been performed at SLDS since April 1994, involving the removal of contaminated soil and demolition of structures. These actions have included excavation of soils from the City Property, excavation of soils at Plant 10 area, building demolition and excavation of Plant 6 and 7 area, and building demolition and excavation in the Plant 2 area. In October 1998, the final ROD for accessible soils, and accessible sediments in storm sewers and drains, was issued (USACE 1998c). The ROD dictates the removal and off-site disposal of approximately 76,455 m^3 (100,000 yd^3) of contaminated soil and perimeter monitoring of groundwater in the Mississippi River alluvial aquifer.

The remaining response actions required under the FFA include remedial actions related to contamination within two remaining buildings (Buildings 25 and 101), and involves soil and ground-water that is inaccessible due to existing active plant infrastructure (i.e., beneath rail lines, roads, buildings, and the levee). In addition, the area of historical sediment contamination on the Mississippi River bed will be resampled; if contaminants are confirmed above Applicable or Relevant and Appropriate Requirements (ARARs), the area will be also be addressed in a subsequent response action. Other authorities are addressing actions resulting from the pre-existing contamination or releases from non-MED sources. These include termination by Mallinckrodt of its Nuclear Regulatory Commission (NRC) license for the Columbium/Tantalum process conducted in the Plant 5 area and Resource Conservation and Recovery Act (RCRA) Part B permitting process for the entire facility. Mallinckrodt currently addresses air emissions and wastewater/stormwater monitoring requirements at the site.

Pending activities include implementation of the remedial action specified in the ROD, inclusive of soil and sediment removal and development of a ground-water monitoring program to monitor the Mississippi River Alluvial Aquifer (B Unit). Agreements to restrict ground-water use on the site and VPs may be proposed to state and local water authorities as part of the site's actions.

2.2 DESCRIPTION AND OPERATIONAL HISTORY FOR THE ST. LOUIS AIRPORT SITE AND VICINITY PROPERTIES

2.2.1 Operational History

The St. Louis Airport Site (SLAPS) is a 21.7-acre site located in St. Louis County approximately 11 miles northwest of the St. Louis Downtown Site (SLDS). The site is immediately north of the Lambert-St. Louis International Airport and is bordered by McDonnell

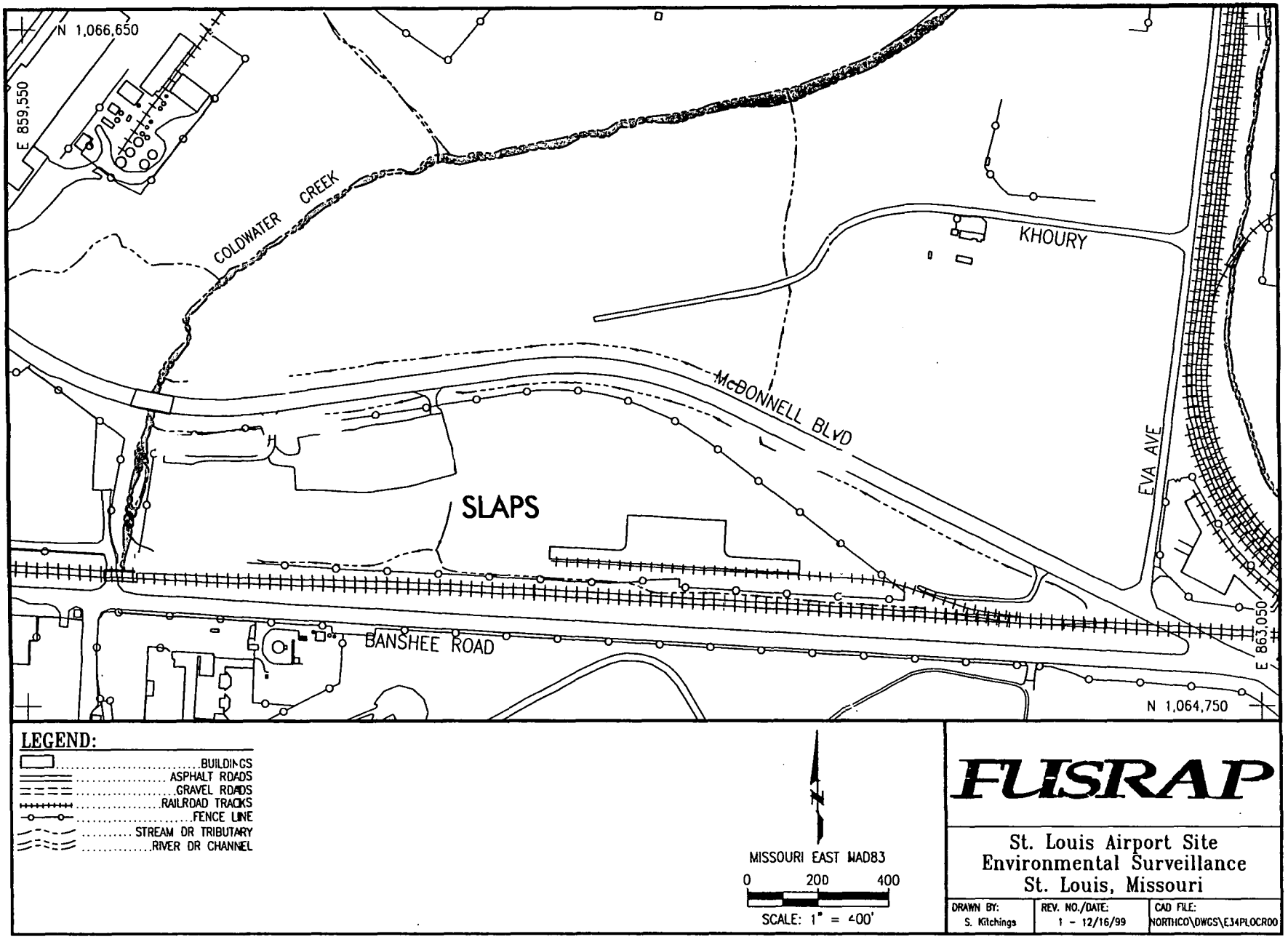


Figure 2-6. Location Map for the SLAPS

this drainage ditch will be diverted from the western portion of this area by berms and discharged through Outfall 002 or redirected to the ballfields drainage ditch (beyond outfall 003.)

Coldwater Creek is the principal surface water feature in the site vicinity. This stream is a Class C waterway (periodic no flow conditions) designated for livestock and aquatic life use.

The creek originates south of SLAPS, has a channel length of 31 km (19.5 mi), and a drainage basin of 122 km^2 (47 mi^2). Water quality in the creek has been impacted by industrial discharges from multiple facilities including stormwater runoff and discharges from three sewage treatment facilities.

The geology of the St. Louis area was briefly summarized in Section 2.1.4. In the vicinity of SLAPS, surficial deposits (Unit 1) include topsoil and anthropogenic fill (rubble, scrap metal, gravel, glass, slag, and concrete) generally less than 4 m (14 ft) thick (Figure 2-7).

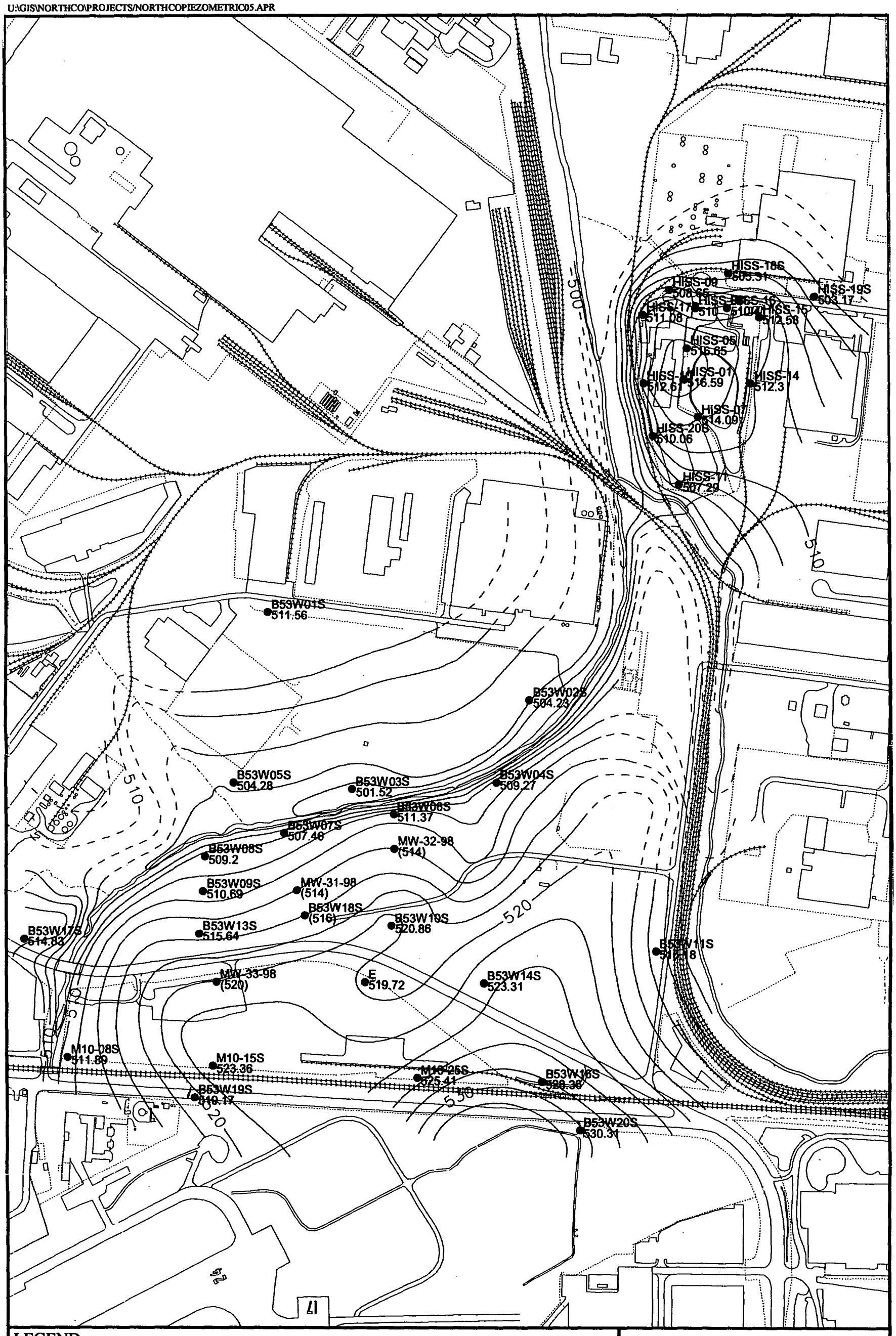
Pleistocene loess and glacial lacustrine deposits underlie the fill (Units 2, 3, and 4). Unit 2 corresponds to wind deposited loess and has a thickness of 3-9 m (11-30 ft). Unit 3, which is subdivided into subunits 3T, 3M, and 3B, consists primarily of clay and silt lakebed deposits. Each of these clay subunits has a thickness of up to approximately 9 m (30 ft). Unit 4 consists of clayey gravel with increasing fine- to very-fine sand and sandy gravel near the bedrock contact.

Below Unit 4 are Units 5 and 6, comprised of shale/siltstone and limestone, respectively. Depth to bedrock ranges from about 17 m (55 ft) on the east of SLAPS to a maximum of 27 m (90 ft) towards Coldwater Creek.

Five hydrostratigraphic zones (HZ) are recognized beneath SLAPS. The fill (Unit 1) and the Pleistocene, glacially-related sediments of stratigraphic Unit 2 and subunit 3T comprise the HZ-A. A clay with low vertical permeability comprising subunit 3M of stratigraphic Unit 3 is HZ-B. HZ-C is comprised of the stratigraphic subunit 3B and Unit 4. The shale and limestone are recognized as HZ-D and HZ-E, respectively. As of August 1997, thirty two (32) wells were screened in the HZ-A and fourteen (14) wells were screened in HZ-C. Shallow groundwater flow in HZ-A is toward Coldwater Creek under normal flow conditions. Although data is not available for high water conditions, it is likely that flow directions are temporarily reversed at these times. The HZ-B is absent in the southeastern portion of the site. The groundwater characterization report for SLAPS completed in May 1998 concluded that hydraulic communication did not exist between the HZ-C and Coldwater Creek (USACE, 1998f). Average depths to the water table at the site range from near the ground surface during the winter months to about 3 m (10 ft) during the summer months. Ground-water flow directions in the bedrock (HZ-D and HZ-E) are indeterminate.

The ground-water flow direction from SLAPS in the upper HZ, interpreted to be perpendicular to ground-water equipotential contours, is westerly to northwesterly towards Coldwater Creek (Figure 2-8). Shallow ground water beneath properties located north of the

U:\GIS\NORTHCO\PROJECTS/NORTHCOPIEZOMETRIC05.APR



LEGEND:

- ● Shallow monitoring well location where 3 Dec. 1998 water level measurement was taken (water level elevation in feet AMSL, in parenthesis where inferred).
- Interpreted shallow piezometric surface (based on measured water level elevations, surficial drainage, and topography). Dashed where inferred. Two foot contour interval.

N

MO-East State Plane Coordinate System (NAD83, feet)

300 0 300 600 Feet

FUSRAP

SLAPS & HISS 3 Dec. 1998
Shallow Piezometric Surface
St. Louis, Missouri

DRAWN BY:	REV. - DATE:
R. Smith	3 - 17 Dec. 1999

Figure 2-8. Upper Potentiometric Surface Map for the SLAPS and the HISS

creek also converges to the creek as shown. The hydraulic gradient increased near the southern side of Coldwater Creek. The shallow-most ground water of the unconfined upper zone is interpreted to discharge into Coldwater Creek, which divides the shallow ground-water system south and east of the creek from areas north and west of Coldwater Creek. One anomalous point is located at monitoring well B53W10S. It is interpreted to be an invalid reading or the location has been influenced by remedial activities in the vicinity.

Potentiometric surface elevation for the lower HZ is highest at well M10-25D located at the southeastern corner of the site. The contour configuration of two radial types of surface patterns northeast and west of SLAPS was also observed in September 1995. The potentiometric surface of the lower zone does not appear influenced by Coldwater Creek because the "confined" the lower HZ ground-water potentiometric surface is higher than the upper zone and the creek (creek elevation is about 500 feet above mean sea level). This condition is also supported by the absence of a potentiometric trend paralleling the creek, the apparent extension of the potentiometric surface beneath the creek, and other hydrogeologic data (presence of 3M unit, the boundary of the upper and lower HZ). The orientation and thickness of the lower HZ material probably influences the configuration of the lower HZ potentiometric surface in the buried channel system, which is oriented similar to the present course of Coldwater Creek.

2.2.4 Site Characterization Summary

Site characterization studies at SLAPS have documented impacts to soils, surface water, stream sediments, and groundwater (DOE, 1994; DOE, 1995). Historical monitoring results for airborne radon, reported in the 1994 RI, indicated concentrations at SLAPS ranging from 0.1 to 3.6 pCi/L. Airborne radon concentrations in subsequent years have been consistent with those reported in the 1994 RI report. The maximum airborne radon concentration in 1996 was 1.6 pCi/L (DOE, 1997). Background radon concentrations in the St. Louis area range from 0.2 to 0.6 pCi/L indicating that historical levels exceed background concentrations. External gamma radiation levels have historically been measured at the four perimeter sampling locations used to monitor airborne radon concentrations. Historical annual external gamma radiation levels at SLAPS reported in the 1994 RI report ranged from 3 to 2157 mR/yr. External gamma levels reported in subsequent years remained consistent with those reported in the RI report. The maximum level reported from environmental surveillance at the site in 1996 was approximately 2400 mR/yr. These maximum external gamma levels have historically occurred at monitoring station 2, which is located along the northeast boundary of the site. Typical background gamma levels for the area range from 45 to 99 mR/yr.

Both surface and subsurface soils on the SLAPS property are contaminated with radionuclide suite similar to that at SLDS (Ra-226, Th-230, Th-232, and U-238, and associated daughter products). The concentrations of U-238 and Th-230 range up to 1600-15,000 pCi/g respectively with average concentrations of approximately 140 pCi/g. Average Ra-226 concentrations are 61 pCi/g (DOE, 1994). Radiological constituents have also been identified on VPs, including ditch lines north and south of Banshee Road and south of McDonnell Boulevard, to the north of Pershall Road, along Latty Avenue, the St. Louis Airport property, and to the north along Coldwater Creek and portions of the ballfields. On-site radiological contamination

has migrated to depths of 5 m (18 ft) but is generally limited to less than 2 m (8 ft) in depth. The extent of contamination is limited mostly to shallow soils on VPs (depths of <1 to 1 m (1 to 4 ft).

Surface water radiological activity in Coldwater Creek downstream of SLAPS has remained approximately equal to the isotopic concentrations observed at the upstream point where Coldwater Creek emerges from underneath Banshee Road. The only radionuclides found at the downstream sampling locations at concentrations above the upstream concentrations were Th-230, Th-232, and Ra-226 but the thorium isotopes exceeded the upstream in only one or two instances. The downstream concentrations of Ra-226 exceeded the upstream values of 0.36 pCi/L in approximately 26% of the historical samples. Combined Ra-226 and Ra-228 concentrations have historically been below the Ambient Water Quality Criteria (AWQC).

Characterization of surface water quality in Coldwater Creek has not historically addressed chemical contaminants. Sampling of Coldwater Creek at the upstream location where it emerges from underneath Banshee Road was conducted to establish criteria for the *North County Potential Contaminants of Concern Assessment Memorandum* (PAM) (USACE, 1999a). The analyses quantitated for this purpose-included metals, major anions, herbicides and pesticides, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). The only metals exceeding AWQC at this sampling location were aluminum, iron, and lead. Mean concentrations of aluminum and iron were somewhat above the AWQC and the detections of lead were slightly elevated above the criteria. The only organic contaminants detected at the upstream location were 2,4 D, bis ethyl hexyl phthalate, and 1,2 dichloroethene but these pollutants were at levels significantly below AWQC.

Historical sediment sampling along Coldwater Creek has indicated concentrations of Ra-226 ranging from 0.3 to 4.9 pCi/g. Although the sediment concentrations of Ra-226 exceeded the background concentrations derived for the North County PAM in approximately 63% of the historical results, the mean sediment concentration of this isotope (1.1 pCi/g) was relatively consistent with the referenced background. Historical concentrations of Th-230 in Coldwater Creek sediments have ranged from 0.2 to 110 pCi/g with 45% of the results above the background levels derived for the North County PAM.

Mean concentrations of cadmium, copper, and selenium from historical sediment samples collected during the RI exceeded the background levels derived for the North County PAM (DOE1994, DOE 1995, USACE, 1999a). The maximum detected concentration of molybdenum in the historical RI sediment samples also exceeded the background levels. A number of polynuclear aromatic hydrocarbons were found in the RI sediment samples at concentrations that exceeded the North County PAM criteria by as much as an order of magnitude. These contaminants may derive from the airport property and roadway runoff. Methylene chloride was found in the RI sediment samples at concentrations somewhat above the PAM criterion.

Activities for Ra-226, Th-230, and uranium isotopes exceed background levels in groundwater in portions of the site close to buried wastes. Groundwater at the SLAPS has also been impacted by organics including VOCs (1,2-dichloroethene (DCE), trichloroethylene (TCE), and toluene). Endosulfan (pesticide compound) and one SVOC (bis[2-ethylhexyl]phthalate)

have also been detected. However, it is noted that the latter is a common laboratory artifact. Metal contaminants detected above primary or secondary maximum contaminant levels (MCLs) include cadmium (Cd), chromium (Cr), manganese (Mn), selenium (Se) , silver (Ag), and zinc (Zn).

A storm-water sedimentation basin related to the first EE/CA noted above is under construction. The Missouri Department of Natural Resources has issued National Pollutant Discharge Elimination System (NPDES) ARARs specifying storm water effluent monitoring.

2.3 DESCRIPTION AND HISTORY FOR THE HAZELWOOD INTERIM STORAGE SITE AND VICINITY PROPERTIES

2.3.1 Operational History

The Hazelwood Interim Storage Site (HISS) is an 11-acre site located in northern St. Louis County approximately 1-mile northeast of the SLAPS. The site is located on Latty Avenue and is bordered to the east by the Stone Container Site (known as Latty Avenue Vicinity Property 2). The FUTURA Site (Figure 2-9) borders the HISS to its north by Latty Avenue and other Vicinity Properties (VPs), and to the west. Multiple rail lines owned by the Norfolk and Western Railroad lie to the west and south of the site.

In 1966, Continental Mining and Milling Co. purchased approximately 106,140 short metric tons of radioactive materials that were stored at the St. Louis Airport Site (SLAPS) and began moving the materials to property located at 9200 Latty Ave. These radioactive materials included pitchblende raffinate, barium sulfate cake and other miscellaneous process residues and wastes. In 1967, the Commercial Discount Corporation purchased these materials and from that time until 1973 shipped the majority of the wastes and residues to Canon City, Colorado. Improper storage, handling and transport of the materials during these activities spread contamination along the haul routes and to the areas adjacent to 9200 Latty Ave (DOE 1990b, USACE 1998g). In 1977, Mr. Dean Jarboe purchased the property and buildings at 9200 Latty Ave. Under Nuclear Regulatory Commission (NRC) guidance in 1979, the property owner decontaminated existing structures and excavated approximately 9,939 m^3 (13,000 yd^3) of soils from 1.4 hectares of land in the western portion of the tract. These soils were transferred to the eastern portion of the property and constitute the main HISS pile. Additional remedial activities conducted by U.S. Department of Energy (DOE) in 1984 resulted in the excavation of approximately 3,058 m^3 (14,000 yd^3). of soils from the FUTURA site and along Latty Ave and these soils were also stockpiled at HISS. In 1986, DOE support to the city of Hazelwood resulted in the excavation of approximately 3,517 m^3 (4600 yd^3)of soils from along roadways that were stored at the HISS as the supplemental pile. Property improvement activities conducted by the owner of the VP to the east of HISS in 1996 resulted in the generation of approximately 8000 yd^3 of soils, wood chips, asphalt debris, roof debris and siding debris that are stockpiled in two smaller VP piles (referred to as the Eastern piles). In addition to these Eastern piles and associated areas, the VPs also include additional contiguous areas that extend eastward

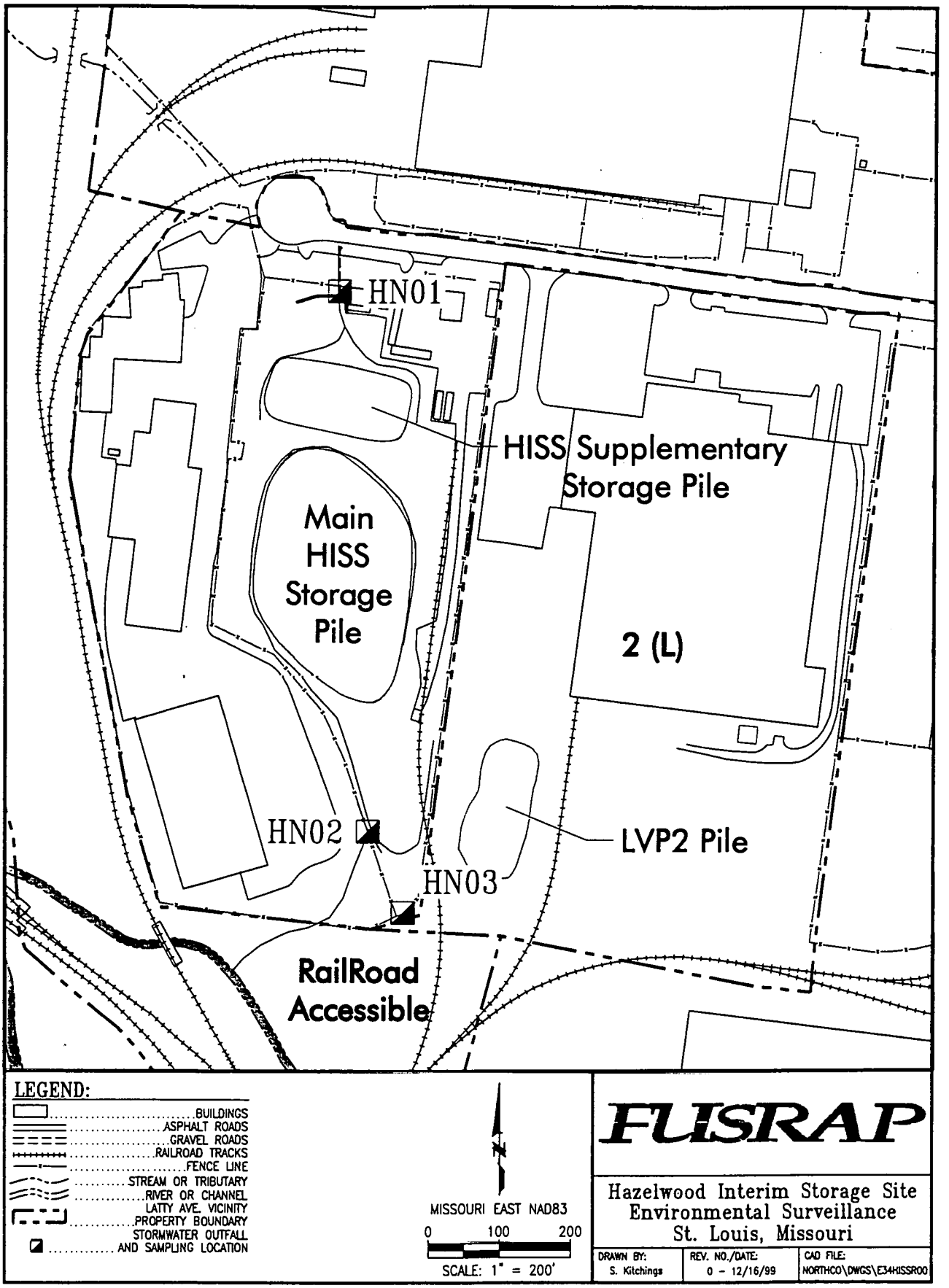


Figure 2-9. Location Map of the HISS and the Latty Ave. Vicinity Properties

along Latty Ave, to the north and west along the Coldwater Creek floodplain, and one area to the south of the HISS piles (Latty VP 6 or Seeger VP).

The HISS is currently leased by the federal government and is mainly used for interim storage of excavated contaminated soil. The adjacent property on which FUTURA Industries is located is an active industrial site. Contiguous VPs also include active industrial facilities. An existing Missouri Department of Natural Resources (MDNR) operating permit requires monitoring of storm water discharges along the drainage ditches surrounding the HISS storage piles. An Engineering Evaluation/Cost Analysis (EE/CA) for removal and off-site disposal of the two storage piles on HISS and stockpiled soil on Latty VP2 (east pile), removal of accessible subsurface soil from Latty Avenue VPs and contiguous properties, and removal of contaminated materials generated in support of FUTURA activities has been issued (USACE 1998e). This action is a component of the comprehensive remedial program for the St. Louis site. Response actions remaining include completion of the remedial investigation/feasibility study (RI/FS) process and issuance of a Record of Decision (ROD) that addresses all contamination present at the site above acceptable risk levels. Pending activities include initiation of the response actions identified in the EE/CA.

2.3.2 Waste Inventory

The waste materials that were historically stored at HISS included uranium extraction and refining residues. These materials included an estimated 106,000 tons of Congo pitchblende and Colorado raffinate; 36,469 metric tons (40,200 tons) of barium sulfate cake; and 350 tons of miscellaneous process residues and wastes (DOE, 1990b). Soils and debris generated by FUTURA Industries in 1979 were placed on the eastern half of the property to form the main storage pile of 9,939 m^3 (13,000 yd^3). Another 10,704 m^3 (14,000 yd^3) of contaminated soils were added to this pile by additional remedial action along Latty Avenue during 1984 (DOE, 1990b). A supplemental storage pile 2,500 m^3 (3,270 yd^3) was created in 1986 to store radioactively contaminated soil from an off-site drainage improvement project in the city of Berkeley. Two piles, containing approximately 6,116 m^3 (8000 yd^3) of soil and debris are located on the Latty VP 2 to store roofing and siding debris, asphalt, rubble, and soils (DOE, 1998g).

2.3.3 Site Characteristics

A summary of the topographic, geologic, and physiographic setting for the St. Louis area and the area encompassing SLAPS and HISS has been previously presented. Local terrain at HISS is flat and the site lies at an elevation between about 157 and 159 m (514 and 522 ft) amsl, except for the storage piles, which reach heights of up to 4 m (12 ft) above grade. The local geology at HISS is similar to that described for the SLAPS. Natural topsoils in the area are comprised of a dark silt loam up to nearly 1 m (3 ft) in thickness. Surface runoff from the site is directed through drainage ditches. Ditchlines around the main storage pile drain to the south toward to an intermittent tributary to Coldwater Creek. Drainage ditches around the secondary storage pile drain to the north, ultimately feeding a tributary to Coldwater Creek. These drainage ditches do not capture Stormwater runoff from the two VP piles. National Pollutant Discharge Elimination System (NPDES) storm water discharge monitoring points NP-001 and NP-002 are located on the northern and southern tributaries, respectively, prior to exiting the site.

3.0 PROGRAM PROTOCOLS

3.1 ORGANIZATION

The U.S. Army Corps of Engineers (USACE) will be responsible for revision of this EMG when necessary to address new or modified program objectives. Revisions of this Environmental Monitoring Guide (EMG) for other causes are not generally anticipated. The USACE shall issue an Environmental Monitoring Implementation for FY (EMIFY) for each fiscal year that defines the Program monitoring requirements for the upcoming year with respect to sampling locations, frequencies, monitoring parameters and the rational for their selection. Organizational responsibilities for implementation of the EMIFY shall correspond to those delineated in the *Sampling and Analysis Guide for the St. Louis Sites (SAG for SLS)* (USACE, 1999b). Where non-periodic environmental sampling activities are required to meet the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) objectives at the St. Louis Sites (SLS), work descriptions (WD) shall be issued that describes the activity-specific requirements. Each WD shall describe responsibilities for it's implementation to the extent those roles differ from those specified by the SAG for SLS.

3.2 SAMPLING RATIONALES

The annual EMIFY shall specify sampling locations, frequencies, and parameters for the various environmental media to be monitored under the program in the upcoming year. The rationale supporting selection of the locations and parameters for monitoring of each media will also be provided in each EMIFY. Each WD for non-periodic monitoring shall describe the sampling locations, parameters, data quality objectives (DQOs) and rationale for that activity.

3.3 SAMPLING PROCEDURES

Field sampling procedures for the various media monitored by the EMG shall confirm the requirements specified in the SAG for SLS. If unique sampling procedures are required to meet the objectives defined in an EMIFY, those protocols will be incorporated into that Implementation Plan.

3.4 SAMPLE MANAGEMENT

Samples collected under the EMG will be managed in the field as specified in the SAG for SLS. Sample container, preservation, and holding time requirements for samples collected under the EMG are also specified in the SAG for SLS. The SAG for SLS specifies sample documentation requirements, including the sample numbering system, logbook requirements, sample labeling that pertain to samples collected under the EMG. Chain of custody requirements for EMG samples are specified in the SAG for SLS.

3.5 ANALYTICAL PROTOCOLS

Samples collected under the EMG shall be analyzed by the methods specified in the SAG for SLS. If unique analytical protocols are necessary to meet an objective identified in an annual EMIFY, the method shall be incorporated into that EMIFY or the SAG for SLS in accordance with the revision procedures specified in the SAG for SLS

3.6 MANAGEMENT OF INVESTIGATION DERIVED WASTE

Investigation derived waste (IDW) resulting from implementation of the EMIFY will be managed in accordance with the requirements described in the SAG for SLS. If EMIFY activities or WD activities are anticipated to result in categories of IDW not addressed by the SLS SAG, those plans will include specific requirements for the handling and disposition of such wastes.

4.0 PROGRAM ACTION

The U.S. Army Corps of Engineers' (USACE) vigilance of new monitoring issues and actions/studies from hazards or contaminants must be diligent. Proper reporting and record keeping is essential to the overall monitoring and compliance strategy for St. Louis Site (SLS). The primary regulatory drivers for reporting results of monitoring performed under the Environmental Monitoring Guide (EMG) are the Federal Facilities Agreement (FFA). Reporting under the EMG involves: (1) reporting of data as required to meet the requirements of permits (or substantive requirements); (2) agreements under regulatory documents (i.e., RODs, EE/CAs, etc.); (3) presentation of additional data obtained as best management practices (BMPs); and (4) evaluation of these data streams. This type of data collection, analysis, and reporting is particularly useful in assessing the effects of interim actions within environmental restoration goals. Additionally, such monitoring provides information that can be used to establish baseline conditions for future remedial actions at the St. Louis sites.

The underlying database for the EMG, in order to achieve these monitoring and reporting objectives, will have a structure that allows reporting of monitoring data for all related media. The FFA reporting mechanism will serve as the integrating point for data presentation and evaluation. As required by the FFA, all validated data obtained from EMG activities in the quarter will be assembled for the FFA quarterly report. The quarterly report will serve as the integrating point for presentation of all data derived from monitoring to meet EMG drivers (i.e., data for compliance reports will also appear in the FFA Quarterly Reports).

The environmental data collected in accordance with the Environmental monitoring Implementation for the fiscal year (EMIFY) for the fiscal year will be summarized in the Annual Data and Analyses Report (ADAR) for the calendar year. Technical evaluation of monitoring results including contaminant migration patterns and trends, general evaluation of data quality, recommendations to add or delete monitoring locations as needed to meet changing drivers, and recommendations for modifying of analyte lists or sampling frequencies. The ADAR will include a summary comparison of EMG results with respect to constituents' potential preliminary remediation goals (PRGs). This component of the report will provide an assessment of environmental conditions, allowing parties to the FFA to make annual determinations of the need that PRGs are being properly accomplished.

5.0 REFERENCES

DOE 1990a. *Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site in St. Louis, MO, Revision* 1, Prepared by Bechtel National, Inc., DOE/OR/20722-258, Oak Ridge, TN. September.

DOE 1990b. *Federal Facility Agreement in the Matter of : The United States Department of Energy, St. Louis and Hazelwood, Missouri*, Docket No. VII-90-F-0005, June.

DOE 1991. *Work Plan for the Remedial Investigation/Feasibility Study-Environmental Impact Statement for the St. Louis Site, St.Louis, Missouri,* Prepared by Bechtel National, Inc., DOE/OR/21949-271.1, December.

DOE 1993. *Baseline Risk Assessment for Exposure to Contaminants at the St.Louis Site, St. Louis, Missouri,* Prepared by Argonne National Laboratory, DOE/OR/23701-41.1, November.

DOE 1994. *Remedial Investigation Report for the St. Louis Site, St. Louis, Missouri,* Prepared by Bechtel National, Inc., DOE/OR/21949-280, January.

DOE 1995. *Remedial Investigation Addendum for the St. Louis Site, St. Louis, Missouri,* DOE/OR/21950-132, Prepared by Bechtel National, Inc., September.

DOE 1997. *St. Louis Airport Site (SLAPS) Interim Action Engineering Evaluation/Cost Analysis (EE/CA), St. Louis, Missouri,* Prepared by Science Applications International Corporation, DOE/OR/21950-1026, September.

EPA 1989. *National Priorities List, St. Louis Airport/Hazelwood Interim Storage/FUTURA Coatings Co.*, St. Louis County, Missouri, NIL-U8-2-6-10/89, October.

USACE 1994. *Requirements for the Preparation of Sampling and Analysis Plans*, Manual No. EM-200-1-3.

USACE 1998a. *Groundwater Characterization Report of 1997/1998 Baseline Data for the St. Louis Downtown Site, St. Louis, Missouri,* Prepared by Science Applications International Corporation, USACE/OR/DACW45-1050, July.

USACE 1998b. *Feasibility Study for the St. Louis Downtown Site, St. Louis, Missouri,* Prepared by Science Applications International Corporation, April.

USACE 1998c. *Record of Decision for the St. Louis Downtown Site, St. Louis, Missouri,* Prepared by Science Applications International Corporation, October.

USACE 1998d. *Engineering Evaluation/Cost Analysis (EE/CA) and Responsiveness Summary for the St. Louis Airport Site (SLAPS), St. Louis, Missouri,* Prepared by Science Applications International Corporation, May.

USACE 1998e. *Groundwater Characterization Report of Baseline 1997 Data for the St. Louis Airport Site (SLAPS), St. Louis Missouri,* Prepared by Science Applications International Corporation, USACE/OR/DACA62-1040, May.

USACE 1998f. *Engineering Evaluation/Cost Analysis (EE/CA) for the Hazelwood Interim Storage Site (HISS), St. Louis, Missouri,* Prepared by Science Applications International Corporation, May.

USACE 1998g. *Groundwater Characterization Report of 1997 Baseline Data for the Hazelwood Interim Storage Site (HISS), St. Louis, Missouri,* Prepared by Science Applications International Corporation, USACE/OR/DACA62-1041, June.

USACE 1999a. *North County Potential Contaminants of Concern Assessment Memorandum* (PAM) (Currently USACE Review Draft)-March

USACE 1999b. *Sampling and Analysis Guide for the St. Louis Sites.* January 1999. (Currently USACE Review Draft).

USEPA, 1986. *Guidelines for Groundwater Classification under EPA Groundwater Protection. Strategy.* (Final Draft)-December

Cataloging Form

{Technical/Project Managers fill in C through G, K through Q. RM completes other fields}

A. Document ID Number: Assigned by database 00-211 **B.** *Further Information Required?*: ☐

C. *Operable Unit (Choose One):*

USACE	☐
St. Louis Sites	☒
Downtown	☐
North County	☐
Madison Sites	☐
Inaccessible Areas	☐
PRP	☐
Oversight Committee	☐

D. *Site (Optional):*

SLDS VPs	☐
Mallinckrodt	☐
SLAPS	☐
SLAPS VPs	☐
CWC	☐
HISS	☐
Madison	☐

E. *Area (Optional):* _____

F. *Primary Document Type (Choose One):*

Site Management Records	☒	Remedial Action	☐
Removal Response	☐	Public Affairs/Community Relations	☐
~~Remedial Investigation~~	☒	Congressional Relations	☐
Feasibility Study	☐	Freedom of Information Act	☐
Record of Decision	☐	Real Estate	☐
Remedial Design	☐	Project Management	☐

G. *Secondary Document Type (see back of form):* Sampling / Analysis Data + Plans

H. *Bechtel Number*: — **I.** *SAIC Number*: —

J. *MARKS Number(Choose One):* FN: 1110-1-8100e ☐ FN: 1110-1-8100f ☐ FN: 1110-1-8100g ☒

K. *Subject:/Title:* SLS Baseline Environmental Monitoring Guide

L. *Author:* — **M.** *Author's Company:* ~~Draft~~ SAIC

N. *Recipient(s)*: _____ **O.** *Recipient(s) Company:* USACE

P. *Version (Choose One):* Draft ☐ Final ☑ **Q.** Date: 12-1-99

R. *Include in the ARF?* ☐ **S.** *Include in the AR?* ☐ **T.** *Filed as Confidential/Privileged?* ☐

U. *Document Format (Choose one):*

Paper	☑	Photographic	☐	Cartographic/Oversize	☐
Electronic	☐	Audio-visual	☐	Microform	☐

V. *Filed in AR Volume Number:* _____

W. *Physical Location (Choose One):*

Central Files	☑	Microfilm Vendor	☐	In ARF	☐
Records Holding Area	☐	Department of Energy	☐	In AR	☐

X. *Associated with Document(s):* _____