Management Action Process Document for the St. Louis, Missouri, FUSRAP Sites

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U.S. Department of Energy

Formerly Utilized Sites Remedial Action Program (FUSRAP)

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MANAGEMENT ACTION PROCESS (MAP) DOCUMENT

FOR THE ST. LOUIS, MISSOURI, FUSRAP SITES

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TABLES

FIGURES

Figure **Title**

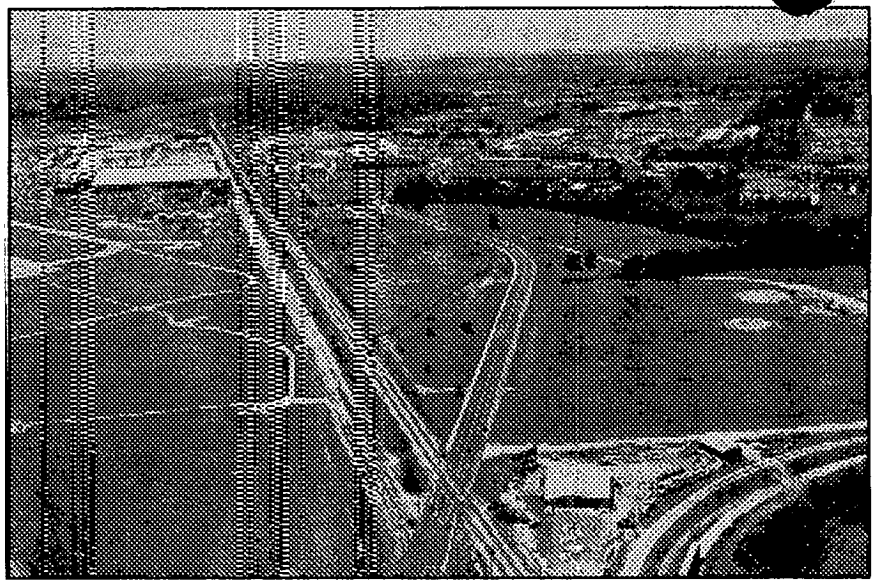
ACRONYMS

ADS	Activity Data Sheet
AEC	Atomic Energy Commission
ANL	Argonne National Laboratory
ARAR	applicable or relevant and appropriate requirement
BEMR	Baseline Environmental Management Report
BNI	Bechtel National, Inc.
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy-Headquarters
DOE-OR	U.S. Department of Energy-Oak Ridge Operations
EE/CA	engineering evaluation/cost analysis
EMAB	Environmental Management Advisory Board
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FFA	federal facilities agreement
FEMA	Federal Emergency Management Agency
FSRD	Former Sites Restoration Division
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	Fiscal Year
HI	hazard index
HISS	Hazelwood Interim Storage Site
LLW	low-level waste
LRAD	long-range alpha detection
MAP	Management Action Process
MDNR	Missouri Department of Natural Resources
MED	Manhattan Engineer District
NEPA	National Environmental Policy Act
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PAH	polyaromatic hydrocarbon
PDCC	Project Document Control Center
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
RI/FS-EIS	remedial investigation/feasibility study-environmental impact statement
ROD	record of decision
SAFER	Streamlined Approach for Environmental Restoration
SAIC	Science Applications International Corporation
SGS	segmented gate system
SLAPS	St. Louis Airport Site
SLDS	St. Louis Downtown Site
S/RID	Standards/Requirements Identification Document
TBC	to-be-considered (requirements)
VPs	vicinity properties
WBS	work breakdown structure

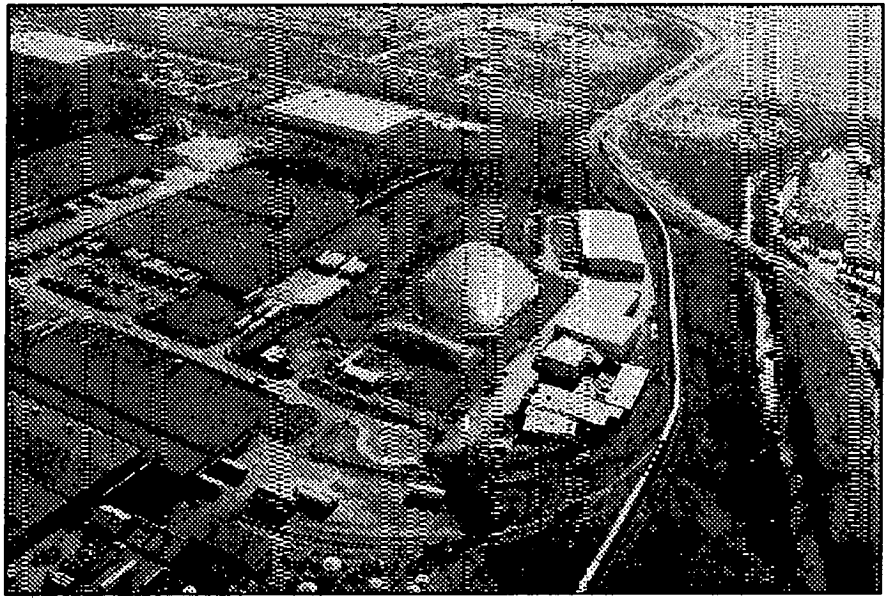
UNITS OF MEASURE

°C	degrees Celsius (Centigrade)
cm	centimeter
°F	degrees Fahrenheit
ft	foot
ft^2	square foot
ft^3	cubic foot
g	gram
gpm	gallons per minute
ha	hectare
in.	inch
km	kilometer
L	liter
m	meter
m^2	square meter
m^3	cubic meter
$mile^2$	square mile
mph	miles per hour
nCi	nanocurie
pCi	picocurie
s	second
yd^2	square yard
yd^3	cubic yard

St. Louis Downtown Site



St. Louis Airport Site



Hazelwood Site

St. Louis Sites, Aerial View

1. INTRODUCTION

The Formerly Utilized Sites Remedial Action Program (FUSRAP) was established in 1974 by the U.S. Atomic Energy Commission (AEC) under authorities granted by the Atomic Energy Act of 1954, as amended. FUSRAP encompasses 46 sites in 14 states and is funded through the U.S. Department of Energy (DOE) Oak Ridge Operations Office. Its mission is to identify, investigate, and clean up or control sites where residual radioactivity exceeding current guidelines remains from the early years of the nation's atomic energy program or other sites assigned to DOE by Congress. Of the 46 FUSRAP sites, 22 sites in 12 states have been completed.

This Management Action Process (MAP) document describes environmental assessment and cleanup at the four FUSRAP sites in St. Louis, Missouri:

- St. Louis Downtown Site (SLDS)
- St. Louis Airport Site (SLAPS)
- SLAPS Vicinity Properties
- Latty Avenue Properties

Residual radioactive contamination being addressed at these sites originated from uranium processing operations conducted at SLDS by Mallinckrodt Chemical Works for DOE predecessor agencies [the Manhattan Engineer District (MED) and AEC] during the 1940s and 1950s. This MAP document summarizes the current remedial action status of these sites. It also presents strategies for remediation and management of contaminated environmental media and buildings and for stakeholder involvement in the remedy selection and decision-making process. Similar documents have been prepared for the Wayne and Maywood sites in New Jersey and for the four sites in Tonawanda, New York. A fifth MAP document covers the remaining fourteen FUSRAP sites where remedial action has not yet been completed, including three sites each in Ohio, New York, and New Jersey; two sites in Massachusetts; and one site each in Connecticut, Illinois, and Maryland.

1.1 PURPOSE OF MANAGEMENT ACTION PROCESS

The purpose of the MAP is to improve communication and facilitate stakeholder involvement in the remedy selection and decision-making process by clarifying the assumptions and strategies that will lead FUSRAP forward. Stakeholders in St. Louis are represented by the St. Louis Site Remediation Task Force. The framework within which DOE works with the Task Force and other stakeholder groups in remedy selection and decision making is the Environmental Management Advisory Board (EMAB), which includes representatives of regulatory agencies, state and local governments, citizen groups, labor organizations, and the scientific community. National and local stakeholder meetings provide a forum for public input to EMAB. The MAP document serves as a tool for interaction among the community, regulators, other stakeholders, and DOE, which together make up the FUSRAP MAP team. The MAP document is not a decision document but will be used as a resource tool to encourage stakeholder involvement through the EMAB process.

1.2 ORGANIZATION OF THE MANAGEMENT ACTION PROCESS DOCUMENT

The organization of the MAP document for the Missouri FUSRAP sites is outlined in Table 1.1.

1.3 ENVIRONMENTAL RESTORATION OBJECTIVES

The mission of DOE's Environmental Restoration (ER) Program is to protect human health and the environment by remediating sites and facilities in a manner that is responsible and cost-effective and

Table 1.1 Organization of the MAP Document

Chapter 1	Introduction	• Purpose of the MAP and organization of the MAP document • FUSRAP ER objectives, mission, vision, goals, and priorities • Core MAP team members and FUSRAP interfaces with other DOE organizations, regulators, stakeholder organizations, and the public • Strategy for future MAP implementation and improvements
Chapter 2	Site Description and Comprehensive Planning	• Operational history (including historic origin of contamination) • Environmental setting (location, geology and hydrogeology, ecological resources) • Current onsite and adjacent offsite land use • Local and regional socioeconomic, environmental, and cultural factors influencing project strategy and implementation • Site facilities, equipment, and infrastructure • Projected future use of land, facilities, and equipment
Chapter 3	Status of Environmental Restoration Activities	• Current status in remedial action process • Nature and extent of contamination • Regulatory status • Waste management/disposition activities affecting site remediation schedules
Chapter 4	Relative Ranking	• Relative ranking based on risk to the public, workers, and the environment
Chapter 5	Environmental Restoration Strategy	• Key assumptions used in ER strategy formulation • Key technical and administrative elements of remedy selection strategy • Strategies for program management, regulatory compliance, and stakeholder involvement • Performance measures used to track progress
Chapter 6	Master Schedule for Environmental Restoration	• Master schedule • Compliance milestones
Chapter 7	Issues and Initiatives	• Issues affecting project performance • Initiatives implemented to address issues and improve performance
Appendix A	Fiscal Year Funding Requirements/Costs	• Cost baseline for ER activities at the Missouri FUSRAP sites
Appendix B	Environmental Restoration Deliverables	• Site documents developed for and funded by ER (1989-present)
Appendix C	Decision Document/ROD Summaries	• Abstracts of decision documents
Appendix D	Conceptual Model Data Summaries	• Conceptual site models depicting contaminant sources and transport mechanisms, exposure routes and pathways, and receptors
Appendix E	Project Controls	• Summary of Project Controls, including responsibility matrices, change control thresholds, and reporting requirements
Appendix F	Summary of CERCLA Remedy Selection Process	• Feasibility study remedial alternatives evaluation summary
Appendix G	Regulatory Drivers	• Regulatory drivers and ARARs under each sitewide alternative
Appendix H	Property Listing	• Detailed listing of St. Louis sites and vicinity properties
Bibliography	References and Bibliography	• Literature cited/Source references

optimizes opportunities for land and facility reuse (DOE 1995a). This mission is accomplished by adhering to the ER Program core values:

- Ensure protection of worker and public health and safety and the environment
- Serve as a model steward of natural and cultural resources
- Comply with federal, state, and local statutes
- Prudently use taxpayers' money in achieving tangible results
- Focus on customer satisfaction and collaborative decision making
- Demonstrate a commitment to excellence

The major objectives of FUSRAP, which are in accordance with the mission, core values, and priorities of the ER Program, are to

- Identify and evaluate sites that supported MED/AEC nuclear work (or other sites assigned by Congress) and determine whether they need cleanup and/or control
- Clean up or manage these sites so that they meet current guidelines
- Dispose of or stabilize radioactive material in a way that is safe for the public and the environment
- Perform all work in compliance with appropriate federal laws and regulations and comply with state and local environmental laws and land use requirements
- Certify the sites for appropriate future use

1.4 PROJECT TEAM

The MAP project team includes key DOE and contractor personnel as well as representatives of regulators [EPA, Missouri Department of Natural Resources (MDNR), etc.] and other stakeholders (St. Louis Site Remediation Task Force, etc.). MAP project team organization is outlined in Figure 1.1. Members of the MAP project team for the Missouri FUSRAP sites are identified in Table 1.2.

1.5 ORGANIZATIONAL INTERFACES

Table 1.3 outlines organizational interfaces and describes the roles of DOE, contractors, regulatory agencies, and stakeholders (represented by the Site Remediation Task Force) in ER at the Missouri FUSRAP sites.

1.6 MAP PROGRESS, ACCOMPLISHMENTS, AND STRATEGY

Table 1.4 identifies FUSRAP efforts to promote stakeholder involvement in remedy selection and decision making and summarizes progress toward consensus through the EMAB process and CERCLA/NEPA community relations activities.

Table 1.3 Organizational Interfaces

Organization	Role/Responsibility
DOE	
DOE-HQ, Office of Environmental Restoration (EM-40), within Office of Environmental Management	Oversight responsibility for achieving approved FUSRAP goals and objectives (executed through DOE Office of Eastern Area Programs and designated program manager in Division of Off-Site Programs, who establish overall program direction, policies, milestones, and budget)
DOE Oak Ridge Operations (OR), Former Sites Restoration Division (FSRD)	Responsibility for accomplishing the FUSRAP ER mission; day-to-day technical, administrative, and financial management of FUSRAP activities; oversight and management of BNI and SAIC contracts. Director is FUSRAP Program Manager
CONTRACTORS	
BNI	Project Management Contractor. Manages field activities and construction required for remedial action; administers subcontracts; coordinates sequence of operations; executes response actions as required; defines/implements QA procedures, environmental compliance activities, and safety programs to meet DOE requirements; ensures completion of remedial action in accordance with DOE goals
SAIC	Environmental Studies Contractor. Responsible for planning, managing, and executing the CERCLA process, integrating NEPA values, and meeting RCRA requirements. Helps DOE plan site investigations and evaluates cleanup alternatives
ORNL	Technical support to DOE-HQ and FSRD including radiological scoping, designation, characterization, and verification services; conducts environmental audits of activities at FUSRAP sites
ORISE	Technical support to DOE-HQ including independent verification activities
ANL	Technical support to DOE-HQ and FSRD including technical review of analyses and documents and assistance to the FUSRAP self-assessment program
DOE SUPPORT PROGRAMS	
DOE Waste Management Program	Oversees management of wastes generated during remediation projects, including notification of projected needs for waste treatment, storage, and disposal
DOE Technology Development Program	Ensures use of safest and most expeditious and cost-effective remedial action technologies
KEY REGULATORS AND OTHER STAKEHOLDERS	
EPA Region VII	Regulatory oversight of remedial actions at FUSRAP sites under CERCLA
Missouri Department of Natural Resources	Key state regulatory agency with oversight of remedial action at the Missouri FUSRAP sites
St. Louis Site Remediation Task Force	Task force consisting of members of city- and county-appointed oversight commissions and representatives of other stakeholder groups established 1994 to evaluate options and make recommendations for cleanup and disposal of FUSRAP waste

Table 1.4 Review of Stakeholder Involvement History and MAP Progress

. scal Year	Activities
1981	• Public meeting at Bridgeton Town Hall held in October by DOE, EPA, MDNR, and NRC to help public understand problems posed by St. Louis sites and remedial actions being planned. • SLDS designated for cleanup under FUSRAP
1982	• Public meeting in Weldon Spring August 10 to address concerns regarding disposal of wastes from SLAPS ditches cleanup at Weldon Spring; DOE postponed action on SLAPS ditches. • Public hearing on health effects of radiation held by Coalition for the Environment; the Coalition favored removal of all waste from cleanup to a disposal site outside the St. Louis area.
1982-91	• Remedial investigation to determine nature and extent of contamination at St. Louis sites (BNI 1994a).
1984	• Latty Avenue Properties designated for cleanup under FUSRAP. • SLAPS designated for cleanup under FUSRAP.
1984-85	• DOE and BNI coordinated activities with local governments during remedial action for ditches along Latty Avenue and repair of erosion on western side of SLAPS property.
1985	• Public hearing on proposed flood control project for Coldwater Creek held by U.S. Army Corps of Engineers November 19; stakeholder concerns centered on potential for contamination of creek from materials at SLAPS. • Energy Water Development Authorization Act legislation (Public Law 98-360) authorized DOE to reacquire SLAPS property from the City of St. Louis for use as a permanent disposal site (whether DOE exercises this authority will depend on record of decision documenting final remedy for St. Louis sites).
1986	• DOE held discussions with St. Louis mayor and board of aldermen on transfer of SLAPS property to DOE; board postponed action on transfer pending further characterization.
1987	• DOE reported to St. Louis, Berkeley, and Hazelwood officials on inability of SLAPS property to accommodate a disposal cell large enough for all contaminated material from St. Louis sites and possibility of acquiring additional land in airport area for disposal cell site. • DOE and BNI representatives met with Berkeley and Hazelwood city councils and St. Louis mayor and board of aldermen to discuss disposal alternatives.
1988	• DOE conducted community interviews to identify stakeholder issues and concerns related to St. Louis sites. • DOE participated in meetings; made presentations to public officials, citizen groups, and the general public; and took part in series of hearings held by St. Louis board of aldermen's Transportation and Commerce Committee to discuss SLAPS property transfer from city to DOE. • DOE provided information to the public on SLAPS and the remediation process during meetings sponsored by Airport Community Program Committee and St. Louis Municipal League.
1989	• DOE and EPA participated in hazardous waste forum sponsored by Congressman Jack Buechner to update St. Louis residents on Superfund status. • Congressman Buechner introduced proposal for legislation requiring DOE to consider alternative sites for disposal of St. Louis site waste; 1990 Congress closed without taking action on this proposed legislation. • St. Louis Post Dispatch published 7-part newspaper series ("Legacy of the Bomb") on St. Louis nuclear waste. • SLAPS and Latty Avenue Properties (HISS/Futura) placed on EPA's National Priorities List.
1990	• DOE opened public information center at 9200 Latty Avenue in Hazelwood; center provides information on all St. Louis sites and opportunities for public comment. • St. Louis board of aldermen adopted plan to transfer property near Lambert Field to DOE; results of non-binding referendum in November indicated that citizens of both city and county of St. Louis opposed storage of radioactive waste near Lambert Field. • DOE held public scoping meeting on programmatic environmental impact statement (EIS) December 6; 97 of 177 attendees made comments. • DOE updated community interviews to identify issues and concerns of affected stakeholders. • DOE published characterization reports for SLAPS VPs and SLDS. • Signing of federal facilities agreement negotiated between DOE and EPA for the St. Louis sites.

Table 1.4 (continued)

Fiscal Year	Activities
1991	• DOE issued EE/CA for cleanup and interim slorage of contaminated soil at SLDS for public comment; DOE prepared responsiveness summary to address comments. • Public officials announced intent to draft plan to move contaminated soil from St. Louis area to less populated area in the state.
1992	• DOE met FFA documentation milestones on or ahead of schedule (EPA approval of work plan, RI report, baseline risk assessment, and initial screening of alternatives). • DOE initiated development and implementation of a public scoping participation process for St. Louis sites. • DOE issued draft final work plan for public comment. • DOE held public scoping meeting January 1992 at Berkeley Senior High School to provide an opportunity for stakeholder comment and input. Meeting was attended by ~250 stakeholders; 30 private citizens and 16 public officials presented testimony. • Revised EE/CA-EA for interim removal action for SLAPS VPs and Latty Avenue Properties issued for public comment. • Technical oversight committee appointed by St. Louis County to work with DOE in addressing concerns and resolve issues raised during public comment on EE/CA-EA.
1994	• DOE completed revised RI report, baseline risk assessment, and FS-EIS/proposed plan for St. Louis sites. • DOE started ROD for St. Louis sites. • Established St. Louis Site Remediation Task Force (includes representatives of city and county appointed oversight committees and other stakeholder groups). Task Force originated in St. Louis Site Stakeholder Summit held in August, organized in response to community opposition to DOE's draft Proposed Plan for St. Louis sites.
1995	• First annual National Stakeholder Summit in Washington, D.C. (May 1995) attended by >60 FUSRAP stakeholders from communities throughout US. • Environmental Management Advisory Board (EMAB) meetings held at St. Louis sites. • DOE worked with St. Louis Site Remediation Task Force in evaluating options for cleanup and disposal of FUSRAP waste. Task force presented list of interim cleanup priorities to DOE in fall of 1995. • Task Force's Coldwater Creek Panel of geologists and hydrogeologists began study of potential impacts of contamination at SLAPS on Coldwater Creek, focusing on groundwater and surface water quality issues. • DOE completed restoration of a city block at SLDS (interim removal action at Mallinckrodt Plant 10 in support of Mallinckrodt's demolition and reconstruction activities). The effort represented a teaming partnership with Mallinckrodt, the property owner.
1996	• Coldwater Creek Panel presented recommendations in draft report to St. Louis Site Remediation Task Force in January; final report expected in September.

2. SITE DESCRIPTION AND COMPREHENSIVE PLANNING

The Missouri FUSRAP sites are located in the downtown and airport areas of metropolitan St. Louis. Locations of these sites (SLDS, SLAPS, SLAPS Vicinity Properties, and the Latty Avenue Properties) are shown in Figures 2.1 through 2.3. Summary site descriptions are presented in Table 2.1. A detailed listing of sites and vicinity properties is provided in Appendix H.

2.1 OPERATIONAL HISTORY

The operational history of the St. Louis sites, including previous and current site ownership, historic site use, and historic origin of contamination, is summarized in Table 2.1 and discussed briefly below. Radioactive contamination at these sites originated from industrial-scale processing at SLDS during the 1940s and 1950s to recover uranium from high-grade uranium ore from the Belgian Congo.

From 1942 to 1957, Mallinckrodt Chemical Works conducted a variety of uranium processing and recovery operations for research, development, and production programs under contract to MED and AEC. Work was performed in Plants 1, 2, and 4 (now Plant 10) at SLDS from 1942 to 1945. In 1946, manufacturing of uranium dioxide from pitchblende ore began at the newly constructed Plant 6. Uranium dioxide was subsequently converted to uranium tetrafluoride, which was reduced with heat and magnesium to produce uranium metal. Between 1948 and 1950, Mallinckrodt decontaminated Plants 1 and 2 to meet AEC criteria then in effect; in 1951, the plants were released for use with no radiological restrictions.

During 1950 and 1951, processing operations began at Plants 6E and 7, and Plant 4 was modified for use as a metallurgical pilot plant, where processing of uranium metal took place until the plant was closed in 1956. Plant 7 was used for storage as well as for uranium processing and recovery. By 1957, Mallinckrodt had processed more than 50,000 tons of natural uranium products at its facilities. Plants 4, 6E, and 7 were decontaminated by AEC in 1957 and returned to Mallinckrodt in 1962 for use without radiological restrictions. SLDS is currently owned by Mallinckrodt, Inc., and includes several operating plants producing various chemical products.

SLAPS was acquired by MED in 1946 and used until 1966 for storage of uranium processing residues from operations at SLDS. The stored residues included barium sulfate cake, pitchblende raffinate residues, radium-bearing residues, Colorado raffinate residues, and contaminated scrap. Most of the wastes and residues were stored in bulk on open ground, although some were buried at the western end of the property. Former areas of use and waste storage at SLAPS are shown in Figure 2.4.

During 1966 and 1967, most of the residues at SLAPS were sold and removed. Onsite structures were demolished, buried onsite, and covered with 1 to 3 ft of clean fill to achieve surface radioactivity levels meeting AEC criteria then in effect. The property at SLAPS is currently unused and is entirely fenced to restrict public access. SLAPS was transferred by quitclaim deed to the St. Louis Airport Authority in 1973; however, DOE is authorized under the Energy and Water Development Appropriations Act of 1985 to reacquire the property for use as a permanent disposal site. The need for reacquisition will be determined based on the final record of decision (ROD) for the St. Louis sites.

The SLAPS Vicinity Properties include approximately 80 commercial and residential properties near SLAPS that became radioactively contaminated as the result of MED/AEC activities, material transfer, utility line construction, and flooding. Radioactive contamination at SLAPS Vicinity Properties could have been caused by surface runoff from SLAPS and/or by spillage during transport of residues from SLAPS to the Latty Avenue Properties; many of the SLAPS Vicinity Properties are along haul roads used for transport by truck. Road and underground utility improvement activities have also resulted in dispersion of contaminants to adjacent properties.

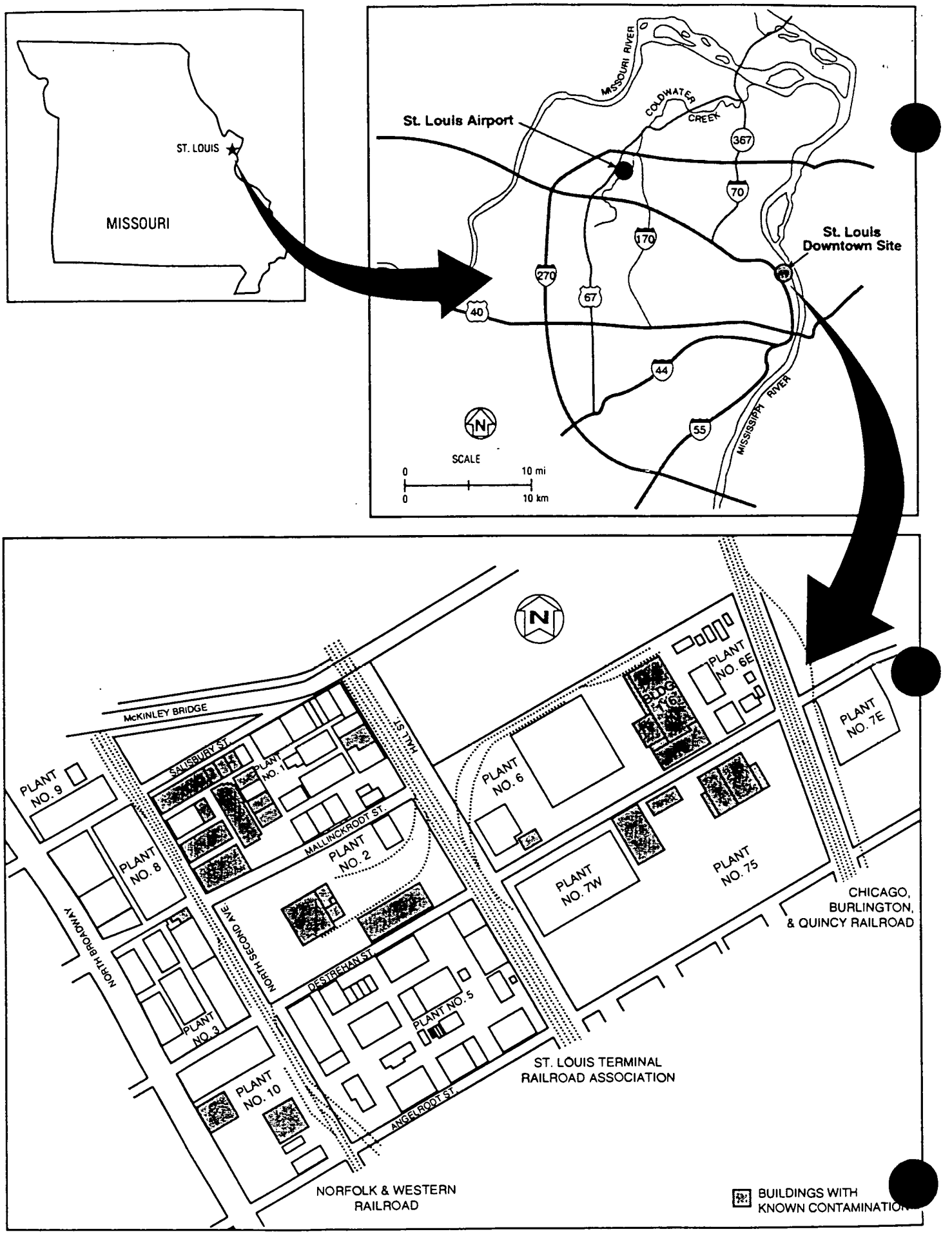


Figure 2.1 Location of St. Louis Downtown Site (SLDS)

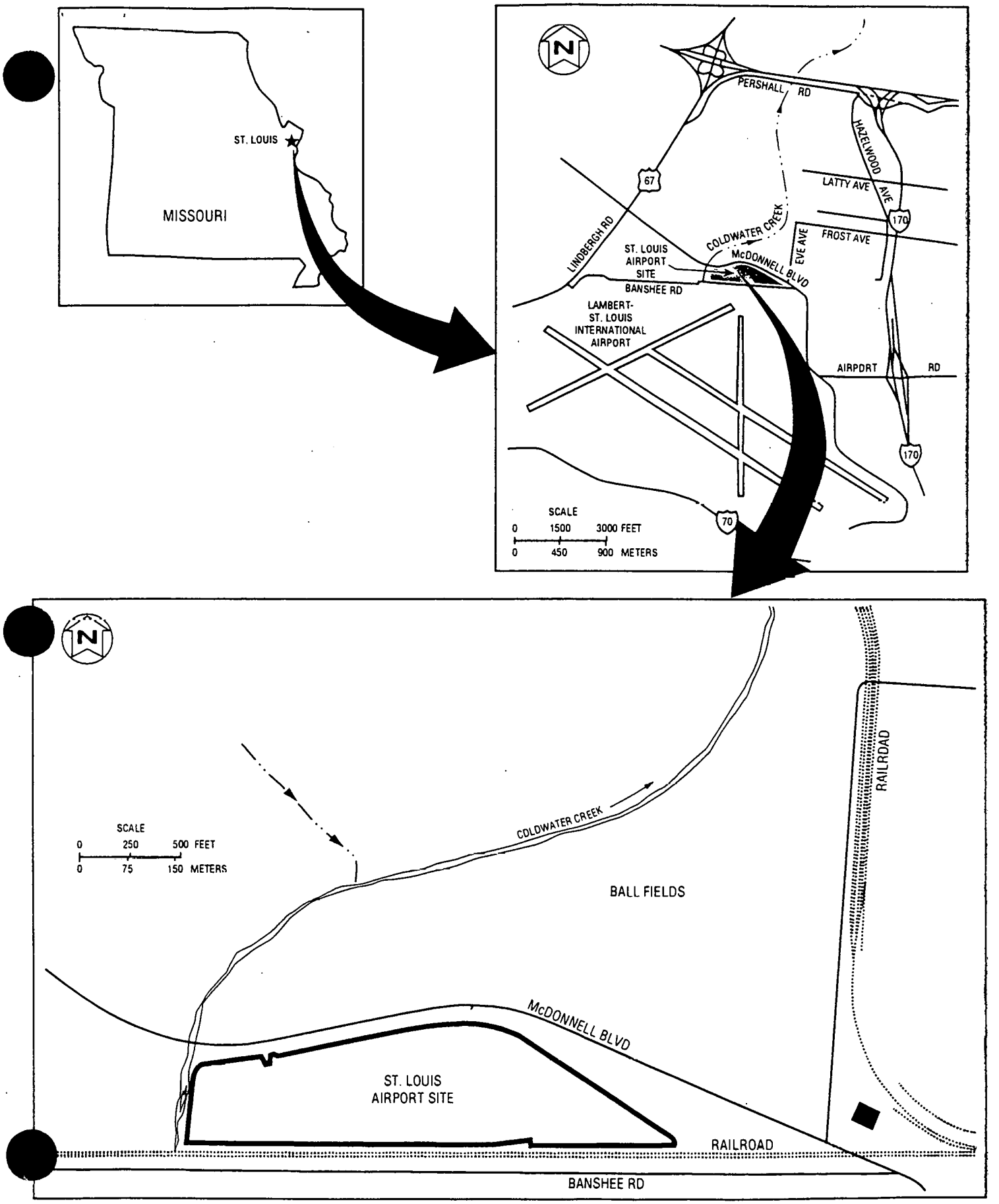


Figure 2.2 Location of St. Louis Airport Site (SLAPS)

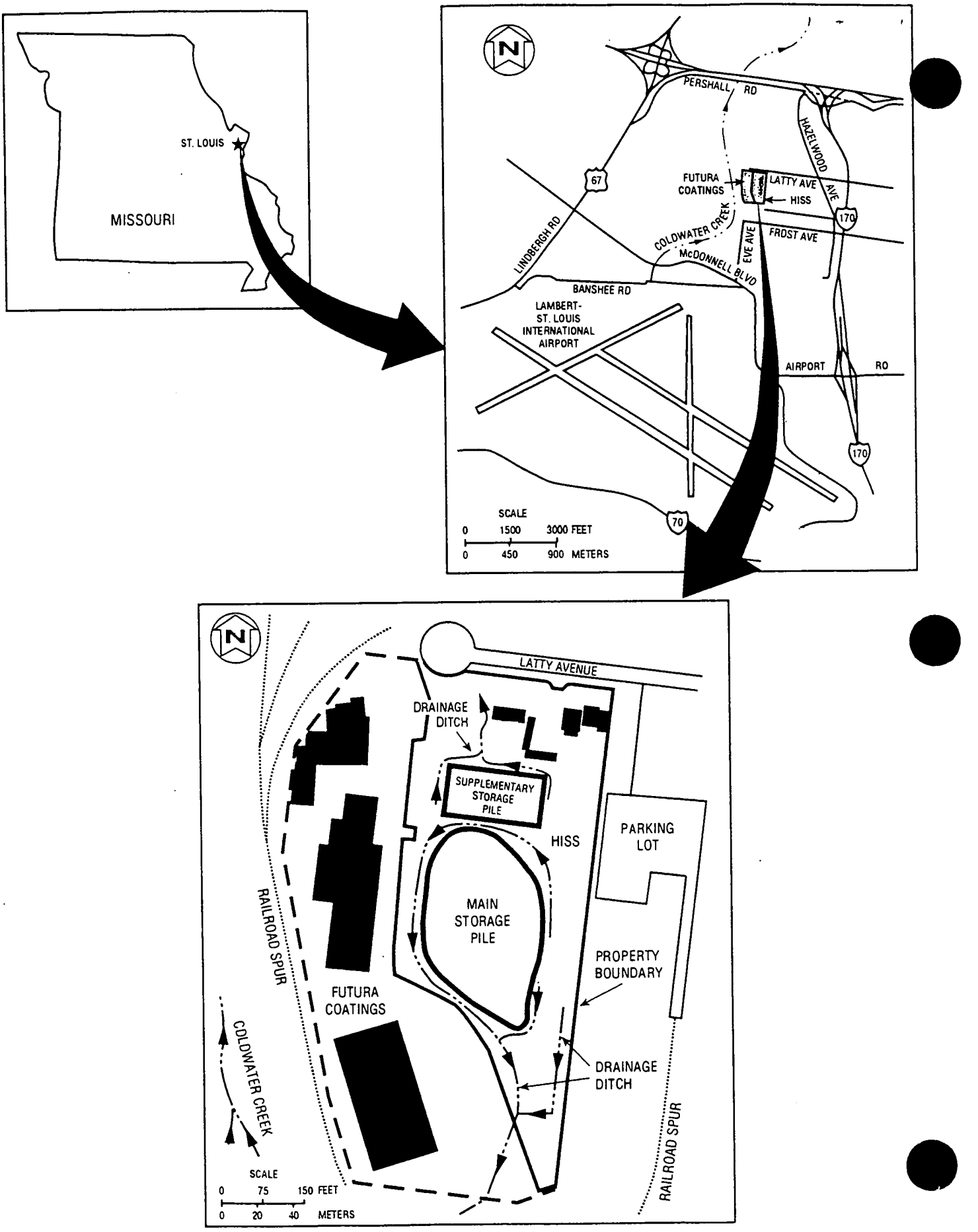


Figure 2.3 Location of Latty Avenue Properties

Table 2.1 Site Description

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
ADS No.	OR-1300-AA	OR-1300-AA	OR-1300-AA	OR-1300-AA
WBS No.	1.4.11.1.1 (116)	1.4.11.1.1 (153)	1.4.11.1.1 (134)	1.4.11.1.1 (140)
Remedial Action Status	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)
Vicinity Properties	6 (see Figure 2.1 and Appendix H)	78 (see Figure 2.2 and Appendix H)	(see SLAPS)	6 (see Figure 2.3 and Appendix H)
OPERATIONAL HISTORY				
Historic Origin of Contamination	Residues from uranium processing by Mallinckrodt for MED/AEC (1942-57)	Uranium processing residues from SLDS (stored at SLAPS 1946-66)	Uranium processing residues from SLDS [via migration from other sites or deposited when waste was hauled over transportation routes (1946-73)]	Uranium processing residues from SLDS (stored at SLAPS 1946-66 and at 9200 Latty Avenue 1967-73)
Owner/Landlord				
Historic	SLDS: Mallinckrodt, Inc. (formerly Mallinckrodt Chemical Works)	MED/AEC (1946-73)	Multiple owners	Continental Mining & Milling Co. of Chicago/Commercial Discount Corp. of Chicago/Cotter Corp. (1966-77)
Current	SLDS: Mallinckrodt, Inc. City of St. Louis property: City of St. Louis 6 commercial/industrial VPs: Owned by Mallinckrodt or City of St. Louis; leased by railroads and commercial enterprises	City of St. Louis (1973-present) [DOE is authorized under 1985 Energy & Water Development Appropriations Act to reacquire SLAPS for use as permanent disposal site]	Multiple owners; land use is primarily commercial/industrial and transportation-related	HISS and Futura: Jarboe Realty & Investment (1977-present) • HISS leased by DOE • Futura property leased by Futura Coatings, Inc. 6 VPs (zoned for industrial use) have multiple owners
ENVIRONMENTAL SETTING				
Location	Industrial area on northeastern border of city of St. Louis near Mississippi River VPs: • City of St. Louis property (adjacent to Plant 7E between SLDS and Mississippi River) • McKinley Iron Co. (immediately north of SLDS Plant 6) • PVO Foods, Inc. (immediately south of SLDS Plant 7E) • Thomas & Proetz Lumber Co. (immediately south of SLDS Plant 7) • St. Louis Terminal Railroad Association property (strip of land with railroad tracks running N-S, bisecting SLDS adjacent to Hall Street) • Norfolk & Western Railroad (strip of land with railroad tracks running N-S in western portion of SLDS) • Chicago, Burlington & Quincy Railroad (strip of land with railroad tracks running NE-SW on eastern portion of SLDS)	Northern St. Louis County, immediately north of Lambert-St. Louis International Airport & approximately 15 miles from downtown St. Louis	78 properties in Hazelwood and Berkeley in Northern St. Louis County within a 2-mile radius of SLAPS: • Coldwater Creek and VPs to west of SLAPS • Ball fields to north and east • Norfolk & Western Railroad properties adjacent to Coldwater Creek • Banshee Road and St. Louis Airport Authority property to south • Ditches to north and south • Haul roads properties along Latty Avenue, McDonnell Boulevard, Pershall Road, Hazelwood Avenue, Eva Avenue, and Frost Avenue	Northern St. Louis County; HISS and Futura are approximately 2 miles northeast of airport control tower HISS: 9170 Latty Avenue Futura Coatings: 9200 Latty Avenue 6 industrial VPs in Hazelwood and Berkeley

Table 2.1 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
Site Area	45 acres	22 acres		HISS/Futura: 11 acres 6 vicinity properties: 60 acres
Topography	Original surface greatly altered by human activity and industrialization. Original slope to Mississippi River is evident, but any other previously existing surface irregularities have been modified.	Essentially flat; surface slopes gently from east to west. SLAPS is on SE boundary of Florissant Basin, a 15-mile^2 shallow depression in bedrock filled with glacial lake sediments and surrounded by an upland area of rolling hills. Coldwater Creek flows through the Florissant Basin.	See SLAPS	Latty Avenue Properties are within Coldwater Creek drainage basin, about 0.5 mile downstream from SLAPS. HISS is about 200 ft east of the creek and slopes gently to the south; larger storage pile is ~26 ft high.
Geology	Basal limestone bedrock covered by upper and lower unconsolidated units composed of stratified clays, silts, sands, and gravels, with a surface layer of rubble and fill. See Figure 2.5.	Sandy limestone bedrock overlain by unconsolidated sediments consisting of interlayered lacustrine silts and clays. See Figure 2.5.	See SLAPS	See SLAPS
Hydrogeology and Water Quality				
Aquifers	Principal aquifers in St. Louis area located in alluvial deposits associated with major rivers. Water is very hard, with high iron and manganese concentrations, but generally of good quality. Yields as high as 3000 gpm. Bedrock aquifers typically yield <50 gpm; water quality tends to decrease with depth due to increasing salinity and mineralization SLDS is underlain by a portion of Mississippi River alluvial aquifer, composed of upper and lower units of unconsolidated deposits; laterally continuous across property.	Principal aquifers in St. Louis area located in alluvial deposits associated with major rivers. Water is very hard, with high iron and manganese concentrations, but generally of good quality. Yields as high as 3000 gpm. Bedrock aquifers typically yield <50 gpm; water quality tends to decrease with depth due to increasing salinity and mineralization Pennsylvanian and Mississippian limestones and sandstones: Yield mineralized water with high chloride and sulfate content, considered unsuitable for drinking. Glaciolacustrine deposits overlying bedrock: Yield water with high iron, magnesium, and sulfate content, but levels do not exceed drinking water standards. No known wells within 3 miles of SLAPS and HISS provide drinking water to public.	See SLAPS	See SLAPS
Potable Water Sources	Principal source of potable water is treated water from Mississippi River (~82% of the 1.2 billion gallons used daily in St. Louis area). Remaining 18% pumped from Meramec and Missouri Rivers near St. Charles; all but one of the water supply intakes are upstream of SLDS. Coldwater Creek is not used as a source of drinking water.	See SLDS	See SLDS	See SLDS

Table [illegible]ontinued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
Groundwater Flow	General flow direction is eastward toward Mississippi River. Recharge to area groundwater system via offsite inflow through upper consolidated unit and bedrock, infiltration of precipitation, and river bed infiltration. Discharge to river during low river stage. Uranium transport significantly retarded relative to groundwater flow (BNI 1993a).	General flow direction is north-northwest toward Coldwater Creek in upper groundwater system and northwest-west in lower system. Recharge to both systems via offsite inflow, infiltration of precipitation, and vertical seepage. Discharge via offsite outflow, vertical seepage, and seepage from upper system into Coldwater Creek during low creek stage. Uranium migration retarded relative to groundwater flow (BNI 1993a).	See SLAPS	Radial flow away from a central area near the western boundary of the larger storage pile at HISS. Recharge to upper groundwater system occurs in east-central area of property. Discharge via offsite outflow. Uranium migration significantly retarded relative to groundwater flow (BNI 1993a).
Dominant Surface Water Features	Mississippi River (located near eastern property boundary)	Coldwater Creek	Coldwater Creek	Coldwater Creek
Site Drainage	Natural drainage disrupted by urban development. Storm runoff currently controlled by system of sewers equipped with weirs to direct excess flow to Mississippi River.	Overland flow is collected by one of four drainage ditches or drains directly into Coldwater Creek.	Variable (multiple properties)	Surface water runoff from HISS drains into two ditches; northern ditch drains offsite to a storm sewer on Latty Avenue; southern ditch discharges to a tributary of Coldwater Creek. Urbanization has resulted in increased surface runoff, and the creek floods almost annually, mostly after high-intensity thunderstorms that cause flash flooding.
Ecological Resources				
Terrestrial Habitats and Biota				
Vegetation				
Woody plants: Typical trees and shrubs of floodplain forests (silver maple, cottonwood, willow, hackberry, elm, ash, box elder)				
Herbaceous plants: Mixture of prairie species, disturbance-related aggressive species, and remnants of landscape plantings typical of old fields and poorly maintained lawns (various grasses, wild carrot, asters, clover, dandelion, goldenrod, dock, milkweed, ragweed, thistle)				
Vertebrate Fauna (limited to species adapted to urban encroachment)				
Birds: Grasshopper sparrow, house sparrow, rock dove, mourning dove, red-winged blackbird, grackle, starling, cardinal, goldfinch, warbler, mallard, common crow, and robin				
Mammals: Opossum, prairie mole, white-footed mouse, house mouse, Norway rat, short-tailed shrew, striped skunk, squirrel, cottontail rabbit. Ranges and habitats of burrowing mammals (woodchuck, eastern mole) include areas occupied by St. Louis sites				
Aquatic Habitats and Biota				
Major aquatic habitats in immediate vicinity of St. Louis sites include Mississippi River near SLDS and Coldwater Creek				
Aquatic flora and fauna of Coldwater Creek downstream of airport are restricted to species tolerant of polluted water and turbid, silty conditions (probably resulting from contamination with petroleum products and high sediment yield in runoff from surrounding industrial facilities)				
Fish: Carp, green sunfish, black bullhead, seven species of minnows and suckers				
Invertebrates: Dominated by aquatic worms (Tubificidae) and midge larvae (Chironomidae)				
Threatened/Endangered Species				
Bald eagle: Observed in St. Louis County (primarily as migrating/overwintering individuals along Missouri River), but use of downtown and airport areas is unlikely because of poor habitat quality (sparse vegetation, substantial noise and human activity, limited hunting opportunity along Coldwater Creek)				
Pallid sturgeon: Found in Mississippi and Missouri rivers; water quality of Coldwater Creek is inadequate to support the species.				
Critical Habitats: None				

Table 2.1 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
Wetlands Downtown Area: None Airport Area (see Figure 2.6): Four remnant wetlands identified by Fish and Wildlife Service along Coldwater Creek between SLAPS and HISS/Futura (located on creek bank; classified as Palustrine/Forested/Broad-leafed/Deciduous/Temporarily Flooded); other wetland areas along the creek shown in Figure 2.6				
Floodplains SLDS: Levees protect against Mississippi river flooding up to a river stage of 52 ft with 2 ft of freeboard; 500-year flood stage is 47 ft (440 ft MSL) SLAPS: 100-year flood level for Coldwater Creek is 522 ft MSL. Extent of 100-year floodplain at SLAPS shown in Figure 2.7. HISS: 100-year flood level at HISS is ~520 ft MSL; majority of property would be covered during a 100-year flood. Storage piles are protected to a level 2 ft above the 100-year flood level.				
Other Ecological Resources Coldwater Creek County Park (234-acre park downstream from SLAPS and HISS developed on right bank of creek to display and enhance ecological resources of the area; includes extensive trails and high-quality areas of climax flora)				
Climate and Meteorology Modified continental climate with few prolonged periods of extreme cold, heat, or humidity. • Temperatures below 32°F <20-25 days per year. • Temperatures above 90°F 35-40 days per year. • Winds predominantly southerly from May through November and northwesterly from December through April • Annual precipitation: ~36 in. • Annual snowfall: averages <20 in. • Severe weather:: Missouri is ranked seventh nationally in tornado occurrence; averages 11 tornado days and 27 storm days per year. Most storms in May and June (NOAA 1990) • Ambient air quality and conditions for air emission control: Worst on summer mornings because of strong temperature inversions at night. St. Louis area particulate levels (mostly from highway traffic dust, commercial and domestic fuel combustion, and construction activities) marginally acceptable. Criteria pollutants within ambient standards.				
LAND USE				
Historic Site Use	Processing uranium ores for MED/AEC by Mallinckrodt (1942-57)	Storage of uranium processing residues from SLDS (1946-66)	Primarily commercial/industrial	Storage of uranium processing residues from SLDS (1967-73)
Current Site Use	Chemical production facility owned and operated by Mallinckrodt, Inc.	Site is unused at present; maintenance and surveillance are the only current onsite activities.	Primarily commercial/industrial (see Figure 2.9 and Appendix H)	HISS: Used by DOE as interim storage facility for low-level radioactively contaminated materials Futura: Occupied by Futura Coatings, Inc., manufacturer of plastic coatings 6 VPs: Industrial/manufacturing
Current Zoning	Industrial	Industrial (municipally owned)	Primarily industrial	Industrial
Current Adjacent Property Use	Commercial and industrial (see Figure 2.8)	Primarily transportation-related and commercial/industrial (see Figure 2.9)	Primarily transportation-related and commercial/industrial (see Figure 2.9)	Primarily transportation-related and commercial/industrial (see Figure 2.9)
Projected Future Site Use (Post-RA)	Depends on ROD; industrial use is likely, based on zoning and use of surrounding property	Depends on ROD; DOE is authorized to reacquire property from City of St. Louis for use as permanent disposal site for onsite waste, contaminated soil in surrounding ditches, and waste from Latty Avenue Properties	Depends on ROD and on the property; continuation of current use is likely for many of the properties	Future use of HISS depends on ROD; residential use is possible, although surrounding land use is industrial and is expected to remain so

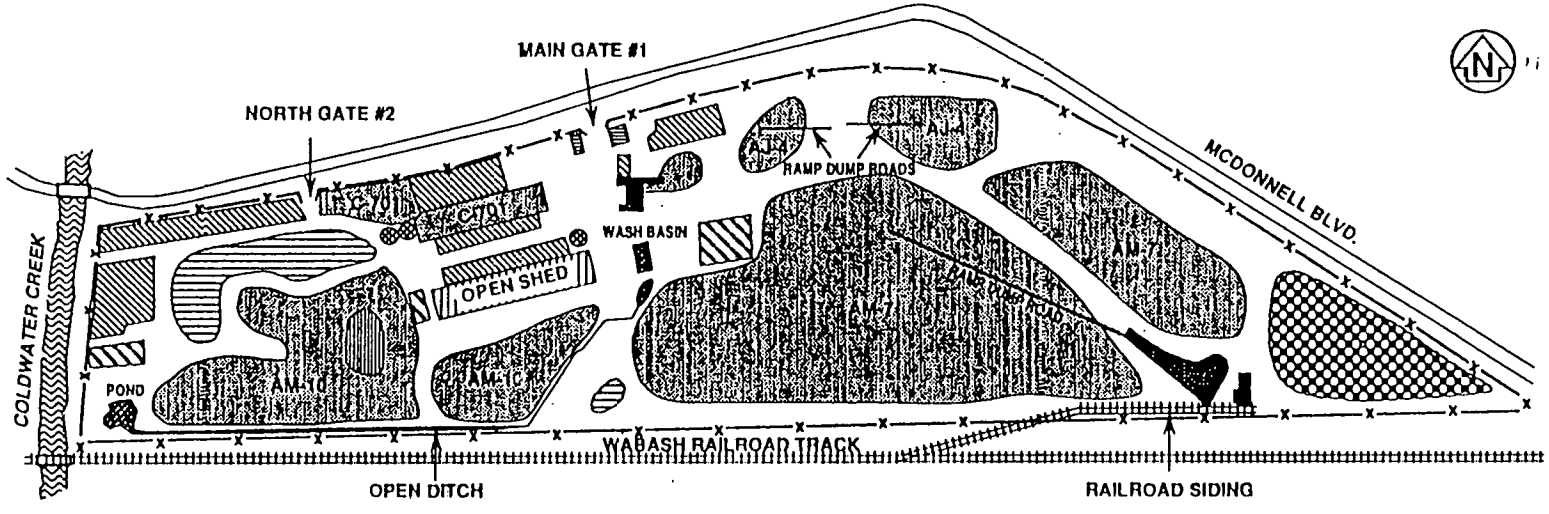
Table 2.1 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
LOCAL/REGIONAL SOCIOECONOMIC AND CULTURAL FACTORS INFLUENCING SITE REMEDIATION STRATEGY				
Demography and Socioeconomics				
Population (1990 census)	~2.5 million within 50-mile radius City of St. Louis: 396,685	~2.5 million within 50-mile radius St. Louis County: 993,529 Hazelwood: 15,324 Berkeley: 12,450	See SLAPS	See SLAPS
Demographic Trends (1980-1990)	Decreases in population growth and density for City of St. Louis, including downtown area	Increases in population growth and density for St. Louis County; decreases for area surrounding airport		
Employment	City of St. Louis: 325,000 (85% private sector, 15% government); per capita income $17,513; annual unemployment 8.2%; largest earnings in manufacturing, services, and government; greatest growth in earnings 1980-89 in agricultural services, military, and service industry	St. Louis County: 701,000 (92% private sector, 8% government); per capita income $22,598; annual unemployment 4.3%; largest earnings in manufacturing, retail trade, and services; greatest growth in earnings 1980-89 in service industry, military, and finance, insurance, and real estate		
Transportation Interstate highways (I-70, I-170, I-270) Air (Lambert-St. Louis International Airport) Rail (AMTRAK and industrial railroads) Water (river barge) Mass transit (Metro Link system)				
Historical Resources	Bissell Street Water Tower and Murphy-Blair Historic District (within 1 mile of SLDS) listed in National Register of Historic Places Most of area W and NW of SLDS and W of I-70 (Mark Twain Expressway) included in official historic district of Hyde Park	Several areas along Coldwater Creek listed in National Register of Historic Places, including City of St. Ferdinand Multiple Resource Area (~2 miles downstream from SLAPS). Multiple Resource Area is oldest settled area in St. Louis County and includes 124 historically significant properties dating from 1790 to 1940.	See SLAPS	See SLAPS
Archaeological Resources	No expected impacts on archaeological resources	No expected impacts on archaeological resources	No expected impacts on archaeological resources	No expected impacts on archaeological resources
FACILITIES AND INFRASTRUCTURE				
Buildings & Structures	Several plant areas including ~60 buildings were involved in MED/AEC operations. <20 original buildings remain. Residual radioactive contamination has been detected in 17. Several additional buildings constructed after closeout of MED/AEC operations have been used for commercial chemical production since 1962. See Figure 2.10 for site map showing plant areas and buildings and Section 3 (Table 3.3) for summary listing indicating radiological status.	None	See Figure 2.9 Most areas of outdoor surface soil contamination are vegetated, paved, or covered with gravel.	HISS: Three office trailers, decontamination pad, storage building, water storage tank Futura: Three buildings used by Futura Coatings, Inc. 6 VPs: Developed with commercial buildings, paved parking lots, and open grassy areas See Figures 2.3 and 2.9

Table 2.1 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
Onsite Storage Piles	None	None	None	2 piles at HISS containing ~32,000 yd^3 of contaminated soil in interim storage Main pile Area = 59,700 ft^2 Volume = 27,000 yd^3 Wastes from 1977 and 1984 onsite cleanups Secondary pile Area = 16,100 ft^2 Volume = 4,600 yd^3 Wastes from cleanup at vicinity properties during installation of municipal storm sewer along Latty Avenue in 1986
Major Roads	Interstate-70 (Mark Twain Expressway), Broadway, Hall Street, Salisbury Street, Angelrodt, Destrehan, McKinley Bridge Except for I-70, roadways surrounding downtown area not heavily traveled	Banshee Road, Lindbergh Boulevard, Pershall Road, Latty Avenue, McDonnell Boulevard, Hazelwood Avenue, Eva Avenue, Frost Avenue, North Hanley Road Roads provide access to major employment centers in the area and are heavily traveled during the work week.	See SLAPS	See SLAPS Latty Avenue is used primarily by large trucks carrying supplies and equipment and employees driving personal vehicles to and from industries adjacent to Latty Avenue.
Railroads	SLDS is traversed by tracks of three railroad lines; several spurs service the property from the main lines	Norfolk & Western Railroad tracks adjacent to southern site boundary between SLAPS and Lambert-St. Louis International Airport	Norfolk & Western Railroad properties south of SLAPS and adjacent to Coldwater Creek, Hanley Road, Eva Avenue, and Hazelwood Avenue (north and south of Latty Avenue)	Three spurs of Norfolk & Western Railroad parallel western boundary of HISS. Two are used for deliveries in surrounding industrial area; easternmost spur is unused. Main spur is owned by Norfolk & Western; others owned by Wagner Electric Corporation.
Utilities	Extensive network of above- and below-grade utility lines. Below-grade utilities include sewer, water, telephone, electric, plant process piping, and natural gas lines. Overhead utilities include electric and telephone wires and plant process piping.	Water main crosses northwestern corner of site and parallels property on north; small onsite line connected to water main supplies mobile site facility. No onsite sewer lines.	Variable (multiple properties)	City water and electricity, overhead electric and telephone lines, underground gas and sanitary sewer lines
Erosion Controls	Water runoff controlled by system of combined sewers that direct excess flow to Mississippi River	Gabion wall installed in western portion of SLAPS at eastern bank of Coldwater Creek (1985) has stabilized creek flow and greatly reduced erosion.	Variable (multiple properties); see SLAPS	Storm sewer lines along northern boundary of HISS
Site Security	Property is fenced. Mallinckrodt maintains 24-hour security.	Surrounded by security fencing	Variable (multiple properties)	Chain link fence completely surrounding HISS/ Futura

Sources: BNI 1993a, 1994a, 1995a, 1995b; SAIC 1994



BARREL STORAGE
EMPTY BARREL STORAGE
METAL SCRAP
BUILDINGS
LOADING RAMPS AND DOCKS
DOLOMITE SLAG DUMP
OIL DUMP
DUMP SITES
WET AREAS
GAS TANKS
—x— FENCE

AM-7: PITCHBLENDE RAFFINATE
AM-10: RAFFINATE
AJ-4: BARIUM CAKE
C-701: TAILINGS OF URANIUM SCALPING OPERATIONS FROM MAGNESIUM FLUORIDE SLAG

NOT TO SCALE
DEPICTION OF AREAS AND NAMES OF ENTITIES CA. 1955

Figure 2.4 Former Areas of Use and Waste Storage at SLAPS

Continental Mining and Milling of Chicago purchased the process wastes at SLAPS in 1966 and stored them at 9200 Latty Avenue during 1966 and 1967. The residues transferred from SLAPS to Latty Avenue included 13 tons of uranium residues and 32,500 tons of leached barium sulfate, all of which were deposited directly on the ground. Most of the residues were dried and shipped to Cotter Corporation facilities in Canon City, Colorado. The material remaining at Latty Avenue was sold to Cotter in 1969. Some of this material was dried and shipped to Cotter mills in Canon City in 1970. The remaining residues included approximately 10,000 tons of Colorado raffinate, which Cotter shipped to Canon City in 1973, and 8,700 tons of leached barium sulfate, which were transported to West Lake Landfill in Bridgeton, Missouri.

Radiological surveys and characterization by the Nuclear Regulatory Commission (NRC) in 1976 and by Oak Ridge National Laboratory (ORNL) in 1977 indicated that residual uranium and thorium concentrations and exposure levels at 9200 Latty Avenue exceeded existing guidelines. Surface contamination exceeding guidelines for thorium and radium was found in and around buildings and in soil to depths of 18 in. (ORNL 1977). Various excavations and renovations were conducted at the Latty Avenue Properties in the late 1970s.

In 1977, the building and grounds at 9200 Latty Avenue were purchased by Mr. E.D. Jarboe, who currently operates Futura Coatings, Inc., located on the western portion of the property. Mr. Jarboe prepared the property for use by demolishing some buildings, erecting several new buildings, and clearing 3.5 acres of land surrounding the buildings. Material from this cleanup (approximately 13,000 yd^3) was placed in interim storage on the eastern portion of the property, now known as the Hazelwood Interim Storage Site (HISS) (ORAU 1981).

In 1984, approximately 14,000 yd^3 of contaminated soil was added to the pile after remediation of a section of property on Latty Avenue designated for street improvements and an area at HISS used for office trailers and a decontamination pad. An additional 4,600 yd^3 of contaminated soil was removed and placed in a second storage pile at HISS in 1986. The total volume of contaminated soil currently in storage at HISS is approximately 32,000 yd^3.

2.2 ENVIRONMENTAL SETTING

The environmental setting of the St. Louis sites, including geology, hydrogeology, and water quality; ecological resources; and climate and meteorology, is summarized in Table 2.1 and described briefly below.

2.2.1 Location

SLDS, an operating chemical production facility owned by Mallinckrodt, Inc., occupies nearly 45 acres in an industrial area on the northeastern border of the city of St. Louis near the Mississippi River. The remedial investigation revealed several offsite areas with radioactive contamination that may be associated with MED/AEC activities at SLDS (Table 2.1; Figure 2.1). These vicinity properties include:

- McKinley Iron Company (adjacent to property boundary immediately north of SLDS Plant 6)
- PVO Foods, Inc. (immediately south of SLDS Plant 7E)
- Thomas and Proetz Lumber Company (immediately south of SLDS Plant 7)
- St. Louis Terminal Railroad Association (a narrow strip of land with railroad tracks running north and south, bisecting SLDS adjacent to Hall Street)
- Norfolk and Western Railroad (a narrow strip of land with railroad tracks running north and south in the western portion of SLDS)
- Chicago, Burlington, and Quincy (now Burlington Northern) Railroad (a narrow strip of land with railroad tracks running northeast to southwest on the eastern portion of SLDS)

- City of St. Louis property (a municipally owned parcel of property adjacent to Plant 7E between SLDS and the Mississippi River)

SLAPS, owned by the City of St. Louis, is located in northern St. Louis County, immediately north of the Lambert-St. Louis International Airport and approximately 15 miles from downtown St. Louis (Figure 2.2). SLAPS is bordered by the Norfolk and Western Railroad and Banshee Road on the south, Coldwater Creek on the west, and McDonnell Boulevard and adjacent recreational fields on the north and east. The site consists of approximately 22 acres.

Within a 2-mile radius of SLAPS are the SLAPS Vicinity Properties, approximately 80 residential, commercial, and municipal properties in Hazelwood and Berkeley (Figure 2.2; Table 2.1). They include:

- Coldwater Creek and its vicinity properties to the west of SLAPS
- Ball fields to the north and east
- Norfolk and Western Railroad properties adjacent to Coldwater Creek
- Banshee Road and St. Louis Airport Authority property to the south
- Ditches to the north and south
- Haul roads (properties along transportation routes including Latty Avenue, McDonnell Boulevard, Pershall Road, Hazelwood Avenue, Eva Avenue, and Frost Avenue)

The Latty Avenue Properties, also in northern St. Louis County, include HISS (9170 Latty Avenue), the Futura Coatings property (9200 Latty Avenue), and six industrial vicinity properties in Hazelwood and Berkeley. HISS and Futura Coatings occupy a tract of approximately 11 acres located approximately 2 miles northeast of the airport control tower; the remaining Latty Avenue Properties cover approximately 60 acres (Figure 2.3; Table 2.1).

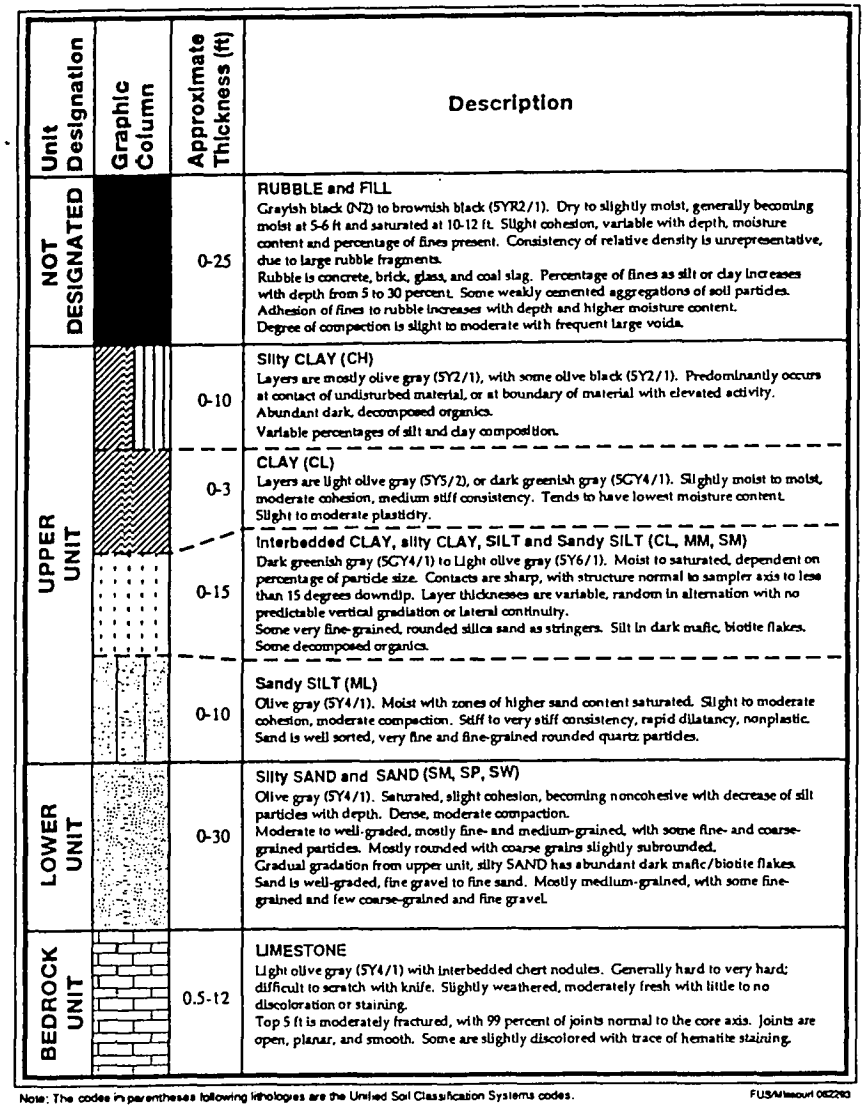
2.2.2 Geology, Hydrogeology, and Water Quality

Detailed information on regional and site-specific geology, hydrogeology, and hydrology is available in previously published characterization reports (BNI 1983, 1985a, 1989a, 1990a; Weston 1982); in the site suitability study for SLAPS; and in the work plan, RI report, and FS-EIS report for the St. Louis sites (BNI 1993a, 1994a; SAIC 1994). Regional and site-specific characteristics potentially influencing site remediation are summarized below and in Table 2.1.

The St. Louis area is located within a stable geologic province. The region is characterized by mature, rugged topography with short, steep valleys draining into large streams (BNI 1994b). St. Louis is located in a tectonically inactive region but is approximately 150 miles from the tectonically active New Madrid seismic zone (Weston 1979; SAIC 1994). Generalized stratigraphic columns for the downtown and airport areas are shown in Figure 2.5.

The principal aquifers in the St. Louis area are located in the alluvial deposits associated with the major rivers. Potentiometric surface maps showing groundwater flow direction at SLDS, SLAPS and vicinity properties, and the Latty Avenue Properties are presented in the RI report (BNI 1994a). Reported yields from production wells pumping from alluvial aquifers are as high as 3,000 gpm. Bedrock aquifers in the St. Louis area typically yield less than 50 gpm, and water quality tends to deteriorate with depth as a result of increased salinity and higher concentrations of other dissolved minerals.

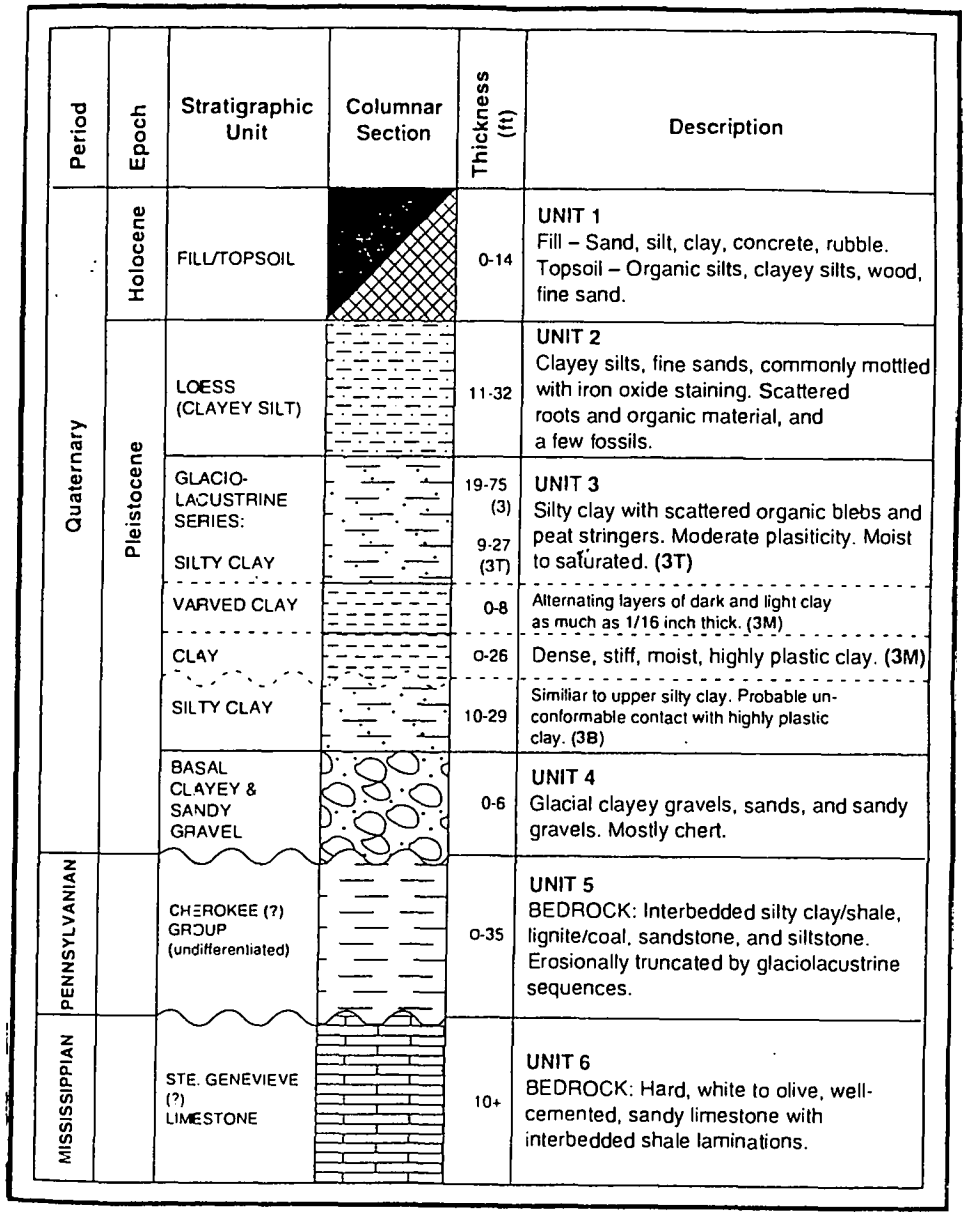
The major surface water bodies in the St. Louis area are the Mississippi, Missouri, and Meramec rivers, which supply most of the drinking and industrial water for the St. Louis area. The Mississippi River intakes for the City of St. Louis are approximately 7 miles upstream of SLDS. Upstream of its confluence with the Missouri River, Mississippi River water is generally of good quality although it is very hard. Downstream of the confluence, the water tends to have high turbidity resulting from sediment transport



Unit Designation	Graphic Column	Approximate Thickness (ft)	Description
NOT DESIGNATED		0-25	**RUBBLE and FILL** Grayish black (N2) to brownish black (5YR2/1). Dry to slightly moist, generally becoming moist at 5-6 ft and saturated at 10-12 ft. Slight cohesion, variable with depth, moisture content and percentage of fines present. Consistency of relative density is unrepresentative, due to large rubble fragments. Rubble is concrete, brick, glass, and coal slag. Percentage of fines as silt or clay increases with depth from 5 to 30 percent. Some weakly cemented aggregations of soil particles. Adhesion of fines to rubble increases with depth and higher moisture content. Degree of compaction is slight to moderate with frequent large voids.
UPPER UNIT		0-10	**Silty CLAY (CH)** Layers are mostly olive gray (5Y2/1), with some olive black (5Y2/1). Predominantly occurs at contact of undisturbed material, or at boundary of material with elevated activity. Abundant dark, decomposed organics. Variable percentages of silt and clay composition.
		0-3	**CLAY (CL)** Layers are light olive gray (5Y5/2), or dark greenish gray (5GY4/1). Slightly moist to moist, moderate cohesion, medium stiff consistency. Tends to have lowest moisture content. Slight to moderate plasticity.
		0-15	**Interbedded CLAY, silty CLAY, SILT and Sandy SILT (CL, MM, SM)** Dark greenish gray (5GY4/1) to Light olive gray (5Y6/1). Moist to saturated, dependent on percentage of particle size. Contacts are sharp, with structure normal to sampler axis to less than 15 degrees downdip. Layer thicknesses are variable, random in alternation with no predictable vertical gradation or lateral continuity. Some very fine-grained, rounded silica sand as stringers. Silt in dark mafic, biotite flakes. Some decomposed organics.
		0-10	**Sandy SILT (ML)** Olive gray (5Y4/1). Moist with zones of higher sand content saturated. Slight to moderate cohesion, moderate compaction. Stiff to very stiff consistency, rapid dilatancy, nonplastic. Sand is well sorted, very fine and fine-grained rounded quartz particles.
LOWER UNIT		0-30	**Silty SAND and SAND (SM, SP, SW)** Olive gray (5Y4/1). Saturated, slight cohesion, becoming noncohesive with decrease of silt particles with depth. Dense, moderate compaction. Moderate to well-graded, mostly fine- and medium-grained, with some fine- and coarse-grained particles. Mostly rounded with coarse grains slightly subrounded. Gradual gradation from upper unit, silty SAND has abundant dark mafic/biotite flakes. Sand is well-graded, fine gravel to fine sand. Mostly medium-grained, with some fine-grained and few coarse-grained and fine gravel.
BEDROCK UNIT		0.5-12	**LIMESTONE** Light olive gray (5Y4/1) with interbedded chert nodules. Generally hard to very hard; difficult to scratch with knife. Slightly weathered, moderately fresh with little to no discoloration or staining. Top 5 ft is moderately fractured, with 99 percent of joints normal to the core axis. Joints are open, planar, and smooth. Some are slightly discolored with trace of hematite staining.

Note: The codes in parentheses following lithologies are the Unified Soil Classification Systems codes. FUS/Missouri 082293

Downtown Area (SLDS and Adjacent Properties)



Period	Epoch	Stratigraphic Unit	Columnar Section	Thickness (ft)	Description
Quaternary	Holocene	FILL/TOPSOIL		0-14	**UNIT 1** Fill – Sand, silt, clay, concrete, rubble. Topsoil – Organic silts, clayey silts, wood, fine sand.
	Pleistocene	LOESS (CLAYEY SILT)		11-32	**UNIT 2** Clayey silts, fine sands, commonly mottled with iron oxide staining. Scattered roots and organic material, and a few fossils.
		GLACIO-LACUSTRINE SERIES: SILTY CLAY		19-75 (3) 9-27 (3T)	**UNIT 3** Silty clay with scattered organic blebs and peat stringers. Moderate plasiticity. Moist to saturated. (3T)
		VARVED CLAY		0-8	Alternating layers of dark and light clay as much as 1/16 inch thick. (3M)
		CLAY		0-26	Dense, stiff, moist, highly plastic clay. (3M)
		SILTY CLAY		10-29	Similiar to upper silty clay. Probable unconformable contact with highly plastic clay. (3B)
		BASAL CLAYEY & SANDY GRAVEL		0-6	**UNIT 4** Glacial clayey gravels, sands, and sandy gravels. Mostly chert.
PENNSYLVANIAN		CHEROKEE (?) GROUP (undifferentiated)		0-35	**UNIT 5** BEDROCK: Interbedded silty clay/shale, lignite/coal, sandstone, and siltstone. Erosionally truncated by glaciolacustrine sequences.
MISSISSIPPIAN		STE. GENEVIEVE (?) LIMESTONE		10+	**UNIT 6** BEDROCK: Hard, white to olive, well-cemented, sandy limestone with interbedded shale laminations.

Airport Area (SLAPS, HISS/Futura, and Adjacent Properties)

Figure 2.5 Generalized Stratigraphic Columns for the Downtown and Airport Areas

and an increase in mineralization. Water from the Missouri River is moderately mineralized, hard, and highly turbid; treatment is necessary for most uses. The Meramec River water is hard but generally of good quality, with low turbidity.

Coldwater Creek, which drains an area of about 46 mile^2 in northern St. Louis County and is the main drainage for SLAPS, discharges into the Missouri River upstream of its confluence with the Mississippi River. Designated uses of the creek include livestock and wildlife watering, fish consumption, and drinking water supply. Coldwater Creek is not currently used as a drinking water source, although two municipal water intakes (the City of St. Louis Chain of Rocks Plant and the East St. Louis Plant) are present on the Mississippi River downstream of the discharge of the creek to the Missouri River.

2.2.3 Ecological Resources

Because of the encroachment of urban development in the downtown and airport areas, biological resources are limited. Ecological resources in the vicinity of the St. Louis sites, including terrestrial and aquatic habitats and biota, threatened or endangered species, critical habitats, wetlands, and floodplains, are summarized in Table 2.1. Federally designated wetlands along Coldwater Creek are shown in Figure 2.6. Figure 2.7 shows the extent of the 100-year floodplain at SLAPS.

2.2.4 Climate and Meteorology

Climatological and meterological conditions in the St. Louis area are summarized in Table 2.1.

2.3 CURRENT LAND USE

Metropolitan St. Louis is a hub of diverse transportation-related, commercial, and industrial activity. Table 2.1 includes a summary of current onsite and adjacent site use. Maps showing current land use in the vicinity of the St. Louis FUSRAP sites are presented in Figures 2.8 and 2.9.

2.4 LOCAL AND REGIONAL FACTORS INFLUENCING REMEDIATION STRATEGY

Socioeconomic, cultural, environmental, and other factors that may influence strategies for site remediation and risk management and stakeholder-based decisions regarding long-term land use are summarized in Table 2.1.

2.5 FACILITIES, EQUIPMENT, AND INFRASTRUCTURE

Facilities and infrastructure at the St. Louis sites are identified in Table 2.1 and shown on site maps in Figures 2.1 through 2.3. A more detailed plan view of SLDS is shown in Figure 2.10. A listing of buildings at SLDS and their radiological status is provided in Section 3 (see Table 3.3).

2.6 PROJECTED FUTURE USE OF LAND, FACILITIES, AND EQUIPMENT

Projected future use of the St. Louis sites after completion of site remediation is summarized in Table 2.1.

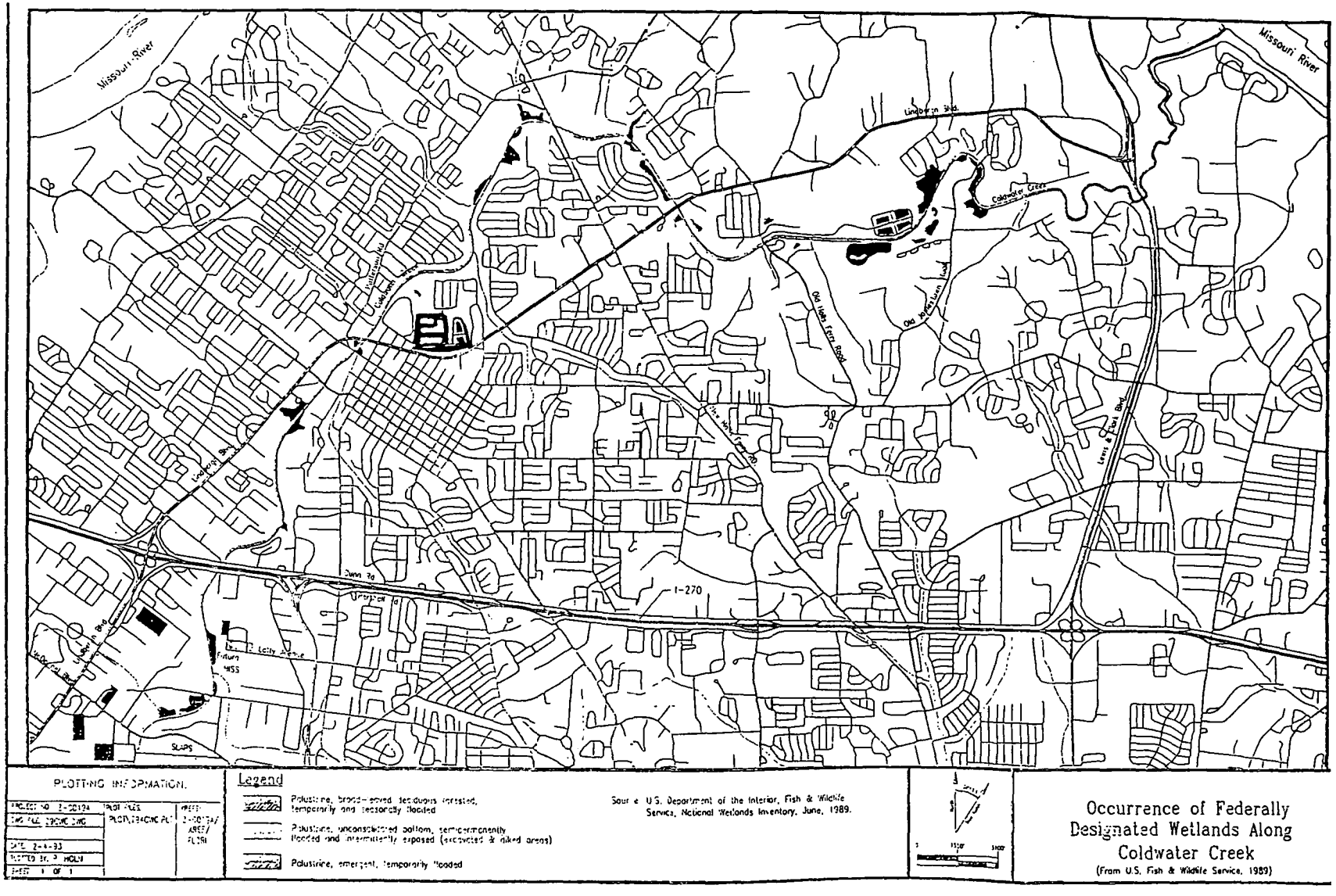


Figure 2.6 Federally Designated Wetlands Along Coldwater Creek

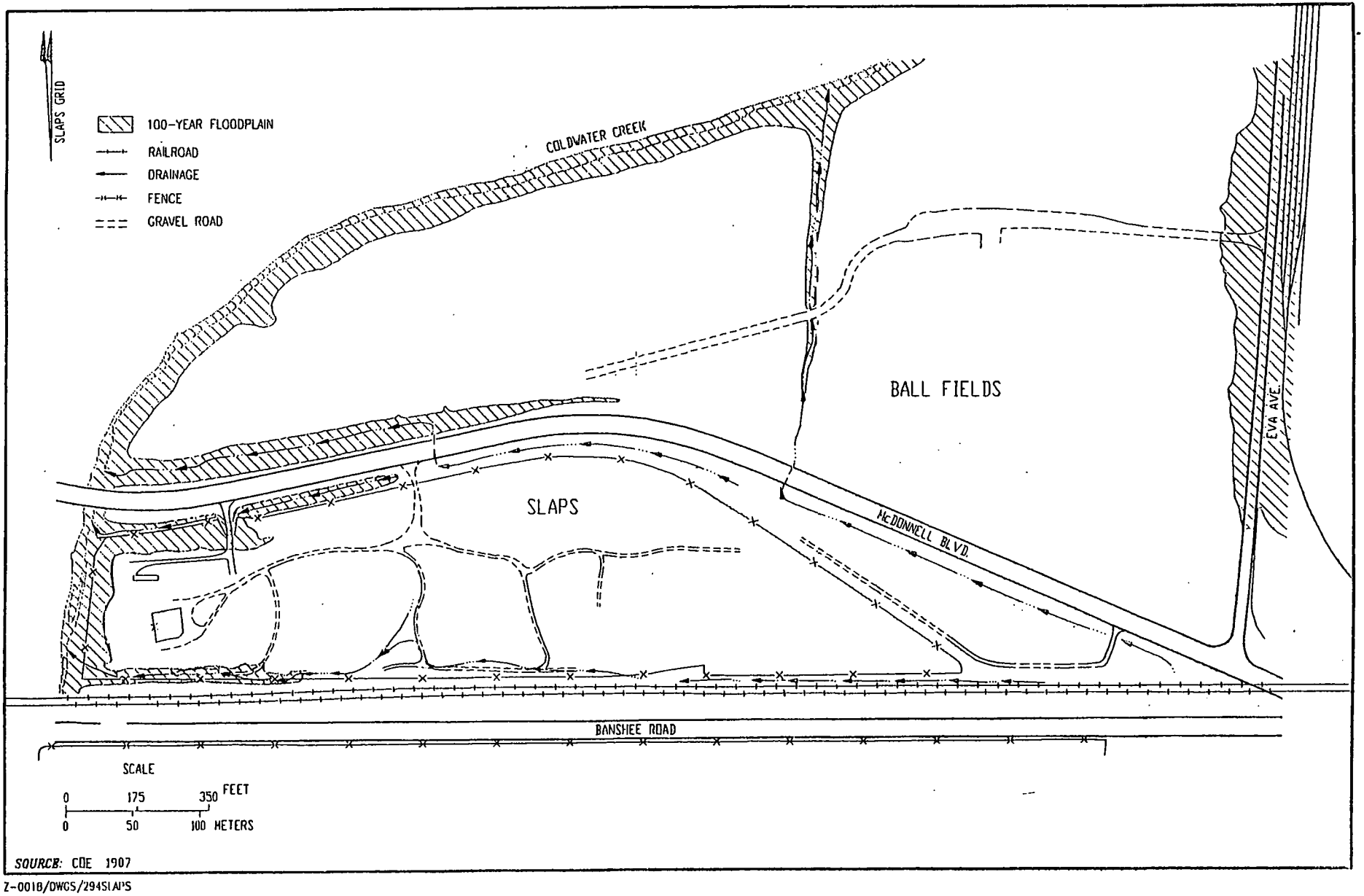


Figure 2.7 Extent of the 100-year Floodplain at SLAPS

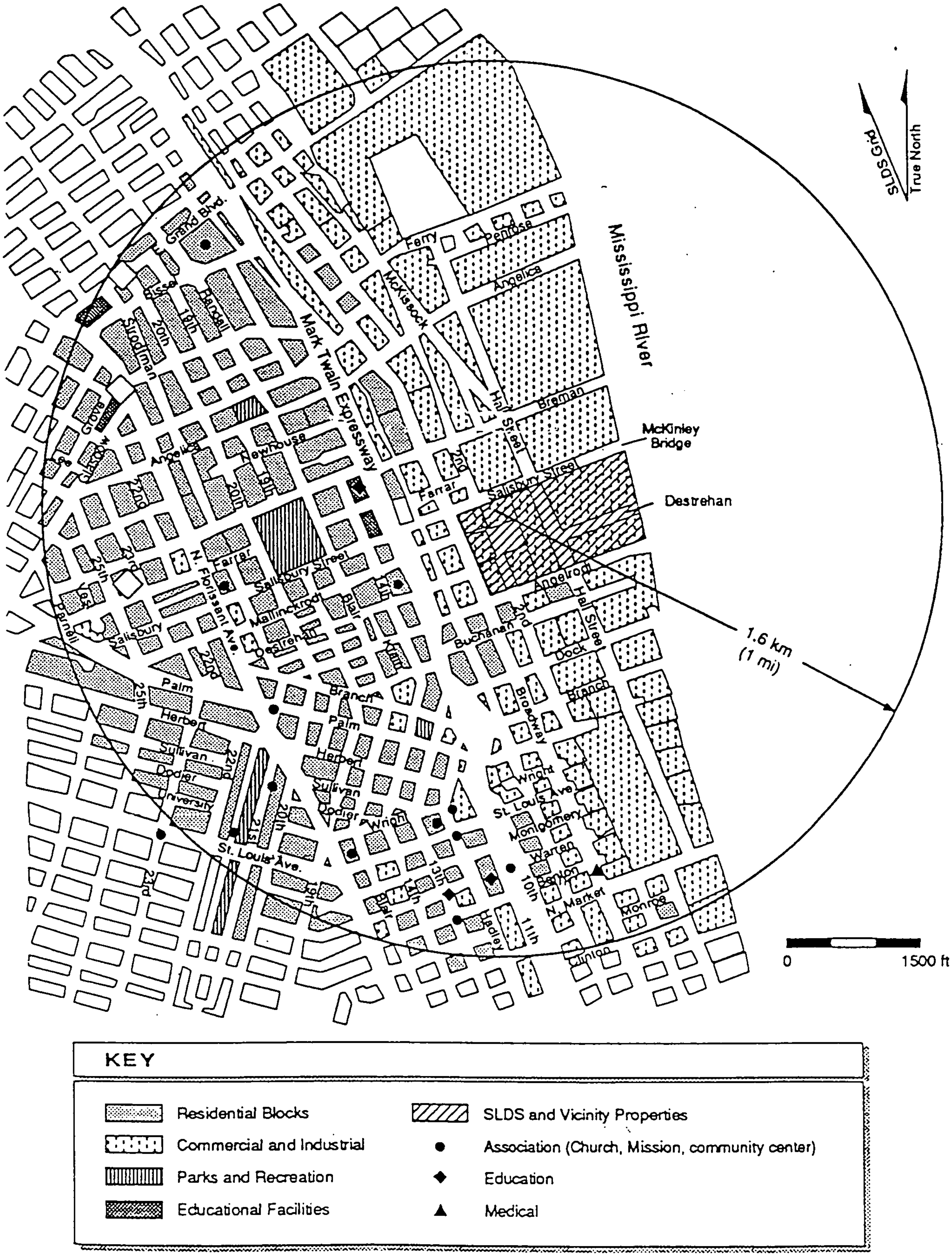


Figure 2.8 Land Use in the Vicinity of SLDS (Downtown Area)

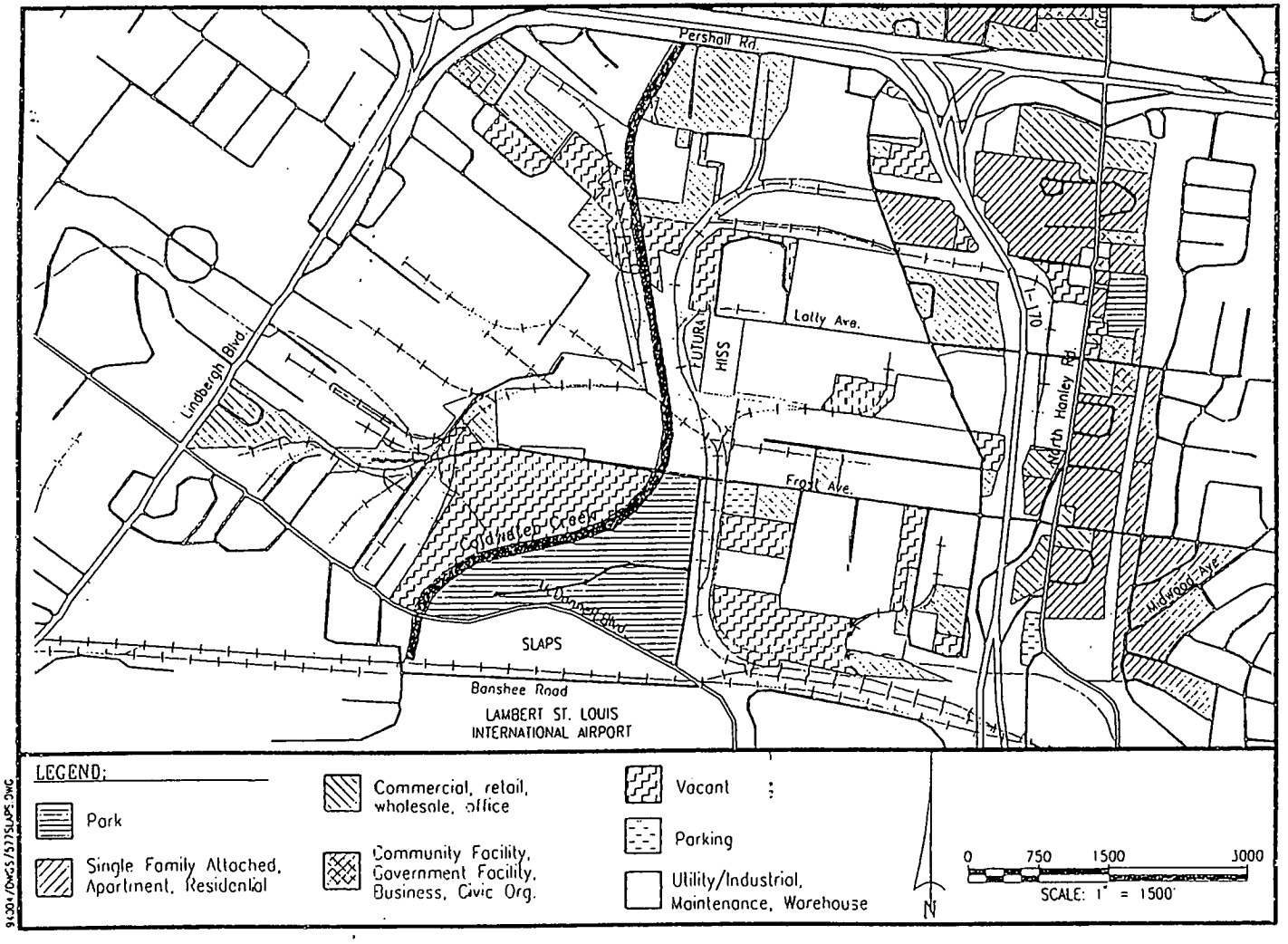


Figure 2.9 Land Use in the Vicinity of SLAPS and HISS/Futura (Airport Area)

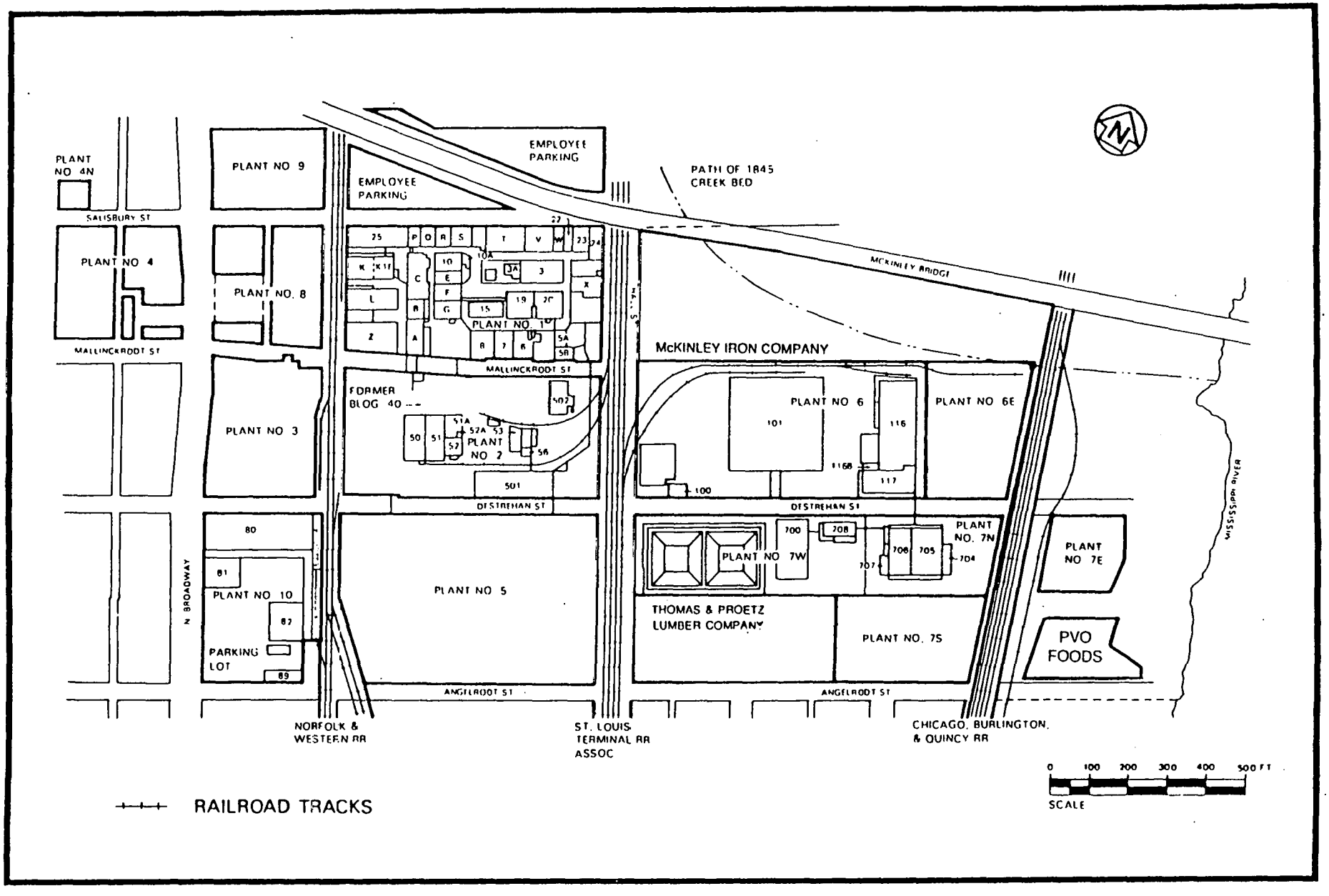


Figure 2.10 Plan View of SLDS

3. SITE ENVIRONMENTAL RESTORATION STATUS

This section summarizes the status of environmental restoration at the St. Louis FUSRAP sites. Table 3.1 reviews site remediation progress to date.

3.1 CURRENT ENVIRONMENTAL RESTORATION STATUS

3.1.1 Site Remediation Activity Summary

Table 3.2 summarizes site remediation activities and current environmental restoration status at the St. Louis sites.

3.1.2 Environmental Condition of Property: Nature and Extent of Contamination

Radiological characterization results for environmental media and buildings at the St. Louis sites are summarized in Table 3.2 and discussed briefly below. Table 3.3 provides additional details on the radiological status of buildings at SLDS. Areas and depths of soil contamination are shown in Figures 3.1 through 3.3.

Soil is the primary contaminated environmental medium at the St. Louis sites, and radionuclides are the primary contaminants. The primary radioactive contaminants are uranium-238, radium-226, and thorium-230 at SLDS, SLAPS, HISS, and Futura and thorium-230 at vicinity properties. Metals that exceed background levels in soil are generally found in known areas of radioactive contamination. Essentially all of the grounds at SLAPS and the Latty Avenue Properties are contaminated in excess of DOE guidelines for residual radioactivity in soil. Radioactive contamination in soil was detected to a maximum depth of 23 ft at SLDS and to depths of 18 ft, 6 ft, and 15 ft at SLAPS, HISS, and Futura, respectively. In general, radioactive contamination at vicinity properties is confined to the edges of the properties adjacent to the haul roads and is shallow, extending to a maximum depth of 2 ft.

SLDS

Radiological and chemical characterization and surveys conducted at SLDS from 1987 through 1993 included walkover gamma scans; collection and analysis of systematic and biased soil samples; collection and analysis of groundwater samples for radioactive and chemical constituents; collection of surface soil samples and analysis for uranium, radium, thorium, and various chemical parameters; downhole gamma logging; and radiological surveys of building surfaces. Characterization results and waste volumes are provided in Table 3.2.

Most residual contamination within buildings was on walls and floors. Residual radioactive contamination exceeding guidelines was also detected during roof surveys for several buildings (Table 3.3). Uranium was the primary radioactive contaminant in 15 of the 17 onsite buildings found to contain residual radioactivity above current guidelines. Radium was the primary contaminant in Buildings K1E (Plant 1) and 101 (Plant 6).

Sediment from 35 of 84 manholes surveyed at SLDS showed residual radioactivity exceeding guidelines. Radionuclide concentrations in groundwater were all near background except for elevated uranium levels in one well near Building K1E (Plant 1). Sixteen metals and 10 organic compounds were detected during groundwater monitoring for chemical indicator parameters; however, results of volatile organics analysis of soil samples generally indicated low concentrations, and metals detected most frequently in soil were not found at elevated levels in groundwater.

Table 3.1 Review of Site Remediation Progress and Accomplishments

Fiscal Year	Activities Completed/Accomplishments
FY 1977-79	• Radiological characterization of HISS and Futura (ORNL 1977) • Radiological survey at SLDS detected alpha and beta-gamma activity exceeding guidelines at several outdoor locations and in some buildings formerly used for MED/AEC uranium processing (ORNL 1981) • 13,000 yd^3 of contaminated soil & debris excavated during partial cleanup of 9200 Latty Avenue characterized & placed at HISS as an interim storage pile
FY 1981	• Radiological survey performed on northern & eastern boundaries of HISS (ORAU 1981) • SLDS designated for cleanup under FUSRAP
FY 1982	• Radiological characterization of ditches to north and south of SLAPS and portions of Coldwater Creek indicated radioactive contamination exceeding guidelines (BNI 1983)
FY 1982-91	• Remedial investigation conducted to characterize nature and extent of contamination at St. Louis sites (BNI 1994a)
FY 1983	• Preliminary gamma survey of properties near SLAPS/HISS identified radioactive contamination exceeding guidelines
FY 1984	• More extensive gamma surveys (including mobile gamma scanning surveys of potential transportation routes between SLAPS and Latty Avenue Properties) (ORNL 1985); based on results, 3 areas (McDonnell Blvd., Pershall Rd., & Hazelwood Ave.) recommended for future onsite surveys • DOE authorized to remediate Latty Avenue Properties under FUSRAP. • DOE cleared HISS property, constructed a decontamination facility, installed the perimeter fence, excavated and backfilled edges and shoulders of Latty Avenue, and consolidated and covered the existing storage pile. • Environmental monitoring/surveillance program initiated at SLAPS and HISS (radionuclide concentrations in surface water and groundwater, external gamma exposure rates, radon)
FY 1985	• DOE provided radiological monitoring support for work involving street improvements along Latty Avenue. As a result of these efforts, 14,000 yd^3 of contaminated soil was excavated and added to interim storage pile at HISS. • Installation of gabion wall to control erosion caused by sloughing and seepage of contaminated fill material in the western portion of SLAPS along Coldwater Creek; construction activities completed within a 7-week period. • Energy Water Development Authorization Act legislation (Public Law 98-360) authorized DOE to reacquire SLAPS property from the City of St. Louis for use as a permanent disposal site (whether DOE exercises this authority will depend on record of decision documenting final remedy for St. Louis sites)
FY 1986	• Extensive radiological & limited chemical characterization identified radioactive contamination to depth of 18 ft at SLAPS. • Cleanup during installation of a storm sewer along Latty avenue (4,600 yd^3 of contaminated soil from the cleanup was placed in a second storage pile at HISS). • Radiological characterization of airport area properties was conducted from 1986-1990 to define extent of radioactive contamination and evaluate potential disposal alternatives
FY 1987	• Radiological, chemical, geological, and hydrological characterization to determine vertical and horizontal limits of contamination at SLAPS. • Sampling and analysis of surface soil and sediment at Coldwater Creek; thorium-230 identified as primary contaminant.
FY 1987-1990	• Radiological and chemical characterization and surveys at SLDS including walkover gamma scans; radiological and chemical sampling and analysis of soil and groundwater, downhole gamma logging, and radiological surveys of buildings.
FY 1989	• Additional characterization of Coldwater Creek (soil samples from banks on both sides of creek north of Pershall Rd) revealed that areas of contamination were most numerous between SLAPS & Pershall Rd. adjacent to SLAPS and HISS.
FY 1990	• Published characterization reports for SLAPS VPs and SLDS • Completed additional characterization at Coldwater Creek • Signed FFA negotiated between DOE and EPA for the St. Louis sites • Developed risk-based uranium cleanup guideline for St. Louis sites
FY 1991	• Issued EE/CA for cleanup and interim storage of contaminated soil at SLDS for public comment • Environmental compliance assessment by ORNL
FY 1992	• Met FFA documentation milestones on or ahead of schedule (EPA approval of work plan, RI report, baseline risk assessment, and initial screening of alternatives) • Initiated development and implementation of a public scoping participation process for St. Louis sites • Building 116 upgrades and RCRA pad removal action at SLDS • Upgrades of Latty Avenue Properties; established NPDES stormwater monitoring system at HISS • Self-assessment of HISS and SLAPS; environmental compliance audit of HISS • Revised EE/CA-EA for SLAPS VPs and Latty Avenue Properties cleanup issued for public comment • Completed data gap characterization

Table 3.1 (continued)

Fiscal Year	Activities Completed/Accomplishments
FY 1993	• Prepared FS-EIS for St. Louis sites • Excavated contaminated soil to support Mallinckrodt construction of a waste storage facility at SLDS; soil was placed in Building 116 for storage
FY 1994	• Completed revised RI report, baseline risk assessment, and FS-EIS/proposed plan for St. Louis sites • Started ROD for St. Louis sites • Established St. Louis Site Remediation Task Force
FY 1995	St. Louis Remedial Action: • Completed interim remedial actions along selected SLAPS VP haul roads (6 North County residential VPs) • Completed interim removal actions at 2 North County industrial properties [Latty Avenue properties 3L (Quaker State pile) and 6L] • Completed restoration of a city block at SLDS (interim removal action at Mallinckrodt Plant 10 in support of Mallinckrodt's demolition and reconstruction activities; effort represented a teaming partnership with Mallinckrodt) • Completed SLAPS fence upgrade • Placed a U.S. government tender with Burlington Northern for transporting St. Louis wastes from interim removal actions to Envirocare (this is the first FUSRAP tender placed with Burlington Northern) St. Louis Stakeholder Involvement: • First annual National Stakeholder Summit in Washington D.C. • Held Environmental Management Advisory Board (EMAB) meetings at St. Louis sites • DOE Worked with St. Louis Site Remediation Task Force in evaluating options for cleanup and disposal of FUSRAP waste • Task Force's Coldwater Creek Panel of geologists and hydrogeologists focused on surface water and groundwater issues at SLAPS Technology Initiatives: • Use of rock crusher generating cost savings of >$500,000 in Missouri and Ohio • Use of field gamma spectroscopy to reduce analytical costs, saving $150,000 in Missouri and Ohio • Design/construction/deployment of mobile wet chemistry lab in St. Louis • Developed GIS modeling for data interpretation and visual communication • Bench-scale demonstration of treatment for St. Louis soils • Completed initial development and testing of Long Range Alpha Detection (LRAD) system for use in St. Louis cleanup activities Documentation • Completed activity safety envelope for SLDS Plant 10 • Completed Environmental Surveillance Technical Memorandum for Hazelwood Interim Storage Site (HISS) • Completed FSRD design reviews for SLAPS and Latty Avenue VP remedial action • Performed onsite Environmental Compliance Self-Assessment at HISS and prepared required QA report to address findings Other: • Continued environmental surveillance and site maintenance • Conducted emergency response exercises at St. Louis sites • Zero lost-time accidents during 8 site remediations and St. Louis surveillance and maintenance • Achieved $1.2 million in cost savings through Productivity Improvement Program and cost savings initiatives

Table 3.2 Environmental Restoration Status: Site Activity Summary

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
ADS No.	OR-1300-AA	OR-1300-AA	OR-1300-AA	OR-1300-AA
WBS No.	1.4.11.1.1 (116)	1.4.11.1.1 (153)	1.4.11.1.1 (134)	1.4.11.1.1 (140)
Remedial Action Status	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)	Radiological and chemical characterization complete Partial remedial action (interim removal actions pending record of decision)
Total Site Area	45 acres	22 acres		HISS/Futura = 12 acres 6 vicinity properties = 60 acres
Vicinity Properties	6	See SLAPS Vicinity Properties	78	6
Vicinity Properties Remediated	0 of 6	See SLAPS Vicinity Properties	6 of 78	2 of 6
Cleanup Actions Completed	See Table 3.1	See Table 3.1	See Table 3.1	See Table 3.1
REGULATORY STATUS				
EPA Region	VII	VII	VII	VII
NPL Site	No	Yes	No	Yes
Federal Facilities Agreement (FFA)	FFA between DOE and EPA for all St. Louis Sites signed 1990	FFA between DOE and EPA for all St. Louis Sites signed 1990	FFA between DOE and EPA for all St. Louis Sites signed 1990	FFA between DOE and EPA for all St. Louis Sites signed 1990
DOE-Owned/Leased Site	No	No	No	HISS leased by DOE from Jarboe Realty & Investment Company
Designation Authority/Date	DOE-designated (1981)	Assigned by Congress 1984	DOE-designated (1984)	Assigned by Congress 1984
Lead Agency for Remedial Action	DOE	DOE	DOE	DOE
Key Regulators	EPA Region VII, Missouri Department of Natural Resources (MDNR)	EPA Region VII, MDNR	EPA Region VII, MDNR	EPA Region VII, MDNR
Regulatory Drivers	CERCLA, NEPA, Clean Air Act, Clean Water Act including NPDES permitting requirements; see Appendix G for summary of ARARs	CERCLA, NEPA, Clean Air Act, Clean Water Act including NPDES permitting requirements; see Appendix G for summary of ARARs	CERCLA, NEPA, Clean Air Act, Clean Water Act including NPDES permitting requirements; see Appendix G for summary of ARARs	CERCLA, NEPA, Clean Air Act, Clean Water Act including NPDES permitting requirements; see Appendix G for summary of ARARs
Level of CERCLA Documentation	RI/FS-EIS with record of decision for St. Louis sites as a group	RI/FS-EIS with record of decision for St. Louis sites as a group	RI/FS-EIS with record of decision for St. Louis sites as a group	RI/FS-EIS with record of decision for St. Louis sites as a group
Compliance Milestones: Record of Decision Complete Remedial Action	 1998 2016	 1998 2016	 1998 2012	 1998 2006
OPERATIONAL HISTORY				
Historic Origin of Contamination	Residues from uranium processing by Mallinckrodt for MED/AEC (1942-57)	Uranium processing residues from SLDS (stored at SLAPS 1946-66)	Uranium processing residues form SLDS [via migration from other sites or deposited when waste was hauled over transportation routes (1946-73)]	Uranium processing residues from SLDS (stored at SLAPS 1946-66 and at 9200 Latty Avenue 1967-73)
Owner/Landlord				
Historic	SLDS: Mallinckrodt Inc. (formerly Mallinckrodt Chemical Works)	MED/AEC (1946-73)	Multiple owners	Continental Mining & Milling Co. of Chicago/ Commercial Discount Corp. of Chicago/Cotter Corp. (1966-77)
Current	SLDS: Mallinckrodt, Inc. City of St. Louis property: City of St. Louis 6 commercial/industrial VPs: Owned by Mallinckrodt or City of St. Louis, leased by railroads and commercial enterprises	City of St. Louis (1973-present) [DOE is authorized under 1985 Energy & Water Development Appropriations Act to reacquire SLAPS for use as permanent disposal site]	Multiple owners; land use is primarily commercial/industrial and transportation-related	Jarboe Realty & Investment (Futura Coatings and HISS, 1977-present) • HISS leased by DOE • Futura property leased by Futura Coatings, Inc. 6 VPs (zoned for industrial use) have multiple

Table 3.2 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
				owners
WASTE INVENTORY				
Site Total Waste Volume (yd^3)	246,000	250,000	195,000	211,000
Total Curies	100	100	5	180
Waste Type	11(e)2	11(e)2	11(e)2	11(e)2
NATURE AND EXTENT OF CONTAMINATION				
Primary Contaminants	Thorium-230, Thorium-232, Uranium-238, Radium-226	Thorium-230, Thorium-232, Uranium-238, Radium-226	Thorium-230	Thorium-230, Thorium-232, Uranium-238, Radium-226
Areas/Locations of Contamination	17 buildings (walls/floors/roofs); surface/subsurface soils near/beneath buildings; sediment from stormwater and sanitary sewer manholes	Surface/subsurface soils over most of property; groundwater near areas of buried residues; surface water/sediment from ditches and streams	Soil/sediment at 78 vicinity properties (VPs) in Hazelwood and Berkeley including Coldwater Creek and VPs to west of SLAPS; ball fields to north and east; Norfolk & Western Railroad properties adjacent to creek; Banshee Road and St. Louis Airport Authority property to south; ditches to north and south; haul roads and VPs	Surface/subsurface soils at HISS (including 2 storage piles), Futura Coatings, and 6 VPs
Site Map Reference	Figure 3.1	Figure 3.2	Figure 3.2	Figure 3.3
Contaminated Media	Surface and subsurface soil, sediment, 17 buildings	Surface and subsurface soil, sediment, groundwater	Surface and subsurface soil, sediment (creek, ditches, stormwater drains)	Surface and subsurface soil including 2 storage piles at HISS
Soil and Sediments				
Primary Contaminants	SLDS (Mallinckrodt): Radium-226, Thorium-230, Thorium-232, Uranium-238 Plant 1: Radium-226 Plant 2: Uranium-238, Thorium-230 Plant 5: Thorium-230 Plant 6: Uranium-238 Plant 7: Uranium-238 Plant 7E: Radium-226, Thorium-230 Plant 10: Uranium-238 City Property: Uranium-238, Radium-226, Thorium-230 McKinley Iron: (see SLDS) Thomas & Proetz Lumber: (see SLDS) PVO Foods: None 3 Railroad properties: (see SLDS) Norfolk & Western RR St. Louis Terminal RR Assoc. Chicago, Burlington, & Quincy RR	Radium-226, Thorium-230, Thorium-232, Uranium-238	Thorium-230 Ditches north & south of SLAPS Ball Field St. Louis Airport Authority property Norfolk & Western Railroad property Banshee Road Haul Roads Coldwater Creek and VPs	HISS: Thorium-230 (lesser amounts of radium-226 and uranium-238) Futura: Thorium-230, Radium-226, Uranium-238, Thorium-232 6 VPs: Thorium-230, Radium-226
Locations of Contamination > Guidelines	SLDS (Mallinckrodt): Surface/subsurface soils (covered by buildings/concrete/asphalt) Plant 1: 7 of 22 boreholes sampled Plant 2: 13 of 27 boreholes sampled Plant 5: 7 of 8 boreholes sampled Plant 6: 53 of 64 boreholes sampled Plant 7: 32 of 45 boreholes sampled Plant 7E: 2 of 5 boreholes sampled Plant 10: 9 of 13 boreholes sampled	Surface and subsurface soil over most of property	Ditches north & south of SLAPS: Most of ditch area Ball Field: Surface and subsurface soil on all areas of property except area north of Latty Avenue adjacent to Hanley Road & Hazelwood Avenue St. Louis Airport Authority property: Entire length of boundary with SLAPS	HISS: Surface and subsurface soil (onsite soil and storage piles) Futura: Surface and subsurface soil, primarily beneath buildings 6 VPs: Surface and shallow subsurface soil

Table 3.2 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
Soil and Sediments: Location of Contamination > Guidelines (continued)	SLDS VPs: City Property: 16 of 21 boreholes sampled McKinley Iron: 19 of 42 samples Thomas & Proetz Lumber: 26 of 65 samples PVO Foods: None 3 Railroad properties (soils covered by railroad bed) Norfolk & Western RR: 18 of 34 samples (entire length of property adjacent to SLDS) St. Louis Terminal RR Assoc.: 19 of 32 samples (entire length of property adjacent to SLDS) Chicago, Burlington, & Quincy RR: 21 of 40 samples (southern 2/3 of property adjacent to SLDS)		Norfolk & Western Railroad property: Highest concentrations on property adjacent to 9200 Latty Avenue Banshee Road: Stormwater drains and ditches adjacent to road Haul Roads: Stormwater drains and ditches adjacent to haul roads Coldwater Creek: Primarily in top 0.5 ft of sediment in creek section between SLAPS and HISS; detected intermittently downstream to maximum depth of 4 ft	
Maximum Depth of Contamination	SLDS (Mallinckrodt): 23 ft Plant 1: 12 ft Plant 2: 23 ft Plant 5: 10 ft Plant 6: 20 ft Plant 7: 20 ft Plant 7E: 1 ft Plant 10: 6 ft City Property: 13 ft	18 ft (average 4-8 ft)	Ditches north & south of SLAPS: 14 ft Ball Field: 1 ft (average) St Louis Airport Authority property: 2 ft Norfolk & Western Railroad property: 2 ft Banshee Road: 2 ft Haul Roads: 2 ft Coldwater Creek: 4 ft	HISS: 6 ft Futura: 15 ft 6 VPs: 1 ft
Contaminant Concentrations (pCi/g) Uranium-238[a] Radium-226[b] Thorium-230[b] Thorium-232[b] [a]Guideline = 50/100 pCi/g for surface/subsurface soil [b]Guideline = 5/15 pCi/g for surface/subsurface soil	 1.0 - 33,000 0.4 - 5,400 0.3 - 14,000 0.4 - 440	 <3.0 - 1,600 <0.3 - 5,620 0.6 - 2,600 0.5 - 63	 <4 - 390 0.6 - 1,100 0.1 - 26,000 0.1 - 9.5	 <3 - 2,500 0.4 - 2,300 0.2 - 5,700 0.4 - 26
Buildings and Structures				
Primary Contaminants	SLDS (Mallinckrodt): Radium-226, Thorium-230, Thorium-232, Uranium-238 Plant 1: Radium-226, Uranium-238 Plant 2: Uranium-238 Plant 5: None Plant 6: Uranium-238, Radium-226 Plant 7: Uranium-238 Plant 10: Uranium-238	Not applicable	Not applicable	HISS: Not applicable Futura: None 6 VPs: Not applicable

Table 3.2 (continued)

Release Site	St. Louis Downtown Site (SLDS)	St. Louis Airport Site (SLAPS)	SLAPS Vicinity Properties	Latty Avenue Properties
Buildings and Structures (continued): Locations of Contamination > Guidelines	SLDS (Mallinckrodt): Nonremovable alpha and beta-gamma activity in 17 buildings; elevated radon levels and external gamma exposure (see Table 3.3 for details) Plant 1: Buildings K1E and 25 Plant 2: Buildings 50, 51, 51A, 52, 52A Plant 5: No activity above guidelines Plant 6: Buildings 100, 116, 116B Plant 7: Buildings 700, 704, 705, 706, 707, 708 Plant 10: No activity above guidelines	Not applicable	Not applicable	HISS: Not applicable Futura: No contamination above guidelines within the 3 onsite buildings 6 VPs: Not applicable
Groundwater				
Primary Contaminants	None	Radium-226, Thorium-230, Thorium-232, Uranium-238	Ball Field: Thorium-230	None
Locations of Contamination > Guidelines	No concentrations above guidelines (17 wells sampled)	Concentrations above guidelines in 4 of 24 wells sampled	See SLAPS	No concentrations above guidelines (24 wells sampled)
RISK				
POTENTIAL EXPOSURE PATHWAYS [From Baseline Risk Assessment (BRA)]	External gamma irradiation, incidental soil ingestion, inhalation of particulates, radon inhalation	External gamma irradiation, incidental soil ingestion, inhalation of particulates, radon inhalation	External gamma irradiation, incidental soil ingestion, inhalation of particulates, radon inhalation	External gamma irradiation, incidental soil ingestion, inhalation of particulates, radon inhalation
POTENTIAL RECEPTORS				
BRA Current Risk Scenarios:	Employee, maintenance worker, construction worker at SLDS and VPs Recreational user at City property adjacent to SLDS	Maintenance worker at SLAPS Trespasser at SLAPS	Construction worker at ditches adjacent to SLAPS Recreational user at ball field Child commuter, resident at residential VPs Recreational user at Coldwater Creek Employee at commercial/municipal/ transportational VPs	Trespasser at HISS Maintenance worker at HISS Employee at Futura Coatings
BRA Future Risk Scenarios:	Future resident	Future resident	Future resident	Future resident
Radiological Risk Estimate > EPA Target Risk Range (10^{-6} - 10^{-4})				
BRA Current Risk Scenarios:	SLDS construction worker	SLAPS maintenance worker	Ditch construction worker	HISS maintenance worker HISS trespasser Futura Coatings employee
BRA Future Risk Scenarios:	Future resident	Future resident	Future resident	Future resident
RELATIVE RISK (RDS)	See Section 4, Table 4.3	See Section 4, Table 4.3	See Section 4, Table 4.3	See Section 4, Table 4.3
RELATIVE RANKING (EM-40)	High (See Section 4, Table 4.1)	High (See Section 4,Table 4.1)	High (See Section 4,Table 4.1)	High (See Section 4,Table 4.1)

Sources: BNI 1993a, 1994a, 1995a, 1995b; ANL 1993; SAIC 1994

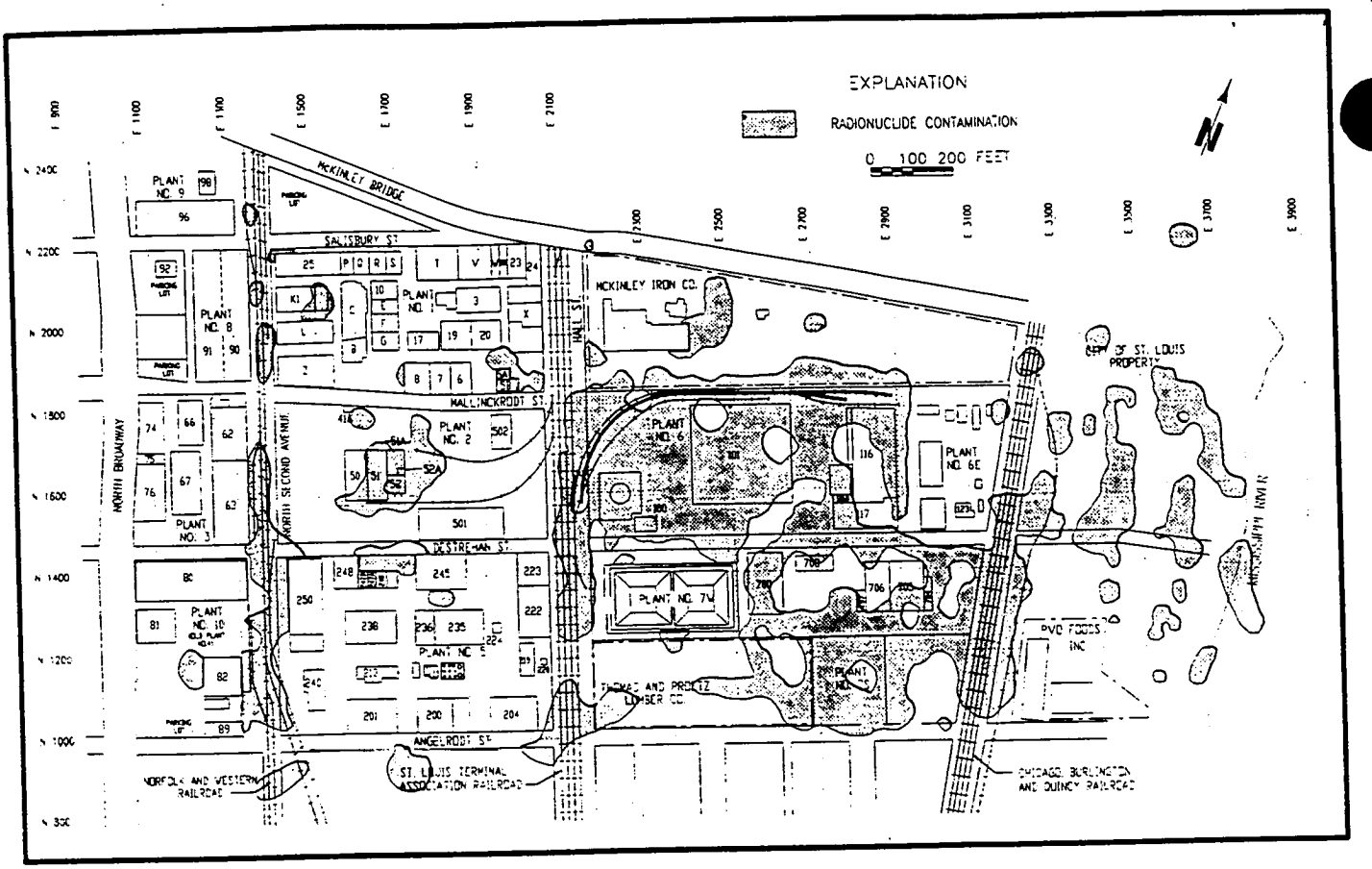
Table 3.3 Radiological Status of Buildings at SLDS

Plant Area/Site Location	Building	Areas Surveyed (1987-89)	Areas with Surface Contamination Above Guidelines	Elevated Radon Levels	Fixed Alpha Activity Above Guidelines	Fixed Beta-Gamma Activity Above Guidelines	Removable Alpha and/or Beta-Gamma Activity Above Guidelines	Average External Gamma Exposure Rate Above Guidelines	Primary Contaminant in Buildings
BUILDINGS ASSOCIATED WITH MED/AEC OPERATIONS									
Plant 1									
	K1E	Floors, walls, ceilings, roof	Roof	Yes	No	Yes	No	No	Radium-226
	25	Floors, walls, ceilings, roof	Walls, floors	No	Yes	Yes	No	No	Uranium-238
Plant 2									
	50	Floors, walls, ceilings, roof	Floors	No	Yes	Yes	No	No	Uranium-238
	51	Floors, walls, ceilings, roof	Walls, floors	No	No	Yes (walls)	No	No	Uranium-238
	51A	Floors, walls, ceilings, roof	Walls, floors	No	No	Yes	No	No	Uranium-238
	52	Floors, walls, ceilings, roof	Walls	No	Yes	Yes	No	No	Uranium-238
	52A	Walls, roof	Walls	Yes	Yes	Yes	No	No	Uranium-238
Plant 6									
	100	Floors, walls, ceilings, roof	All surfaces	No	Yes	Yes	No	No	Uranium-238
	101	Floors	None	Yes	No	No	No	No	Radium-226
Plant 6E									
	116	Walls, floors, roof	Walls, floors	No	No	Yes	No	No	Uranium-238
	116B	Floors, walls, ceilings, roof	Ceilings, roof	No	No	Yes	No	No	Uranium-238
	117	Floors, walls, ceilings, roof	All surfaces	No	Yes	Yes	No	No	Uranium-238
Plant 7									
	700	Floors, walls, ceilings, roof	All surfaces	No	No	Yes	No	No	Uranium-238
	704	Floors, walls, ceilings, roof	Floors, roof	No	Yes	Yes	No	No	Uranium-238
	705	Floors, walls, ceilings, roof	All surfaces	No	Yes	Yes	No	No	Uranium-238

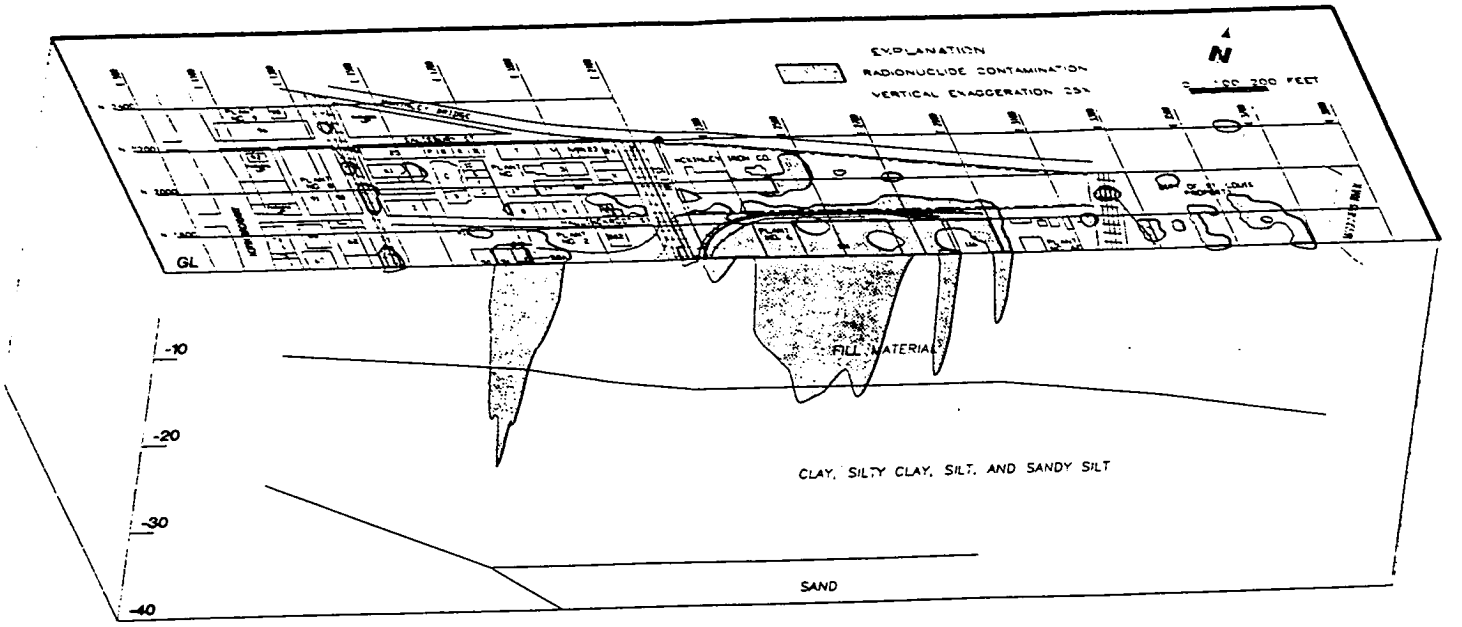
Table 3. (continued)

Plant Area/Site Location	Building	Areas Surveyed (1987-89)	Areas with Surface Contamination Above Guidelines	Elevated Radon Levels	Fixed Alpha Activity Above Guidelines	Fixed Beta-Gamma Activity Above Guidelines	Removable Alpha and/or Beta-Gamma Activity Above Guidelines	Average External Gamma Exposure Rate Above Guidelines	Primary Contaminant in Buildings
Plant 7 (continued)	706	Floors, walls, ceilings, roof	Floors, ceilings	No	No	Yes	No	No	Uranium-238
	707	Floors, walls, ceilings, roof	Roofs, floors	No	No	Yes	No	No	Uranium-238
	708	Floors, walls, ceilings, roof	Roofs, floors	No	No	Yes	No	No	Uranium-238
Plant 10 (formerly Plant 4)									
	81	Floors, walls, ceilings, roof	None above guidelines	No	No	No	No	No	Uranium-238
	82	Floors, walls, ceilings, roof	None above guidelines	No	No	No	No	No	Uranium-238
BUILDINGS ADJACENT TO BUILDINGS ASSOCIATED WITH MED/AEC OPERATIONS									
Plant 1									
	10	Roof			No	Some areas			Uranium-238
	B	Roof			No	Some areas			Uranium-238
	C	Roof			No	Some areas			Uranium-238
	F	Roof			No	Some areas			Uranium-238
	G	Roof			No	Some areas			Uranium-238
	L	Roof			No	Some areas			Uranium-238
	P	Roof			No	Some areas			Uranium-238
	Q	Roof			No	No			Uranium-238
	R	Roof			No	Some areas			Uranium-238
	T	Roof			No	No			Uranium-238
	V	Roof			No	No			Uranium-238
	W	Roof			No	No			Uranium-238
	X	Roof			No	Some areas			Uranium-238
Plant 2									
	53	Roof			No	Some areas			Uranium-238
	56	Roof			No	Some areas			Uranium-238
	501	Roof			No	Some areas			Uranium-238

Sources: BNI 1993a, 1994a, 1995a, 1995b; SAIC 1994



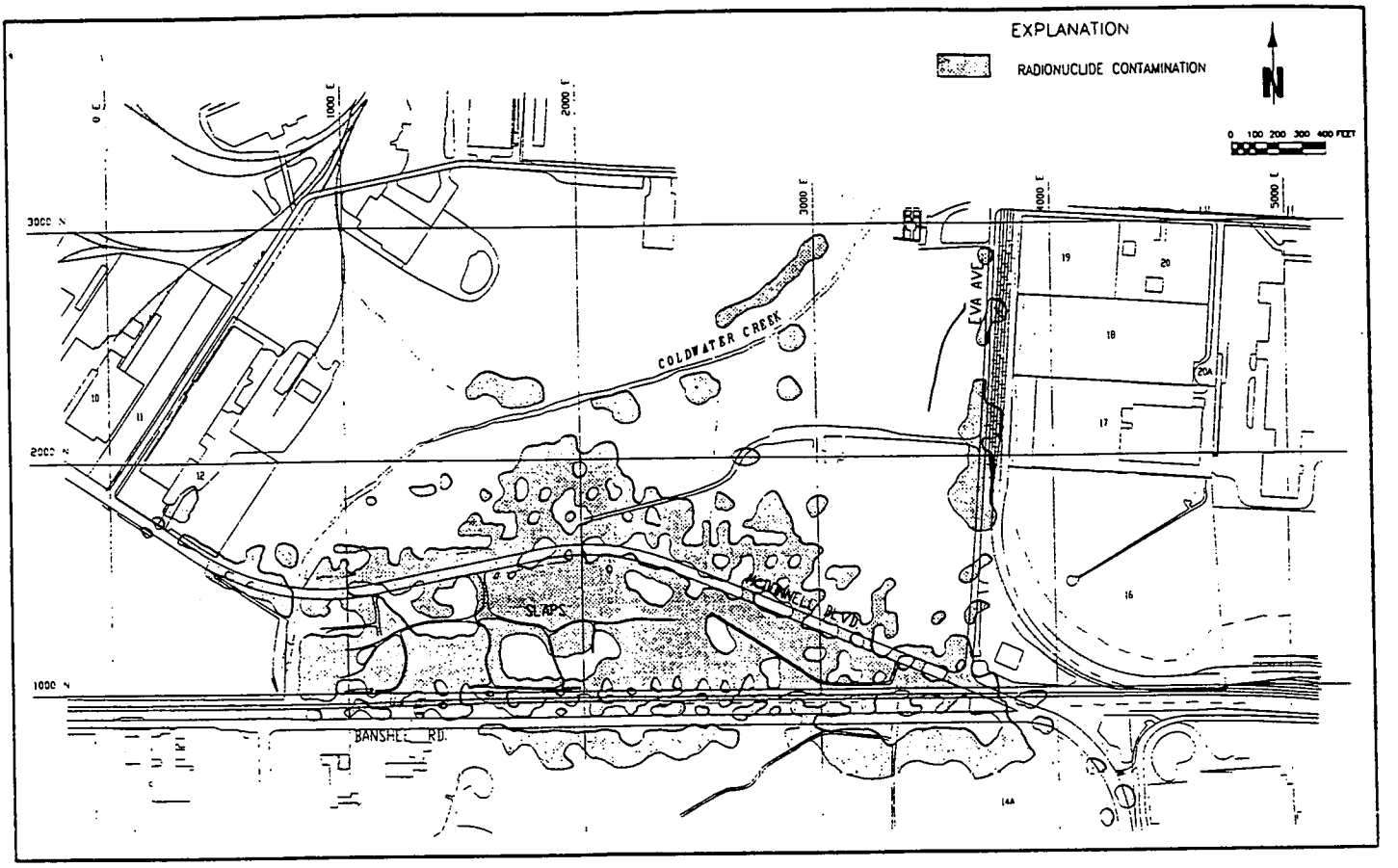
(a) Areal Extent of Radioactive Contamination



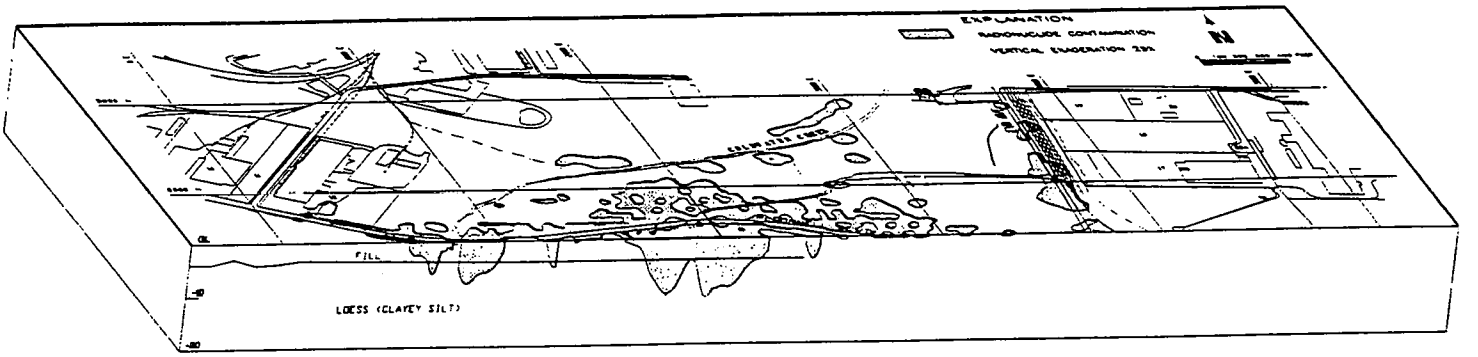
(b) Vertical Extent of Radioactive Contamination

Vertical exaggeration = 25X (vertical axis is expanded relative to horizontal axis).
Note that actual maximum depth of contamination shown is 23 ft.

Figure 3.1 Areal and Vertical Extent of Radioactive Contamination in Soil at SLDS and Adjacent Vicinity Properties



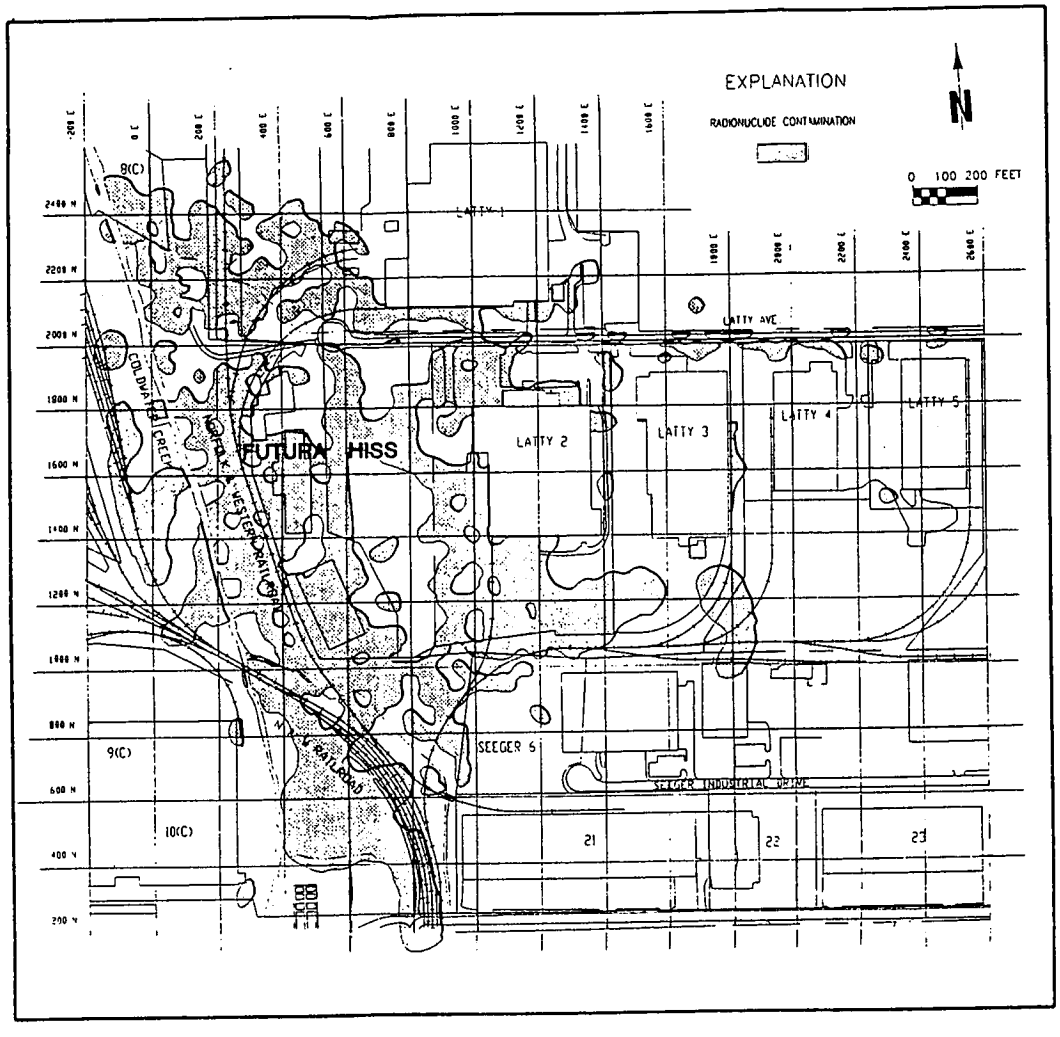
(a) Areal Extent of Radioactive Contamination



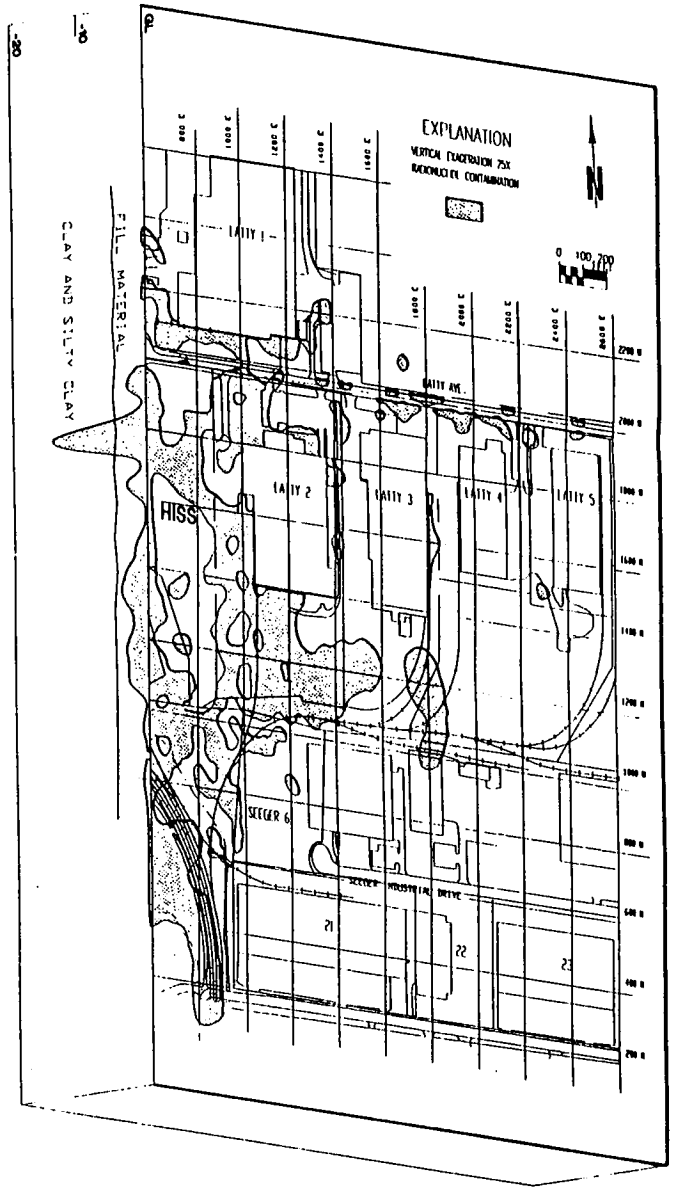
(b) Vertical Extent of Radioactive Contamination

Vertical exaggeration = 25X (vertical axis is expanded relative to horizontal axis).
Note that actual maximum depth of contamination shown is 18 ft.

Figure 3.2 Areal and Vertical Extent of Radioactive Contamination in Soil at SLAPS and Adjacent Vicinity Properties



(a) Areal Extent of Radioactive Contamination



(b) Vertical Extent of Radioactive Contamination

Vertical exaggeration = 25X (vertical axis is expanded relative to horizontal axis).
Note that actual maximum depth of contamination shown is 15 ft.

Figure 3.3 Areal and Vertical Extent of Radioactive Contamination in Soil at HISS/Futura and Adjacent Vicinity Properties

SLAPS

Field investigations for SLAPS have consisted of radiological, chemical, and geological/hydrological characterization to determine the vertical and horizontal limits of contamination, including surface and subsurface investigations, walkover surveys to detect gamma radiation, and sampling and monitoring of environmental media (surface and subsurface soil, sediment, surface water, groundwater, and air). Results of radiological characterization are summarized in Table 3.2.

Environmental surveillance data since the surveillance program began in 1984 indicate that radon levels and measured concentrations of radionuclides in surface water have remained low and relatively constant. External gamma radiation exposure rates exceeded background readings and current guidelines at only one of nine locations monitored. Groundwater has shown relatively stable levels of radium-226 and thorium-230, although uranium levels have fluctuated and have exceeded guidelines in several monitoring wells.

SLAPS Vicinity Properties

Radiological characterization at the SLAPS Vicinity Properties included performing gamma radiation walkover scans and near-surface gamma radiation measurements; direct alpha and beta-gamma measurements on structural surfaces; sampling and analysis for radioactive and chemical constituents; and collecting and analyzing geologic and hydrogeologic data to characterize subsurface transport. Characterization results are summarized in Table 3.2. Thorium-230 was identified as the primary contaminant at all SLAPS vicinity properties characterized.

In general, contamination is confined to the boundaries of properties adjacent to the haul roads and has been detected to a maximum depth of 2 ft. Soil sampling along the haul roads revealed radioactive contamination in areas under Latty Avenue, McDonnell Boulevard, and Pershall Road; along both sides of Hazelwood Avenue, Pershall Road, and Eva Avenue; and primarily on the northern side of Frost Avenue.

Surface soil and sediment samples from Coldwater Creek and vicinity properties were collected in 1986 from the sides and center of the creek at 100-ft intervals beginning at SLAPS and continuing downstream to HISS. The data from these analyses indicated spotty contamination over the entire distance. Sediment contained elevated concentrations of thorium-230, which is the primary contaminant in Coldwater Creek, and radium-226.

Areas of contamination were most numerous between SLAPS and Pershall Road, adjacent to SLAPS and HISS. A correlation has been observed between the creek's configuration and the areas of contamination: above-guideline concentrations of thorium-230 appear to be localized along the inner banks of the creek at the bends, indicating settling of contaminated sediment.

Latty Avenue Properties

Radiological and chemical characterization at the Latty Avenue Properties has included surface and subsurface investigations, walkover gamma surveys, and sampling and monitoring of environmental media (surface and subsurface soil, sediment, surface water, groundwater, and air). Results are summarized in Table 3.2.

Environmental monitoring results for HISS indicate that external gamma radiation exposure rates have decreased at most monitoring locations since the environmental surveillance program began in 1984. Overall radon concentrations have remained stable since 1984. Since 1985, concentrations of uranium, radium-226, and thorium-230 in surface water have remained stable, and concentrations of radionuclides in groundwater have in general changed little.

3.2 REGULATORY AGREEMENTS, PERMITS, AND OTHER DRIVERS

The regulatory history of the St. Louis sites, including regulatory agreements, permits, and other drivers and the current status in the CERCLA process, is summarized in Table 3.2. A summary listing of regulatory drivers for remedial action at these sites [including applicable or relevant and appropriate requirements (ARARs) under the five remedial alternatives developed and evaluated during the feasibility study (SAIC 1994)] is provided in Appendix G.

SLAPS and HISS/Futura are listed on the National Priorities List (NPL). CERCLA is the principal statutory authority for NPL sites and for inactive sites that have been designated for remedial action. Interim removal actions are documented in action memoranda based on CERCLA engineering evaluations/cost analyses (EE/CAs).

Although DOE is the lead agency for remedial action at the St. Louis sites, DOE plans and activities are subject to oversight by EPA Region VII and are being coordinated with appropriate Missouri state agencies, including the Missouri Department of Natural Resources. DOE also provides for participation of federal and state legislators, local and county officials, and the general public in the decision-making process regarding options for remedial action and waste disposal.

FUSRAP activities under CERCLA are conducted in accordance with the values of NEPA. Other regulatory drivers at the Missouri FUSRAP sites include the Clean Air Act, the Clean Water Act, and state and local environmental laws and regulations (see Appendix G).

A federal facilities agreement negotiated between DOE and EPA for the St. Louis sites was signed in 1990. The agreement covers remedial action at all four sites and establishes responsibilities and interactions of the two agencies in DOE's remedial action activities and procedural and documentation requirements under CERCLA. The record of decision documenting the final remedy for the sites as a group is scheduled to be issued in 1998.

3.3 WASTE MANAGEMENT AND DISPOSITION ACTIVITIES IMPACTING SITE REMEDIATION

Predominantly low-level residual radioactive contamination remains at FUSRAP sites. Contaminated media and materials at the St. Louis sites include soil; building materials; solidified material and other solids; liquids and other liquid-containing waste; personal protective equipment; site sampling, remediation, and maintenance equipment; and solid waste not directly associated with remedial action activities. Remediation generally involves excavation of soil and decontamination and/or removal of building material, equipment, and hazardous substances. An inventory identifying type, volume, and location of wastes at the St. Louis FUSRAP sites is included in Table 3.2.

The FUSRAP waste management strategy addresses pollution control; waste treatment, storage, disposal, and transportation; interface requirements; and implementation of new technology. FUSRAP has in place programs for waste management, waste minimization, and pollution prevention awareness (BNI 1991b, 1993d). The radioactive material at the St. Louis sites is classified as 11e(2) waste (Table 3.2).

3.4 PROJECT SUPPORT ACTIVITIES

3.4.1 Public Participation Program/Stakeholder Involvement

DOE is committed to a program of public participation and stakeholder involvement in the remedial action process for the St. Louis sites. In evaluating options for cleanup and disposal of FUSRAP waste at the St. Louis sites, DOE is actively working with the St. Louis Site Remediation Task Force, established in 1994 to work with DOE and make recommendations on short-term and long-term remedies. The Task Force, which consists of members of city and county appointed oversight commissions and representatives

of additional stakeholder groups, integrates guidance offered by the Environmental Management Advisory Board (EMAB). EMAB was established as a framework to set general boundaries within which DOE will work in remedy selection and decision making. National Stakeholder Summits provide a forum for public input to EMAB.

During the past 2 years, FUSRAP communities have been invited to participate in the National Summit process and EMAB as a means for providing input to issues involving the remedy selection and implementation process. EMAB operates as a "board of directors" to the Assistant Secretary for Environmental Management and provides advice and recommendations on a wide range of issues confronting the program. Members of EMAB include representatives of state and local governments, environmental and citizen activist groups, labor organizations, federal agencies, and the scientific and academic communities. EMAB established several committees, including the FUSRAP Committee, to address key issues affecting both DOE and the Office of Environmental Management. The EMAB FUSRAP Committee, working with the National FUSRAP Stakeholders Forum, will propose a set of general guiding principles for implementation of DOE's FUSRAP efforts. These guiding principles will help to ensure consistency and cost-effectiveness of remedies for FUSRAP sites.

The St. Louis Site Remediation Task force has its origins in the St. Louis Site Stakeholder Summit held in August 1994. This summit conference was organized in response to community opposition to DOE's draft Proposed Plan for the St. Louis sites. Thomas Grumbly, DOE Assistant Secretary for Environmental Management, suggested that summit participants organize for the purpose of studying site-related issues and developing viable alternatives for a final site remedy. In addition, he solicited recommendations from the group on how interim FY 1995-1997 cleanup dollars could best be spent in St. Louis.

Several working groups were formed to focus on specific issues under consideration, including alternative sites, local cleanup priorities, the Mallinckrodt (SLDS) cleanup proposal, and health risks/cleanup guidelines. During the fall of 1995, the Task Force presented DOE with a list of interim cleanup priorities for the St. Louis sites. A blue ribbon panel of geologists and hydrogeologists was assembled at the direction of the "Priorities" working group. The panel was tasked with investigating the impact of SLAPS contamination on Coldwater Creek. The Coldwater Creek panel presented a draft report to the task force in January 1996 and is expected to submit a final report in February.

DOE also continues to interact with the public and other stakeholders through the FUSRAP community relations program as part of the CERCLA/NEPA process. Through this program, DOE gathers information from the community, informs the public of ongoing and planned activities, and facilitates public input to the decision-making process. The community relations program provides interaction with the public through news releases and fact sheets, public meetings, discussions with local interest groups, response to public comments, and maintenance of a public repository for site-related information. DOE held a public scoping meeting in January 1992 to provide an opportunity for stakeholders to comment on the work plan for the St. Louis sites and the ongoing environmental restoration process. Stakeholder issues and community concerns identified during this meeting, in community interviews, and through the EMAB/National Stakeholder Summit process are summarized in Table 3.4.

3.4.2 Technology Initiatives

Various treatment technologies are used to reduce the toxicity, mobility, or volume of generated or existing wastes at FUSRAP sites. For example, a soil-washing machine being tested at FUSRAP sites in New Jersey reduces waste volume by separating clean soils from soils contaminated above guidelines. New waste treatment technologies and other technology initiatives currently being tested and/or used at the St. Louis FUSRAP sites include the following (see Table 3.1):

- Use of a mobile rock-crushing machine that reduces building rubble and debris to soil-like material (which has a much lower unit cost for disposal), saving >$500,000 in Missouri and Ohio

- Use of field gamma spectroscopy to reduce analytical costs, saving $150,000 in Missouri and Ohio
- Use of mobile wet chemistry lab in St. Louis
- Development of GIS modeling for data interpretation and visual communication
- Bench-scale demonstration of treatment for St. Louis soils
- Development and testing of Long Range Alpha Detection (LRAD) system for use in St. Louis cleanup activities

Table 3.4 Stakeholder Issues and Community Concerns

Stakeholder Issues identified at Public Scoping Meeting (January 1992)
General Issues
• Schedule, pace, and cost of cleanup • Safety and health concerns (exposure risk) • Interim cleanup measures • Storage and disposal site selection • Public participation in the cleanup process • Economic impacts • Land use considerations • Transportation issues • Extent of contamination • Data quality and sufficiency
Specific Community Concerns
• Possible contamination of Coldwater Creek from the SLAPS materials as they now exist or from a disposal cell that might be constructed on the property • Reduction of property values in Berkeley and Hazelwood if a disposal site is developed in the area • Loss of use of the recreational fields adjacent to SLAPS • Accidents during transport of contaminated soil • Possible use of a local disposal cell for materials outside the area • Adverse effects on future economic development of Hazelwood and Berkeley if they are perceived as a "dump site" for radioactive materials • Possible interference with airport operations or future airport expansion • Ability of a disposal cell to withstand earthquakes, floods, and aircraft collisions • Lack of confidence that DOE will involve the public in the decision-making process • Safety of interim storage and future permanent storage technologies (i.e., what is safe under current conditions may not be safe under future conditions) • Potential liability of the City of St. Louis resulting from inclusion of SLAPS and the Latty Avenue Properties on EPA's National Priorities List • Impact of complexity of the environmental review process on length of time required for cleanup • Health and safety risks to the public and site workers • Need for an impartial citizens' review during the entire process • Preference for storing radioactive waste outside St. Louis in a less heavily populated nonurban area • Potential for increasing contaminant transport pathways by installing groundwater wells • Potential spread of contamination during cleanup and/or movement of radioactive waste
General Issues Identified at First Annual FUSRAP National Stakeholder Summit (May 1995)
• Funding • Cleanup criteria • Risk management • Remedy selection • Community acceptance
Site-specific Issues Identified by St. Louis Site Remediation Task Force (September 1995)
• Local cleanup priorities • Alternative disposal sites • Mallinckrodt (SLDS) cleanup proposal • Health risks/cleanup guidelines
Key Issues Identified by Task Force's Coldwater Creek Panel (1995-96)
• Potential effects of contaminated groundwater at SLAPS and vicinity properties on Coldwater Creek • Potential effects of surface water runoff from SLAPS and vicinity properties on the creek • Potential effects of contamination at SLAPS on the deep groundwater aquifers
Coldwater Creek Panel Recommendations in Draft Report to Task Force (January 1996)
• Designing and implementing a drainage control system to control surface water runoff at SLAPS • Developing a program for long-range data collection, modeling, and risk assessment

4. RELATIVE RANKING

A number of separate evaluations have been performed for the St. Louis sites:

- DOE EM-40 Relative Ranking Evaluation
- DOE Risk Data Sheet (RDS) Evaluation
- Risk assessment driven by regulatory requirements of CERCLA, including the baseline risk assessment and the feasibility study alternatives assessment

4.1 DOE EM-40 RELATIVE RANKING

The EM-40 relative ranking process ranks each release site in one of three categories (high, medium, or low) describing conditions to which the public and site workers are exposed. The ranking assesses four different media as potential sources of risk: groundwater, surface water/sediments, soil, and facility conditions. The ranking considers:

- Source Hazard Factor (SHF): the significance and concentration of the source
- Pathway Factor (PF): the existence or potential for a contaminant migration/exposure pathway
- Receptor Factor (RF): the potential for receptors to have access to the contaminated media

The EM-40 relative ranking for the four St. Louis release sites is summarized in Table 4.1. The basis for each ranking category is provided in Table 4.2, which describes the SHF, PF, and RF for the affected environmental media at each release site.

4.2 RISK DATA SHEET EVALUATION

The RDS evaluation process provides information to the Environmental Management (EM) program that assists in budget development decisions. The process provides data that allow the assessment of possible effects of various budget levels on the ability of a given site or program to manage risk in comparison with other EM programs.

Each site is evaluated in seven categories:

- Public Safety and Health (PS&H)
- Site Personnel Safety and Health (SPS&H)
- Environmental Impact (EI)
- Compliance with laws, regulations, and agreements (C)
- Mission Impact to stated DOE goals and mission (MI)
- Mortgage Reduction (i.e., reducing long-term DOE financial liabilities) (MR)
- Social/Cultural/Economic Impacts in the affected community/state (S/C/E)

Within each category, the site is evaluated in terms of

- "Before" risk (the risk associated with the site/activity before the fiscal year's budget expenditures for the budgeted activity)
- "During" risk (the risk associated with undertaking the budgeted activity)
- "After" risk (the residual risk remaining after completing the budgeted activity)

The RDS ratings in each category are defined as either high, medium, or low. The RDS ratings for the four St. Louis sites are provided in Table 4.3.

Table 4.1 EM-40 Relative Ranking for the St. Louis Sites

Site	EM-40 Relative Ranking				
	Groundwater	**Surface Water/ Sediment**	**Soil**	**Facility**	**Overall Ranking**
SLDS	Medium	High	High	High	HIGH
SLAPS	Medium	High	High	High	HIGH
SLAPS Vicinity Properties	Low	High	High	Not Applicable	HIGH
Latty Avenue Properties	Low	High	High	High	HIGH

Table 4.2 Basis for EM-40 Relative Ranking Categories

Site	Media	Factor	Description
SLDS	Groundwater	SHF	Radionuclides have been detected at low concentrations in groundwater
		PF	Contaminant migration from the source is possible at a very slow rate
		RF	There is limited potential for public or site worker access to groundwater
	Surface Water/Sediment	SHF	Radium, thorium, and uranium are present in sediment onsite
		PF	Radionuclides have been detected at low concentrations in sediment in active storm sewers, drains, and basins
		RF	Potential exists for access of members of the public and onsite workers to contaminated sediments if controls are not maintained
	Soil	SHF	Radium, thorium, and uranium are present in surface and subsurface soil
		PF	Contaminated soil is accessible to personnel performing facility improvement/maintenance; however, controls are used to minimize exposure
		RF	Potential exists for contact of site workers and members of the public with contaminated soils
	Facility	SHF	Gamma exposure rates and radon levels are above guidelines at some locations within buildings
		PF	Site workers could be present in areas of exposure
		RF	Site worker exposure has been identified but is minimized by site controls
SLAPS	Groundwater	SHF	Radionuclides have been detected at low concentrations in groundwater
		PF	Contaminant migration is possible at a very slow rate based on hydrogeologic monitoring
		RF	There is limited potential for public or site worker access to groundwater
	Surface Water/Sediment	SHF	Radium and thorium are present in sediment onsite
		PF	Potential exists for migration of radionuclides in surface water and erosional sediments
		RF	Access of onsite workers and members of the public to surface water and sediment containing radionuclides is possible if site controls are not maintained

Table 4.2 (continued)

Site	Media	Factor	Description
SLAPS (continued)	Soil	SHF	Radium, thorium, and uranium are present in surface and subsurface soil
		PF	Contaminated soil is accessible to personnel performing facility maintenance; however, site controls are used to minimize exposure
		RF	Potential exists for contact of site workers and members of the public with contaminated soils if site controls are not maintained
	Facility	SHF	Potential exists for gamma exposure at the facility fenceline
		PF	Potential exists for presence of site workers and members of the public in areas of exposure
		RF	Exposure of site workers and members of the public has been identified but is minimized by access controls
SLAPS Vicinity Properties	Groundwater	SHF	Concentrations of contaminants are low and represent a low source hazard
		PF	Contaminant migration at a very slow rate is possible based on hydrogeologic modeling
		RF	There is limited potential for public or site worker access to groundwater
	Surface Water/Sediment	SHF	Radium and thorium are present in sediment onsite
		PF	Radionuclides have been detected in sediment in drainage ditches
		RF	Potential exists for access of members of the public and site workers to sediment containing radionuclides
	Soil	SHF	Radionuclides (primarily thorium-230) are present in soil
		PF	Soil containing radionuclides is potentially accessible in areas undergoing facility improvement/maintenance
		RF	Potential exists for contact of site workers and members of the public with soil containing radionuclides
	Facility	SHF	Not applicable
		PF	Not applicable
		RF	Not applicable

Table 4-1 (Continued)

Site	Media	Factor	Description
Latty Avenue Properties	Groundwater	SHF	Concentrations of contaminants are low and represent a low source hazard
		PF	Potential exists for contaminant migration at a very slow rate
		RF	There is limited potential for site worker or public access to groundwater
	Surface Water/Sediment	SHF	Radium, thorium, and uranium are present in sediment onsite
		PF	Potential exists for migration of radionuclides in surface water and erosional sediments
		RF	Potential exists for access of site workers and members of the public to surface water and sediment containing radionuclides
	Soil	SHF	Radium, thorium, and uranium are present in surface and subsurface soil
		PF	Contaminated soil is accessible to personnel performing facility improvement/maintenance
		RF	Potential exists for contact of site workers and members of the public with contaminated soils
	Facility	SHF	Potential exists for gamma exposure at the facility fenceline if access controls are not maintained
		PF	Potential exists for presence of site workers and members of the public in areas of exposure
		RF	Exposure of site workers and members of the public has been identified but is minimized by access controls

SHF = Source Hazard Factor; PF = Pathway Factor; RF = Receptor Factor

Table 4.3 Risk Data Sheet (RDS) Ratings for the St. Louis Sites

Site	Category	Risk		
		Before Budgeted Activity	During Budgeted Activity	After Budgeted Activity
SLDS	Public Safety and Health (PS&H)	High	Medium	Low
	Site Personnel Safety and Health (SPS&H)	High	Medium	Low
	Environmental Impact (EI)	High	Medium	Low
	Compliance (C)	High	*	Low
	Mission Impact (MI)	High	*	Low
	Mortgage Reduction (MR)	High	*	Low
	Social/Cultural/Economic Impacts (S/C/E)	High	High	Low
SLAPS	PS&H	High	Medium	Low
	SPS&H	High	Medium	Low
	EI	High	Medium	Low
	C	High	*	Low
	MI	High	*	Low
	MR	High	*	Low
	S/C/E	High	High	Low

Table 4.5 (continued)

Site	Category	Risk		
		Before Budgeted Activity	During Budgeted Activity	After Budgeted Activity
SLAPS Vicinity Properties	PS&H	High	Medium	Low
	SPS&H	Medium	Medium	Low
	EI	High	Medium	Low
	C	High	*	Low
	MI	High	*	Low
	MR	High	*	Low
	S/C/E	High	High	Low
Latty Avenue Properties	PS&H	High	Medium	Low
	SPS&H	Medium	Medium	Low
	EI	High	Medium	Low
	C	High	*	Low
	MI	High	*	Low
	MR	High	*	Low
	S/C/E	High	High	Low

* Compliance, Mission Impact, and Mortgage Reduction are not evaluated for risk "During" the budgeted activity.

The RDS ratings indicate that the sites currently rank high, based on the management criteria used to assign funding priority. In all cases, the residual risk after completing the funded activities is low, indicating a significant net benefit associated with funding the activity. Detailed explanations of the basis for each rating are included in the EM Risk Data Sheet database. A general summary of the rating rationale is provided in Table 4.4.

4.3 CERCLA-BASED RISK ASSESSMENT

Available characterization and monitoring data were used to perform an assessment of potential impacts to human health and the environment from exposure to contaminants at the St. Louis sites in accordance with CERCLA requirements. The baseline risk assessment evaluated potential risks to human health and the environment from all contaminants at the St. Louis sites (ANL 1993). The risk assessment used all currently available radiological and chemical characterization data, estimates of exposure pathways, and both current and hypothetical future risk scenarios for the St. Louis properties.

Reasonable maximum exposure in both current and hypothetical future use scenarios as well as carcinogenic risks and non-carcinogenic health effects were estimated and compared with EPA's target carcinogenic risk and hazard index, respectively. EPA's acceptable exposure levels for carcinogenic risk are generally those that represent an excess upper bound lifetime individual cancer risk of 10^{-6} to 10^{-4} using information on the relationship between dose and response.

4.3.1 Receptors, Routes of Exposure, and Risk Estimates for Current Site Use Scenario

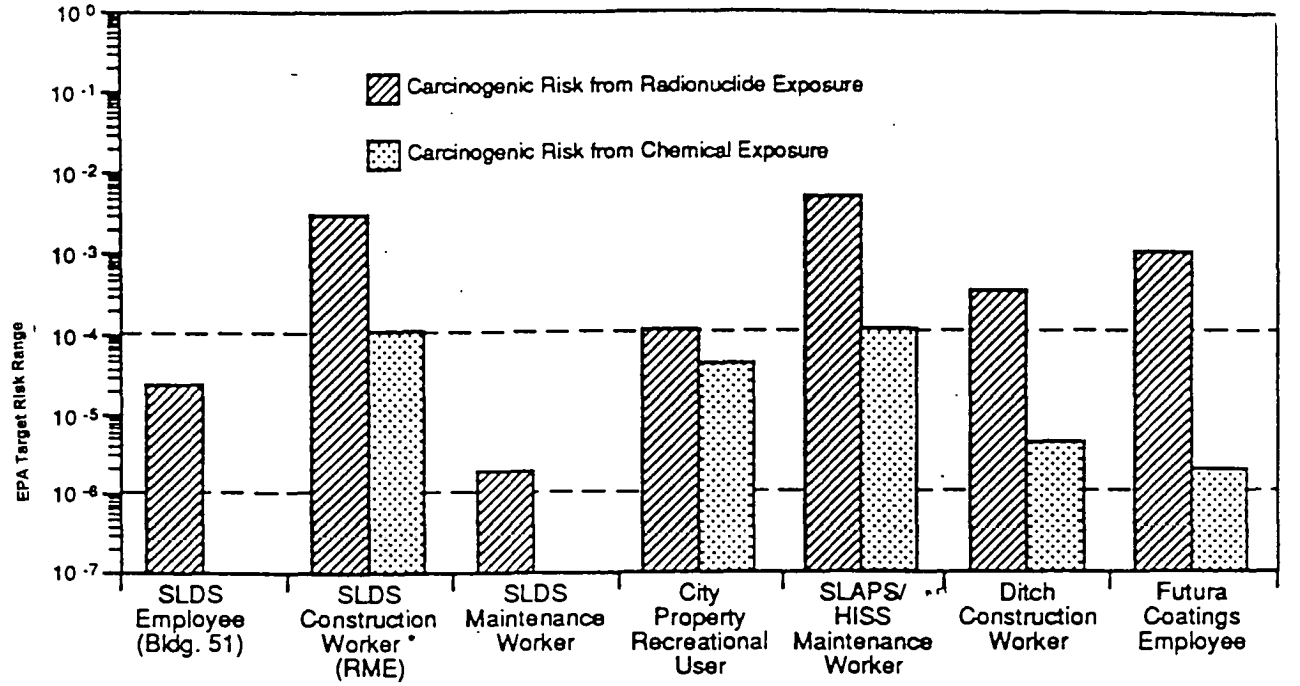
The receptors identified for current site use include an employee, a construction worker, and a maintenance worker at SLDS and the SLDS vicinity properties; a recreational user at the city property adjacent to SLDS; a trespasser and a maintenance worker at SLAPS; a construction worker at the ditches adjacent to SLAPS; a recreational user at the ball field; a child commuter and a resident at the residential vicinity properties; a recreational user at Coldwater Creek; an employee at the Futura Coatings property and all commercial/municipal/transportational vicinity properties; and a trespasser and a maintenance worker at HISS.

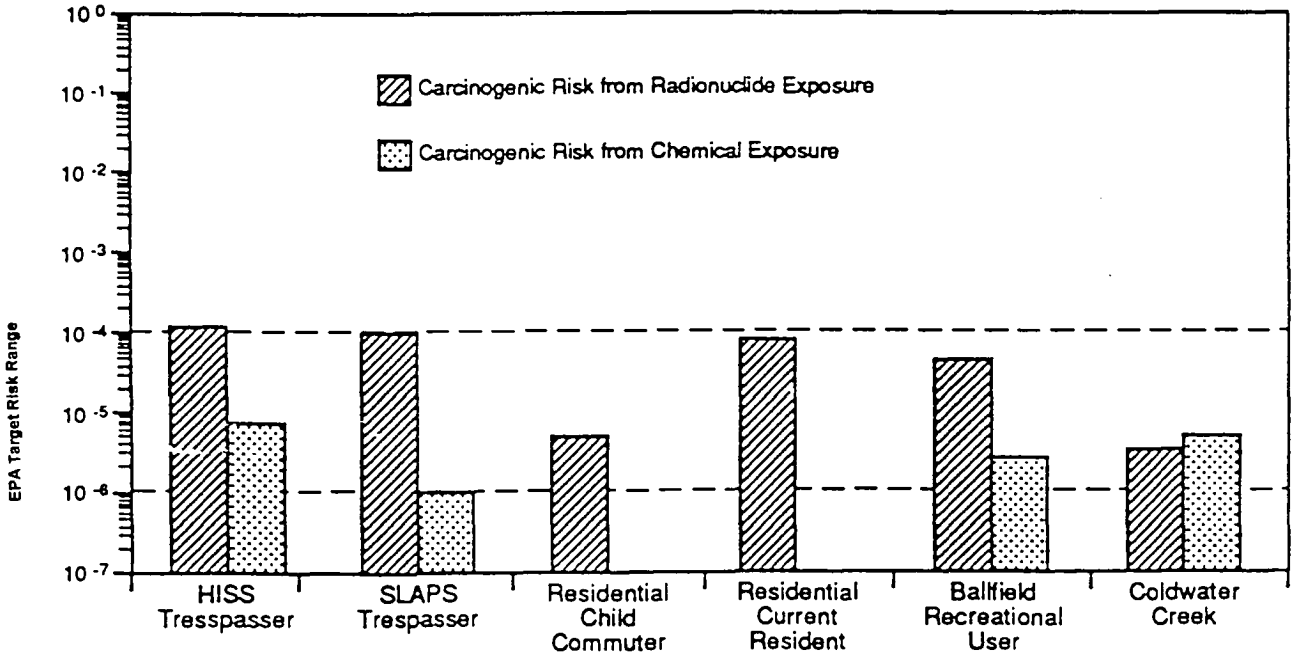
Exposure pathways assessed for current scenarios were external gamma irradiation, incidental soil ingestion, inhalation of particulates, and inhalation of radon-222 and its decay products. For current plant employees at SLDS, only potential external gamma and radon inhalation exposures were assessed because SLDS is almost completely covered with buildings and pavement. Ingestion and inhalation of particulates were assessed for the SLDS construction worker because of potential exposure during excavation or renovation activities. No current scenarios included contaminated groundwater as a source because the aquifer is considered to be of naturally low quality and is not known to be used for any domestic purpose in the vicinity of the St. Louis sites (ANL 1993).

The radiological risk estimates for the SLDS construction worker, the SLAPS/HISS maintenance worker, the ditch construction worker, the HISS trespasser, and the Futura Coatings employee exceeded the EPA target risk range of 10^{-6} to 10^{-4} (Figure 4.1). Where evaluated, the carcinogenic risk from radon and its decay products was a major portion of the overall risk from radionuclides. The radiological risks (including the radon pathway) estimated for current site use by other potential receptors were within the EPA risk criteria, and total chemical carcinogenic risk for the combined pathways was in the EPA target range for all current receptors. Potential noncarcinogenic risks evaluated under all current risk scenarios were determined to be acceptable (HI < 1.0) except for the SLAPS/HISS maintenance worker (HI = 3.2) (ANL 1993).

Table 4.4 Summary of RDS Rating Rationale for St. Louis Sites

Evaluation Category	Period Relative to Budgeted Activity	RDS Rating Rationale
Public Safety and Health (PS&H)	Before	All sites have the potential for public exposures >15-100 mR/year if funding for cleanup/maintenance/monitoring is eliminated.
	During	There is a small possibility of below-guideline public exposure during cleanup activities.
	After	There is very little risk of public exposure or injury following cleanup from either residual contamination or a potential onsite disposal cell.
Site Personnel Safety and Health (SPS&H)	Before	Non-DOE onsite workers could receive radiation exposures in excess of 1,000 mR/year at SLDS and SLAPS and in excess of 15-100 mR/year at Latty Avenue Properties and SLAPS Vicinity Properties, particularly if site cleanup/maintenance/monitoring were discontinued.
	During	There is a likelihood of moderate site worker injury (greater than a first aid case but less than 3 months disability) during the course of remedial action work.
	After	Following remedial action, the onsite risk of injury or radiation exposure at all sites is low.
Environmental Impact (EI)	Before	There is a significant possibility of redistribution of contaminated soils/debris in publicly accessible areas if site cleanup/maintenance/ monitoring activities are discontinued.
	During	There is a small possibility of localized *onsite* releases resulting from stormwater redistribution of contamination, small fuel spills, etc.
	After	Following remedial action, the possibility of environmental releases from residual contamination have either been eliminated or are very small (e.g., radon release from a capped disposal cell within EPA regulated limits).
Compliance (C)	Before	Work on the St. Louis sites is being performed in accordance with a federal facilities agreement (FFA); lack of program funding for this work would result in noncompliance with the FFA.
	After	Completing budgeted work in accordance with approved FFA schedules would permit compliance with the terms of the FFA.
Mission Impact (MI)	Before	Not undertaking the funded work would directly affect fundamental DOE missions such as protection of environmental safety and health (ES&H) and environmental restoration (ER).
	After	Undertaking the planned budgeted work would allow DOE to meet its ER and ES&H missions.
Mortgage Reduction (MR)	Before	Not undertaking the planned work would result in an increase in the total cleanup cost for the St. Louis sites as a result of continued program support requirements and escalation during the time that cleanup work is unfunded.
	After	Expenditure of the planned budget would avoid the increase in the site's total estimated cost resulting from added program support costs for the year(s) that the project is unfunded.
Social/Cultural/ Economic Impact (S/C/E)	Before	Not undertaking the work as budgeted and planned would be expected to result in organized public outcry and unfavorable media attention.
	During	During the execution of the cleanup work, periodic public outcry from a limited number of stakeholders is possible.
	After	Following cleanup, it is expected that any further social, cultural, or economic impacts would be very low.





Source: ANL 1993

FUS/Missouri FS 082293

Figure 4.1 Total Carcinogenic Risks for Current Receptors

4.3.2 Receptors, Routes of Exposure, and Risk Estimates for Future Use Scenario

In addition to the pathways assessed for current receptors, potential risk from ingestion and inhalation of contaminants in groundwater (although unlikely) was also assessed for future residents. A future residential scenario at SLDS is considered unlikely because the site has been used for industrial purposes for more than 100 years. Carcinogenic risk from chemical exposure was not quantified for the SLDS employee and SLDS maintenance worker because chemical exposure is not a pathway of concern for these receptors.

Future risk scenarios were evaluated for onsite residents at all sites except Coldwater Creek, where a recreational user was assumed. The estimated carcinogenic risk levels for all sites exceeded the EPA target range of 10^{-6} to 10^{-4}. The future resident at the HISS property is estimated to incur the highest risk from exposure to radionuclides, primarily due to radionuclide levels in the two storage piles. Inhalation of radon and its decay products is the highest contributor of all radiological pathways assessed for the future resident at all properties, representing approximately half of the total risk from radionuclide exposure. External gamma irradiation is the highest contributor of the nonradon sources.

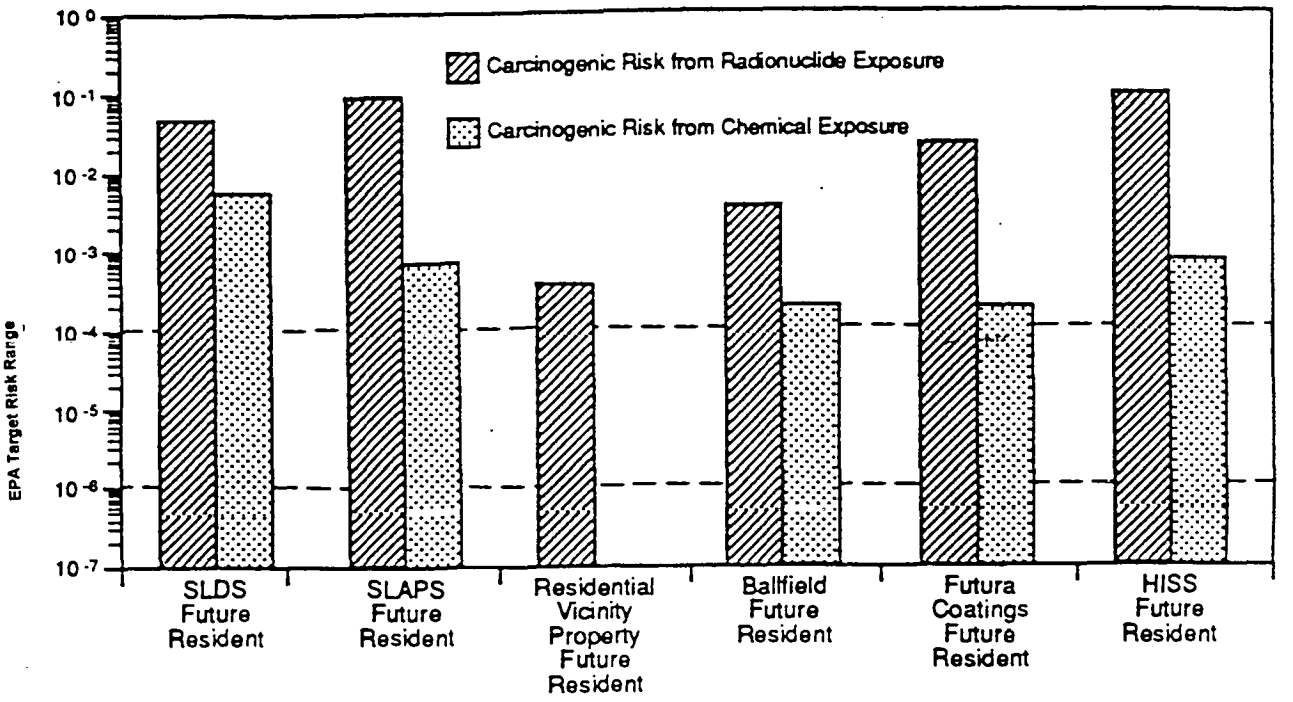
The future resident at the SLDS property would incur the highest chemical carcinogenic risk, primarily from ingestion of polyaromatic hydrocarbons (PAHs) present in soil and arsenic present in groundwater. The chemical carcinogenic risk for future residents at SLAPS would result primarily from ingestion of groundwater containing arsenic and beryllium, and risks for future residents at the ball field and the Futura Coatings property would result primarily from incidental ingestion of soil containing arsenic. At HISS, the chemical carcinogenic risk is equally attributable to ingestion of arsenic in soil and ingestion of carcinogens including arsenic and beryllium in groundwater (Figure 4.2) (ANL 1993).

The calculated HI for future residents at all sites exceeded the target value of 1.0. The future resident at SLAPS is estimated to incur the highest noncarcinogenic chemical risk (HI = 330). Future residents at SLDS (HI = 85), the ball fields (HI = 5.9), Futura Coatings (HI = 2.7), and HISS (HI = 130) are also estimated to incur noncarcinogenic chemical risks. The HI > 1.0 at SLDS is related primarily to ingestion of groundwater containing thallium and arsenic; at SLAPS, the highest contributor is ingestion of groundwater containing thallium and selenium.

The results of the human health risk assessment for the St. Louis sites indicated that the highest potential health impacts result from hypothetical future exposures at HISS (ANL 1993). Estimated risks from exposure to radioactive contaminants were higher for site workers than for other hypothetical receptors. Under current site conditions and uses, the highest risks were associated with the SLAPS/HISS maintenance worker, the SLDS construction worker, the ditch construction worker, and the Futura Coatings employee; the estimated risks to these workers from exposure to radionuclides onsite exceed the upper end of the EPA target carcinogenic risk range. The estimated chemical risk to the SLAPS/HISS maintenance worker also slightly exceeded the target risk range, although the actual risk would be significantly reduced by standard work protection measures mandated by health and safety requirements and other precautionary measures observed by site maintenance workers. The potential exposure of nearby offsite receptors should be minimal because the site is fenced and monitored by DOE.

4.3.3 Results of Supplemental Human Health Risk Assessment

A supplemental risk assessment was conducted to evaluate the risk associated with specific portions of Coldwater Creek in the airport area (SAIC 1993a). Potential receptors for this pathway included recreational users of the creek and community members periodically involved in cleanup of the creek. Neither ingestion of fish nor swimming were considered activities for the recreational user since very few fish populate the creek and swimming is unlikely because of its low water levels and poor water quality. The estimated exposure for recreational use and community cleanup were estimated and exposure points were evaluated for each of the four stream segments on Coldwater Creek. A "hot spot" analysis was conducted on the assumption that the maximum exposure would occur in the area where sediment



Source: ANL 1993

Figure 4.2 Total Carcinogenic Risks for Future Receptors

contaminants are most concentrated. The estimated cancer risk for combined recreational and cleanup exposure to sediments in this area was significantly lower than the annual background risk due to exposure and doses from terrestrial sources and cosmic radiation.

The human health risks associated with incidental sediment ingestion and inhalation of particulates were evaluated for remediation workers during dredging activities at Coldwater Creek. The total estimated dose received by workers was significantly less than the occupational exposure limit for radiation workers and was within the target range specified by EPA as acceptable risk for the general public. The human health risks associated with beneficial reuse of soils as fill material beneath an airport runway were also evaluated (SAIC 1993b). The runway design consisted of the FUSRAP soil pile beneath a soil and concrete cover. The runway was conservatively treated as an infinite plane source with an air gap above two to three shielding layers. Dose rates were calculated for SLAPS and HISS area soils beneath the runway. For SLAPS and HISS/Futura soils (the two source term scenarios run), dose rates were substantially lower than background both above the runway and at the apron. For both SLAPS and HISS/Futura soils, incremental lifetime cancer risks calculated for four distinct subpopulations of receptors (airliner passenger and crew, landscape worker, emergency response personnel, and a hypothetical maximally exposed individual) were significantly less than the risk associated with background levels (SAIC 1993b).

4.3.4 Conceptual Site Model

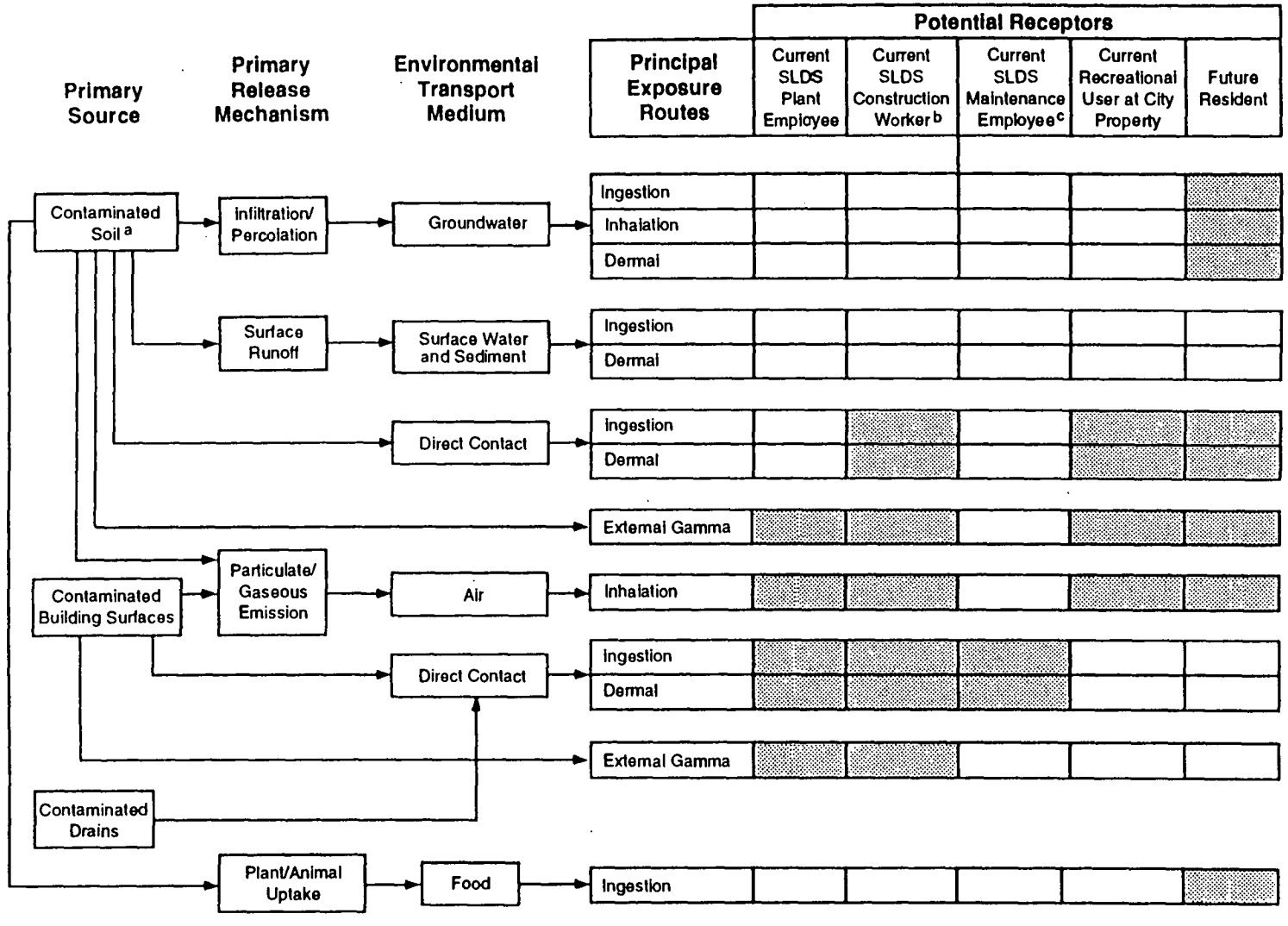
The conceptual models outlined in Figures 4.3 (downtown area properties) and 4.4 (airport area properties) incorporate information on primary sources of radioactive contamination, potential contaminant release mechanisms and transport pathways, and potential human exposure pathways identified in the baseline risk assessment (ANL 1993).

4.4 ECOLOGICAL RISK ASSESSMENT

Because the majority of property constituting the St. Louis sites is located in industrial areas, species found onsite are probably affected by both site-related contamination and contaminants from other sources. Although there are no known threatened or endangered species or critical habitats at these sites, some wildlife habitats do exist. Aquatic habitats potentially affected include Coldwater Creek and its drainages. Coldwater Creek is polluted by runoff both upstream and downstream of SLAPS and HISS.

Based on current land use, impacts to the environment from site contaminants are expected to be similar to those typically encountered at industrial sites. Several metals detected in site soils were found at concentrations reported to adversely affect wildlife under laboratory and field experimental conditions. Although the mobility of species that inhabit the St. Louis sites, in conjunction with the presence of similar nonradioactive contaminants throughout the urban/industrial area, renders a quantitative assessment of environmental impacts of site contaminants to wildlife impracticable, a qualitative assessment of environmental impacts is included in the draft baseline risk assessment prepared for these sites (ANL 1993). Potential adverse impacts to wildlife would be expected to occur only at the level of the individual; impacts of ecological significance (those that occur at the population or community level) are not anticipated.

Due to urban environment, the downtown and airport areas have limited habitat and biotic diversity. The ecological risk assessment compared contaminant concentrations detected in soil, sediment, and water at the St. Louis sites with literature on toxicity of contaminants to biota (ANL 1993). Based on this study, only arsenic, thallium, and PAHs are present at concentrations that could adversely impact biota. Ecological effects are not expected to be a significant concern, particularly since the habitats and biota at these sites are not unique, the biota are not essential for continued propagation of key species, and they are not highly valued economically, recreationally, or aesthetically (ANL 1993).

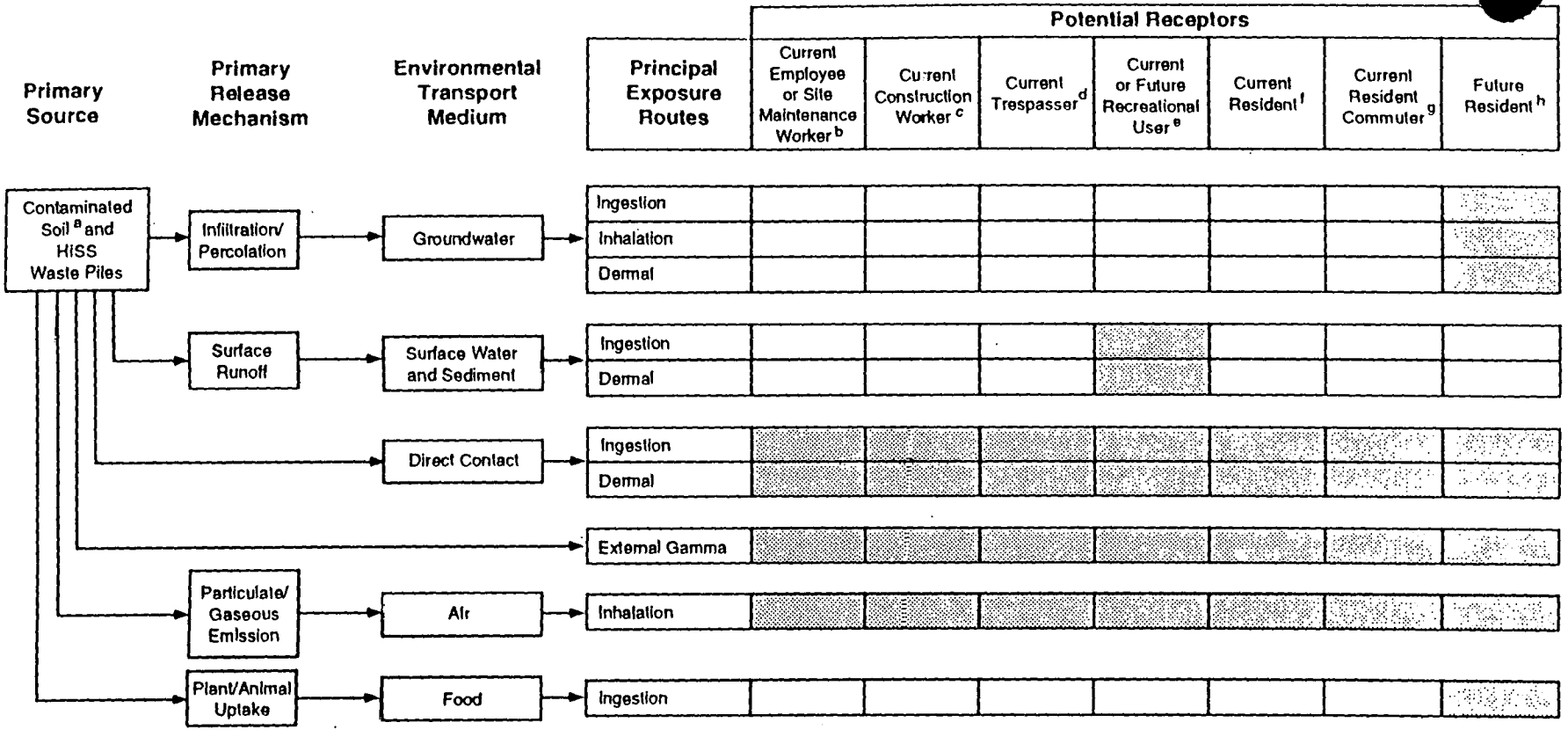


[a] Contaminated soil at the SLDS is currently covered by buildings, concrete, or asphalt, which prevents exposure via direct contact or surface runoff.
[b] Exposure of the SLDS construction worker assumes that concrete and asphalt has been removed.
[c] Represents worker conducting infrequent drain maintenance; only exposure to drain sediment is considered.

Potentially complete exposure pathway

Source: ANL 1993

Figure 4.3 Conceptual Site Model for SLDS and Vicinity Properties (Downtown Area)



[a] Includes soil along the banks of Coldwater Creek.
[b] Employee at Futura or commercial/industrial/municipal vicinity property; maintenance worker at SLAPS or HISS.
[c] Construction worker doing excavation activities at the ditches or other vicinity properties.
[d] Trespasser at SLAPS or HISS.
[e] Current recreational user of ballfield area and current or future recreational user of Coldwater Creek.
[f] Receptor in dwelling at residential vicinity property.
[g] Receptor near area of contamination at residential vicinity property.
[h] A resident at all properties except Coldwater Creek.

Potentially complete exposure pathway

Source: ANL 1993

Figure 4.4 Conceptual Site Model for SLAPS/HISS and Vicinity Properties (Airport Area)

5. ENVIRONMENTAL RESTORATION STRATEGY

Key components of the FUSRAP program-wide ER strategy include

- Relative risk prioritization (assigning higher priority to remediating high-relative-risk sites, based on the relative risk from exposure to site contaminants)
- Expediting the remediation of non-DOE-owned sites and vicinity properties (relative to DOE-owned sites where public access is precluded or minimized by institutional controls)
- Interim removal actions at NPL sites and other large sites to progressively reduce risk while remedy selection is still in progress
- Reduction of long-term program management costs by using expedited protocols to compress the remediation schedule and complete sites ahead of schedule whenever possible
- Identifying and applying new technologies for waste volume reduction
- Promoting stakeholder involvement in remedy selection and decision-making through the EMAB/National Stakeholder Summit process

Emphasis on these strategic elements, which are based on strategic goals and program priorities outlined in the ER Strategic Plan (DOE 1995a), allows DOE to channel available resources in a manner that most efficiently and cost-effectively accomplishes the overall objective of protection of human health and the environment.

5.1 KEY ASSUMPTIONS

The site remediation strategy for the St. Louis sites is based on technical, cost/schedule, and other assumptions identified in Table 5.1.

5.2 REMEDY SELECTION STRATEGY

The risk-based FUSRAP remedial action strategy focuses on risk reduction and assigns higher priority to remediating high-relative-risk sites than to cleanup of low-relative-risk sites. Risk prioritization depends on adequate characterization to identify sources, nature, and extent of contamination and provide other information needed for accurate determination of relative risk, scope, cost, and schedule of remedial action at each site.

DOE is conducting an RI/FS-EIS for the St. Louis sites as part of the CERCLA/NEPA process. Based on information from the remedial investigation and baseline risk assessment, remedial action alternatives were developed and evaluated during the feasibility study, and a draft proposed plan presenting a preferred remedy was issued for regulatory agency and public review (DOE 1994a). The remedy presented in the draft proposed plan encountered opposition from the community, and DOE is currently working with the St. Louis Site Remediation Task Force to achieve consensus on a final remedy that is protective, cost-effective, and acceptable to the community. The ongoing remedy selection process is outlined in Figure 5.1. A summary of remedial alternatives evaluated in the draft FS-EIS report (SAIC 1994) is provided for reference in Appendix F, although the evaluation of cleanup and disposal options for the St. Louis sites is still in progress and various options are under consideration, taking into account stakeholder input. After resolution of issues and final review by regulatory agencies and the public, a record of decision documenting the selected remedy for these sites will be issued. Signing of the record of decision is expected in 1998.

Table 5.1 Key Assumptions for Site Remediation Strategy

Category/Activity	Assumptions
General	• Highest levels of contamination are at SLDS, SLAPS, and HISS • Principal radioactive contaminants are radium-226, thorium-230, uranium-238 • Access to SLAPS and HISS is restricted • Vicinity properties have lower soil concentrations of radionuclides (primarily Th-230) • St. Louis site soils not classified as RCRA hazardous waste
DOE Remediation Authority	• Federal Facilities Agreement covers all wastes (radioactive and chemical) resulting from or associated with MED/AEC operations at SLDS. • At non-DOE-owned sites such as the St. Louis sites and vicinity properties, DOE remediation authority does not include non-DOE-related contamination unless it is commingled with DOE-related residual radioactive contamination or might impact cleanup activities.
Waste Volumes/Contaminated Media (BNI 1995a)	• SLDS and vicinity properties: 246,000 yd^3 (soil/building debris) • SLAPS: 250,000 yd^3 (soil) • SLAPS Vicinity Properties: 195,000 yd^3 (soil) • Latty Avenue Properties: 211,000 yd^3 (soil)
Relative Ranking (EM-40)	High
Future Site Use Scenario Used for 1996 BEMR Cost Estimate (BNI 1995a)	Future site use depends on record of decision that will document the remedy selected for implementation. The record of decision will involve input from EPA, state and local agencies, and stakeholders. Future use assumptions used for the 1996 BEMR cost estimate, based on the hypothesis that the final remedy would include onsite disposal, were as follows: • Onsite disposal of wastes from all St. Louis FUSRAP sites at SLAPS, which would be reacquired from the City of St. Louis by DOE and would remain a DOE property under institutional control • Future land use at the SLAPS vicinity properties after remediation would remain commercial/industrial and transportation-related • Future land use at the Latty Avenue Properties and SLDS would continue to be commercial/industrial. Operations at the Mallinckrodt chemical facility (SLDS) and Futura Coatings would be expected to continue. Based on surrounding land use, future use of the HISS property after remediation is assumed to be commercial/industrial.
Schedule (BNI 1995a)	
Complete Characterization/Record of Decision for the St. Louis sites	• 1998
Complete Remedial Action	• 2006 Latty Avenue Properties • 2012 SLAPS Vicinity Properties • 2016 SLAPS and SLDS
Remedial Action Scenario for 1996 BEMR Cost Estimate (BNI 1995a)	The hypothetical scenario used for the 1996 BEMR cost estimate for the St. Louis sites was based on the following assumptions: • Excavation of accessible contaminated soils and sediments from SLDS, vicinity properties in the downtown and airport areas, the Latty Avenue Properties, and Coldwater Creek • Consolidation and construction of an onsite disposal cell for all St. Louis site wastes at SLAPS • Total waste volume of approximately 902,000 yd^3 would be consolidated for disposal at SLAPS, including 250,000 yd^3 at SLAPS and approximately 652,000 yd^3 from SLAPS Vicinity Properties, SLDS, and the Latty Avenue Properties • Design and construction of waste disposal cell at SLAPS would begin after record of decision is signed (expected in 1998) • Waste soils from other St. Louis sites would be transported to SLAPS and added to the disposal cell as they are excavated from their current locations • Construction of the disposal cell at SLAPS would require that DOE exercise its authorization to reacquire the SLAPS property from the City of St. Louis • DOE would continue onsite surveillance and maintenance at SLAPS for 2 years after remedial action is complete • Responsibility for long-term surveillance and maintenance would be transferred to the Grand Junction Projects Office

Table 5[illegible]ntinued)

Category/Activity	Assumptions
Total Project Costs (FY 1996$) Under Each Cleanup/Disposal Option	• $70M FUSRAP Lite I (Institutional controls, site monitoring, minimal engineered measures) • $150M FUSRAP Lite II (Modest engineering improvements "in place," institutional controls, site monitoring • $330M Onsite consolidation and capping of material at SLAFS • $520M UMTRA-type disposal cell at SLAPS • $630M Instate disposal • $750M Commercial disposal with soil treatment for volume reduction • $980M FUSRAP Stout (Commercial disposal)
Regulatory Compliance	Site remediation activities will comply with ARARs and TBCs (see Appendix G)
Stakeholder Acceptance	• DOE will continue its commitment to stakeholder involvement and public participation in the remedy selection process. • The final remedy documented in the record of decision for the St. Louis sites (scheduled to be issued/signed in 1998) will incorporate recommendations of the St. Louis Site Remediation Task Force and other input from stakeholders as appropriate. • DOE will continue to coordinate with the Task Force through the EMAB process.
Other Assumptions (see Community Commitment Register, October 10, 1995)	• DOE will consolidate and dispose of FUSRAP wastes from SLAPS, Latty Avenue, and vicinity properties by reacquiring, stabilizing, and using the old 21 7-acre AEC airport site in a manner acceptable to the City of St. Louis (1985 Energy and Water Development Appropriation Act). • DOE will not remove radioactive materials from any source whatsoever, within or outside the State of Missouri, to Weldon Spring unless and until it has achieved full compliance with NEPA requirements (Stipulation signed by R.J. Hart, Manager, DOE Oak Ridge Operations, CCN 85462, Attachment 4, October 26, 1982).
Sources: BNI 1993a; 1994a, 1995a; ANL 1993; SAIC 1994; DOE 1995a	

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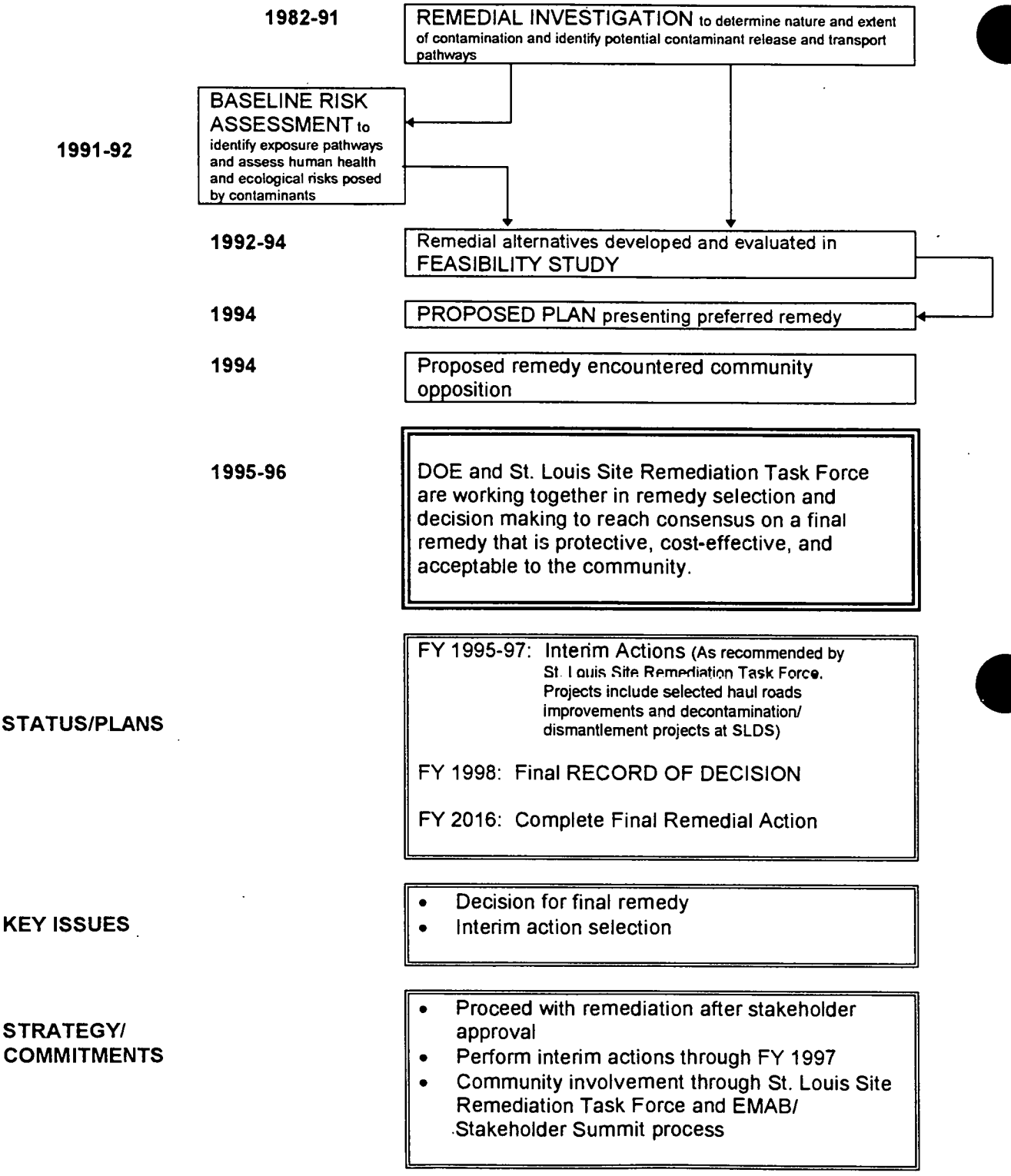


Figure 5.1 Summary of Remedy Selection Process

5.2.1 Stakeholder Participation in Remedy Selection and Decision Making

During the past 2 years, FUSRAP communities have been invited to participate in the EMAB/Stakeholder Summit process as a means for providing input to issues involving the remedy selection and implementation process. In evaluating options for cleanup and disposal of FUSRAP waste at the St. Louis sites, DOE is actively working with the St. Louis Site Remediation Task Force, established in 1994 to work with DOE and make recommendations on short-term and long-term remedies. The Task Force integrates guidance provided by EMAB, which serves as a framework within which DOE works with stakeholders in remedy selection and decision making. National Stakeholder Summits and local meetings provide a forum for public input into EMAB.

EMAB operates as an advisory board to the Assistant Secretary for Environmental Management and provides advice and recommendations on a wide range of issues confronting the program. Members of EMAB include representatives of state and local governments, environmental and citizen activist groups, labor organizations, federal agencies, and the scientific and academic communities. EMAB established several committees, including the FUSRAP Committee, to address key issues affecting both DOE and the Office of Environmental Management. The EMAB FUSRAP Committee, working with the National FUSRAP Stakeholders Forum, will propose a set of general guiding principles for implementation of DOE's FUSRAP efforts. These guiding principles will help to ensure consistency and cost-effectiveness of remedies for FUSRAP sites.

On May 2-3, 1995, more than 60 FUSRAP stakeholders from communities throughout the United States convened in Washington, D.C., to attend the first annual FUSRAP National Stakeholder Summit. Summit participants identified and prioritized issues and values and developed action plans. The five major issues identified at the conference were

- Funding
- Cleanup criteria
- Risk management
- Remedy selection
- Community acceptance

The EMAB FUSRAP Committee used the issues and information from the National Stakeholder Summit to begin its deliberations on guiding principles. When draft principles have been developed, they will be reviewed in a similar national forum, and ample opportunity will be provided for the public to influence final recommendations to DOE.

The St. Louis Site Remediation Task Force originated in the St. Louis Site Stakeholder Summit held in August 1994. This conference was organized in response to community opposition to DOE's draft Proposed Plan for the St. Louis sites. Thomas Grumbly, DOE Assistant Secretary for Environmental Management, suggested that summit participants organize to study site-related issues, develop viable alternatives for a final site remedy, and make recommendations on how interim FY 1996-1997 cleanup dollars could best be spent in St. Louis.

The Site Remediation Task Force initially consisted of members of city and county radioactive waste oversight commissions. Stakeholder representation was later expanded to include residential and commercial property owners and state and federal regulators. As of November 1995, the Task Force included 38 official members; DOE Site Manager David Adler serves as an ex-officio member. The Task Force held its first meeting on September 13, 1995, and began regular monthly meetings on October 11. The Task Force drafted and adopted a mission statement, a charter, and operating ground rules at its October and November meetings. Sally Price, who represents the St. Louis County Radioactive and Hazardous Waste Oversight Committee and also is a member of the EMAB FUSRAP committee, serves as chairman of the Task Force. Anna Ginsburg, who represents the city of St. Louis, serves as vice-

chairman. At the September meeting, Jim Dwyer was selected to serve as facilitator, and Miranda Duncan was chosen to assist him in that effort. DOE provides technical and administrative support to the Task Force, including funding for these support services.

Several Task Force working groups were formed to focus on specific issues, including alternative sites, local cleanup priorities, the Mallinckrodt (SLDS) cleanup proposal, and health risks/cleanup guidelines. During the fall of 1995, the Task Force presented DOE with a list of interim cleanup priorities for the St. Louis sites. A blue ribbon panel of geologists and hydrogeologists was assembled at the direction of the "Priorities" working group and tasked with investigating the impact of SLAPS contamination on Coldwater Creek. The Coldwater Creek Panel presented a draft report to the task force in January 1996 and is expected to submit a final report in February.

Specific issues considered by the panel included

- Potential effects of contaminated groundwater at SLAPS and vicinity properties on Coldwater Creek
- Potential effects of surface water runoff from SLAPS and vicinity properties on the creek
- Potential effects of contamination at SLAPS on the deep groundwater aquifers

Based on review of pertinent data and groundwater modeling information, the panel recommended designing and implementing a drainage control system at SLAPS to control surface water runoff and developing a program for long-range data collection, modeling, and risk assessment but did not recommend removing the waste material from SLAPS as part of the remedy. The recommendations and conclusions presented in the panel's final report will be used by the Site Remediation Task Force in developing its final recommendations to DOE on remedy selection at SLAPS and the Coldwater Creek vicinity properties.

5.2.2 Interim Removal Actions

During the remedy selection process leading to a record of decision, interim removal actions have been and will continue to be conducted to expedite site remediation and progressively reduce risk. Interim onsite storage also has been and will continue to be employed for wastes resulting from site maintenance activities or plant development at SLDS. Interim storage locations include existing structures (e.g., Building 116 at SLDS) and outdoor engineered piles (e.g., the two interim storage piles at HISS).

- A removal action was conducted at SLAPS in 1985, when gully erosion in the western portion of the site along Coldwater Creek necessitated emergency maintenance. Sloughing and seepage were causing erosion of contaminated fill material into the creek. Construction activities to combat the erosion problem were completed within a 7-week period.

- Several interim removal actions have been conducted at the Latty Avenue Properties. The storage piles at HISS resulted from partial cleanup at the site in 1977 and 1985 and during installation of a municipal storm sewer system along Latty Avenue in 1986. In 1984, DOE cleared the site, selected adjacent properties, constructed a decontamination facility, installed the perimeter fence, excavated and backfilled the edges and shoulders of Latty Avenue, and consolidated and covered the larger storage pile. In 1985, DOE conducted cleanup activities at Latty Avenue, conducted radiological surveys, tested materials, and installed monitoring wells. Wastes from these activities and from installation of a storm sewer along Latty Avenue in 1986 to improve the municipal drainage were added to the storage piles. Interim removal actions at Latty Avenue Property 3L (Quaker State Pile) and another north county industrial property (6L) were completed in 1995.

- During an interim removal action at SLAPS Vicinity Properties in 1995, approximately 1,400 yd^3 of contaminated soil was removed from six haul roads residential vicinity properties and shipped to Envirocare of Utah for disposal.

- An interim removal action was completed in 1995 at SLDS Plant 10 in support of Mallinckrodt's demolition and reconstruction activities; the effort represented a successful teaming partnership with Mallinckrodt and resulted in restoration of a city block at SLDS.

Future interim actions are planned within the next 2 to 3 years to the extent that funding permits.

5.3 FUSRAP RELEASE SITE MANAGEMENT STRATEGY

Management of characterization and remediation activity at FUSRAP sites is at the release site level. The four release sites in St. Louis are

- St. Louis Downtown Site (SLDS)
- St. Louis Airport Site (SLAPS)
- SLAPS Vicinity Properties
- Latty Avenue Properties

The composition (including a listing of vicinity properties) and remediation status of each release site is provided for reference in Appendix H (Property Listing).

FUSRAP strategy in management and remediation of release sites is driven by eight ER program priorities (DOE 1995a), which are used to determine budget priorities and to plan and sequence work activities:

- **Reduce offsite contamination** (e.g., at vicinity properties) that may pose risk to the public and the environment.

- **Prevent contaminant migration** through timely identification, reporting, assessment, application of best technologies, and safe storage.

- **Remediate non-DOE-owned sites and facilities** formerly used by DOE and its contractors.

- **Reduce onsite contamination** that could pose risk to the public and the environment during future use of the site. DOE works collaboratively with stakeholders and regulators to determine the projected future site use and select remedies to prevent exposure and minimize potential risk.

- **Cost-effectively maintain the essential infrastructure** by responsibly investing in site safety, security, utilities, and maintenance, thereby making funds available for other restoration activities.

- **Make prudent business decisions:**

    ⇒ Invest in capital projects that upgrade efficiency of operations
    ⇒ Complete sites ahead of schedule to reduce longer-term costs
    ⇒ Train employees for safety and enhanced job performance
    ⇒ Implement technically effective and cost-effective remedial action approaches

- **Release facilities and land for public use** and involve the public in land and facility reuse decisions.

- **Reduce uncertainty through characterization** to more accurately determine relative risk, scope, cost, and schedule for site remediation activities. Establish data needs and objectives before characterization to increase cost-effectiveness and efficiency.

In accordance with these program priorities, FUSRAP program-wide ER strategic goals (DOE 1995a) are to:

- Address immediate risk concerns and prevent further increases in relative risk at all FUSRAP sites
- Complete 50% of current FUSRAP sites (23 of 46) by the end of FY 1996
- Reach agreement with regulators and stakeholders on the cleanup approach at large sites by FY 1998
- Complete an aggressive interim action program at large sites by FY 2000
- Complete cleanup at all small FUSRAP sites by FY 2008
- Complete remediation of all FUSRAP sites and related vicinity properties by FY 2016

The ultimate objective is to remediate all FUSRAP sites in a safe, cost-effective, and timely manner that optimizes opportunities for land and facility reuse.

5.4 NON-ENVIRONMENTAL RESTORATION REGULATORY STRATEGY

Remedial and removal actions conducted by DOE at the St. Louis sites are being coordinated with EPA Region VII under CERCLA. It is DOE policy to integrate the requirements of CERCLA with the values of NEPA for remedial actions at sites for which it has responsibility. Under this integrated policy, the CERCLA process is supplemented as appropriate to incorporate NEPA values.

FUSRAP non-ER regulatory strategy for the St. Louis sites includes compliance with applicable or relevant and appropriate legal requirements other than those under CERCLA/NEPA. The evaluation of remedial alternatives during the feasibility study included consideration of compliance with ARARs and to-be-considered (TBC) requirements under each cleanup/disposal option (SAIC 1994).

The federal facilities agreement (FFA) negotiated between DOE and EPA in 1990 covers all wastes (radioactive and chemical) traceable to MED/AEC operations at SLDS. DOE is not responsible for other contamination at the St. Louis sites unless it is commingled with MED/AEC/DOE-related radioactive contamination or might impact site cleanup activities. DOE's commitment to meet compliance milestones under the FFA is an important component of the regulatory strategy for the St. Louis sites. Other non-ER regulatory requirements include:

- Clean Air Act [applicable provisions of NESHAPs: 40 CFR 61, Subparts H (radon flux), Q (radionuclides other than radon), and M (remedial activities involving asbestos)].

- Clean Water Act (applicable provisions of NPDES regulations, 40 CFR 121-125, imposing engineered controls and limits on stormwater and pollutant discharges through federal permit programs under Clean Water Act Section 402). An NPDES stormwater monitoring system was established at the Latty Avenue Properties in 1992.

- OSHA regulations (29 CFR 1910 and 1926 ensuring site worker safety and health, setting standards to prevent injuries, regulating exposures, and requiring that employees be informed about job dangers at FUSRAP sites).

- DOE Orders (including guidelines for residual radioactive materials in soil and requirements for public and worker radiation protection, radioactive waste management and disposal, labeling and packaging waste for transportation, decommissioning, and radiation dosimetry programs).

- Executive Orders (including requirements involving impacts on floodplains and wetlands).

- State of Missouri laws and regulations regarding water quality and effluent limitations.

A detailed listing and brief description of these and other potential ARARs for the St. Louis sites are provided in Appendix G.

5.5 PROJECT SUPPORT ACTIVITY STRATEGY

DOE is committed to a program of public participation and stakeholder involvement in the remedial action process for the St. Louis sites. As described in Section 5.2, DOE is actively working with the St. Louis Site Remediation Task Force through the EMAB process in evaluating options for cleanup and disposal of FUSRAP waste at these sites. As part of the CERCLA/NEPA process, DOE also continues to interact with the public and other stakeholders through the FUSRAP community relations program to gather information from the community, inform the public of ongoing and planned activities, and facilitate public input to the decision-making process. The community relations program provides interaction with the public through news releases and fact sheets, public meetings (e.g., the public scoping meeting held at the Berkeley Senior High School in January 1992 to provide an opportunity for public comment on the St. Louis work plan), discussions with local interest groups, response to public comments, and maintenance of a public repository for site-related information.

Arrangements with waste transporters and commercial disposal vendors could affect project performance by affecting disposal of waste from interim removal actions. No problems are currently anticipated in continuing commercial disposal of waste from interim actions. Plans are to continue pursuing cost-effective contracting strategies with waste transporters and disposal vendors. Progress in transportation and disposal arrangements during 1995 included the following:

- Sponsored comprehensive transportation and disposal planning meeting with waste transporters and Envirocare for FY 1995 shipping campaign
- Reached agreement with Envirocare on method for determining densities for bulk shipments of FUSRAP waste
- Coordinated FUSRAP waste shipping and disposal campaigns through teleconferences with Envirocare, transportation contractors, and field and home office personnel
- Awarded 11(e)2 waste disposal subcontract to dispose of 100,000 yd^3 of FUSRAP waste
- Awarded mixed waste treatment subcontract to Envirocare
- Executed Low-Level Waste Disposal Subcontract Amendment lowering unit disposal cost rates
- Issued waste moisture control design basis document

Other support activities with the potential to affect cleanup progress include:

- Landlord activities (lease agreement with Jarboe Realty and Investment at HISS). No impediments to site remediation progress are anticipated.

- Access agreements needed to conduct work at vicinity properties. Any necessary agreements will be negotiated and signed far enough in advance to prevent any schedule disruptions.

- Program management support programs (including verification support). No problems are anticipated.

- Interface with DOE waste management and technology development programs. No problems anticipated.

- Surveillance and maintenance. No problems anticipated.

FUSRAP has developed a Standards/Requirements Identification Document (S/RID) using a selection process that resulted in the identification of a set of standards/requirements that

- maintains protection of the safety and health of workers, the public, and the environment
- provides a balance between cost and benefits
- is reasonable, tailored to the work to be performed, and defensible

The S/RID meets an objective set forth in the Secretary of Energy's August 3, 1995, "Roll Out," in which she identified in an "Honor Roll" certain initiatives that were expected to reduce DOE expenditures. One of the initiatives identified was the "use of commercial standards for non-nuclear facilities, which will save millions throughout the DOE complex."

In developing the S/RID, those DOE directives that were deemed "non-applicable" and those that were deemed "applicable yet duplicative" of other federal requirements were not selected for inclusion. The substantive value of "applicable yet duplicative" DOE directives will be maintained through direct recognition and adherence to the federal requirements and through the use of commercial codes, standards, and best management practices. Use of common codes and standards for work under FUSRAP parallels other agency processes for similar work.

The selection process for S/RID development recognized the important variations in the hazards, work, and other circumstances for FUSRAP; therefore, it provided a systematic and disciplined application of the graded approach. The S/RID contains those requirements that are necessary to conduct an effective FUSRAP program, are sufficient for protection of human health and the environment, and represent efficient use of financial resources. No impediments to site remediation progress are anticipated as a result of implementing the S/RID. In fact, S/RID implementation is expected to facilitate remediation progress.

5.6 PERFORMANCE MEASURES

FUSRAP will use performance measures derived from the strategic measures outlined in the EM-40 ER Strategic Plan (DOE 1995a) to track overall accomplishment of the mission and vision of the ER program at the St. Louis sites. These measures examine macro-level long-term trends and are part of a larger body of performance measures used for shorter-term management and external reporting purposes. FUSRAP performance measures for FY 1996 are summarized in Table 5.2.

5.6.1 Relative Risk Reduction

FUSRAP will track all FUSRAP sites, including the St. Louis sites and vicinity properties, by relative risk to public health, the environment, and worker safety. Relative risk categories will include high-, medium, and low relative risk sites as determined by EM-40 relative ranking. As program priorities are implemented and program goals are attained, it is expected that high relative risk sites and properties will move to a lower risk classification or to the "Completed Site" category. Similarly, the general trending of medium- and low-relative-risk sites and properties should be toward the Completed Site category. Progressive risk reduction through interim response actions is an important component of this strategy.

5.6.2 Program Efficiency

Cost-effectiveness and program efficiency will be achieved through reductions in infrastructure costs, elimination of unnecessary management and oversight costs, and use of cost-effective technologies. Indicators such as infrastructure costs and program management costs will be used in measuring effectiveness and efficiency trends.

5.6.3 Land and Facility Status

FUSRAP will track trending patterns in the status of land and facilities (including buildings and other structures) at the St. Louis sites with regard to remediation of site soils and decontamination of buildings so that they are ready to be transferred for appropriate future use.

5.6.4 Resource Distribution

FUSRAP will track overall trending in distribution of funds committed to core activities, assessment activities, and remediation progress. The desired trend is a steady decline in funding requirements for core activities and assessment, with a corresponding increase in funds allocated to remedial action.

Table 5.2 FUSRAP FY 1996 Performance Measures

WBS No.	Release Site	Subproject or Interim Action Name	Planned Completion Date	Number Committed to Headquarters
Assessments				3
1.4.11.1.03	New Brunswick Site	New Brunswick Site	June 1996	
1.4.11.1.04	Ventron	Ventron	May 1996	
1.4.11.1.04	B&T Metals	B&T Metals	June 1996	
Interim Actions				5
1.4.11.1.03	Wayne	• Pile Removal -- Phase A	September 1996	
1.4.11.1.03	Maywood	• Pile Removal -- Phase C	September 1996	
1.4.11.1.02	Linde	• Decon Building 31 • Decon Building 14 • Demolish Building 38	January 1996 September 1996 September 1996	
Remedial Actions				2
1.4.11.1.03	New Brunswick Site	New Brunswick Site	August 1996	
1.4.11.1.04	B&T Metals	B&T Metals	September 1996	
1.4.11.1.04	Baker Brothers	Baker Brothers	December 1995	Completed
Decommissioning				0
None				
Vicinity Properties				15
1.4.11.1.01	Latty Avenue Properties	• Rykoff-Sexton (Property 6L) • Quaker State (Property 3L)	December 1995 December 1995	Completed Completed
1.4.11.1.01	St. Louis Airport Site (SLAPS) Vicinity Properties	• 21 Frost Avenue • 22 Frost Avenue • 23 Frost Avenue • 24 Frost Avenue • 26 Frost Avenue • 27 Frost Avenue • 30 Frost Avenue • 47 Hazelwood Avenue • 48 Hazelwood Avenue	August 1996 August 1996 August 1996 July 1996 August 1996 July 1996 July 1996 September 1996 September 1996	
1.4.11.1.01	St. Louis Downtown Site (SLDS)	• Site Owners D&D	September 1996	
1.4.11.1.03	Maywood	• 90 Avenue C • 79 Avenue B • 113 Avenue E • 112 Avenue E • 108 Avenue E • 16 Long Valley • 18 Long Valley • 20 Long Valley • 22 Long Valley • 24 Long Valley • 26 Long Valley	December 1995 December 1995 July 1996 July 1996 July 1996 August 1996 August 1996 September 1996 September 1996 September 1996 September 1996	Completed Completed Completed Completed Completed
1.4.11.1.03	Middlesex Sampling Plant	• Remediate Ditch	September 1996	

5-12

6. MASTER SCHEDULE

6.1 MASTER SCHEDULE FOR ENVIRONMENTAL RESTORATION

A master schedule for environmental compliance and restoration activities planned for the St. Louis sites is provided in Figure 6.1. The schedule was developed in accordance with FUSRAP budget planning as of fiscal year 1996 and shows the events projected through the point at which the record of decision is issued; signing of the record of decision is expected to occur in FY 1998. Remedial design and remedial action consistent with the National Contingency Plan will be initiated following issuance of the record of decision. The schedule shows the relationships between the tasks and their projected durations. Specific dates beyond 1996 should not be considered as firmly established, however, because funding is allocated on a yearly basis by congressional action.

6.2 COMPLIANCE MILESTONES

Compliance milestones for remediation of the St. Louis sites are shown in Table 6.1.

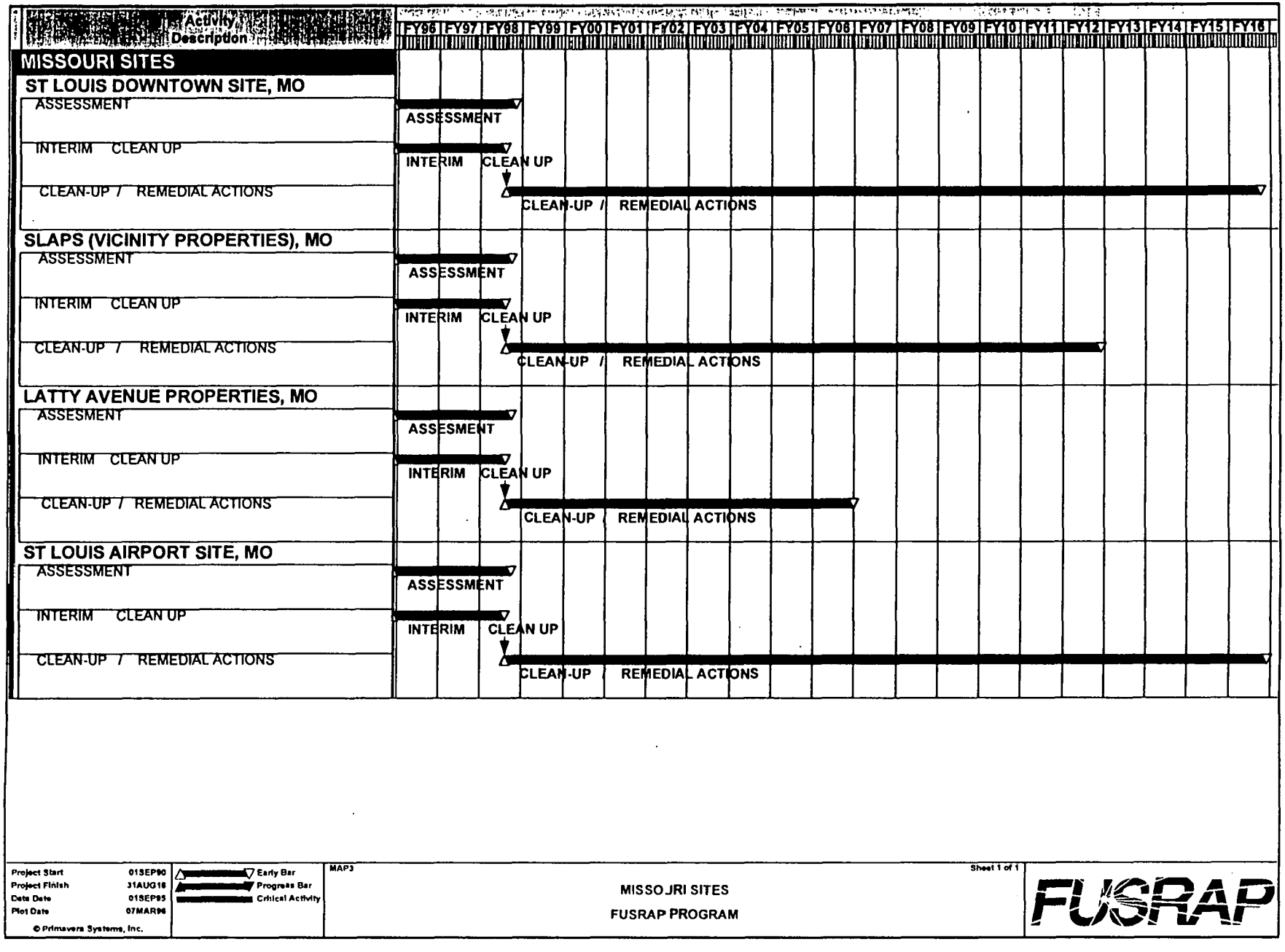


Figure 6.1 Master Environmental Restoration Schedule

Table 6.1 Major Activity Milestones

Site	Activity	Completion Date (Fiscal Year)
St. Louis Downtown Site (SLDS)	• Record of Decision Signed by EPA	1998
	• Complete Remedial Action	2016
SLAPS Vicinity Properties	• Record of Decision Signed by EPA	1998
	• Complete Remedial Action	2016
Latty Avenue Properties	• Record of Decision Signed by EPA	1998
	• Complete Remedial Action	2012
St. Louis Airport Site (SLAPS)	• Record of Decision Signed by EPA	1998
	• Complete Remedial Action	2006

7. ISSUES AND INITIATIVES

7.1 ISSUES AFFECTING PROJECT PERFORMANCE

A number of issues related to remediation of the St. Louis sites have the potential to impede progress of the environmental restoration process and drive costs upward. FUSRAP must focus attention on these obstacles to quickly, safely, and cost-effectively complete its mission at these sites. Key strategic issues potentially affecting project performance in remediation of the St. Louis sites are listed in Table 7.1. Issues and concerns identified by stakeholders are summarized in Table 7.2.

7.2 INITIATIVES IMPLEMENTED TO IMPROVE PROJECT PERFORMANCE

Technology Initiatives

- Use of rock crusher to reduce volume of contaminated material for disposal, generating cost savings of >$500,000 in Missouri and Ohio
- Use of field gamma spectroscopy to reduce analytical costs, saving $150,000 in Missouri and Ohio
- Use of mobile wet chemistry lab in St. Louis
- Developed GIS modeling for data interpretation and visual communication
- Bench-scale demonstration of treatment for St. Louis soils
- Completed initial development and testing of Long Range Alpha Detection (LRAD) system for use in St. Louis cleanup

Stakeholder Involvement/Community Relations

- Established St. Louis Site Task Remediation Task Force (originated in St. Louis Site Stakeholder Summit held in August 1994) to work with DOE and provide recommendations and input to remedy selection process
- First annual National Stakeholder summit held in Washington, D.C., May 1995
- Held Environmental Management Advisory Board (EMAB) meetings at St. Louis sites
- Worked with Site Remediation Task Force in evaluating options for cleanup and disposal of FUSRAP waste and provided funding for facilitator and other Task Force administrative costs
- Worked toward developing consensus on cost/risk management
- Task Force's panel of geologists and hydrogeologists focused on surface water and groundwater issues at SLAPS
- Increased visibility of program; increased level of site work and number of site completions in 1995
- First use of Innovator (a computer-assisted decision-making tool) by a FUSRAP citizens' group to prioritize remedial alternative evaluation criteria
- Presented workshop on FUSRAP's innovative community relations strategic planning process at international conference
- Conducted conflict resolution training for program, site, and project managers

Productivity and Cost Savings Initiatives

- Achieved $1.2 million in cost savings through Productivity Improvement Program and Cost Savings Initiatives
- Developed FUSRAP protocol for expedited response actions at FUSRAP sites where contamination is minimal and generally limited to indoor areas
- Achieved substantial characterization cost savings using Streamlined Approach for Environmental Restoration (SAFER)
- Prepared and issued 27 Project Instructions and revisions in 1995

Table 7.1 Key Issues Affecting Project Performance

Issue	Program Impacts	Major Parties Involved in Resolution	Action Planned for Resolution
Technical Issues			
• Cleanup Criteria/Supplemental Standards for Access-Restricted Soils	Access-restricted soils do not pose current risk to public or workers (ANL 1993). Excavation beneath existing buildings to remove access-restricted soils could increase exposure risk from particulate inhalation, undermine structural integrity of buildings, and displace workers. Supplemental standards would establish alternative criteria for soil in these areas. Applying supplemental standards would require notification of all private owners and occupants at affected locations and solicitation of comments and periodically informing EPA of general and individual determinations.	DOE, property owners/occupants, EPA	Required notifications and solicitation of comments if supplemental standards are applied
• Disposition of Access-Restricted Soils	Access-restricted soils would remain in place (beneath buildings at SLDS and Futura, the levee, roads, railroads, and other permanent structures) until made accessible to DOE by owner removal of the structural hindrance.	DOE, property owners	If access-restricted soils become accessible during remediation, they can be disposed of at the selected disposal location. Institutional controls would be used where necessary to reduce any potential for exposure.
• Availability of Treatment Options Within the Remedy Implementation Time Frame	Treatment to reduce waste volume can significantly reduce disposal costs	DOE technology initiatives/technology development interface	Continue development, testing, and use of new/improved technologies to reduce volume of material to be disposed and/or toxicity/mobility of contaminants (see Section 7.2)
Cost/Schedule Issues			
• Availability of Funding Necessary to Complete Selected Remedies Within a Reasonable Time	Impacts progress toward remedy selection and implementation and ability to meet FFA milestones	DOE/Congress	Incorporate technically sound, cost-effective and protective remedies and cost-saving scheduling and contracting strategies in preparing proposed budgets to be submitted for funding approval
Regulatory Issues			
• None			
Stakeholder-related Issues			
• Acceptance of FUSRAP Guiding Principles	Impacts effort to reach consensus with stakeholders on final remedy	DOE/Stakeholders	Continue to work with stakeholders through the St. Louis Site Remediation Task Force and the EMAB/National Stakeholder Summit process in remedy selection and decision-making

Table 7.2 Stakeholder Issues and Recommendations

Stakeholder Issues Identified at Public Scoping Meeting (January 1992)

General Issues

- Schedule, pace, and cost of cleanup
- Safety and health concerns (exposure risk)
- Interim cleanup measures
- Storage and disposal site selection
- Public participation in the cleanup process
- Economic impacts
- Land use considerations
- Transportation issues
- Extent of contamination
- Data quality and sufficiency

Specific Community Concerns

- Possible contamination of Coldwater Creek from the SLAPS materials as they now exist or from a disposal cell that might be constructed on the property
- Reduction of property values in Berkeley and Hazelwood if a disposal site is developed in the area
- Loss of use of the recreational fields adjacent to SLAPS
- Accidents during transport of contaminated soil
- Possible use of a local disposal cell for materials outside the area
- Adverse effects on future economic development of Hazelwood and Berkeley if they are perceived as a "dump site" for radioactive materials
- Possible interference with airport operations or future airport expansion
- Ability of a disposal cell to withstand earthquakes, floods, and aircraft collisions
- Lack of confidence that DOE will involve the public in the decision-making process
- Safety of interim storage and future permanent storage technologies (i.e., what is safe under current conditions may not be safe under future conditions)
- Potential liability of the City of St. Louis resulting from inclusion of SLAPS and the Latty Avenue Properties on EPA's National Priorities List
- Impact of complexity of the environmental review process on length of time required for cleanup
- Health and safety risks to the public and site workers
- Need for an impartial citizens' review during the entire process
- Preference for storing radioactive waste outside St. Louis in a less heavily populated nonurban area
- Potential for increasing contaminant transport pathways by installing groundwater wells
- Potential spread of contamination during cleanup and/or movement of radioactive waste

General Issues Identified at First Annual FUSRAP National Stakeholder Summit (May 1995)

- Funding
- Cleanup criteria
- Risk management
- Remedy selection
- Community acceptance

Site-specific Issues Identified by St. Louis Site Remediation Task Force (September 1995)

- Local cleanup priorities
- Alternative disposal sites
- Mallinckrodt (SLDS) cleanup proposal
- Health risks/cleanup guidelines

Key Issues Identified by Task Force's Coldwater Creek Panel (1995-96)

- Potential effects of contaminated groundwater at SLAPS and VPs on Coldwater Creek
- Potential effects of surface water runoff from SLAPS and VPs on the creek
- Potential effects of contamination at SLAPS on the deep groundwater system

Coldwater Creek Panel Recommendations in Draft Report to Task Force (January 1996)

- Design and implement a drainage control system to control surface water runoff at SLAPS
- Develop a program for long-range data collection, modeling, and risk assessment
- Panel did not recommend removing waste material from SLAPS as part of final remedy

Transportation and Disposal

- Sponsored comprehensive transportation and disposal planning meeting with waste transporters and Envirocare for FY 1995 shipping campaign
- Reached agreement with Envirocare on method for determining densities for bulk shipments of FUSRAP waste
- Coordinated FUSRAP waste shipping and disposal campaigns through teleconferences with Envirocare, transportation contractors, and field and home office personnel
- Awarded 11(e)2 waste disposal subcontract to dispose of 100,000 yd^3 of FUSRAP waste
- Awarded mixed waste treatment subcontract to Envirocare
- Executed Low-Level Waste Disposal Subcontract Amendment lowering unit disposal cost rates
- Issued waste moisture control design basis document

Safety and Health

- Zero lost-time accidents during 8 site remediations and St. Louis surveillance and maintenance
- Conducted emergency response exercises at six FUSRAP sites (including St. Louis) during 1995
- Completed and issued annual Emergency Readiness Assurance Plan

APPENDIX A

FISCAL YEAR FUNDING REQUIREMENTS

APPENDIX A: FISCAL YEAR FUNDING REQUIREMENTS/COSTS

The cost baseline for the Missouri FUSRAP sites is provided in Table A.1.

Table A.1 Site Cost Baseline

Site	Phase	FY 1989-95 (000$)	FY 1996 (000$)	FY 1997 (000$)	FY 1998 (000$)	FY 1999 (000$)	FY 2000 - Completion (000$)
High Relative Ranking							
SLDS	Assessment		969	104	107		
	Remediation		3,483	4,487	7,456		
SLAPS	Assessment		438	--	--		
	Remediation		649	1,091	6,230		
SLAPS Vicinity Properties	Assessment		931	100	192		
	Remediation		7,246	7,838	2,503		
Latty Avenue Properties	Assessment		620	353	421		
	Remediation		859	1,435	1,510		
Subtotal High	Assessment		2,958	557	790	550	1,417
	Remediation		12,237	14,851	14,213	31,006	1,014,312
Medium Relative Ranking							
None	Assessment		--	--	--		
None	Remediation		--	--	--		
Subtotal Medium	Assessment		--	--	--	--	--
	Remediation		--	--	--	--	--
Low Relative Ranking							
None	Assessment		--	--	--		
None	Remediation		--	--	--		
Subtotal Low	Assessment		--	--	--	--	--
	Remediation		--	--	--	--	--
Program Management	Included Above		--	--	--	--	--
Other	None		--	--	--	--	--
Total		73,851	15,195	15,408	15,003	31,556	1,015,729

APPENDIX B

ENVIRONMENTAL RESTORATION DELIVERABLES

APPENDIX B: ENVIRONMENTAL RESTORATION DELIVERABLES

A listing of ER documents developed and issued for the St. Louis FUSRAP sites between 1989 and 1995 is provided in Table B.1. These documents are part of the Administrative Record and are available at the DOE Public Information Center [9200 Latty Avenue, Hazelwood, MO 63402, (314) 524-3329].

Table B.1 Environmental Restoration Deliverables

Title	Date	Document No.	Phase	Point of Contact
Deliverables 1989-1995				
Preliminary Geological, Hydrogeological, and Chemical Characterization Report for the Ball Field Area	1989	DOE/OR/20722-211	Assessment	BNI
St. Louis Airport Site Annual Site Environmental Report, Calendar Year 1988	1989	DOE/OR/20722-220	Assessment	BNI
Hazelwood Interim Storage Site Annual Site Environmental Report, Calendar Year 1988	1989	DOE/OR/20722-218	Assessment	BNI
Conceptual Design for a Permanent Disposal Site for FUSRAP Wastes	1989	DOE/OR/20722-212	Design	BNI
Radiological, Chemical, and Hydrogeological Characterization Report for the St. Louis Downtown Site, Rev. 1, Vols. 1-3	1990	DOE/OR/20722-258	Assessment	BNI
Radiological Characterization Report for FUSRAP Properties in the St. Louis /area, Vols. 1-3	1990	DOE/OR/20722-203	Assessment	BNI
St. Louis Airport Site Environmental Report for Calendar Year 1989	1990	DOE/OR/20722-262	Assessment	BNI
Hazelwood Interim Storage Site Environmental Monitoring Report for Calendar Year 1989	1990	DOE/OR/20722-263	Assessment	BNI
Chemical Characterization Report for the St. Louis Airport Site and the Latty Avenue Properties, Rev. 1	1990	DOE/OR/27022-206	Assessment	BNI
Environmental Compliance Assessment for the St. Louis Downtown Site	1990	Unnumbered	Assessment	BNI
Environmental Compliance Assessment for the St. Louis Airport Site	1990	Unnumbered	Assessment	BNI
1989 Annual Environmental Monitoring Report for the St. Louis Airport Site	1990	DOE/OR/20722-262	Assessment	BNI
1989 Annual Environmental Monitoring Report for the Hazelwood Interim Storage Site	1990	DOE/OR/20722-263	Assessment	BNI
1990 Annual Environmental Monitoring Report for the St. Louis Airport Site	1991	DOE/OR/20722-288	Assessment	BNI
1990 Annual Environmental Monitoring Report for the Hazelwood Interim Storage Site	1991	DOE/OR/20722-283	Assessment	BNI
Waste Minimization and Pollution Prevention Awareness Plan	1991	Unnumbered	Planning	BNI
Environmental Responsibilities on the Job Site	1991	Unnumbered	Training	BNI
Pile Cover Study for FUSRAP	1991	Unnumbered	Design	BNI
Environmental Monitoring Plan for the Hazelwood Interim Storage Site	1991	DOE/OR/21949-305	Planning	BNI
Input to the St. Louis Feasibility Study Report (Draft)	1991	Unnumbered	Assessment	BNI
Remedial Action Cost Study for Contaminated Building Surfaces and Underlying Soil at the St. Louis Downtown Site	1991	Unnumbered	Assessment	BNI
Engineering Evaluation/Cost Analysis for Decontamination at the St. Louis Downtown Site, St. Louis, Missouri	1991	DOE/OR/23701-02.2	Assessment	DOE
FUSRAP Roadmap	1992	Unnumbered	Planning	BNI
ALARA Plan for the Formerly Utilized Sites Remedial Action Program	1992	Unnumbered	Planning	BNI
Site Security Plan for DOE-Owned or -Leased Sites Under FUSRAP	1992	DOE/OR/21949-299	Planning	BNI
Final Report on Test Cell Monitoring	1992	Unnumbered	Assessment	BNI
Hazelwood Interim Storage Site Environmental Report for Calendar Year 1991	1992	DOE/OR/20722-340	Assessment	BNI
Quality Assurance Program Plan for U.S. DOE FUSRAP, Rev. 2	1992	Unnumbered	Planning	BNI
Initial Screening of Alternatives Report for the St. Louis Sites, St. Louis, Missouri	1992	DOE/OR/21590-777	Assessment	SAIC
U.S. Department of Energy Project Plan, Formerly Utilized Sites Remedial Action Program, Rev. 3	1992	Unnumbered	Planning	DOE
Site-Specific Plan for the Formerly Utilized Sites Remedial Action Program	1992	MSA-142	Planning	DOE
FUSRAP Management Requirements and Policy Manual, Rev. 3	1992	Unnumbered	Management	DOE
Baseline Risk Assessment for Exposure to Contaminants at the St. Louis Site	1993	DOE/OR/23701-41.1	Assessment	ANL
Work Plan-Implementation Plan for the Remedial Investigation/Feasibility Study-Environmental Impact Statement for the St. Louis Sites	1993	DOE/OR/21949-271.1	Planning	BNI
Hazelwood Interim Storage Site Environmental Report for Calendar Year 1992	1993	DOE/OR/20722-369	Assessment	BNI
Community Relations Plan for the Remedial Investigation/Feasibility Study-Environmental Impact Statement for the St. Louis Sites, St. Louis, Missouri	1993	DOE/OR/21949-271.2	Planning	BNI

Table B.1 (Continued)

Title	Date	Document No.	Phase	Point of Contact
Waste Management Program Plan for FUSRAP	1993	191-WMPP-Rev. 0	Planning	BNI
Environmental Protection Program Implementation Plan for November 9, 1991 through November 9, 1993	1993	Unnumbered	Planning	BNI
Quality Assurance Document for Site Environmental Reports	1993	DOE/OR/21949-362	Planning	BNI
Health and Safety Plan for the St. Louis Sites, St. Louis, Missouri	1993	116/134/140/153-HSP, Rev. 0	Planning	BNI
Quality Assurance Project Plan for the Remedial Investigation/Feasibility Study-Environmental Impact Statement for the St. Louis Sites	1993	DOE/OR/21949-271.3	Planning	BNI
Field Sampling Plan for the Remedial Investigation/Feasibility Study-Environmental Impact Statement for the St. Louis Sites	1993	DOE/OR/21949-271.4	Planning	BNI
Groundwater Protection Management Plan	1993	191-GPMP-Rev. 0	Planning	BNI
Letter Report on the Risks Associated with Contaminated Sediment During Remediation Activities at Coldwater Creek	1993	CCN 099899	Assessment	SAIC
Letter Report on a Direct Exposure Assessment for the St. Louis Site Beneficial Reuse Disposal Option	1993	CCN 098856	Assessment	SAIC
Evaluation of Contaminated Sediment Transport in Coldwater Creek, St. Louis, Missouri	1993	CCN 105790	Assessment	SAIC
Evaluation of Disposal Options for Wastes Generated During Remediation of Formerly Utilized Sites Remedial Action Program Sites	1993	Unnumbered	Assessment	SAIC
Remedial Investigation Addendum Report for the St. Louis Sites, St. Louis, Missouri	1993	DOE/OR/21950-132	Assessment	SAIC
Letter Report on the Risks Associated with Contaminated Sediments Present in Coldwater Creek	1993	CCN 106332	Assessment	SAIC
Feasibility Study/Environmental Impact Statement for the St. Louis Sites, St. Louis, Missouri	1994	DOE/OR/21950-130	Assessment	SAIC
Groundwater Flow and Transport Model for the Airport Area, St. Louis, Missouri	1994	Unnumbered	Assessment	SAIC
Remedial Investigation Report for the St. Louis Sites	1994	DOE/OR/21949-280	Assessment	BNI
Site Suitability Study for the St. Louis Airport Site, St. Louis, Missouri, Vols. 1 and 2	1994	Unnumbered	Assessment	BNI
1993 Environmental Surveillance Report for the Hazelwood Interim Storage Site	1994	DOE/OR/21949-378	Assessment	BNI
Emergency Readiness Assurance Plan for the Formerly Utilized Sites Remedial Action Program, Rev. 2	1994	Unnumbered	Planning	BNI
Proposed Plan for the St. Louis Sites, St. Louis, Missouri	1994	DOE/OR/21950-131	Planning	DOE
FUSRAP Cultural Resource Management Plan, Rev. 0	1995	191-CRMP	Planning	BNI
1996 Baseline Environmental Management Report for U.S. Department of Energy Formerly Utilized Sites Remedial Action Program (FUSRAP) (Draft)	1995	DOE/OR/21949-394	Assessment	BNI
Post-Remedial Action Report for Remedial Action Conducted in St. Louis, Missouri, During Calendar Year 1994	1995	DOE/OR/21949-396	Remedial Action	BNI
FUSRAP Environmental Monitoring Plan (Draft)	1995	Unnumbered	Planning	BNI
1994 Environmental Surveillance Results for the Hazelwood Interim Storage Site	1995	Unnumbered	Assessment	BNI
Environmental Restoration Strategic Plan: Remediating the Nuclear Weapons Complex	1995	DOE/EM-0257	Planning	DOE
FUSRAP FY-1995 Year End Review	1995	Unnumbered	Management Review	DOE
FY 1997 ADS Submission for the Formerly Utilized Sites Remedial Action Program	1995	MSA-142	Cost/Schedule Review and Planning	DOE
FUSRAP Management Appraisal -- 1995	1995	Unnumbered	Management Review	DOE
Expected Deliverables 1996				

APPENDIX C

DECISION DOCUMENT/ROD SUMMARIES

APPENDIX C: DECISION DOCUMENT/ROD SUMMARIES

The final record of decision for the St. Louis sites is expected to be signed in FY 1998. Decision documents for the St. Louis sites to date include action memoranda based on engineering evaluations/cost analyses (EE/CAs) for interim removal actions (DOE 1992d, 1994b, 1995e, 1995f). These interim actions have included:

- Cleanup at SLAPS Vicinity Properties and the Latty Avenue Properties (1991)
- Cleanup/interim storage of contaminated soil at SLDS (1991)
- Interim removal actions along SLAPS Vicinity Property haul roads (6 North County residential properties) (1995)
- Interim removal actions at Latty Avenue properties 3L (Quaker State Pile) and 6L (1995)
- Interim removal action at SLDS Plant 10 (in support of Mallinckrodt's demolition and reconstruction activities) (1995)

Summaries of action memoranda for these interim actions are provided below. These documents are part of the Administrative Record and are available at the DOE Public Information Center [9200 Latty Avenue, Hazelwood, MO 63402, (314) 524-3329].

DOE, 1992d. "Action Memorandum for the Removal of Contaminated Materials at the St. Louis Downtown Site, St. Louis, Missouri," Memorandum from L.K. Price (OR-FSRD) to File, CCN 086138 (February 27).

An EE/CA analyzing alternatives for managing contaminated material at SLDS was issued for public comment June 7, 1991. The preferred alternative included temporary storage of wastes from onsite cleanup in Building 116 at SLDS. This action memorandum, supported by a responsiveness summary addressing comments received on the EE/CA, announced that the recommended alternative would be implemented in accordance with requirements of CERCLA and NEPA.

DOE, 1994b. "HISS -- Action Memorandum for Residential Property Cleanups," Memorandum from L.K. Price (OR-FSRD) to File, CCN 121854 (October 12).

This action memorandum announced planned interim actions involving removal of contaminated soils on a set of residentially zoned properties in Hazelwood and Berkeley and relocation of these soils to a commercial disposal facility. The cleanup included six haul roads residential properties (properties 19, 20, 41, 43, 44, and 45) completed in 1995. Wastes from this interim removal action were shipped to Envirocare of Utah for disposal.

DOE, 1995e. "St. Louis Site -- Action Memorandum for Vicinity Property Cleanups," Memorandum from L.K. Price (OR-FSRD) to File, CCN 130703 (June 2).

This action memorandum announced planned interim actions involving removal of contaminated soils on two industrial properties in St. Louis County and relocation of these soils to a commercial disposal facility. The cleanup included Latty Avenue Properties 3L (Quaker State property) and 6L (Rykoff-Sexton property) completed in 1995. Wastes from this interim removal action were shipped to Envirocare of Utah for disposal.

DOE, 1995f. "SLDS -- Action Memorandum for the Removal of Contaminated Materials at the St. Louis Downtown Site," Memorandum from L.K. Price (OR-FSRD) to File, CCN 131596 (June 26).

This action memorandum announced planned interim actions involving cleanup of contaminated material at SLDS. The interim actions included cleanup of Plant 10 at SLDS, completed in 1995, which returned an entire city block to use with no radiological restrictions. Wastes from this interim removal action were shipped to Envirocare of Utah for disposal.

APPENDIX D

CONCEPTUAL MODEL DATA SUMMARIES

APPENDIX D: CONCEPTUAL MODEL DATA SUMMARIES

The conceptual models outlined in Figures D.1 (downtown area properties) and D.2 (airport area properties) incorporate information on primary sources of contamination, potential contaminant release mechanisms and transport pathways, and potential exposure pathways and receptors for contaminants detected at the St. Louis sites. Potential human exposure pathways were identified in the baseline risk assessment (ANL 1993) on the basis of the following factors:

- Locations of contaminated source areas, types of contaminants found at source areas, and potential mechanisms of contaminant release
- Likely contaminant fate and transport within or between environmental media
- Estimated exposure point concentrations and the associated probable routes of human exposure
- Completeness of each exposure pathway (presence of source, mechanism of contaminant release, environmental transport medium, point of human contact with the source or medium, and route of human exposure at that point)

D.1 PRIMARY CONTAMINANTS AND CONTAMINANT SOURCES

Radium, thorium, and uranium are the primary radioactive contaminants at the St. Louis sites. Nonradioactive contaminants detected at elevated levels include metals (antimony, arsenic, beryllium, lead, nickel, thallium) at SLDS, SLAPS, HISS, Futura, and the ball field area and polyaromatic hydrocarbons (PAHs) at SLDS.

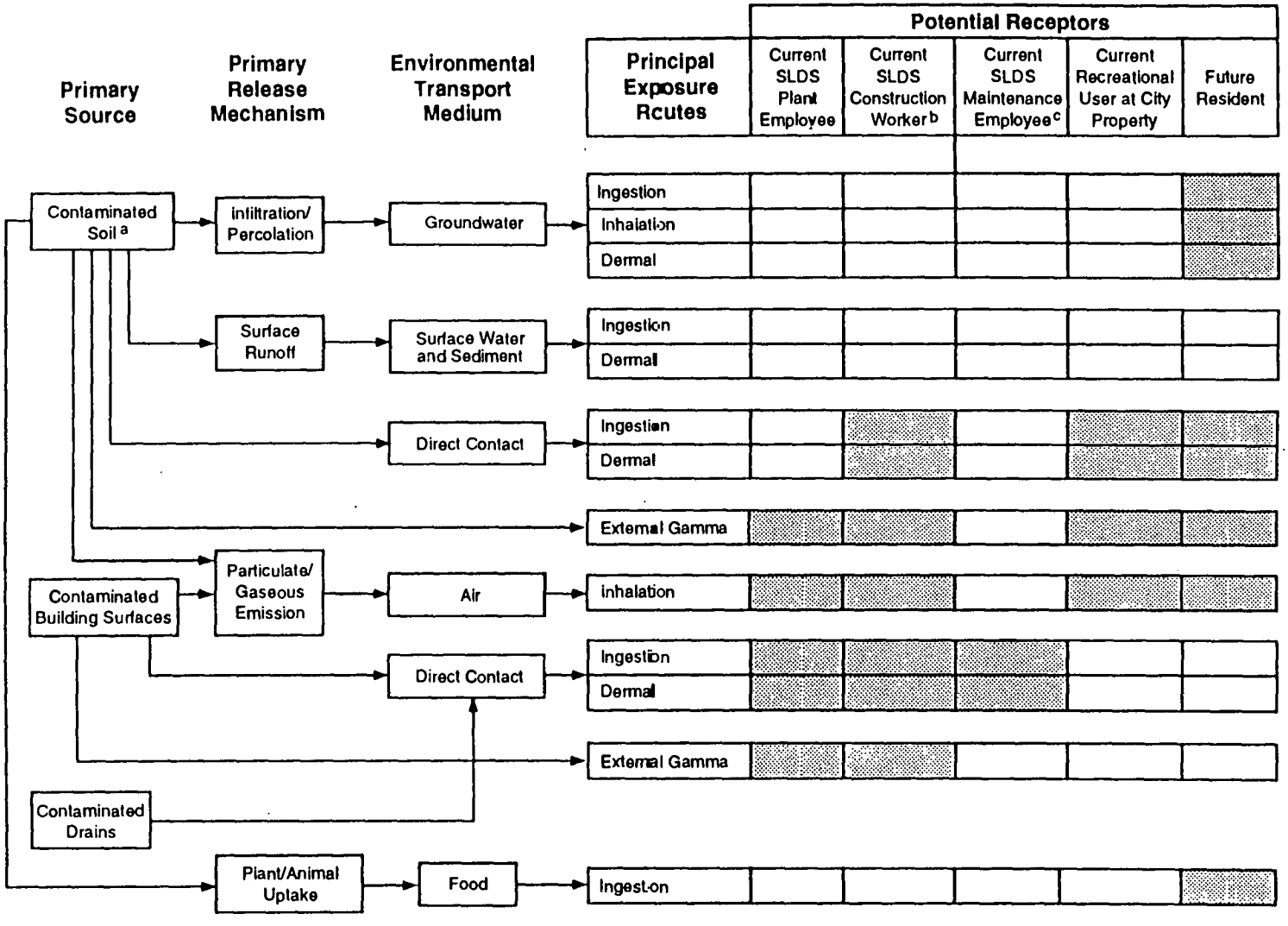
The primary source of contamination at both downtown and airport area properties is surface and subsurface soil. At SLDS, the highest levels of radioactive contamination were detected in the Plant 1 and Plant 2 areas. Although some building surfaces and manholes/drains also exhibited levels of radioactivity above guidelines, contamination on building surfaces at SLDS is primarily fixed, with the higher levels detected in buildings used mainly for storage, and the majority of manholes are not currently in operation. In the airport area, soil at SLAPS and in the storage piles at HISS is a potential source of exposure, but the piles are covered and monitored. Soil contamination at haul roads vicinity properties is found primarily along the roads at the edges of the properties.

D.2 POTENTIAL CONTAMINANT RELEASE AND TRANSPORT PATHWAYS

Potential release mechanisms and potentially impacted environmental media at the St. Louis sites include

- External gamma irradiation from radioactively contaminated surfaces (soil, building surfaces, drains, manholes)
- Radon gas generation from radium-contaminated soil, groundwater, and building surfaces
- Wind dispersal of building contaminants and fugitive dust (particulates) from contaminated soil
- Surface deposition of airborne particulates
- Surface runoff over contaminated soil and transport to other onsite soil and drainage areas (e.g., Coldwater Creek)
- Leaching from contaminated surface and subsurface soil to groundwater
- Transport from contaminated groundwater to surface water and sediment (e.g., Coldwater Creek)
- Uptake of soil contaminants by biota

Under current conditions, the primary sources of contamination at SLDS either are located beneath substantial cover (e.g., buildings, concrete, or asphalt) or are inaccessible (e.g., contaminated drains), and potential receptors are limited to workers within plant buildings. In areas where there is no soil cover (or

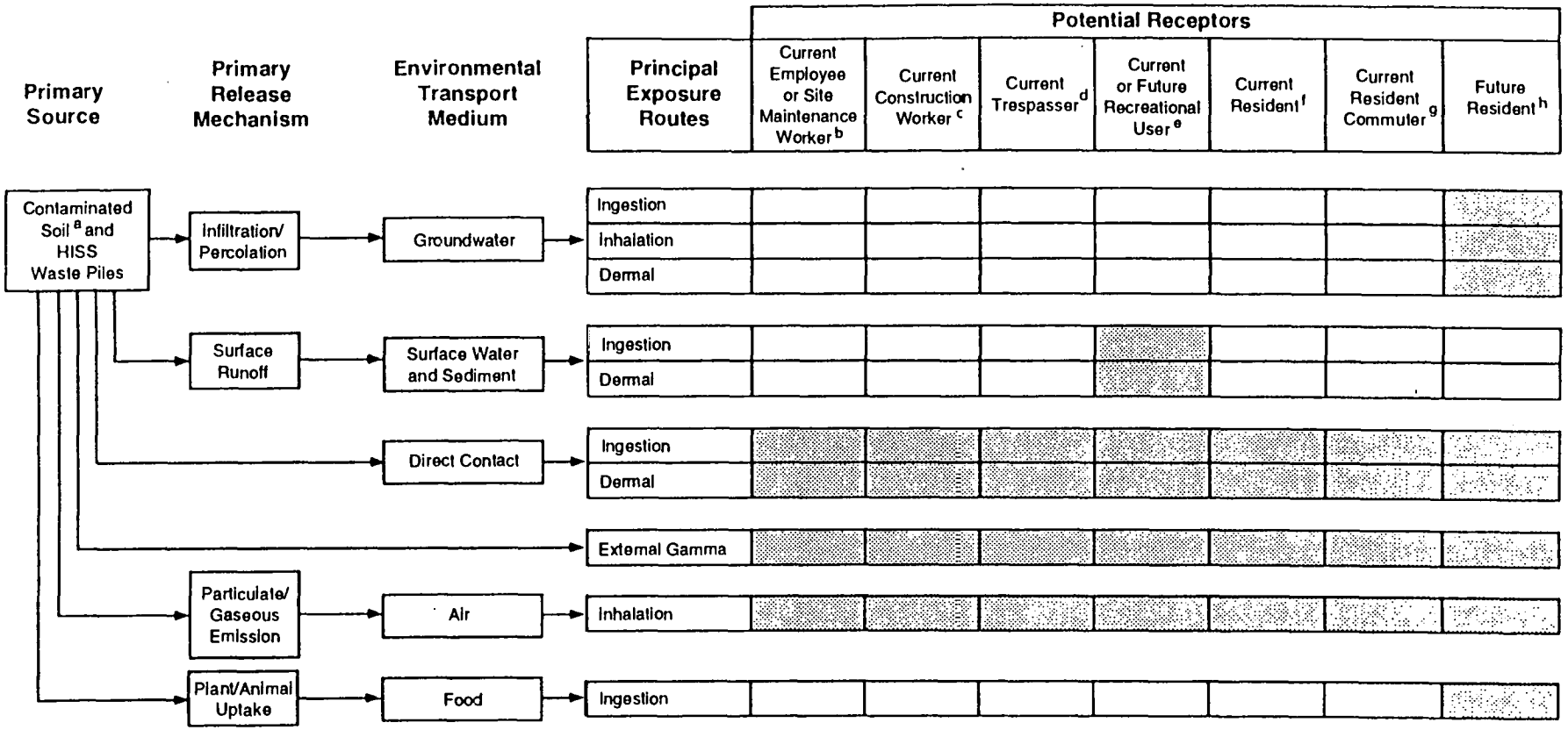


[a] Contaminated soil at the SLDS is currently covered by buildings, concrete, or asphalt, which prevents exposure via direct contact or surface runoff.
[b] Exposure of the SLDS construction worker assumes that concrete and asphalt has been removed.
[c] Represents worker conducting infrequent drain maintenance; only exposure to drain sediment is considered.

Potentially complete exposure pathway

Source: ANL 1993

Figure D.1 Conceptual Site Model for SLDS and Vicinity Properties (Downtown Area)



[a] Includes soil along the banks of Coldwater Creek.
[b] Employee at Futura or commercial/industrial/municipal vicinity property; maintenance worker at SLAPS or HISS.
[c] Construction worker doing excavation activities at the ditches or other vicinity properties.
[d] Trespasser at SLAPS or HISS.
[e] Current recreational user of ballfield area and current or future recreational user of Coldwater Creek.
[f] Receptor in dwelling at residential vicinity property.
[g] Receptor near area of contamination at residential vicinity property.
[h] A resident at all properties except Coldwater Creek.

Potentially complete exposure pathway

Source: ANL 1993

Figure D.2 Conceptual Site Model for SLAPS/HISS and Vicinity Properties (Airport Area)

if the cover is removed in the future), contaminants may be released to air as particulates or as gaseous emissions (e.g., radon gas). Contaminants on building surfaces may also be released to air.

Contaminants in soils could be transported to groundwater via surface water infiltration, although this pathway is currently limited by the inability of surface water to penetrate the soil cover. Contaminant release via surface runoff and erosion is also possible in areas with no soil cover. Contaminant migration could also occur via groundwater or surface water transport and atmospheric dispersion. Direct contact of receptors with exposed contaminants and exposure to external gamma radiation could also occur. Similar contaminant release mechanisms and transport routes are applicable at SLAPS, HISS, and vicinity properties, where current contaminant migration may be more likely because the soils are not covered with concrete or asphalt.

In summary, the most important release mechanisms and transport pathways under current conditions are

- External gamma radiation from contaminated soil and structural surfaces
- Radon gas generation from radium-contaminated soil and structural surfaces
- Wind dispersal of particulates from contaminated soil

Leaching of soil contaminants to groundwater and biouptake by plants are not currently viable pathways but could become factors in future scenarios.

D.3 POTENTIAL RECEPTORS AND EXPOSURE ROUTES

The baseline risk assesment assesses potential impacts to human health and the environment that could result from exposure to site contaminants under current and hypothetical future conditions if no cleanup action were taken. Potentially completed exposure pathways (Figures D.1 and D.2) for current and future land use scenarios were assessed in the baseline risk assessment (ANL 1993) on the basis of

- a source of contamination and a release from that source
- an exposure point at which contact could occur
- an exposure route by which the contact could occur

Reasonable maximum exposure and carcinogenic and non-carcinogenic risk were estimated and compared with EPA's target carcinogenic risk range and hazard index. EPA's acceptable exposure levels for carcinogenic risk are generally those that represent an excess upper bound lifetime individual cancer risk of 10^{-6} to 10^{-4} using information on the relationship between dose and response. The EPA hazard index (HI) is a measure of the potential for adverse noncarcinogenic health effects from exposure to site-related chemicals; HI > 1.0 indicates levels of potential concern for adverse health effects.

D.3.1 Receptors, Routes of Exposure, and Risk Estimates for Current Site Use Scenario

The receptors identified for current site use include an employee, a construction worker, and a maintenance worker at SLDS and the SLDS vicinity properties; a recreational user at the city property adjacent to SLDS; a trespasser and a maintenance worker at SLAPS; a construction worker at the ditches adjacent to SLAPS; a recreational user at the ball field; a child commuter and a resident at the residential vicinity properties; a recreational user at Coldwater Creek; an employee at the Futura Coatings property and all commercial/municipal/transportational vicinity properties; and a trespasser and a maintenance worker at HISS.

Exposure pathways assessed for current scenarios were external gamma irradiation, incidental soil ingestion, inhalation of particulates, and inhalation of radon-222 and its decay products. For current plant employees at SLDS, only potential external gamma and radon inhalation exposures were assessed because

SLDS is almost completely covered with buildings and pavement. Ingestion and inhalation of particulates were assessed for the SLDS construction worker because of potential exposure during excavation or renovation activities. No current scenarios included contaminated groundwater as a source because the aquifer is not known to be used for any domestic purpose in the vicinity of the St. Louis sites (ANL 1993).

The radiological risk estimates for the SLDS construction worker, the SLAPS/HISS maintenance worker, the ditch construction worker, the HISS trespasser, and the Futura Coatings employee exceeded the EPA target risk range of 10^{-6} to 10^{-4} (Figure D.3). Where evaluated, the carcinogenic risk from radon and its decay products was a major portion of the overall risk from radionuclides. The radiological risks (including the radon pathway) estimated for current site use by other potential receptors were within the EPA risk criteria, and total chemical carcinogenic risk for the combined pathways was in the EPA target range for all current receptors. Potential noncarcinogenic risks evaluated under all current risk scenarios were determined to be acceptable (HI < 1.0) except for the SLAPS/HISS maintenance worker (HI = 3.2) (ANL 1993).

D.3.2 Receptors, Routes of Exposure, and Risk Estimates for Future Use Scenario

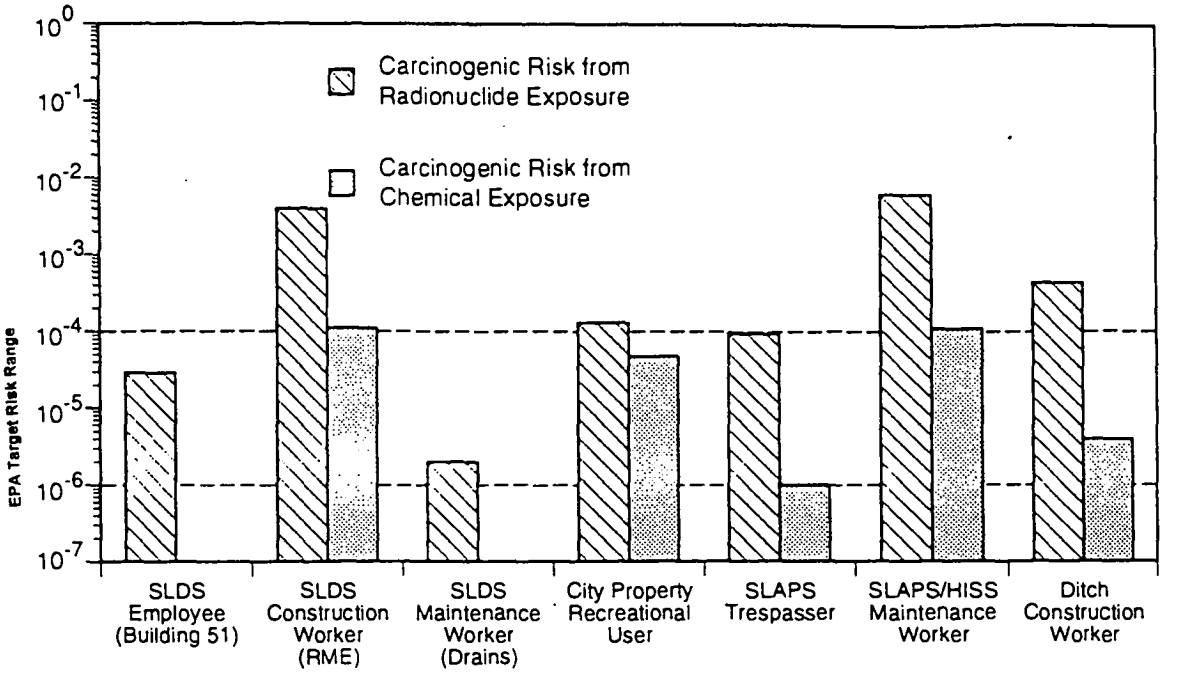
In addition to the pathways assessed for current receptors, potential risk from ingestion and inhalation of contaminants in groundwater (although unlikely) was also assessed for future residents. A future residential scenario at SLDS is considered unlikely because the site has been used for industrial purposes for more than 100 years. Carcinogenic risk from chemical exposure was not quantified for the SLDS employee and SLDS maintenance worker because chemical exposure is not a pathway of concern for these receptors.

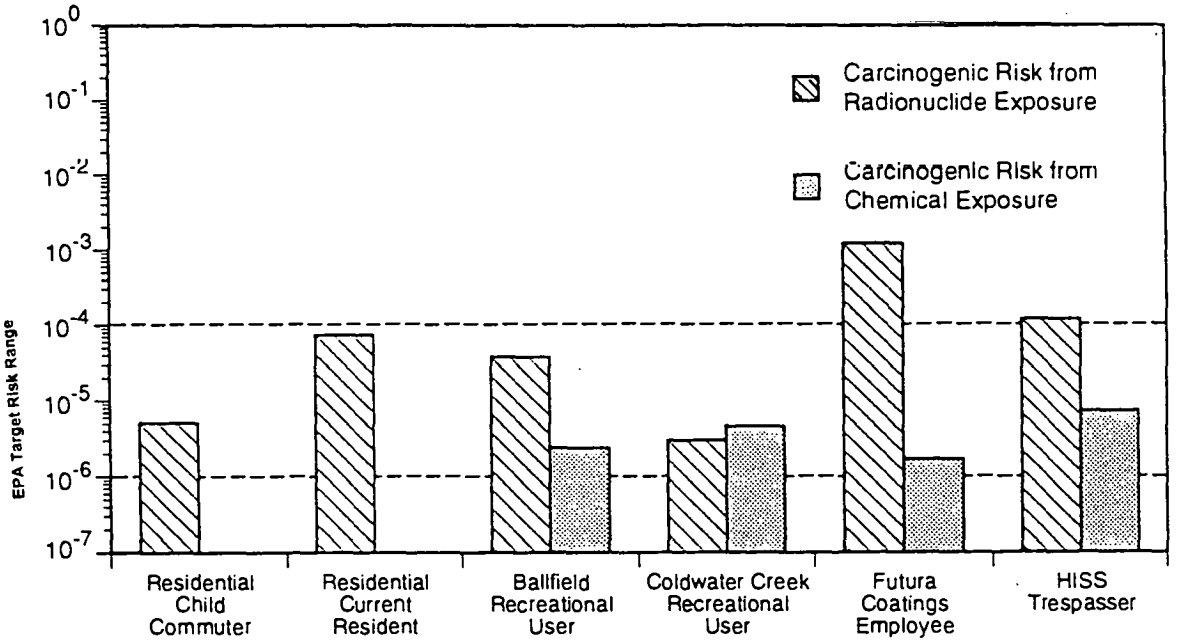
Future risk scenarios were evaluated for onsite residents at all sites except Coldwater Creek, where a recreational user was assumed. The estimated carcinogenic risk levels for all sites exceeded the EPA target range of 10^{-6} to 10^{-4}. The future resident at the HISS property is estimated to incur the highest risk from exposure to radionuclides, primarily due to radionuclide levels in the two storage piles. Inhalation of radon and its decay products was a major contributor to the total risk from radionuclide exposure for the hypothetical future resident at all properties. External gamma irradiation was the highest contributor among the nonradon sources.

The future resident at the SLDS property would incur the highest chemical carcinogenic risk, primarily from ingestion of PAHs present in soil and arsenic present in groundwater. The chemical carcinogenic risk for future residents at SLAPS would result primarily from ingestion of groundwater containing arsenic and beryllium, and risks for future residents at the ball field and the Futura Coatings property would result primarily from incidental ingestion of soil containing arsenic. At HISS, the chemical carcinogenic risk is equally attributable to ingestion of arsenic in soil and ingestion of carcinogens including arsenic and beryllium in groundwater (Figure D.4) (ANL 1993).

The calculated HI for future residents at all sites exceeded the target value of 1.0. The future resident at SLAPS is estimated to incur the highest noncarcinogenic chemical risk (HI = 330). Future residents at SLDS (HI = 85), the ball fields (HI = 5.9), Futura Coatings (HI = 2.7), and HISS (HI = 130) are also estimated to incur noncarcinogenic chemical risks. The HI > 1.0 at SLDS is related primarily to ingestion of groundwater containing thallium and arsenic; at SLAPS, the highest contributor is ingestion of groundwater containing thallium and selenium.

The results of the human health risk assessment for the St. Louis sites indicated that the highest potential health impacts result from hypothetical future exposures at HISS (Figure D.4) (ANL 1993). Estimated risks from exposure to radioactive contaminants were higher for site workers than for other hypothetical receptors. Under current site conditions and uses, the highest risks were associated with the SLAPS/HISS maintenance worker, the SLDS construction worker, the ditch construction worker, and the Futura Coatings employee; the estimated risks to these workers from exposure to radionuclides onsite exceed the

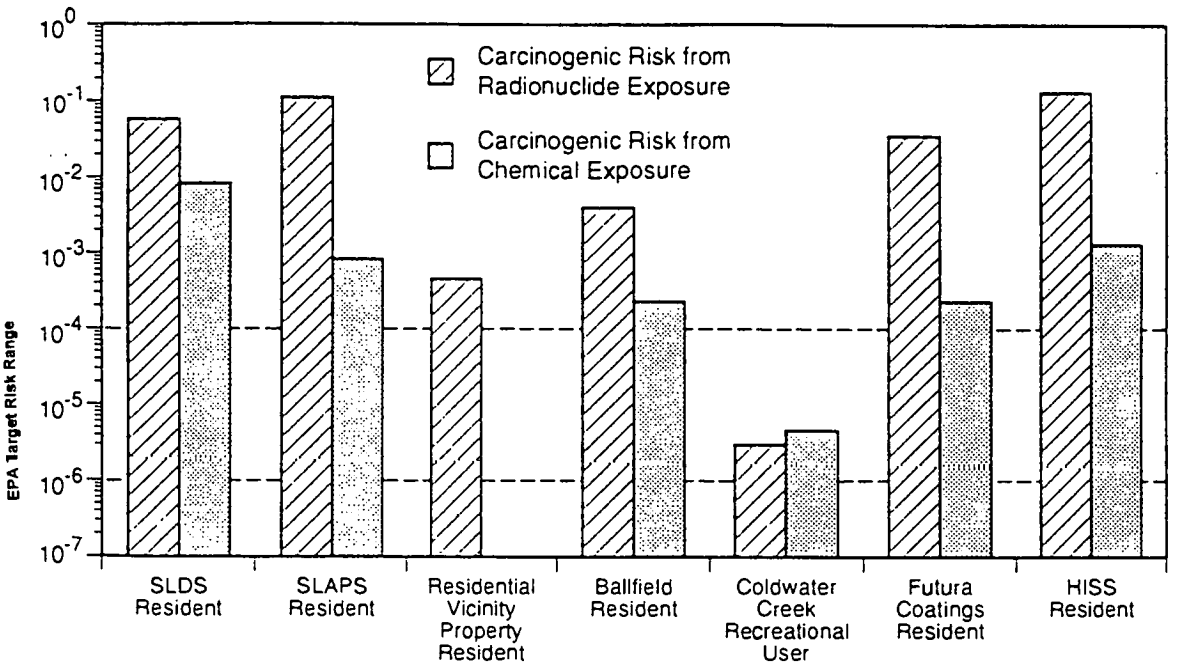




Source: ANL 1993

RME = Reasonable maximal exposure

Figure D.3 Total Carcinogenic Risks for Current Receptors



Source: ANL 1993

Figure D.4 Total Carcinogenic Risks for Future Receptors

upper end of the EPA target carcinogenic risk range. The estimated chemical risk to the SLAPS/HISS maintenance worker also slightly exceeded the target risk range, although the actual risk would be significantly reduced by standard work protection measures mandated by health and safety requirements and other precautionary measures observed by site maintenance workers. The potential exposure of nearby offsite receptors should be minimal because the site is fenced and monitored by DOE.

D.3.3 Results of Supplemental Human Health Risk Assessment

A supplemental risk assessment was conducted to evaluate the risk associated with specific portions of Coldwater Creek in the airport area (SAIC 1993a). Potential receptors for this pathway included recreational users of the creek and community members periodically involved in cleanup of the creek. Neither ingestion of fish nor swimming were considered activities for the recreational user since very few fish populate the creek and swimming is unlikely because of its low water levels and poor water quality. The estimated exposure for recreational use and community cleanup were estimated and exposure points were evaluated for each of the four stream segments on Coldwater Creek. A "hot spot" analysis was conducted on the assumption that the maximum exposure would occur in the area where sediment contaminants are most concentrated. The estimated cancer risk for combined recreational and cleanup exposure to sediments in this area was significantly lower than the annual background risk due to exposure and doses from terrestrial sources and cosmic radiation.

The human health risks associated with incidental sediment ingestion and inhalation of particulates were evaluated for remediation workers during dredging activities at Coldwater Creek. The total estimated dose received by workers was significantly less than the occupational exposure limit for radiation workers and was within the target range specified by EPA as acceptable risk for the general public.

The human health risks associated with beneficial reuse of soils as fill material beneath an airport runway were also evaluated (SAIC 1993b). The runway design consisted of the FUSRAP soil pile beneath a soil and concrete cover. The runway was conservatively treated as an infinite plane source with an air gap above two to three shielding layers. Dose rates were calculated for SLAPS and HISS area soils beneath the runway. For SLAPS and HISS/Futura soils (the two source term scenarios run), dose rates were substantially lower than background both above the runway and at the apron. For both SLAPS and HISS/Futura soils, incremental lifetime cancer risks calculated for four distinct subpopulations of receptors (airliner passenger and crew, landscape worker, emergency response personnel, and a hypothetical maximally exposed individual) were significantly less than the risk associated with background levels (SAIC 1993b).

D.4 ECOLOGICAL RISK ASSESSMENT

Because the majority of property constituting the St. Louis sites is located in industrial areas, species found onsite are probably affected by both site-related contamination and contaminants from other sources. Although there are no known threatened or endangered species or critical habitats at these sites, some wildlife habitats do exist. Aquatic habitats potentially affected include Coldwater Creek and its drainages. Coldwater Creek is polluted by runoff both upstream and downstream of SLAPS and HISS.

Based on current land use, impacts to the environment from site contaminants are expected to be similar to those typically encountered at industrial sites. Several metals detected in site soils were found at concentrations reported to adversely affect wildlife under laboratory and field experimental conditions. Although the mobility of species that inhabit the St. Louis sites, in conjunction with the presence of similar nonradioactive contaminants throughout the urban/industrial area, renders a quantitative assessment of environmental impacts of site contaminants to wildlife impracticable, a qualitative assessment of environmental impacts is included in the draft baseline risk assessment prepared for these sites (ANL 1993). Potential adverse impacts to wildlife would be expected to occur only at the level of the individual; impacts of ecological significance (those that occur at the population or community level) are not anticipated.

Due to urban environment, the downtown and airport areas have limited habitat and biotic diversity. The ecological risk assessment compared contaminant concentrations detected in soil, sediment, and water at the St. Louis sites with literature on toxicity of contaminants to biota (ANL 1993). Based on this study, only arsenic, thallium, and PAHs are present at concentrations that could adversely impact biota. Ecological effects are not expected to be a significant concern, particularly since the habitats and biota at these sites are not unique, the biota are not essential for continued propagation of key species, and they are not highly valued economically, recreationally, or aesthetically (ANL 1993).

APPENDIX E

PROJECT CONTROLS

APPENDIX E: PROJECT CONTROLS

Project controls are implemented to provide detailed planning for cost, schedule, and technical performance to maximize efforts toward achievement of project goals. Project controls are implemented for FUSRAP as a whole because there are 46 sites in 14 states for which costs and schedules must be tracked and controlled. Bechtel National, Inc. (BNI) has established and DOE has validated a system that conforms to the criteria for cost and schedule control systems developed by the U.S. Department of Defense. This system provides a basis for assessing the quality of the cost and schedule controls used by the project participants; aids in ensuring effective planning, management, and control of project work; and provides a quick and effective means of measuring cost, schedule, and technical performance. This cost and schedule control system uses a work breakdown structure (WBS) to divide FUSRAP into distinct sites and then into discrete work packages that can be effectively managed. The WBS also provides the framework for integrating budget requirements with schedule and technical performance. Finally, it establishes the management analysis and reporting structure to permit data presentation to various levels of management.

The FUSRAP Project Controls department provides cost and schedule support, including budgeting, monitoring, variance analysis, and trend analysis. A Project Document Control Center (PDCC) is maintained in the BNI office in Oak Ridge, Tennessee, to collect, register, distribute, and retain all project documents. Each document related to the St. Louis site is coded with a unique WBS number to associate the document with a particular St. Louis property. Subject codes are also assigned from predetermined categories that can be used to organize the documents. The PDCC system provides for rapid identification and retrieval of all project documents by allowing documents to be searched/sorted by WBS number, subject code, author, recipient, transmittal date, a unique identification number, or any combination of the above.

All relevant information obtained during the RI/FS-EIS process for the St. Louis sites is retained by PDCC: aerial photographs, topographic maps, reports on features of the site and surrounding area, correspondence involving the site, findings of previous surveys, and analytical data obtained during site characterization. Types of characterization data on file include radiological and chemical data based on analyses of soil, groundwater, and surface water; borehole logging data; air sampling data; and information about geological and soil properties. Well construction data and field notebooks and documentation (e.g., chain-of-custody forms) are also on file in PDCC.

APPENDIX F

SUMMARY OF REMEDY SELECTION PROCESS

APPENDIX F: SUMMARY OF REMEDY SELECTION PROCESS

DOE is conducting an RI/FS-EIS for the St. Louis sites as part of the CERCLA/NEPA process. Based on information from the remedial investigation and baseline risk assessment, remedial action alternatives were developed and evaluated during the feasibility study. A draft proposed plan, presenting a preferred remedy based on comparative analysis of sitewide alternatives in the feasibility study, was issued for regulatory agency and public review in 1994. The remedy presented in the draft proposed plan encountered opposition from the community, and DOE is currently working with the St. Louis Site Remediation Task Force to achieve consensus on a final remedy that is protective, cost-effective, and acceptable to the community. After resolution of issues and final review by regulatory agencies and the public, a record of decision documenting the selected remedy for this group of sites will be issued. Signing of the record of decision is expected in 1998. A summary of the remedy selection process for the St. Louis sites is provided in Figure F.1.

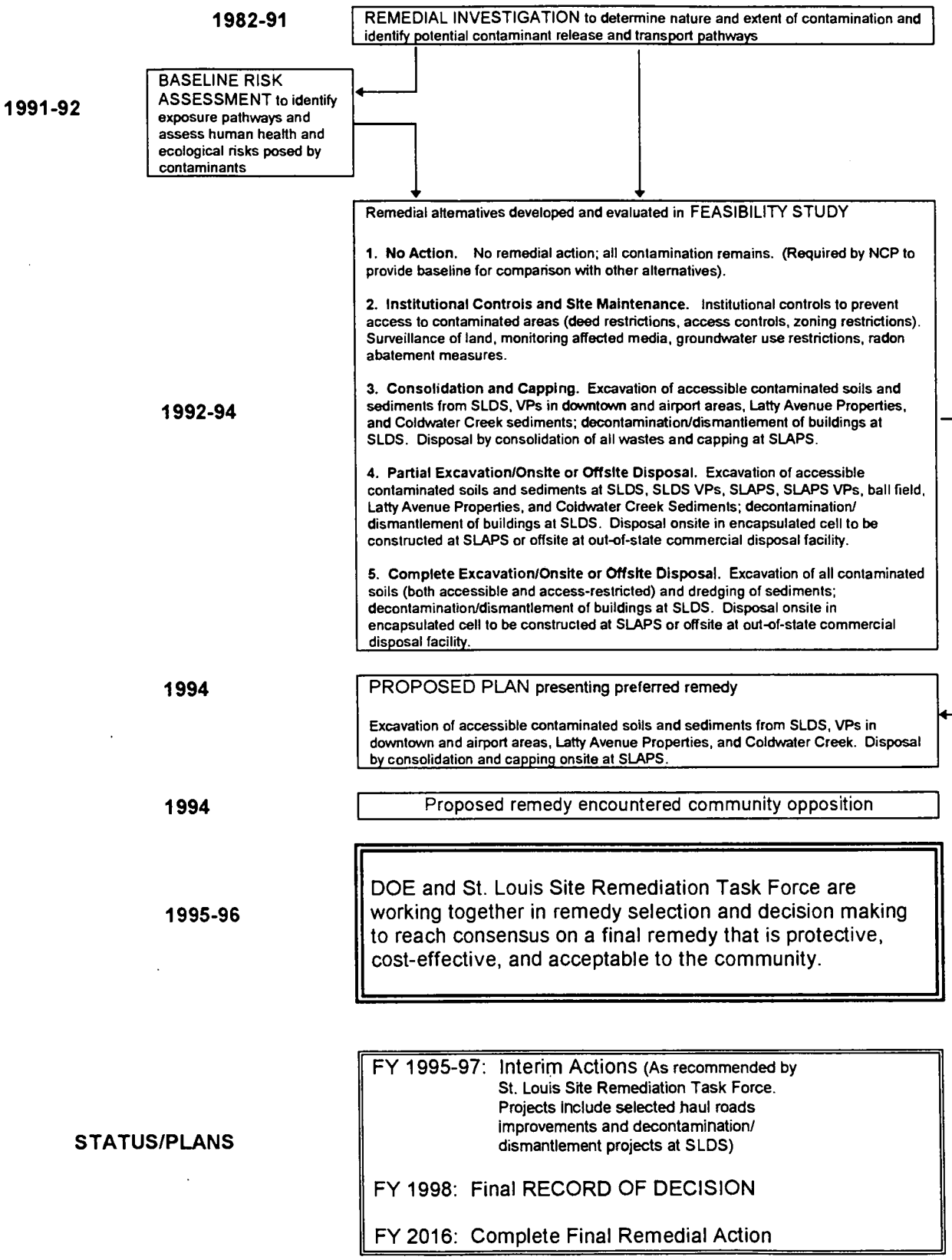


Figure F.1 Summary of Remedy Selection Process

APPENDIX G

REGULATORY DRIVERS/ARARS

Table G.1 Regulatory Drivers/ARARs

Statute, Regulation, or Requirement	Citation	Description	Applicability or Relevance and Appropriateness to St. Louis Site Remediation							
			Applicable	Relevant/ Appropriate	TBC	Under Sitewide Alternatives (see Sect. 5)				
						1	2	3	4	5
Atomic Energy Act of 1954 (9/92, Rev. 6)	42 U.S.C. 2011-2394	Drives DOE Orders & NRC regulations	x				x	x	x	x
CERCLA	42 U.S.C. 9601 et seq.	Principal statutory authority for conducting response actions at FUSRAP sites	x			x	x	x	x	x
	Sect. 121	Mandates that responses comply with substantive requirements of other environmental laws								
NCP	40 CFR 300	EPA regulations directing cleanup activities under CERCLA								
National Environmental Policy Act (NEPA)	40 CFR 1500-1508	Basic national charter for protection of the environment; establishes environmental policies for federal agencies, sets goals, and provides means to carry out policies	x			x	x	x	x	x
	10 CFR 1021	Revision of NEPA guidance manual for DOE compliance with NEPA and related environmental statutes; allows categorical exclusions from certain NEPA requirements for remedial actions conducted at DOE facilities								
Clean Air Act (8/91, Rev. 4) (Primary federal statute regulating air emissions)										
	40 CFR 61 Subpart H (includes NESHAPs)	Regulates emission of radionuclides other than radon from DOE facilities		x				x	x	x
	40 CFR 61 Subpart Q	Effluent limitations for radon emissions from DOE facilities	x				x	x	x	x
	40 CFR 61 Subpart T	Effluent limitations for radon emissions from inactive uranium mill tailings disposal sites		x			x	x	x	x
	40 CFR 61 Subpart M	Standards for removal, demolition, & renovation of asbestos-containing structures (applicable only if asbestos is present in buildings to be decontaminated/demolished)	x					x	x	x
Clean Water Act (Establishes basic framework for federal water pollution control regulations)										
NPDES (1/93, Rev. 6)	40 CFR 122-125	Requires obtaining permits for discharge of pollutants from any point source into U.S. waters. Effluent limitations must protect beneficial uses of water. Permit not required for alternatives 2, 3, 4, 5 but substantive requirements apply.	x				x	x	x	x
Water Quality Standards Regulation (1/93, Rev. 6)	40 CFR 131	Chemical-specific criteria for toxic pollutants for states not fully compliant with CWA provisions; applicable to onsite activities for alternatives 2, 3, 4, 5 because MO is not in full compliance.	x				x	x	x	x
Discharge of Radioactive Pollutants to Surface Waters (3/92, Rev. 4)	40 CFR 440.32(b)	Liquid effluent limitations for discharge of Ra-226 and uranium		x			x	x	x	x
	40 CFR 440.34(b)	Prohibits discharge of process waste water to navigable waters		x			x	x	x	x

Table G.1 (continued)

Statute, Regulation, or Requirement	Citation	Description	Applicability or Relevance and Appropriateness to St. Louis Site Remediation							
			Applicable	Relevant/ Appropriate	TBC	Under Sitewide Alternatives (see Sect. 5)				
						1	2	3	4	5
Resource Conservation and Recovery Act (RCRA) (3/92, Rev. 11) (Principal federal statute governing management of hazardous and radioactive mixed wastes)										
	40 CFR 260, Appendix I	Determines definitions of a waste as solid waste (Appendix I Fig. 1 Flow Chart) and/or as hazardous waste as defined in 40 CFR 261, Subparts C & D; St. Louis wastes defined as solid wastes but not hazardous wastes (by-product exemption)	x				x	x	x	x
Criteria for Municipal Solid Waste Landfills	40 CFR 258, Subpart A	Describes purpose, scope, and applicability of criteria		x				x	x	x
	40 CFR 258, Subpart B	Describes location restrictions		x				x	x	x
	40 CFR 258, Subpart C	Describes operating criteria		x				x	x	x
	40 CFR 258, Subpart D	Describes design criteria		x				x	x	x
	40 CFR 258, Subpart E	Describes groundwater monitoring and corrective action		x				x	x	x
	40 CFR 258, Subpart F	Describes closure and postclosure requirements		x				x	x	x
Executive Orders										
Protection and Enhancement of Environmental Quality	Executive Order 11514 (3/5/70)	Requirements for monitoring; sharing information with public, other states & agencies; & compliance with CEQ regulations (in accordance with mandate of NEPA)			x		x	x	x	x
Floodplain Management/Wetlands Protection	Executive Order 11988	Requires federal agencies to evaluate potential effects of actions in floodplains to avoid adverse impacts of direct or indirect development of floodplain; applicable to extent that disposal site involves development in floodplains	x					x	x	x
	Executive Order 11990	Requires federal agencies to evaluate potential effects of actions on wetlands & to avoid actions with negative impacts on wetlands; applicable if remedial action involves dredging in riparian areas determined to be jurisdictional wetlands	x					x	x	x
	40 CFR 6.302(a) and (b), Appendix A	Procedures for floodplain management & wetlands protection; applicable to extent that remedial action involves excavation or disposal facility development in floodplain or wetlands	x					x	x	x
DOE Compliance with Floodplain/Wetland Review Requirements	10 CFR 1022	Implements Executive Orders 11988 & 11990; applicable to extent that remedial action involves excavation in floodplain or wetlands	x					x	x	x
Dredge or Fill Requirements	40 CFR 230-231	Requires permits for discharge of dredged or fill material into US waters including wetlands; applicable if remedial action involves dredging in riparian areas determined to be jurisdictional wetlands	x					x	x	x
	33 CFR 320-330	General regulatory policies on permitting; applicability as for 40 CFR 230-231 requirements	x					x	x	x

Table G.1 (Continued)

Statute, Regulation, or Requirement	Citation	Description	Applicability or Relevance and Appropriateness to St. Louis Site Remediation							
			Applicable	Relevant/ Appropriate	TBC	Under Sitewide Alternatives (see Sect. 5)				
						1	2	3	4	5
Fish and Wildlife Coordination Act (9/92)	16 USC 661-668ee; 40 CFR 6.302 (g)	Requires consultation when federal agencies propose stream modification, with adequate provision for protection of fish & wildlife resources; applicable if remedial action involves stream modification	x					x	x	x
Governor's Executive Order, Floodplains	Order 82-19	Requires evaluation of potential effects of actions in floodplains to avoid adverse impacts; applicable to extent that disposal site involves development in floodplains	x					x	x	x
DOE Orders										
Radiation Protection of the Public and the Environment	DOE Order 5400.5	General - Requirements for protection of public from radiation exposures			x		x	x	x	x
Radiation Protection for Occupational Workers	DOE Order 5480.11	General - Requirements for protection from radiation exposures in a confined area	x				x	x	x	x
Safety Requirements for Packaging and Transportation of Hazardous Materials, Substances, and Wastes	DOE Order 5480.3	Requirements for labeling and packaging			x			x	x	x
Environmental Protection, Safety, and Health Protection Standards	DOE Order 5480.4	Other applicable regulations, standards, requirements, and guidance			x		x	x	x	x
DOE Laboratory Accreditation Program for Personnel Dosimetry	DOE Order 5480.15	Criteria for radiation dosimetry programs			x		x	x	x	x
Radioactive Waste Management	DOE Order 5820.2A	Establishes criteria for required radwaste activities associated with a DOE operation, including waste minimization & stabilization			x		x	x	x	x
	Chapter IV	Criteria (40 CFR 192) for waste (uranium tailings) disposal			x			x	x	x
	Chapter V	Criteria for decommissioning of radioactively contaminated facilities			x			x	x	x
	Chapter VI	Requirements for waste management plan for DOE operations			x		x	x	x	x
DOE Guidelines for Residual Radioactivity at FUSRAP Sites (3/87, Rev. 2)	PDCC, BNI, Oak Ridge, TN, E-03195	Criteria for residual radioactive material in soil and other media			x			x	x	x
Uranium Mill Tailings Radiation Control Act (UMTRCA) (10/92)										
Cleanup of Radioactively Contaminated Land and Contaminated Buildings	40 CFR 192.12(a), 192.32(b)(2), 192.41	Concentration limitations for Ra-226 in soil averaged over specified land area and depths; relevant & appropriate based on NCP evaluation factors (purpose, substance, action/activity, & type of place) [see SAIC 1994 Appendix A]		x				x	x	x
	40 CFR 192.12(b)(1)	Specifies limitations for annual average radon decay product concentrations in occupied or habitable buildings; relevant & appropriate based on NCP evaluation factors		x				x	x	x
	40 CFR 192.12(b)(2)	Specifies limitations for gamma radiation in occupied or habitable buildings; relevant & appropriate based on NCP evaluation factors		x				x	x	x

Table G.1 (continued)

Statute, Regulation, or Requirement	Citation	Description	Applicability or Relevance and Appropriateness to St. Louis Site Remediation							
			Applicable	Relevant/ Appropriate	TBC	Under Sitewide Alternatives (see Sect. 5)				
						1	2	3	4	5
	40 CFR 192.20-192.22	Defines supplemental standards for difficult-to-access contaminated soils left in place based on no significant current risk and control of future exposures by institutional controls; relevant & appropriate based on NCP evaluation factors		x				x	x	x
Standards for Management of Uranium and Thorium By-product Materials;	40 CFR 192.02(a), 192.32(b)(1)(i), 192.41	Design criteria for disposal areas (effective for at least 200 years and up to 1000 years if reasonably achievable); relevant & appropriate based on NCP evaluation factors		x				x	x	x
	40 CFR 192.02(b), 192.32(b)(1)(ii), 192.41	Design criteria for disposal areas specifying limitations on rates of release of Rn-222 from residual radioactive material to the atmosphere; relevant & appropriate based on NCP evaluation factors		x				x	x	x
Closure of Uranium and Thorium Mill Tailings Sites	40 CFR 192.32(b)	Requires compliance of disposal areas with closure performance standards in 40 CFR 261.111 for nonradiological hazards; relevant & appropriate based on NCP evaluation factors		x				x	x	x
Nuclear Regulatory Commission (NRC) Regulations (1991)										
	10 CFR 20 Subpart 20.311	Requires transfer of radioactive waste intended for land disposal in accordance with established requirements, with proper manifests and waste transfer documentation; applicable only to commercial disposal	x						x	x
	10 CFR 30	Rules generally applicable to domestic licensing of by-product material; applicable only to commercial disposal	x						x	x
	10 CFR 30.41	Licensing verification requirements for waste transfers; applicable only to commercial disposal	x						x	x
	10 CFR 40, Appendix A	Siting criteria for disposal of FUSRAP waste at non-DOE facilities; applicable to commercial disposal	x						x	x
Licensing Requirements for Land Disposal of Radioactive Waste	10 CFR 61 Subpart A	General provisions; applicable to commercial disposal	x						x	x
	10 CFR 61 Subpart B	Licenses; applicable to commercial disposal	x						x	x
	10 CFR 61 Subpart C	Performance objectives; applicable to commercial disposal	x						x	x
	10 CFR 61 Subpart D	Technical requirements for land disposal facilities; applicable to commercial disposal	x						x	x
	10 CFR 61 Subpart E	Financial assurances; applicable to commercial disposal	x						x	x
	10 CFR 61 Subpart F	Participation by state government and Indian tribes; applicable to commercial disposal	x						x	x
	10 CFR 61 Subpart G	Records, reports, tests, & inspections; applicable to commercial disposal	x						x	x
State of Missouri										
Missouri Water Well Construction Standards	MO Code Regs., Title 10, Sect. 23, Ch. 1-3	Water & monitoring well requirements, including construction standards; substantive portions applicable consistent with DOE Orders	x				x	x	x	x
Missouri Clean Water Law (1991)	MO Rev. Stat. Parts 644.006-644.141	Requires construction/operating permits to build/operate/maintain any water contaminant or point source; substantive requirements applicable consistent with DOE Orders	x				x	x	x	x

Table G.1 (Continued)

Statute, Regulation, or Requirement	Citation	Description	Applicability or Relevance and Appropriateness to St. Louis Site Remediation							
			Applicable	Relevant/ Appropriate	TBC	Under Sitewide Alternatives (see Sect. 5)				
						1	2	3	4	5
Missouri Water Pollution Control Regulations (1992, as amended)	MO Code Regs., Title 10, Div. 20, Ch. 1-6	Requires compliance with permitting procedures and exemptions outlined in Missouri Clean Water Law; substantive requirements applicable consistent with DOE Orders to offsite discharge to Coldwater Creek or Mississippi River	x				x	x	x	x
Missouri Drinking Water Act (1991)	MO Rev. Stat. Parts 640.100-640.140	Requires compliance with established rules for safe quality of water dispensed to public; substantive requirements applicable consistent with DOE Orders if drinking water supplies are affected	x				x	x	x	x
Missouri Water Quality Standards (1992, as amended)	MO Code Regs., Title 10, Part 10-7.031	Sets water quality criteria necessary to protect designated beneficial uses; substantive requirements applicable consistent with DOE Orders	x				x	x	x	x
Missouri Effluent Limitations Standards (1992, as amended)	MO Code Regs., Title 10, Part 20-7 015	Sets limitations on quantities of pollutants discharged into the 7 categories of state waters; substantive requirements applicable to remedial actions involving discharge to surface waters consistent with DOE Orders	x				x	x	x	x
Missouri County Options Dumping Grounds Law (1991)	MO Rev. Stat., 1959, Cumulative Supplement 1967, Ch. 64	Licenses & regulates garbage & refuse disposal areas; substantive requirements applicable consistent with DOE Orders to onsite & instate disposal of garbage & refuse	x				x	x	x	x
Missouri Solid Waste Law (1991)	MO Rev. Stat., Parts 260.200-260.247	Requires permit to operate solid waste processing facility or disposal area; specifies size/weight limitations for trucks transporting solid waste; requires site closure plan with permit application		x			x	x	x	x
Missouri Hazardous Substance Rules (1991)	MO Rev. Stat., Title 16, Parts 260.350-260.430	Requires notification for all hazardous substance emergencies; not expected to be necessary	x				x	x	x	x

Sources: BNI 1993a; SAIC 1994

APPENDIX H

PROPERTY LISTING

Table II.1 Property Listing

Site/Vicinity Property	Property	Type of Property	Status	Reference(s)
St. Louis Downtown Site (SLDS)	SLDS (Mallinckrodt, Inc.)	Industrial	Rad & Chem Characterization Complete; Partial RA	ORNL 1981; BNI 1990a)
SLDS Vicinity Properties	McKinley Iron Co.	Industrial	Rad Characterization Complete	
	Thomas & Proetz Lumber Co.	Commercial	Rad Characterization Complete	
	PVO Foods, Inc.	Commercial	Rad Characterization Complete	
	Norfolk & Western Railroad	Industrial	Rad Characterization Complete	
	St. Louis Terminal Railroad Association	Industrial	Rad Characterization Complete	
	Chicago, Burlington, & Quincy Railroad	Industrial	Rad Characterization Complete	
	City of St. Louis property	Municipal	Rad Characterization Complete	
Latty Avenue Properties	Hazelwood Interim Storage Site (HISS)	Industrial	Rad & Chem Characterization Complete; Partial RA	BNI 1985a,1985d,1985e, 1986b; 1987b, 1987e, 1988b, 1989b, 1989c; ORNL 1977, 1986b, 1986c
	Futura Coatings, Inc.	Industrial	Rad & Chem Characterization Complete; Partial RA	BNI 1990b
	Latty Avenue Vicinity Property 1	Industrial	Rad Characterization Complete	BNI 1990b
	Latty Avenue Vicinity Property 2	Industrial	Rad Characterization Complete	BNI 1990b
	Latty Avenue Vicinity Property 3	Industrial	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Latty Avenue Vicinity Property 4	Industrial	Rad Characterization Complete	BNI 1990b
	Latty Avenue Vicinity Property 5	Industrial	Rad Characterization Complete	BNI 1990b
	Latty Avenue Vicinity Property 6	Industrial	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
St. Louis Airport Site (SLAPS)	SLAPS	Municipally owned	Rad & Chem Characterization Complete	BNI 1985b, 1985c, 1986a, 1987a, 1987d, 1988a, 1989a, 1989b, 1990c
SLAPS Vicinity Properties				
Norfolk & Western Railroad	Norfolk & Western Railroad adjacent to 9200 Latty Avenue	Industrial	Rad Characterization Complete	BNI 1990b
	Norfolk & Western Railroad adjacent to Hanley Road	Industrial	Rad Characterization Complete	BNI 1990b
	Norfolk & Western Railroad south of SLAPS	Industrial	Rad Characterization Complete	BNI 1990b
	Norfolk & Western Railroad adjacent to Coldwater Creek	Industrial	Rad Characterization Complete	BNI 1990b
	Norfolk & Western Railroad adjacent to Hazelwood Ave. & south of Latty Ave.	Industrial	Rad Characterization Complete	BNI 1990b
	Norfolk & Western Railroad adjacent to Hazelwood Ave. & north of Latty Ave.	Industrial	Rad Characterization Complete	BNI 1990b
	Norfolk & Western Railroad adjacent to Eva Avenue	Industrial	Rad Characterization Complete	BNI 1990b
Banshee Road	Banshee Road	Municipal	Rad Characterization Complete	BNI 1990b
St. Louis Airport Authority	St. Louis Airport Authority property	Municipal	Rad Characterization Complete	BNI 1990b
Ditches north & south of SLAPS	Ditches north & south of SLAPS	Municipal	Rad Characterization Complete	BNI 1983, 1987a, 1990b
Ball Field	Ball Field Area	Municipal	Rad & Chem Characterization Complete	BNI 1990b
Coldwater Creek	Coldwater Creek	Municipal	Rad & Chem Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 1	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 2	Industrial	Rad Characterization Complete	BNI 1990b

Table H.1 (continued)

Site/Vicinity Property	Property	Type of Property	Status	Reference(s)
	Coldwater Creek Vicinity Property 3	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 4	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 5	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 6	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 7	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 8	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 9	Industrial	Rad Characterization Complete	BNI 1990b
	Coldwater Creek Vicinity Property 10	Industrial	Rad Characterization Complete	BNI 1990b
Haul Roads	Latty Avenue	Comm/Industrial	Rad Characterization Complete	BNI 1990b; ORNL 1986a
	McDonnell Boulevard	Comm/Industrial	Rad Characterization Complete	BNI 1990b; ORNL 1986a
	Hazelwood Avenue	Comm/Industrial	Rad Characterization Complete	BNI 1990b; ORNL 1986a
	Pershall Road	Comm/Industrial	Rad Characterization Complete	BNI 1990b; ORNL 1986a
	Haul Roads Vicinity Property 1	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 2	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 3	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 4	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 5	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 6	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 7	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 8	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 9	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 10	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 11	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 12	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 13	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 14	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 14A	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 15	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 16	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 17	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 18	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 19	Residential	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Haul Roads Vicinity Property 20	Residential	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Haul Roads Vicinity Property 20A	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 21	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 22	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 23	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 24	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 25	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 26	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 27	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 28	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 29	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 30	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 31	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 31A	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 32	Comm/Industrial	Rad Characterization Complete	BNI 1990b

Table H.1 (continued)

Site/Vicinity Property	Property	Type of Property	Status	Reference(s)
	Haul Roads Vicinity Property 33	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 34	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 35	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 37	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 38	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 39	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 40	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 41	Residential	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Haul Roads Vicinity Property 42	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 43	Residential	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Haul Roads Vicinity Property 44	Residential	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Haul Roads Vicinity Property 45	Residential	Rad Characterization Complete; RA complete	BNI 1990b, 1995b
	Haul Roads Vicinity Property 46	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 47	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 48	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 48A	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 49	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 50	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 51	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 52	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 53	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 54	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 55	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 56	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 57	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 58	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 59	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 60	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 61	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 62	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 63	Comm/Industrial	Rad Characterization Complete	BNI 1990b
	Haul Roads Vicinity Property 63A	Comm/Industrial	Rad Characterization Complete	BNI 1990b

Sources: BNI 1990b, 1993a, 1995a, 1995b

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