FINAL

PROPOSED PLAN
FOR THE ST. LOUIS NORTH COUNTY SITE

ST. LOUIS, MISSOURI

MAY 1, 2003

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

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prepared by

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

with assistance from

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ACRONYMS AND ABBREVIATIONS

AEC	U.S. Atomic Energy Commission
ARAR	applicable or relevant and appropriate requirement
BRA	Baseline Risk Assessment
CDC	Commercial Discount Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm	centimeter
CMM	Continental Mining & Milling Company
COC	contaminant of concern
COPC	contaminants of potential concern
DOE	Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EWDAA	Energy and Water Development Appropriations Act
FAA	Federal Aviation Administration
FFA	Federal Facility Agreement
FS	Feasibility Study
ft	feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
FY	fiscal year
HI	hazard index
HISS	Hazelwood Interim Storage Site
HZ	hydrostratigraphic zone
IA	investigation area
in	inches
MARSSIM	Multi-Agency Radiation Site Survey and Investigation Manual
MCW	Mallinckrodt Chemical Works
MDNR	Missouri Department of Natural Resources
MED	Manhattan Engineer District
mrem/yr	millirem per year
NCP	National Contingency Plan

ACRONYMS AND ABBREVIATIONS (CONT'D)

NPDES	National Pollutant Discharge Elimination System			
NPL	National Priorities List			
NRC	Nuclear Regulatory Commission			
pCi/g	picocuries per gram			
PCOC	potential chemical of concern			
POTW	publicly owned treatment works			
PP	Proposed Plan			
PRG	preliminary remediation goal			
Ra	radium			
RAO	remedial action objective			
RCRA	Resource Conservation and Recovery Act			
RG	remediation goal			
RI	remedial investigation			
RME	reasonable maximum exposure			
ROD	Record of Decision			
SLAPS	St. Louis Airport Site			
SLDS	St. Louis Downtown Site			
SOR	sum of the ratios			
SO_4^{2-}	sulfate ion			
TCE	trichloroethene			
TEDE	total effective dose equivalent			
Th	thorium			
U	uranium			
UMTRCA	Uranium Mill Tailings Radiation Control Act			
USACE	United States Army Corps of Engineers			
VOC	volatile organic compound			
VP	vicinity property			
yd^3	cubic yard			
10^{-4}	=	1/10,000	=	one in ten thousand
10^{-6}	=	1/1,000,000	=	one in one million

GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan are defined below.

100 mrem/year **-** Dose limit to members of the general public, used in the development of supplemental cleanup standards for the North County Site.

Administrative Record - the collection of all relevant documents produced to support remediation activities at the site. The documents in the administrative record are available for public use.

Applicable or Relevant and Appropriate Requirements (ARARs) – those Federal environmental or State environmental or facility siting laws that establish cleanup goals, requirements, or limitations that specially address hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances at a site. ARARs must be met by the selected remedial action for a site.

CERCLA risk range - The acceptable lifetime risk range for carcinogens of 10^{-6} to 10^{-4} for site cleanups under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It corresponds to a predicted statistical increase in the cancer incidence rate in the range of about one case for every million people to about one case for every 10,000 people exposed to the carcinogen.

Chronic reference dose values - The lifetime average daily level of exposure below which no harmful health effects are expected.

Contaminants of concern **–** Those hazardous substances or pollutants or contaminants that are established in the Remedial Investigation (RI) and Feasibility Study (FS) process as having been released on this site and requiring response action for protection of human health or welfare of the environment. Related terms are potential chemical of concern (PCOC) and contaminants of potential concern (COPC). The screening process is described in the FS.

Dose **-** The amount of energy from ionizing radiation that is absorbed per unit mass of matter.

Exposure pathway - The path from sources of pollutants via soil, water, or food to man and other organisms including intermediate pathways e.g., soil to plant to animal to man.

Ex-situ –a medium (e.g., water or soil) removed from its original place, as through excavation, in order to perform the remedial action. Ex-situ soils volumes are larger than the calculated in-situ volumes of contaminated material, due to normal expansion from the excavation process, as well as the addition of clean overburden material removed during the course of excavation. For these reasons, the ex-situ volume of soils requiring disposition as contaminated material is calculated at 1.5 times the estimated in-situ volume of contaminated material.

FUSRAP - the Formerly Utilized Sites Remedial Action Program (FUSRAP) is a federal government program with the authority to remediate properties where residual radioactive material remains because of uranium manufacturing and processing activities conducted during the early years of the nation's atomic energy program or other sites assigned as a result of U.S. Congressional action.

Ground water – underground water that fills interstitial spaces between soil and rock to the point of saturation. Ground water accessed through public or private wells is often used as a source of drinking water.

Hazard index - Parameter used to assess the overall potential for non-cancer effects posed by individual and multiple chemicals.

MARSSIM - the Multi-Agency Radiation Site Survey and Investigation Manual (MARSSIM) was developed as jointly-approved guidance by multiple federal government agencies (DOE, DoD, EPA, NRC) and defines a standard approach for radiation surveys and investigations.

Monitoring – ongoing collection of information about the environment that helps gauge the effectiveness of a clean-up action, determine potential exposures to workers, and establish potential risks to workers or members of the public.

National Priorities List - the National Priorities List (NPL) maintained by the U.S. Environmental Protection Agency (EPA) is comprised of those contaminated sites that have been determined to have a high priority for remediation based on overall risk to public health and the environment.

Organic compounds – chemicals that contain carbon atoms, such as solvents, oils, and pesticides. Some organic compounds can cause cancer.

Process options **-** The specific technical processes applicable to each identified general response action. (General response actions include institutional controls, containment, collection, treatment, or disposal.) Process options can be combined to form a range of possible remedial alternatives.

Property groups - Groupings of related properties at the North County Site (e.g., vicinity properties, SLAPS, HISS/Futura, etc.).

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

Remediation - the activities conducted to address environmental risk and hazards.

Revegetate – to place topsoil, seed, and mulch on prepared soil so that plant roots will hold the soil in place and prevent wind and water erosion.

Risk-Based Preliminary Remediation Goal (PRGs) **–** concentration levels set at scoping for individual chemicals that correspond to a specific cancer risk level of 10^{-6} or an HQ/HI of 1. They are generally selected when ARARs are not available.

Sum of the Ratios (SOR) – a numerical approach to account for the presence of multiple contaminants by further limiting the concentration of a single contaminant to a fraction of its cleanup standard such that the sum total of the fractions (or ratios) for all contaminants is no greater than one.

e.g., $$\frac{Concentration\ A}{Cleanup\ Criteria\ for\ A} + \frac{Concentration\ B}{Cleanup\ Criteria\ for\ B} + \ldots \leq 1$$

Proposed Plan
for the
St. Louis North County Site

Formerly Utilized Sites Remedial Action Program (FUSRAP)
United States Army Corps of Engineers (USACE)

USACE ANNOUNCES PROPOSED PLAN

This Proposed Plan (PP) identifies the preferred alternative for the St. Louis North County Site (North County Site), provides the rationale for this preference, and includes summaries of other cleanup alternatives evaluated for use at the North County Site. This document is issued by United States Army Corps of Engineers (USACE), which is the lead agency for site activities being conducted subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). USACE, in consultation with the U.S. Environmental Protection Agency (EPA), will select a final remedy for the North County Site after reviewing and considering all comments submitted during the public comment period.

Therefore, the public is encouraged to review and comment on *all* alternatives presented in this PP. The preferred alternative can change in response to public comment or new information.

USACE is issuing this PP for at least 30 days of public comment. This PP summarizes information that can be found in greater detail in the Remedial Investigation/Feasibility Study (RI/FS), as well as other documents contained in the Administrative Record File for the North County Site. USACE and the EPA encourage the public to review these documents, available at the locations shown below, to gain a more comprehensive understanding of the site and FUSRAP activities that have been conducted at the site.

Dates to remember:
MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
May 1, 2003 to May 30, 2003
USACE will accept written comments on the Proposed Plan during the public comment period of at least 30 days, which begins May 1, 2003.

PUBLIC MEETING:
May 29, 2003
USACE will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at **Hazelwood Civic Center – East** at 8969 Dunn Road, beginning at 6:00 PM on May 29, 2003.

For more information, see the Administrative Record File at the following location:

USACE, FUSRAP Project Office
8945 Latty Avenue
Berkeley, Missouri 63134
Phone: (314) 260-2905

St. Louis Public Library
Gov. Information Room
1301 Olive Street
St. Louis, Missouri 63103

PROPOSED PLAN
FOR THE
ST. LOUIS NORTH COUNTY SITE

INTRODUCTION

Purpose

The purpose of this Proposed Plan (PP) is to describe the United States Army Corps of Engineers' (USACE's) preferred remedy for remediation of properties at the St. Louis North County Site (North County Site) that have been impacted by contaminants resulting from uranium manufacturing and processing activities conducted during the early years of the nation's atomic energy program. This PP is being used to solicit public and agency comments, as specified in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). USACE, in conjunction with the U.S. Environmental Protection Agency (EPA), is requesting input from the public to select a remedial alternative. The alternative preferred by USACE is indicated in this document. However, the final remedy will not be selected until after receipt and full consideration of all public comments and will be documented in a Record of Decision (ROD) for the North County Site.

The North County Site is part of the St. Louis Formerly Utilized Sites Remedial Action Program (FUSRAP) Site, which comprises multiple properties located in two distinct areas: the North County Site and the St. Louis Downtown Site (SLDS). The properties that constitute the St. Louis Site and its subsets are shown in Figures 1 and 2. The North County Site is located in northern St. Louis County near the Lambert-St. Louis International Airport. The North County Site includes the St. Louis Airport Site (SLAPS); the Latty Avenue properties [which are: the Hazelwood Interim Storage Site, Futura Coatings (HISS/Futura), and the Latty Avenue Vicinity Properties (VPs)]; and SLAPS VPs. SLAPS VPs include properties near SLAPS and areas along Coldwater Creek. The North County Site includes three properties on the EPA's National Priorities List (NPL): SLAPS, HISS, and Futura Coatings. This PP addresses all of the properties that constitute the North County Site.

SLDS is located in downtown St. Louis near the Mississippi River. Remediation of wastes in accessible soils and ground water at SLDS that resulted from uranium manufacturing and processing activities was addressed in a separate ROD, which was signed in 1998.

Authority

USACE is conducting response actions under the legislative authority contained in Public Law 107-66, the Energy and Water Development Appropriations Act (EWDAA) for Fiscal Year 2002 (FY02). This law establishes the authority of USACE to conduct response actions for releases related to the nation's early atomic energy program as the lead federal agency, subject to CERCLA and the National Contingency Plan (NCP). This plan is being submitted as part of USACE's public participation responsibilities under Section 117(a) of CERCLA.

Actions taken at the North County Site will be conducted under FUSRAP. FUSRAP was initiated to identify and clean up or otherwise control sites where residual radioactive material remains because of uranium manufacturing and processing activities conducted during the nation's atomic energy program. FUSRAP also addresses commercial operations that Congress has authorized or directed FUSRAP to remediate. The Department of

Energy (DOE) managed FUSRAP until 1997. On October 13, 1997, the U.S. Congress transferred responsibility for FUSRAP from the DOE to USACE through the 1998 EWDAA.

The scope of this PP is limited to FUSRAP wastes. As defined by the Federal Facility Agreement (FFA), these wastes include the following types of materials:

- all wastes, including but not limited to radiologically contaminated wastes, resulting from or associated with uranium manufacturing or processing activities conducted at SLDS; and,

- other chemical or non-radiological wastes that have been mixed or commingled with radiologically contaminated wastes resulting from or associated with uranium manufacturing or processing activities conducted at SLDS.

Those contaminants not resulting from FUSRAP-related activities are outside the scope of this PP.

CERCLA Process

Several CERCLA documents preceded the development of this PP. The DOE completed and received EPA approval of the RI Report and Baseline Risk Assessment (BRA) prior to the transfer of FUSRAP to USACE. The RI report characterizes the nature and extent of contamination. The BRA describes the risks to human health and the environment posed by radiological and associated chemical contamination. The BRA also evaluates the need for action by defining the potential risks associated with taking no action to mitigate or eliminate the risks. The results from the RI and BRA reports were used by USACE to prepare a Feasibility Study (FS) for the North County Site in accordance with procedures developed under CERCLA. Supplementary documents (such as the SLAPS Implementation Report and the Ecological Risk Assessment) have been prepared to analyze new data and to evaluate new guidance that was generated or issued since the RI and BRA were prepared. Similarly, information in supplementary documents was used in the FS.

USACE, and previously DOE, have for many years involved the regulators and public in the CERCLA process for the St. Louis Sites. As a result, USACE has a good understanding of the regulator and public positions. USACE provides monthly briefings at the St. Louis Oversight Committee meetings. A Citizens Remediation Task Force actively investigated the St. Louis Sites from 1994 to 1996 and published their report, which included specific recommendations and hundreds of pages of analysis. (The Citizens Remediation Task Force became the St. Louis Oversight Committee after publishing their report.) EPA Region VII has been actively involved and has provided informal comments from region staff and from the National Remedy Review Board pursuant to DOE's FFA. The Missouri Department of Natural Resources (MDNR) has a local office working on FUSRAP and interacts regularly with USACE staff.

Public input regarding response activities conducted at the North County Site has been received from these and many other sources. Public meetings are held as part of response efforts and include monthly meetings with a local interest group (St. Louis Oversight Committee) and concerned members of the public. Another source of input was comments received from the public and the regulators on the draft FS/Environmental Impact Statement prepared by the DOE before FUSRAP was

transferred to USACE. Comments were also received on the Engineering Evaluation/Cost Analysis (EE/CA) documents, prepared to evaluate and select removal actions at North County Site properties. In addition, some comments relevant to the North County Site were received on the FS and PP for SLDS, which resulted in the 1998 ROD for accessible soils and ground water for SLDS.

The FS identifies, develops, and evaluates six remedial action alternatives to achieve a final remedy for the North County Site. The FS addresses all media within all of the properties that constitute the North County Site. Media addressed specifically include soil, sediment, surface water, ground water, and structures. Alternatives are developed on the basis of the nature and extent of FUSRAP-related contamination documented in the RI, the BRA, the FS, and related reports. The FS report evaluates the potential impact of the remedial action alternatives based on the nine CERCLA evaluation criteria that are discussed in subsequent sections of this document. The FS process includes regulatory agency and public review.

SITE HISTORY

From 1942 to 1957, under contracts with the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC), the SLDS was used for processing various forms of uranium compounds. In 1946, MED acquired the 21.7 acre tract of land now known as SLAPS to store residues and scrap from uranium processing at the Mallinckrodt (SLDS) facility. In 1966 and 1967, most of the stored residues were sold and removed from SLAPS. On-site structures at SLAPS were razed and buried on the property. Buried deposits of uranium-238 (U-238), radium-226 (Ra-226) and thorium-230 (Th-230) remain on the SLAPS property. The company that purchased the vast majority of the material stored at the SLAPS moved the materials to the HISS on Latty Avenue. Most of this material was later shipped to Colorado. Over time, residues migrated from the sites or were released or otherwise deposited when waste was hauled along transportation routes, contaminating the soils and sediments at the SLAPS VPs.

Initially the uranium-bearing feed materials were relatively pure "black oxides," which had been extracted from uranium ores by other companies located throughout the United States. As the demand for purified uranium continued to increase, SLDS began extracting uranium directly from uranium ores rather than only purifying uranium extracted by other companies. In 1944, Belgian Congo Shinkolobwe ore containing unusually high percentages of uranium (greater than 30% by weight) were processed.

Because there was no room to store the raffinate cake at the downtown site, the AEC began searching for a suitable storage location for the raffinate cake. The AEC ultimately obtained title to SLAPS by condemnation proceedings on January 3, 1947.

The uranium production process at SLDS is described in more detail in Section 2.1 of the FS. The general historical storage layout at SLAPS is shown in Figure 3. Several wastes and by-products were transported from SLDS to SLAPS for storage:

- Radium-bearing residues, referred to as "K-65" residues;
- AM-7 Pitchblende raffinate cake;
- AM-10 or Colorado raffinate cake;

- AJ-4 Barium Sulfate Cake (unleached) and AJ-4 Barium Cake (leached);
- C-liner slag that was created during metal forming operations; and
- Empty drums, contaminated steel and alloy scrap, and building debris.

The scrap metal stored at SLAPS was sold in 1962 and moved to Knoxville, Tennessee, and the SLAPS residues were purchased by a private company, Continental Mining & Milling Company (CMM) in 1966. The conditions of CMM's license specified that it was only for removal of stockpiled residues from 50 Brown Road (SLAPS) and storage at the licensee's facility at 9200 Latty Avenue.

In February 1967, CMM became insolvent and its lender, the Commercial Discount Corporation (CDC) of Chicago obtained possession of the Latty property and the residues. On June 26, 1967, CDC began shipping the residues to Cotter Corporation facilities. CDC sold remaining residuals at Latty Avenue to Cotter Corporation in 1969. In 1973, Cotter shipped undried AM-10 Colorado raffinate cake to Canon City and transported the leached AJ-4 barium sulfate cake, mixed with topsoil, to Westlake landfill in western St. Louis County.

Several removal actions conducted in accordance with approved engineering evaluation/cost analyses (EE/CAs) are either on-going or completed at the North County Site. These removal actions were conducted at numerous properties from 1994 to the present. Table 9 summarizes the response status of each of the designated properties in North County. In addition, Figure 5 illustrates those areas of the North County Site where previous response actions have been conducted by DOE and the USACE. Removal actions started under the EE/CAs are complete at the time the ROD is approved. The ROD criteria would supersede commitments to cleanup criteria in previously issued documents (e.g., EE/CAs).

The first removal action at SLAPS was conducted in Spring 1985, when gully erosion occurred in the western portion of the site along Coldwater Creek. A retaining wall (gabion wall) was constructed along the bank to combat the erosion problem. In Fall 1997, an interim removal action was conducted at SLAPS to address contamination in an area immediately east of the gabion wall. Approximately 5,100 cubic yards (yd^3) of contaminated material were removed from the western end of SLAPS under this action and transported off-site. In 1998, a removal action was begun at SLAPs and the Ballfields (a SLAPS Vicinity Property) in accordance with an approved May 1998 EE/CA. As part of this action, a sedimentation basin was constructed in 1999 at the west end of SLAPS to limit the migration of contamination offsite via surface-water runoff. Other components of this removal action include excavation of contaminated soils from SLAPS and the Ballfields (excluding the ditch north of McDonnell Boulevard), offsite disposal of the excavated materials, and backfilling with approved fill material. A rail spur was installed on SLAPS in 1998 to provide a load-out area and staging area for shipment of contaminated materials to off-site disposal or recycling locations.

During 2000 and 2001, removal actions were conducted in the eastern portion of SLAPS and at the barium/radium pits. These actions resulted in the removal of approximately 20,600 m^3 (27,000 yd^3) of contaminated soils from the East End of SLAPS and 38,100 m^3 (49,800 yd^3) of contaminated soils from the Radium Pits area by the end of 2001. Additional removals are ongoing at the East End

Extension of SLAPS, which includes the areas of contaminated soil between the Radium Pits and the East End and in the drainage ditch immediately south of McDonnell Boulevard. By Fall 2001, approximately 45,900 m^3 (60,000 yd^3) had been removed from portions of the East End Extension. Removal of contaminated soils located in the central portion of SLAPS, referred to as Phase 1, was initiated in Fall 2001 and continued through 2002. Phase 1 is expected to be completed by May 2003. A total of 74,200 m^3 (97,000 yd^3) will have been removed from the Phase I area. To date, all material has been shipped to properly permitted or licensed off-site disposal facilities.

Removal actions have also been conducted at several SLAPS VPs and Latty VPs. In 1995, DOE excavated contaminated soils from six residential SLAPS VPs and two industrial Latty Avenue VPs and transported 3,500 m^3 (4,610 yd^3) of material off-site for disposal (DOE, 1995). Another removal action resulted in the excavation and disposal of about 8,600 m^3 (11,300 yd^3) (ex-situ) of contaminated soils from the North Ditch between McDonnell Boulevard and the former ballfield area. During 2000, approximately 5,400 m^3 (7,100 yd^3) of contaminated soils were excavated from a portion of VP-38, a haul road vicinity property located at the northwest corner of Latty Avenue and Hazelwood Avenue.

At HISS, removal of all storage and spoil piles has been conducted under the 1998 HISS EE/CA. Preparation for the removal action included the construction of a railroad spur along the eastern boundary of HISS that was completed in early 1999. Removal of the stockpiles began in March 2000 and was completed approximately 18 months later. Nearly 44,300 m^3 (58,000 yd^3) of material from the two Spoil Piles, two Eastern Piles, the HISS Supplemental Storage Pile, and the HISS Main Pile were removed.

SITE CHARACTERISTICS

Site Description

The North County Site properties are located in northern St. Louis County, Missouri and involve five local municipal jurisdictions. Specific sites include the SLAPS, Latty Avenue Properties (HISS/Futura and Latty Avenue VPs), and SLAPS VPs. A total of more than 87 properties are involved. Coldwater Creek, which is a SLAPS VP, flows adjacent to SLAPS and drains the North County Site. Average annual precipitation for the area is approximately 36 inches per year. Depth to ground water varies from 27 to 75 feet (ft). The population of this immediate area is approximately 38,000 and is located within the St. Louis Metropolitan area, which has a population of 2.7 million.

In the 1940s, the area was primarily agricultural with a few private residences. In the 1950s and 1960s, private residences and commercial/industrial developments began to populate the North County Site. In the last twenty years, commercial/industrial development of the area has continued. Currently this urban area consists predominately of commercial and industrial properties, although it also includes private residences, vacant lots, a farming area, a community garden, a recreation area, and Coldwater Creek. The reasonably anticipated future land use for most habitable properties is industrial. Given the rapid changes in the uses of these properties in the last 50 years, however, reasonably anticipated land uses may include residential with some limited agricultural.

Coldwater Creek is the major drainage mechanism for the SLAPS and HISS/Futura areas. Coldwater Creek flows adjacent to SLAPS, then meanders near HISS/Futura and other Latty Avenue properties and continues to flow through northern St. Louis County until it discharges into the Missouri River. Coldwater Creek floods areas of the North County Site including portions of SLAPS, HISS/Futura, and several VPs. Periodic maintenance and flood control measures are regularly undertaken. From the airport through the industrial areas, the water quality in Coldwater Creek is generally poor. Coldwater Creek is protected for livestock and wildlife watering and aquatic-life usage from its intersection with U.S. Highway 67 downstream to the mouth of the creek at the Missouri River. This portion of the Creek is classified by the state as a Class "C" waterway, which means there are periods of no flow in the creek, but permanent pools are always present.

Studies of aquatic life in Coldwater Creek have shown the stream ecology is severely impacted by industrial and other operations in North County unrelated to the FUSRAP-related activities. Pollutants enter the stream in storm water from commercial and industrial facilities, residential areas, and the Lambert-St. Louis International Airport. SLAPS storm-water run-off also flows into Coldwater Creek. More than a dozen facilities that are permitted under the National Pollutant Discharge Elimination System (NPDES) program discharge directly into the stream, including Ford Motor Company, Lambert-St. Louis International Airport, and Boeing Corp. Discharges include storm-water runoff, airport deicing fluids, and manufacturing discharges.

The North County Site is situated on a modest upland area between the Missouri and Mississippi River flood plains in northern St. Louis County. The upland area surrounds a topographic depression known as the Florissant Basin. Pleistocene soils and recent fill overlay shale and limestone bedrock. Faulting is not evident at the site, and limestone appears to be almost flat.

The North County Site is underlain by a sequence consisting of loess, clay, sands, and gravel that was deposited by wind, stream and lake processes. This sedimentary sequence was deposited on limestone bedrock, which lies at a depth of approximately 100 ft below ground surface at the North County Site. Pennsylvanian shale overlies the limestone on the east side of SLAPS, but is absent to the west and absent at HISS/Futura. Chemical and hydrologic characteristics define five hydrostratigraphic (water property) zones (HZs) at the North County Site. The shallow ground-water zone, HZ-A, consists of fill and fine-grained silts and clays. Underlying HZ-A are HZ-B, which consists of highly impermeable clay, and HZ-C, which consists of silty clay and clayey silt deposits. The underlying shale and limestone bedrock are recognized as HZ-D and HZ-E, respectively. The limestone aquifer (HZ-E) is the protected aquifer for the site. All five HZs (HZ-A through HZ-E) occur beneath SLAPS; HZ-D (shale) is not found beneath HISS/Futura.

The uppermost hydrostratigraphic zone, HZ-A, has a low recharge rate. HZ-A cannot be considered a viable source of potable water because of the low recharge rate and the presence of chemical pollutants from the highly industrialized North County region. The ground water in HZ-A generally flows to the west and northwest. Water flow through soil is interpreted to discharge into Coldwater Creek from SLAPS and the Latty Avenue properties.

Chemical compositions of ground-water samples collected from the shallow hydrostratigraphic zone, HZ-A, are highly variable and include major anions and cations, radionuclides, metals, and organic compounds. On the other hand, chemical compositions of ground-water samples collected from lower zones are remarkably similar to each other but distinctly different from the bulk of the ground-water samples collected from HZ-A. Additionally, while contaminants of potential concern (COPCs) were found in HZ-A no contaminants of concern (COCs) were identified for the potential drinking water zone, the limestone aquifer (HZ-E). The rate of vertical contaminant movement suggests times exceeding 1,000 years to reach the Limestone Aquifer. This arrival period assumes continued soils contamination. Removal of the soil source of contamination would result in lower concentrations reaching ground water and would lengthen the arrival period to still greater time lengths. Combined with low measured hydraulic conductivities in HZ-A, HZ-B, and HZ-D, these characteristics indicate that ground water in HZ-A has limited communication with water in the lower HZs.

This interpretation is supported by tritium concentrations in samples from HZ-A and the lower HZs. Tritium concentrations in HZ-A are significantly higher than in any of the other HZs, indicating that HZ-A has communication with atmospheric tritium. Tritium is not a FUSRAP-related contaminant but is present in the atmosphere as a result of a natural process (the interaction of cosmic rays with the atmosphere) and man-made processes (nuclear weapon fallout). The uniform tritium concentrations in HZ-B through HZ-E indicate an older tritium reservoir (likely naturally-occurring) that has not been connected with the contaminated shallow zone.

EPA has developed a ground-water classification system to assess ground water on the basis of ground-water value and vulnerability to contamination. Using EPA's Superfund Ground-Water Classification Flow Chart, the ground-water classification was evaluated as part of the FS. The water-bearing units of the HZ-E limestone aquifer meet the requirements for a Class IIB designation. Class IIB means the ground-water source could be used for drinking water, but is not currently used. The upper HZ-A water-bearing unit at the airport areas is of poor quality and low yield. This shallow unit meets Class III definitions. Class III includes ground waters that "are so contaminated by naturally occurring conditions, or by the effects of broad-scale human activity (i.e., unrelated to a specific activity), that they cannot be cleaned up using treatment methods reasonably employed in public water-supply systems". Class III also encompasses ground waters where yields are insufficient to meet the needs of an average size family. Except for HZ-E, the water bearing units (HZ-A, B, C and D) were classified as Class IIIA, because the site is surrounded by industrial activities and the creek feeds surface water bodies (the Missouri River) that are used for drinking water.

No threatened or endangered species have been found at the North County Site. The only federal and state designated endangered or threatened species that have any significant possibility of occurring within the area of the North County Site are the pallid sturgeon and the bald eagle. Pallid sturgeons are found in the Mississippi and Missouri Rivers, but Coldwater Creek does not provide adequate water quality or quantity for a suitable habitat. No sightings of Bald Eagles have been reported at this site.

Potential wetlands have been identified along Coldwater Creek, and portions of the North County Site lie within the 100-year flood plain.

No known archeological or historical sites are impacted by the contamination at the North County Site.

NATURE AND EXTENT OF CONTAMINATION

The media affected by contamination are soils and sediments. The total risk from COPCs in surface water (Coldwater Creek) did not exceed the acceptable risk levels; therefore surface water is not considered to be a medium of concern. Some COPCs were identified in the upper hydrostratigraphic zone (HZ-A) of ground water under the SLAPS, but this zone is not currently used as a water supply source, and does not communicate with the water in the lower zones. COPCs were not found in lower hydrostratigraphic zones. Therefore, useable ground water is not impacted and the media of concern are soils and sediments.

The patterns of soil contamination around SLAPS and HISS/Futura indicate that airborne transport has been a significant contributor in the past [e.g., from SLAPS north to Investigation Area 9 (IA-9), the former ballfield and park area]. Spillage from trucks was also a major mechanism for contaminant transport to haul road properties when materials were transported from SLAPS to the site on Latty Avenue (HISS/Futura). Contamination in Coldwater Creek has been affected by flood events that moved contaminated sediment within the floodplain as well as downstream.

Soil Elevated levels of radioactive materials in the uranium, thorium, and actinium decay series including radium-226 (Ra-226), thorium-230 (Th-230), and uranium-238 (U-238) have been detected in SLAPS soil. The remedial investigations found concentrations ranging from background to 5,600 picocuries per gram (pCi/g), 37,780 pCi/g, and 1,700 pCi/g, respectively. (However, some slightly higher values for Th-230 were found at test pits for IA-4 removals.) The characterization data indicate that non-radiological contaminants related to uranium manufacturing and processing activities at SLDS are present. However, these chemicals would be addressed by remediating the radionuclides at the North County Site because the FUSRAP-related chemicals are generally co-located with the radionuclides. Chemical sampling will be done to confirm that chemicals are addressed. Chemicals not associated with uranium manufacturing or processing activities are expected to be present at the North County Site. Substantial development has taken place at the site since the early 1940s. Because the site is located in an industrial area, there is a limited occurrence of some chemicals associated with industrial activities and vehicle emissions.

Contamination at SLAPS covers most of the surface, and covers subsurface soils down to about 20 ft deep. Contaminated scrap and building rubble were also reportedly buried on SLAPS. Geotechnical investigations have identified features on SLAPS consistent with burials of this type. Sampling indicates that the radioactively contaminated soils generally do not exhibit Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics. Although some volatile organic compounds (VOCs) were found, there is no documentation or other evidence to date to indicate that organic COCs were released at these sites from uranium ore processing wastes that originated at SLDS. A records search of industrial facilities surrounding the

Latty Avenue properties has identified processes that could generate RCRA-listed wastes. The remedial design investigations done prior to any soil removal must consider the presence of these contaminants.

The results of investigations conducted at the Latty Avenue properties are similar to results for investigations conducted at SLAPS. The radioanalytical studies indicate that Ra-226, Th-230, and U-238 are present in HISS/Futura surface soils at concentrations as high as 700 pCi/g, 830 pCi/g, and 800 pCi/g, respectively.

Ground Water Current risks associated with exposure to contaminated ground water are minimal. Although some contaminants are present in shallow HZ-A ground water, their presence does not require action because a complete pathway to receptors does not exist. The potential yield is very low for HZ-A ground water, so it is not considered a source of potable drinking water. In addition, sample data show that there are no COCs in HZ-E ground water, the potential water resource. The hydrologic and chemical data also show that the contaminated ground-water zone (HZ-A) has limited connection with the lower ground-water zone, and that contaminated ground water is not likely to migrate to the lower water-bearing units. Ground water from HZ-A at SLAPS flows toward Coldwater Creek. Hydrological studies of SLAPS indicate the slow discharge of ground water to Coldwater Creek is not significantly impacting the creek.

The results presented in Figure 4 summarize the nature and extent of radioactive soil and sediment contamination at the North County Site. The impacted areas are projected over an aerial photograph of the North County Site. In order to reflect differences in contaminant concentrations, the figure shows areas of contamination in multiples of the concentrations defined in the legend. Areas of the North County Site where previous response actions have been conducted by DOE and the USACE are shown in Figure 5.

SCOPE AND ROLE

The FS and PP define cleanup actions to address all COCs in soils and sediments, including but not limited to radiological COCs, resulting from or associated with FUSRAP uranium manufacturing or processing activities. The alternatives presented in these documents also address non-radiological COCs that are commingled with radiological COCs resulting from or associated with FUSRAP uranium manufacturing or processing activities. Other contamination present at the North County Site that is not related to work under FUSRAP is beyond the scope of this document. Specific media addressed include surface and subsurface soils and sediment. Actions will be taken to ensure the continued protection of other media including surface water, ground water, air, and adjacent buildings/structures, and to fully address any commingled RCRA contamination as an integral part of remedial design. ROD criteria will be implemented using final status surveys compatible with the Multi-Agency Radiation Site Survey and Investigation Manual (MARSSIM) and ARARs on all properties remediated after 1 January 1998. ROD criteria will be implemented in accordance with existing survey protocols for all properties where removal actions were performed prior to 1 January 1998 as MARSSIM was published in December 1997. Prior to MARSSIM, DOE utilized their verification protocol to ensure that properties were remediated to protective levels. For areas where removal actions were previously conducted, the data will be evaluated to ensure that ROD criteria

are met and that they require no further action.

SUMMARY OF SITE RISKS

The BRA and related studies were prepared to evaluate the risk to human health and the environment from radioactive materials and chemicals if no cleanup were conducted at the North County Site. The BRA concluded that remedial action at the site was warranted. However, because additional data have been gathered, a supplemental risk assessment was included in the FS. The FS risk assessment evaluated risks at the site (for the no action alternative) and evaluated the potential risk in the future following cleanup for each of the remedial alternatives presented in the FS. The results of the FS risk evaluation are discussed below.

The primary health risks include cancer (carcinogenic) and toxic (non-carcinogenic) human health effects. Cancer risk estimates were compared to the CERCLA risk range of one in one million (10^{-6}) to one in ten thousand (10^{-4}) outlined in the NCP. As defined in the NCP, acceptable exposure levels are generally levels that represent an excess upper-bound lifetime cancer risk to an individual in the range of 10^{-6} to 10^{-4}. The potential for non-carcinogenic effects from chemicals was evaluated by adding the intake ratios to published chronic reference dose values. These values were then added for each chemical to obtain a hazard index. A hazard index greater than one indicated a potential for adverse health effects.

An ecological risk screening was also conducted. The screening process involved comparing the maximum concentrations of contaminants at the site to screening values. The ecological evaluation also considered the rarity, diversity, and importance of habitats at the site.

Table 1 presents the total risk for the reasonable maximum exposure (RME) expected to occur under current and future land use. The excess lifetime cancer risk and dose for six land-use scenarios at all North County Site properties are summarized in Tables 2a and 2b. The dose represents the energy absorbed from exposure to ionizing radiation and is expressed in units of mrem/year. Risks and doses from exposure to radionuclides were calculated for year 0 through year 1000. For each property unit, receptors were evaluated for a range of current and future uses, including residential land use, an industrial worker, a construction worker, a maintenance worker, a recreational user (or trespasser), and a utility worker. The resident is assumed to live at the site for 350 days per year for 30 years. The industrial worker is assumed to be at the site for 8 hours per day, 250 days per year, for 25 years. The maintenance worker is assumed to be present for 8 hours per week and holds the position for 6.6 years. The recreational user (or trespasser) is assumed to be on-site for 2 hours per day, 26 days per year, for 9 years. The construction worker is assumed to be exposed 8 hours per day, 250 days per year, for one year. (The construction worker scenario best represents the current risks at SLAPS where removal actions are being performed.) For road and rail work, the construction worker is assumed to be exposed 8 hours per day, 90 days per year, for one year (36% of the construction worker exposure duration). A utility worker is classified as a subset of the construction worker scenario. While the exposure parameters for a utility worker would be similar to a construction worker, the exposure durations for a utility worker would be much less. Input from local utility companies suggests that a reasonable

exposure duration is 8 hours per day, 10 days per year, for one year (4% of the construction worker exposure duration).

Table 2b summarizes risk from exposure to radionuclides only. The data show that the non-radiological contaminants associated with FUSRAP-related activities are commingled with radiological contaminants, and that the risks from exposure to non-radionuclides are at least an order of magnitude lower than risks from exposure to radionuclides at most properties. As shown in Table 2a, the risks due to radiological COCs at most properties at the North County Site for the current RME receptor scenario are within the CERCLA risk range (10^{-6} to 10^{-4}), whereas the risks due to non-radiological COCs for the current RME receptor scenario are generally between 10^{-8} to 10^{-4}.

Risk levels determined using the actual current land uses indicate that most properties included in the North County Site (including all designated residential properties) are within the CERCLA risk range (10^{-6} to 10^{-4}) specified for protection of human health for members of the general public. This results from current practices used to control exposures (e.g., USACE radiation safety support to utility operations). As shown in Table 2b, current risks for several properties exceed the CERCLA risk range for some scenarios. If land uses should change in the future (e.g., properties that are currently under commercial/industrial uses become residential), risks exceeding the CERCLA risk range could exist at many of the property units.

CONCLUSIONS OF RISK EVALUATION

The risk evaluation indicates there is a need for cleanup action within the St. Louis North County Site. Under current land use conditions, the cancer risks and hazard indices are calculated to exceed the CERCLA risk range for plausible scenarios (recreational/trespasser, maintenance, industrial, and construction worker) within the North County Site. In addition, for reasonably anticipated future land use scenarios (industrial and residential), the risks and/or the HIs could exceed the CERCLA risk range and/or a HI of 1 at many properties. COPCs were screened based on potential risks and hazards to identify COCs. Those contaminants related to FUSRAP uranium manufacturing or processing activities and that were detected at the site at levels that present a risk greater than 10^{-6} (given that the media-specific and receptor-specific total risk is above 10^{-4}) or a hazard quotient greater than 0.1 (given that the media-specific and receptor-specific total hazard is above 1) were identified as COCs for the North County Site. It is the lead agency's current judgement that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the PP, is necessary to protect the public health or welfare from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment.

Soils: The radionuclides identified as COCs in soils and sediments include isotopes of radium, thorium, uranium, protactinium, and actinium. Eleven metals are identified as non-radiological surface soil COCs: antimony, arsenic, barium, cadmium, chromium, molybdenum, nickel, selenium, thallium, uranium, and vanadium. Four non-radionuclide subsurface soil COCs are identified. They are antimony, arsenic, thallium, and uranium.

Ground Water: An assessment of ground water concluded that there are no COCs in HZ-E ground water, the protected

water resource. Although some soil contaminants have entered the shallow HZ-A ground water, their presence does not require action. The HZ-A ground water has no defined COCs because a complete pathway to receptors does not exist. Therefore the chemicals do not meet the definition of COC.

Although the chemical trichloroethene (TCE) was found in HZ-A, it was not identified as a COC because the shallow ground water is not a source of potable drinking water and because TCE is not identified as FUSRAP-related. The USACE will continue to monitor the ground water for TCE where appropriate if TCE is co-located with FUSRAP COCs requiring remediation. In addition, soils containing TCE source-term commingled with FUSRAP COCs above RGs will be remediated.

Surface Water: Several COPCs were identified in surface-water samples from Coldwater Creek. However, an evaluation of the data against background, risk, and hazard criteria indicates that the levels present are within the acceptable risk range. For that reason, no COCs were identified for surface water and surface water was eliminated as a medium of concern.

Sediments: As with soils, radionuclides are identified as COCs in Coldwater Creek sediments. One metal (arsenic) and five organics also exceed risk criteria in Coldwater Creek sediment. Organic and arsenic concentrations increase with distance downstream from SLAPS and HISS/Futura. Thus, the elevated concentrations are most likely the result of the heavy industrial activity in the area and are not FUSRAP related. For this reason, neither the organics nor arsenic are retained as COCs in the sediments, limiting COCs for sediments to only radionuclides.

Ecological Risk: A screening level ecological risk evaluation was conducted for the site. Further risk evaluation was not needed because of the low risks relative to the uncertainty in the risk estimates; the low probability of significant ecological effects on local populations; and the lack of unique, rare, and critical habitat at the North County Site. The ecological risk evaluation concluded that remediation of the site was not required to protect the environment.

REMEDIAL ACTION OBJECTIVES

USACE is conducting response actions under the legislative authority contained in Public Law 107-66, the EWDAA for FY02. This law establishes the authority of USACE to conduct response actions for releases related to the nation's early atomic energy program as the lead federal agency, subject to CERCLA and the NCP. CERCLA requires that a remedial action "shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment." In addition, CERCLA requires that the remedial action selection "shall require, at the completion of the remedial action, a level or standard of control for such hazardous substance or pollutant or contaminant which at least attains such legally applicable or relevant and appropriate standard, requirement, criteria, or limitation." For that reason, the second primary remedial action objective is to attain the criteria or standards of control that are established in the ARARs for the site COCs.

To determine the appropriate remedial action, the NCP sets forth a requirement for establishing remedial action objectives

(RAOs). RAOs are based on the nature and extent of contamination, threatened resources, the potential for human and environmental exposure, and reasonably anticipated land uses. The RAOs for the North County Site are established, in general, to eliminate or minimize potential human exposure to soils and sediments contaminated with FUSRAP-related COCs at levels that exceed the standards established in the ARARs or the site-specific risk-based RGs. Although risk levels based on a commercial/industrial future anticipated land use are within the CERCLA risk range (10^{-6} to 10^{-4}) for most properties in the North County Site, action is required to comply with ARARs and site-specific RGs. Remediation will result in residual site conditions that allow for unlimited use and unrestricted exposure. There are no goals for HZ-A ground-water improvement. The pathways and risks are such that the HZ-A ground water does not require remediation. COC removal from soil will lessen the impact of contaminants upon HZ-A ground water. The media-specific RAOs developed for the North County Site for soils and sediments are shown in Table 3.

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires the selection of a remedial action that is protective of human health and the environment and complies with "applicable or relevant and appropriate requirements (ARARs)." CERCLA states this is a standard, requirement, criteria, or limitation under a Federal environmental law or a more stringent State environmental or facility siting law, which is not legally applicable to the hazardous substance or pollutant or contaminant, but which is relevant and appropriate under the circumstances of the release of the hazardous substance or pollutant or contaminant. With respect to ARARs, CERCLA specifically requires that "the remedial action selected shall require, at the completion of the remedial action, a level or standard of control for [a] hazardous substance or pollutant or contaminant which at least attains such legally applicable or relevant and appropriate standard, requirement, criteria, or limitation (ARAR)." Pursuant to 40 CFR 300.430(e)(9)(iii)(B) the alternatives "shall be assessed to determine whether they attain applicable or relevant and appropriate requirements (ARARs) under Federal environmental laws and state environmental or facility siting laws."

The proposed ARARs for the radionuclides addressed in this response action includes Title 40 Code of Federal Regulations Part 192 (40 CFR 192), Subparts A, B and C; and 10 CFR 40, Appendix A, Criterion 6(6).

40 CFR Subpart A defines the "standards for control of residual radioactive materials from inactive uranium processing sites." This section sets several standards that provide protection for stabilized residual materials disposal areas at Uranium processing sites. 40 CFR 192.02(a) states that control of residual radioactive materials must be designed to be effective for up to 1000 years to the extent achievable, and in any case, for at least 200 years.

Subpart B identifies EPA's standards for remedial actions of land and buildings contaminated with residual radioactive materials at inactive uranium processing sites and provides cleanup standards for Ra-226 in soil, among other things.

Subpart C provides regulations for the implementation of standards established in

Subparts A and B. Among other things, it sets forth conditions appropriate for the development of supplemental standards. Supplemental standards are derived pursuant to 40 CFR 192 Subpart C for subsurface materials at the primary storage areas (i.e., SLAPS and HISS/Futura) for use with the containment and treatment alternatives. The supplemental standards are appropriate in accordance with 40 CFR 192.21 (c) which specifies that supplemental standards may be applied under circumstances that would result in excessive remedial action costs relative to the long-term benefits and where the residual radioactive materials do not pose a clear present or future hazard. The supplemental standards for the primary storage areas in the containment and treatment alternatives (Alternatives 2 and 3) are to be used in conjunction with institutional controls.

10 CFR 40, Appendix A, is the Nuclear Regulatory Commission's (NRC's) regulations for active uranium processing sites, and these regulations conform to the standards set by EPA in 40 CFR 192. Criterion 6(6) is the NRC process for developing remediation goals (RGs) for other radionuclides to be consistent with the Ra-226 limits. 10 CFR 40, Appendix A, Criterion 6(6) is used in the North County Site as an ARAR to derive cleanup goals for non-radium radionuclides, particularly uranium and thorium, which are not explicitly included in EPA's 40 CFR 192 standards. In addition, this criteria requires the use of the unity rule when multiple contaminants are present. The unity rule sums the ratio of the residual concentration to remediation goals for each radiological contaminant of concern. Criterion 6(6) also provides relevant and appropriate radiological criteria for decommissioning lands and structures associated with uranium recovery facilities.

Criteria which are the basis of ARARs (40 CFR Part 192 and 10 CFR Part 40) are protective for all future anticipated land uses. This protectiveness has been upheld by judicial action.

DERIVATION OF REMEDIATION GOALS AND CLEANUP LEVELS

The remediation goals proposed for the North County Site comply with ARARs, are protective of human health and environment and are consistent with the NCP. They are protective under conditions of RME for residential site conditions (see Preamble to the final rule for 40 CFR 192 as specified in 48 FR 600). No directly applicable chemical-specific requirements are identified. Relevant and appropriate requirements are identified for radioactive contaminants in soil. Remediation goals for other contaminants in soil are derived using site-specific evaluations. Risk and dose assessments were also performed to assure protectiveness in light of multiple contaminants and multiple pathways (e.g., inhalation, ingestion, and direct exposure) at the North County Site. The remediation goal for Ra-226 is set forth in 40 CFR 192, Subpart B. Site-specific remediation goals for U-238 and Th-230 are derived in accordance with 10 CFR 40, Appendix A, Criterion 6(6) and 40 CFR 192, Subpart A. Table D-11 of the FS lists concentrations that produce the radium benchmark doses for the key St Louis North County Site radionuclides for a range of potential receptors. The remediation goal for Th-230 accounts for the in-growth of Ra-226 which is the limiting risk consideration.

No chemical-specific requirements were identified for non-radiological contaminants. Remediation goals were derived based on site-specific exposure assumptions and with the objective of meeting the acceptable risk

range as provided in the NCP (See FS, Appendix D, Section D.2.2.2). According to the NCP, acceptable exposure levels to known or suspected carcinogens are levels that represent an excess upper bound lifetime cancer risk to an individual of between one in 1,000,000 (10^{-6}) and one in 10,000 (10^{-4}). The EPA establishes preliminary remediation goals (PRGs) for all carcinogenic chemicals at the 10^{-6} level, also known as the point of departure. Final remediation goals may be different based on factors such as uncertainty, technical limitations on detection, or other considerations consistent with the remedy selection criteria defined in the NCP. In this case, practical limits on the ability to distinguish between naturally occurring background levels and very small increments above background require the use of final remediation goals that exceed the 10^{-6} level for some of the non-radiological contaminants; however, final cleanup levels remain within the acceptable risk range. Aggregate risks from final cleanup levels are also within the risk range. Remediation goals for non-carcinogens were developed to ensure that the cumulative toxic effects would result in a HI < 1.0.

The soil cleanup standards found in 40 CFR 192, Subpart B, were developed specifically for the cleanup of uranium mill tailings sites designated under Section 102 (a)(1) of the Uranium Mill Tailings Radiation Control Act (UMTRCA). These standards are intended to provide for unrestricted use of remediated properties. These standards address contaminants and circumstances similar to those found at the North County Site and are, therefore, considered relevant and appropriate to soil cleanup at the North County Site. The surface and subsurface soil criteria in 40 CFR 192, Subpart B for radium–226 are 5 and 15 pCi/g, respectively. The surface remediation goal applies to the 100 m^2 areal average concentration above background in the top 15 cm (6 in.) layer. The subsurface remediation goal applies to the 100m^2 areal average concentration above background in any subsequent 15 cm (6 in) layer. The Ra-226 remediation goal of 5 and 15 pCi/g in surface and subsurface soils has been used with St Louis sites pursuant to the Record of Decision for the St Louis Downtown Site and to Engineering Evaluation/Cost Analyses for the St Louis North County Site. Implementation of the subsurface remediation criterion for Ra-226 results in actual average residual concentrations of Ra-226 significantly less than 5 pCi/g. This is based on cleanup results of a number of different areas and properties within the St Louis North County Site and St Louis Downtown Site, using cleanup goals of 15 pCi/g subsurface criterion for Ra-226 in combination with subsurface cleanup goals of 15 and 50 pCi/g for Th-230 and U-238, respectively.

The site-specific Th-230 and U-238 remediation goals are derived based on the 10 CFR 40, Appendix A, Criterion 6(6), also referred to as the benchmark dose approach. These requirements supplement the standards found in 40 CFR 192.

The U-238 goal was established using U-238 as a surrogate for all of the uranium isotopes (including U-234 and U-235) and certain uranium decay products. Using the U-238 as a surrogate, the residual concentration was determined to be about 81 pCi/g. However, since some of the decay products are present above the natural abundance, the site-specific remediation goal of 50 pCi/g for U-238 is considered appropriate. Site experience shows that a 50 pCi/g limit is reasonably achievable at little extra cost. This limit has been used on the St Louis North County Site for removal actions conducted by USACE and the DOE since 1991 and is the site-specific Remediation

Goal for U-238 established in the Record of Decision for the St Louis Downtown Site.

Table D-11 of the FS presents the calculation resulting from 10 CFR Part 40, Appendix A, Criterion 6(6) and lists the most restrictive Th-230 concentration as 330 pCi/g. This concentration, although protective with respect to Th-230, would result in the in-growth of Ra-226 such that future concentrations of Ra-226 would exceed the limits specified in ARARs. 40 CFR 192.02(a) requires the selected remedial action be designed to be effective for up to 1000 years to the extent reasonably achievable, and in any case, for at least 200 years. To ensure ARAR is met, the in-growth of Ra-226 from the Th-230 decay process must be calculated and examined. A soil concentration of 14 pCi/g of Th-230 would result in the in-growth of 5 pCi/g Ra-226 concentration at the end of the1000 year time period stated in 40 CFR 192.02(a). Although a subsurface soil concentration of 43 pCi/g would result in the in-growth of 15 pCi/g Ra-226, EPA's guidance documents for the cleanup of CERCLA sites using 40 CFR 192 as ARAR set forth EPA's expectation that remediation of subsurface soil contamination will, in practice, achieve the surface cleanup criterion- of 5 pCi/g for Ra-226. (See OSWER 9200.4-25, "Use of Soil Cleanup Criteria in 40 CFR Part 192 as Remediation Goals for CERCLA Sites). EPA approval of this ROD is contingent upon satisfying EPA's expectations for cleanup of CERCLA sites; therefore, USACE has adopted, on a site specific basis, Th-230 surface and subsurface soil cleanup levels that are consistent with a residual Ra-226 concentration of 5 pCi/g. Constraining the concentration of Th-230 in surface soils to 14 pCi/g and subsurface soils to 15 pCi/g along with the use of the unity rule assures that the concentration of Ra-226 does not exceed 5 pCi/g during the 1000-year time period.

No remediation goal is developed for Th-232. Removal of Th-230 to the remediation goals will effectively remove Th-232 present in site soils. Analytical data indicate that Th-232 is co-located with Th-230 and is present at relatively low concentrations. Removal of soils to the radionuclide criteria results in Th-232 concentrations of less than 1.5 pCi/g including background for SLAPS, SLDS, and North County VPs. Residual concentrations do not produce risks significantly above background.

Remediation goals for radiological contaminants of concern for the St Louis North County Site soils are 5/14/50 pCi/g for Ra-226, Th-230 and U-238 in surface soils and 15/15/50 pCi/g for subsurface soils. These remediation goals are consistent with the remediation standards used in Engineering Evaluation/Cost Analyses (EE/CAs) by DOE prior to transfer of FUSRAP execution to USACE, in USACE EE/CAs and in local Records of Decision both at the St Louis Downtown Site and by DOE at Weldon Springs Remedial Action Project. These remediation goals meet the threshold criteria of overall protection of human health and the environment and compliance with ARARs and will achieve a final status that requires no restrictions on land use.

Supplemental cleanup standards have been developed for subsurface materials at the primary storage areas (SLAPS and HISS/Futura) under the containment and treatment alternatives (Alternatives 2 and 3) to ensure protectiveness under commercial/industrial use. These supplemental standards are appropriate in accordance with criteria specified in 40 CFR 192.21 (c), which states that supplemental standards may be applied under circumstances where removal would result

in excessive remedial action costs relative to the long-term benefits and the residual radioactive materials do not pose a clear present or future hazard. The supplemental standards for subsurface materials at the primary storage areas are to be used in conjunction with institutional controls. For those remedial alternatives involving land use restrictions at SLAPS and HISS/Futura (Alternatives 2 and 3), supplemental standards of 25/70/250 pCi/g above background for Ra-226/Th-230/U-238 would be used for subsurface soils. These supplemental standards would protect the most likely current and future receptors (e.g., construction and utility workers) and ensure that doses to the general public would be limited to less than 100 mrem/yr if institutional controls were lost.

The Benchmark dose approach defined in Criterion 6(6) was applied in development of the Coldwater Creek subsurface sediment remediation goals. The remediation goal derived for subsurface sediments (i.e., 15 pCi/g of Ra-226, 43 pCi/g of Th-230 and 150 pCi/g of U-238 above background) is implemented for soils and sediments under the mean water gradient for Coldwater Creek. This remediation goal assures protectiveness of Coldwater Creek under all future anticipated land use conditions (e.g., recreational/trespasser, maintenance, construction, and utility uses) and minimizes adverse environmental impact associated with greater excavation in Coldwater Creek.

Other site contaminants derived from the uranium ores tend to be co-located with the principal radionuclides such that remediation of the contaminated soil to the cleanup levels described above is expected to adequately remove all ore-related contaminants. Supporting information is presented in Appendix D of the Feasibility Study (Section D.2.1 and Table D-10). To verify that removal of radiological contaminants achieve remediation goals for non-radiological contaminants associated with the uranium processing activities, chemical sampling will be conducted as required during pre-design investigation and as part of the final status survey pending confirmation of co-location with radiological contaminants.

No ARARs have been identified for the non-radiological contaminants in soils at the North County Site. The remediation goals for non-radiological COCs were developed based on site-specific risk assessments and hazard evaluations. At the North County Site, eleven non-radionuclides are identified as COCs for soils: antimony, arsenic, barium, cadmium, chromium, molybdenum, nickel, selenium, thallium, uranium, and vanadium. These noncarcinogens have different effects on different organs or systems in the body. The remediation goals for noncarcinogens were developed to ensure that the cumulative effect of the chemical levels of the COCs produces a HI < 1.0 for each target organ/system affected. In addition, remediation goals were selected at levels above detection limits and background levels.

Toxicologists evaluated the primary effects of the 11 metals in the soils at North County. The HIs were calculated for all six different types of receptors – residential, industrial, construction worker, maintenance worker, recreational/trespasser, and utility worker. Generally, the construction worker was identified as the most sensitive receptor, except for a few cases where the residential receptor was the most sensitive or restrictive scenario. The remediation goals for all non-radionuclides were calculated based on the HIs for the different primary target organs. The protectiveness to each primary organ was tested by adding up the HIs of the corresponding COCs targeted to that

primary organ. In each case, the HI value was less than one.

Remediation goals have been derived for the 11 surface soil and 4 subsurface soil non-radiological COCs, based on their noncarcinogenic effects. These proposed remediation goals are presented in Table 6. Surface and subsurface soil remediation goals for antimony, arsenic, thallium, and uranium are 15/25 mg/kg, 36/40 mg/kg, 25/30 mg/kg, and 150/150 mg/kg, respectively. Seven additional non-radiological COCs were identified for surface soil only. The applicable remediation goals are as follows: 2800 mg/kg barium, 12 mg/kg cadmium, 350 mg/kg chromium, 1,000 mg/kg molybdenum, 1,500 mg/kg nickel, 300 mg/kg selenium, and 112 mg/kg vanadium. Antimony, arsenic, barium, cadmium, chromium, molybdenum, nickel, selenium, thallium, uranium, and vanadium are identified as COCs for SLAPS and contiguous areas; and antimony, arsenic, barium, cadmium, molybdenum, nickel, selenium, thallium, and vanadium are identified as COCs for HISS/Futura and Latty Avenue VPs 2L and 10k530087. The non-radiological COCs will be evaluated in the final status survey pending confirmation of their co-location with radiological COCs to verify that risk and hazard criteria are fully protective under CERCLA and have been satisfied.

The proposed remediation goals (summarized in Table 5 for radionuclides and Table 6 for other chemicals) are protective based on the future anticipated land use, are achievable, and can be implemented. Further cleanup goals comply with the ARAR criteria for radionuclides and would achieve protectiveness to levels within the CERCLA risk range and below a HI of 1.0.

SUMMARY OF FEASIBILITY STUDY ALTERNATIVES

Six cleanup alternatives were developed in the FS and evaluated using the nine criteria outlined in the NCP. Per EPA's FS guidance, the cost estimates include a 30 year performance period for ongoing actions, such as monitoring and maintenance, and identify any continuing costs beyond the 30 year period. Technologies were identified that might have potential application at the North County Site. These technologies were evaluated in the Initial Screening of Alternatives document developed by DOE and subsequently re-evaluated by USACE as part of the FS.

The first step in the alternative selection process was to identify potential remedial technologies for the North County Site. In the second step, the technologies and process options for each technology were further evaluated using effectiveness, implementability, and cost criteria. Several technologies and process options were screened out as a result of the evaluations. Disposal of contamination into a permanent on-site cell located at the North County Site was eliminated due to the time and expense necessary to develop such an option. Public comments that have been received indicate strong public opposition to an on-site cell. Immobilization and stabilization technologies were narrowed to a few process options. Vitrification, biological techniques, and incineration were eliminated. The technology screening is summarized in Table 7. In the third step of alternatives development, the technologies and process options were combined to form six site-wide alternatives.

Emphasis was placed on the development of site-wide alternatives that ensure adequate protection of human health

and the environment, achieve ARARs, and permanently and significantly reduce the volume, toxicity, or mobility of site-related contaminants. The alternatives cover a broad range, from no further action to complete removal of contamination. For each alternative, USACE would conduct post-remedial action surveys to ensure that remediated areas meet the selected cleanup criteria. Table 8 provides a summary of soil removals under each alternative. Table 9 provides a summary of current and future land-use assumptions by property. The reasonable future land uses were determined based on current land uses and other considerations, including the public preference expressed for remedial alternatives that would allow unrestricted use of the North County Site. Evaluating a range of alternatives that provides for both unrestricted and restricted use enables costs of restricted and unrestricted use to be compared relative to the degree of protectiveness of human health and the environment that is achieved and relative to the probability that institutional controls will ensure future protectiveness.

Alternative 1, No Further Action

Alternative 1 includes no further remedial actions for the North County Site. This no-further-action alternative provides a baseline against which to compare other remedial alternatives and is required by the NCP and CERCLA guidance.

This alternative assumes that no additional remedial actions would be implemented at the North County Site. The rail spurs at SLAPS and HISS would be left in place. Contaminated soil and sediment would remain at current locations. The limited site security (e.g., fencing) would be left in place, but would not be maintained. Continued routine monitoring of air, buildings, ground water, and storm water would not be performed. Five-year reviews would be conducted pursuant to CERCLA for areas in which contamination is such that conditions do not allow for unlimited use and unrestricted exposure.

The estimated total cost of this alternative is $1.5 million, due to the cost of conducting recurrent 5-year reviews.

Technologies and Processes Common to Alternatives 2 through 6

Alternatives 2 through 6 share certain features. In order to avoid duplicate discussions of the details of these features under each alternative, similar elements are discussed in the following text.

On-going Removal Actions: Removal actions started under the EE/CAs are complete at the time the ROD is approved. The ROD criteria would supersede commitments to cleanup criteria in previously issued documents (e.g., EE/CAs). Excavation under buildings and other permanent structures would be done when the areas are made available by the owner. Final status surveys would be conducted to ensure that remediated areas meet the cleanup criteria. Final status surveys performed pursuant to EE/CAs prior to the MARSSIM effective date would be compared to ROD criteria using the existing confirmation approaches.

Excavation: Consistent with the scope defined in the FFA, for alternatives that involve excavation, remediation of soils containing non-radionuclide contaminants would be conducted in those areas where they are co-located with North County Site COCs. Non-radiological COCs include antimony, arsenic, barium, cadmium, chromium, molybdenum, nickel, selenium, thallium, uranium, and vanadium for SLAPS and contiguous areas; and antimony, arsenic,

barium, cadmium, molybdenum, nickel, selenium, thallium, and vanadium for HISS/Futura and Latty Avenue VPs 2L and 10k530087. To verify that removal of radiological contaminants also achieves the RGs for non-radiological COCs, chemical sampling will be conducted as required during pre-design investigation and as part of the final status survey, pending confirmation of co-location with radiological contamination.

Institutional Controls: For alternatives that use institutional controls, a long-term stewardship plan would be developed to address notification requirements for property owners for changes in land use as well as future monitoring and maintenance requirements. This plan would include provisions addressing the process by which property owners can contact the federal government agency responsible for long-term control of impacted areas and periodic reviews, maintenance, and monitoring. Institutional controls are used to ensure protectiveness for alternatives at areas in which the residual soil contamination exceeds the concentrations specified in ARARs for the site-specific RGs for unrestricted use.

Transportation and Waste Management: Local transportation of contaminated materials (e.g., from VPs to rail spurs) would use sealed or covered trucks. On-site movement would be performed using open trucks and conventional construction equipment. Long distance shipment would be primarily by rail from the rail spurs to off-site licensed or permitted disposal facilities. Trucking may also be used for long distance shipping. Rubble and similar materials would be crushed as appropriate for disposal. Site soils could be used as backfill if they are unimpacted, or if they meet the cleanup criteria for surface soils.

Uranium would be recycled if the costs are similar to the cost for disposal of the materials.

As necessary, pre-remedial design investigation sampling for COCs would be conducted to define the extent of contamination. Those properties where current or past activities unrelated to uranium processing have resulted in RCRA characteristic or listed waste being co-located with radioactive waste will be evaluated and sampled, as necessary, prior to remediation for the purpose of treatment and disposal.

Monitoring: Short-term monitoring would be continued during the remedial actions. Monitoring would be used to assure that contamination from the soils and the unusable ground water zone (HZ-A) does not significantly impact surface water or potable ground water. The results of the short-term monitoring of surface water, sediment, and HZ-A ground water would be used to assess any potential impacts to Coldwater Creek resulting from the remedial actions and would assist in evaluating the effectiveness of the remedial actions. In addition, monitoring will support evaluation of impacts resulting from the remaining soils unavailable for remedial action (not in Alternative 6) or residual contamination left in place. The protective nature of existing geologic deposits to resist vertical water passage would not be changed by any FUSRAP remedial alternatives.

Remedial Action Control Measures: Water encountered during remedial actions will be characterized, treated (if necessary), and released to the publicly owned treatment works (POTW), or to Coldwater Creek or its tributaries, as permitted. The treatment would address chemicals and radionuclides consistent with relevant and appropriate federal and state regulations. Excavation

waters contaminated with TCE or its degradation products will not be released off-site above appropriate levels. Supporting technologies would be used to prevent the spread of contamination. These include revegetation, dust mitigation, storage pile covers, sedimentation basins, and dewatering as required during the excavation process. Backfill would be added, and the site graded to ensure appropriate surface water drainage. Erosion and sediment controls would be used.

Wetlands: Any wetlands designated using the 1987 Corps of Engineers Wetlands Delineation Manual which are impacted during removals would be restored, or equivalent wetlands would be created.

FAA Restrictions: USACE construction activities during remedial action would comply with the Federal Aviation Administration (FAA) restriction of air space around the airport, such as limits on the height of structures and equipment.

The following text presents unique features of Alternative 2 through 6.

Alternative 2, Partial Excavation and Capping at SLAPS and HISS/Futura

Alternative 2 consists of partial excavation and capping with institutional controls. The specific components include:

- *Capping*: A multi-layer cover (cap) would be constructed at SLAPS and HISS/Futura to provide an additional barrier to limit exposures. SLAPS and HISS/Futura would be contoured and covered with 1 ft of stone intrusion barrier and 3 ft of clean soil.

- *Excavation*: All soils exceeding the RGs for unrestricted land use would be excavated at SLAPS VPs and Latty Avenue VPs, with the exception of soils beneath roads, bridges, railroads, and other permanent structures. Soils under roads, bridges, railroads, and other permanent structures, are inaccessible and will not be remediated as part of this response action. When and as the inaccessible soils become available as a result of decisions by the entities that control their accessibility, new decision documents will identify the response actions to address the inaccessible soils as appropriate. Inaccessible soils for the North County Site are identified in Figure 6. Additional soils may be identified as inaccessible during implementation and will be deferred for separate action as documented in the post remedial action report. Institutional controls may be applied under this alternative to properties with inaccessible soils as appropriate. At SLAPS and HISS/Futura, subsurface soils exceeding the supplemental standards of 25/70/250 pCi/g above background for Ra-226/Th-230/U-238 would be shipped offsite to a permitted disposal facility. Those soils having contaminant levels exceeding the RGs for unrestricted release but below the supplemental standards would be disposed of on-site beneath a multilayer cover at SLAPS and HISS/Futura. The use of supplemental standards at SLAPS and HISS/Futura is appropriate in accordance with 40 CFR 192.21 (c) because excavation to unrestricted criteria would result in excessive remedial action costs relative to the long-term benefits and the residual radioactive materials remaining beneath the cap do not pose a clear present or future hazard. The supplemental standards for subsurface materials at the primary storage areas are to be used in conjunction with institutional controls to

allow commercial/industrial use of SLAPS and HISS/Futura.

- *Dredging*: Dredging of contaminated sediments from Coldwater Creek is not part of Alternative 2. Sediments removed by other projects such as flood control would be monitored, and any sediment exceeding criteria would be shipped for off-site disposal at a licensed or permitted facility.

- *Institutional Controls:* No institutional controls would be required for accessible soils at SLAPS VPs or Latty Avenue VPs. However, institutional controls would be imposed to restrict land use at SLAPS, HISS/Futura, Coldwater Creek, and for areas beneath roads, bridges, railroads, and other permanent structures as appropriate. The controls could include deed notices to assure future owners are made aware of the presence of residual contamination; land use restrictions to limit activities that could disturb soils; and well-drilling prohibitions. Controls could also include zoning restrictions at SLAPS and HISS/Futura. Land use would be restricted to commercial/industrial uses at SLAPS and HISS/Futura, recreational uses at Coldwater Creek, and transportation/utility uses for roads, bridges, and railroad beds.

Five-year reviews would be conducted pursuant to CERCLA and long-term ground-water monitoring would be performed near SLAPS and HISS/Futura as part of the five-year review process. Long-term monitoring of HZ-A and long-term monitoring of Unit 4 in HZ-C (as a surrogate for HZ-E) would be required.

Total cost of this alternative is estimated to be $205 million.

Alternative 3, Partial Excavation and Treatment at SLAPS

Alternative 3 emphasizes consolidation and treatment of site soils at SLAPS. It involves excavation of contaminated soils followed by treatment. Specific components include:

- *Excavation*: All soils exceeding the RGs for unrestricted land use would be excavated at SLAPS VPs, HISS/Futura, and Latty Avenue VPs, with the exception of soils beneath roads, bridges, railroads, and other permanent structures. SLAPS would be excavated to meet the supplemental standards of 25/70/250 pCi/g above background for Ra-226/Th-230/U-238 to allow commercial/industrial land use with the use of institutional controls. Soils not meeting the supplemental standards would be shipped offsite to a permitted disposal facility. Soils under roads, bridges, railroads, and other permanent structures, are inaccessible and will not be remediated as part of this response action. When and as the inaccessible soils become available as a result of decisions by the entities that control their accessibility, new decision documents will identify the response actions to address the inaccessible soils as appropriate. Inaccessible soils for the North County Site are identified in Figure 6. Additional soils may be identified as inaccessible during implementation and will be deferred for separate action as documented in the post remedial action report.

- *Dredging*: Soils and sediments above the Coldwater Creek criteria for unrestricted release discussed in Table 4 would be dredged from Coldwater Creek and consolidated at SLAPS for treatment.

- *On-site Treatment*: Excavated soils and sediments would be consolidated at SLAPS for treatment (soil sorting and enhanced soil washing). Treated soils that meet supplemental standards for subsurface soils would be used as backfill at SLAPS and covered with clean soils. Any materials not meeting the supplemental standards for subsurface soil would be shipped off-site to a permitted disposal facility. Limited phytoremediation (planting and harvesting of selected plant species to draw contamination from soils) would be conducted in the Coldwater Creek flood plain in areas where sediments accumulate downstream of Pershall Road. The residual materials would be disposed of at properly licensed or permitted disposal facilities.

- *Institutional Controls:* No institutional controls would be required for accessible soils at SLAPS VPs, Latty Avenue VPs, and HISS/Futura. Institutional controls would be used to restrict land use at SLAPS and beneath roads, bridges, railroads, and other permanent structures as appropriate. The controls could include deed notices to ensure that future owners are made aware of the presence of residual contamination; land use restrictions to limit activities that could disturb soils; and well-drilling prohibitions. Controls could also include zoning restrictions at SLAPS. Land use would be restricted to commercial/industrial uses at SLAPS and transportation/utility uses for roads, bridges, and railroad beds.

Five-year reviews and long-term ground-water monitoring of HZ-A near SLAPS are included as part of this alternative. Long-term monitoring of Unit 4 in HZ-C (as a surrogate for HZ-E) would be required.

Total cost of this alternative is estimated to be $284 million.

Alternative 4, Institutional Controls (No Further Excavation)

Alternative 4 emphasizes the use of institutional controls. It consists of the following:

- *Institutional Controls:* Institutional controls would be imposed to limit land use at SLAPS, HISS/Futura, roads, bridges, railroads, and other permanent structures, Coldwater Creek, and the VPs. Other than specific areas zoned for commercial and inductrial uses and FAA limitations, no known land use controls or restrictive easements exist on the subject properties. Potential administrative problems are anticipated with enforcement, access and monitoring, and voluntary compliance with regulatory controls. Further, property owners are often less than willing participants in subordinating their fee title interests for residual site contamination. Missouri real estate law is amenable and supportive of restrictive land use controls, conveyance by quitclaim, and zoning overlay districts. The controls would vary by property and could include deed notices to assure future owners are made aware of the presence of residual contamination, land use restrictions to limit activities that could disturb soils; and well-drilling prohibitions. Zoning restrictions at SLAPS, HISS/Futura, and Vicinity Properties are also potential institutional controls. Land use would be restricted to commercial/industrial uses at SLAPS, HISS/Futura, and vicinity properties, recreational uses at Coldwater Creek, and transportation/utility uses for roads, bridges, and railroad beds. Although the implementation of institutional controls

at SLAPS, HISS/Futura, under buildings, roads, bridges, and railroads, and at the VPs is technically feasible, it involves complex administrative requirements. Maintaining controls at numerous properties would be difficult. The controls would have to be maintained for a considerable period of time and would have to be enforced through a government or municipal entity. A requirement that land use restrictions "run with the land" despite ownership changes would be used to help ensure that controls are not lost. Details of institutional controls will be documented in the site long-term stewardship plan.

Five-year reviews would be accomplished in accordance with CERCLA. Long-term monitoring of ground water is included as part of this alternative until stopped as part of the five-year review process. Long-term monitoring of HZ-A and log-term monitoring of Unit 4 in HZ-C (as a surrogate for HZ-E) would be required. Title to the properties with residual contamination would remain with current landowners and would not be transferred to the federal or state government.

Total cost of this alternative is estimated to be $129 million.

Alternative 5, Excavation with Institutional Controls Under Roads, Bridges, Railroads, and Other Permanent Structures

Alternative 5 emphasizes excavation and dredging with off-site disposal for all property units except under roads, bridges, railroads, and other permanent structures. Remediation of inaccessible soil is not included in this alternative and will be deferred for action at the time property becomes accessible as a result of decisions by entities that control accessibility. Institutional controls may be applied under this alternative to properties with inaccessible soils as appropriate. When and as the inaccessible soils become available, new decision documents will identify the response actions to address the inaccessible soils as appropriate. Specific components include:

- *Excavation*: All soils exceeding the RGs for unrestricted land use would be excavated and shipped for off-site disposal or recycle, with the exception of soils beneath roads, bridges, railroads, and other permanent structures. Soils under roads, bridges, railroads, and other permanent structures, are inaccessible and will not be remediated as part of this response action. When and as the inaccessible soils become available as a result of decisions by the entities that control their accessibility, new decision documents will identify the response actions to address the inaccessible soils as appropriate. Inaccessible soils for the North County Site are identified in Figure 6. Additional soils may be identified as inaccessible during implementation and will be deferred for separate action as documented in the post remedial action report.

- *Dredging*: Coldwater Creek sediments below the mean water gradient that exceed the subsurface soil criteria defined in Table 5 would be dredged and disposed.

- *Institutional Controls:* Institutional controls are used to ensure protectiveness for alternatives at areas in which the residual soil contamination exceeds the concentrations specified in ARARs for residential use. No institutional controls would be required for accessible soils. Institutional controls would be used to restrict land

use beneath roads, bridges, railroads, and other permanent structures as appropriate. The controls could include deed notices to ensure that future owners are made aware of the presence of residual contamination and land use restrictions to limit activities that could disturb soil. Controls could also include zoning restrictions at Futura. Roads, bridges, and railroad beds would be limited to use as transportation/utility corridors.

- *Monitoring:* Long-term monitoring is not required for the limestone aquifer (HZ-E). Under this alternative, the majority of the contaminant sources and all highly contaminated soils at the site will be removed. The few contaminant sources remaining in HZ-A soils, unavailable for RA at the present, are separated from HZ-E by a low hydraulic conductivity clay aquitard, Unit 3M, and the low conductivity of Unit 3 in general. The potential for contaminant migration to HZ-E is very small, as noted by prior study. In addition, although HZ-E meets the definition of a potential source of drinking water (Class IIB), it is not a current source of drinking water in the area so an exposure pathway from HZ-E ground water to receptors does not exist. Short-term ground-water monitoring of Unit 4 of HZ-C is proposed to prove continued protection of the limestone aquifer. Short-term monitoring of HZ-A ground-water would be used to assess the effects the remedial action has on HZ-A ground-water quality and the approximate contaminant transport rate through HZ-A ground water to Coldwater Creek. Short-term surface water and sediment monitoring of Coldwater Creek will be conducted to provide additional data to assess, if Coldwater Creek is being significantly impacted by contaminant migration from HZ-A, and to determine if remedial actions are having any adverse impacts on the creek. Long-term monitoring for Unit 2 of HZ-A may be required depending upon the contamination of the post-remedial action HZ-A ground water and the rate of contaminant delivery to Coldwater Creek. HZ-A long-term monitoring is not anticipated. Short-term monitoring of HZ-A ground water after removal/remedial actions and base flow contaminant evaluation of Coldwater Creek will resolve whether long-term monitoring of HZ-A is warranted.

Inaccessible soils are not included in this remedial action and will be deferred for action until such time that they become accessible as a result of decisions by the entities that control their accessibility. The inaccessible areas at the North County Site are shown in Figure 6. Additional areas may be identified as inaccessible during implementation and will be deferred for separate action as documented in the post remedial action report. When and as the inaccessible soils become available, new decision documents will identify the response actions to address the inaccessible soils as appropriate.

Five-year reviews would be conducted only for those areas where contamination remains above unrestricted use criteria (i.e., roads, bridges, railroads, and other permanent structures).

Total cost of this alternative is estimated to be $223 million.

Alternative 6, Excavation at all Properties

Alternative 6 emphasizes excavation of all contaminated material, regardless of location or accessibility. All soils exceeding

the RG for unrestricted land use would be removed for all property units and disposed off-site. Unlike other alternatives roads, bridges, railroads, and other permanent structures would be removed as required to allow excavation of soils that exceed the unrestricted use criteria. Five-year reviews and institutional controls would not be necessary.

Total cost of this alternative is estimated to be $286 million.

EVALUATION OF ALTERNATIVES

The six alternatives were evaluated using the nine CERCLA evaluation criteria established in Section 300.430(d)(9)(iii) of the NCP to determine the most favorable alternative for cleanup of the North County Site. These criteria are described below.

CERCLA EVALUATION CRITERIA

Threshold Criteria (must be met)

- ***Overall Protection of Human Health and the Environment*** – addresses whether an alternative provides adequate protection and describes how potential exposures to COCs are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- ***Compliance with Applicable or Relevant and Appropriate Requirements*** – addresses whether a remedy would meet all of the site ARARs. ARARs are federal and state environmental laws and promulgated regulations identified for the North County Site.

Primary Balancing Criteria (identifies major trade-offs among alternatives)

- ***Long-Term Effectiveness and Permanence*** – addresses the remaining risk and the ability of an alternative to protect human health and the environment over time once cleanup goals have been met.

- ***Short-Term Effectiveness and Environmental Impacts*** – addresses the impacts to the community and site workers during cleanup including the amount of time required for completing the action.

- ***Reduction in Toxicity, Mobility, or Volume through Treatment*** – addresses the anticipated performance of treatment that permanently and significantly reduces the toxicity, mobility, or volume of the contamination.

- ***Implementability*** – addresses the technical and administrative feasibility of an alternative, including the availability of materials and services required for cleanup.

- ***Cost*** – compares the differences in cost, including capital, operation, and maintenance costs.

Modifying Criteria (formally evaluated after the comment period)

- ***State Acceptance*** – evaluates whether the State agrees with, opposes, or has no comment on the preferred alternative. This criterion is evaluated formally when comments on the PP are reviewed.

- ***Community Acceptance*** – addresses the issues and concerns the public may have regarding each of the alternatives. This criterion is evaluated formally when comments on this PP are reviewed.

ALTERNATIVE EVALUATION AND COMPARISON

Alternative 1, No Action

Alternative 1 is the No-Further-Action Alternative required by the NCP and CERCLA guidance. Alternative 1 would not achieve the threshold criteria, because it would not be protective of human health and the environment as required by the NCP. Because it does not meet the threshold criteria, no further evaluation is required.

Alternative 2, Partial Excavation and Capping at SLAPS and HISS/Futura

This alternative is protective of human health and the environment and compliant with ARARs. The long-term effectiveness and permanence is good at all of the VPs where material is removed to the unrestricted RGs. For the areas at SLAPS, HISS/Futura, Coldwater Creek, and roads, bridges, railroads, and other permanent structures, this alternative is less permanent because institutional controls could be lost in the future. Land at SLAPS and HISS/Futura would be restricted, and the economic benefit to the local community would likely be reduced, if there is no appropriate commercial/industrial use of the property after capping. There is a short-term risk to workers during the excavation and removal actions, and a short-term risk to members of the public due to construction and transportation activities. There is no reduction in mobility, toxicity, or volume through treatment. However, because of the capping, the mobility would be slightly reduced because material would be consolidated and covered.

Technically this alternative is implementable, but administratively it would be difficult. MDNR has objected to placement of radioactive material on land in Missouri, and this objection may also apply to leaving existing contaminated soils in place at SLAPS and HISS/Futura. Condemnation may be required to obtain the necessary real estate interests. On-site remedies have received strong objections from local stakeholders in the past. This is the fourth most expensive alternative.

Alternative 3, Partial Excavation and Treatment at SLAPS

This alternative is protective of human health and the environment and is compliant with ARARs. The long-term effectiveness and permanence is good at all of the VPs where material is removed to the unrestricted RGs. Removal of soils to the criteria for Coldwater Creek would assure protectiveness. For the areas at SLAPS and beneath roads, bridges, railroads, and other permanent structures, this alternative is less permanent because institutional controls could be lost in the future. Future development of land at SLAPS would be restricted. Some economic benefit from cleanup of other properties is expected. There is a short-term risk to workers during the excavation and removal actions. The added complexity of the treatment operation would increase short-term impacts and there would be a small increase in short-term risks to the public. There is a reduction in volume through treatment. There would be little change to toxicity.

Technically this alternative is implementable, but administratively it would be difficult. MDNR has stated objections to placement of radioactive material on land in Missouri, which is likely to be applied to the use of the treated soils as backfill. On-site remedies have received strong objections from local stakeholders in the past.

Institutional controls consisting of a restrictive covenant would be required to ensure commercial/industrial use and other developmental restrictions. It is likely that this real estate instrument would need to be obtained through condemnation.

This is the second most expensive alternative.

Alternative 4, Institutional Controls (with no further excavation)

Institutional controls are used at all remaining properties. These controls are consistent with the present and expected future land use for these areas. This alternative is protective of human health and the environment as long as the controls are effective. Because no additional soils are excavated, the risks could exceed the CERCLA risk range and doses could exceed 100 mrem/yr should institutional controls fail. This alternative does not achieve either the 40 CFR 192, Subpart B or C standards. In addition, Alternative 4 does not comply with 40 CFR 192 Subpart A standards for the control of residual radioactive materials from inactive uranium processing sites. Subpart A requires that controls be maintained for at least 200 years and up to 1,000 years. Inability to meet the threshold criteria of compliance with ARARs is a significant problem with this alternative. Section 121(d) of CERCLA and the NCP § 300(f)(l)(ii)(B) require that remedial actions at CERCLA sites attain ARARs, unless such ARARs are waived under CERCLA Section 121(d)(4). Alternative 4 is less permanent because institutional controls could be lost in the future. Land use would be restricted.

Short-term risks would be unchanged until institutional controls are implemented.

There is no reduction in mobility, toxicity, or volume through treatment.

Technically this alternative is implementable, but administratively it would be very difficult. The implementation of institutional controls is a complicated process. Maintaining controls at numerous properties under control of private and governmental agencies would be very difficult. Condemnation may be required to obtain some land rights. On-site remedies have received strong objections from local stakeholders in the past. This is one of the cheaper alternatives because much of the material is being left on-site.

Alternative 5, Excavation with Institutional Controls Under Roads, Bridges, Railroads, and Other Permanent Structures

This alternative is protective of human health and the environment and compliant with ARARs. Institutional controls are used to ensure protectiveness at inaccessible areas in which the residual soil contamination exceeds the RGs for unrestricted use (i.e., areas beneath roads, railroads, bridges, or other permanent structures). When and as these inaccessible areas become available as a result of decisions made by the entities that control their accessibility, new decision documents will identify the response actions to address the inaccessible soils as appropriate.

In general, the long-term effectiveness and permanence for this alternative is high. However, at buildings, roads, bridges, and railroads, it is less permanent because institutional controls could be lost in the future. Land would be returned to economic benefit. There is a moderate short term risk to workers during the excavation and removal actions. There is no reduction in toxicity or volume through treatment. Mobility would be slightly reduced because material would be consolidated and placed in a properly designed and permitted

disposal facility. Technically and administratively this alternative is highly implementable. Also administratively this alternative would not conflict with state polices regarding radioactive contaminated material in Missouri. This is the third most expensive alternative. This alternative balances the cost and the permanence, long-term effectiveness, and state and community acceptance.

Alternative 6, Excavation at All Properties

This alternative is protective of human health and the environment and is compliant with ARARs. Alternative 6 would provide the highest long-term effectiveness and permanence because all of the radiologically contaminated materials would be recycled or sent to permanent off-site disposal. Short-term effectiveness and environmental impacts would be in the moderate to high range. The removal of soil, particularly under roads, bridges railroads, and other permanent structures would increase the potential for accidents. Due to traffic disruption there could be significant economic impacts to the local community. There is, as in Alternatives 2 through 5, a short-term risk to workers during the excavation and removal actions. This is slightly greater for this alternative due to the greater volume of soil being excavated and the nature of the excavation under roads, bridges, railroads, and other permanent structures. There is no reduction in toxicity, mobility or volume through treatment because there is no treatment component of this alternative. However, mobility will be slightly reduced because the contaminated material would be placed in a regulated and properly designed disposal facility. While technically implementable, this alternative would require additional safety considerations in areas of excavation along roads, bridges, railroads, and other permanent structures. Administratively this alternative would require considerable coordination with federal, state and local departments of transportation and with railroads. Also administratively this alternative would not conflict with state polices regarding radioactive contaminated material in Missouri. Alternative 6 is the most expensive alternative.

Overall Difference Among Alternatives

Overall Protectiveness: Each of the alternatives, except Alternative 1, is protective of human health and the environment. Alternatives 2, 3, 4, and 5 require the effective use of institutional controls. Alternative 4 relies only on institutional controls and is the least likely to provide a permanent protective solution. Alternative 6 removes the most soil and provides the greatest long-term permanence at the St. Louis Site, but it is also the most costly and disruptive to the community and has the highest risks over the short-term. Removal of soils to an off-site disposal location provides an improvement in overall protection at the North County Site compared to treatment and containment. Removal and consolidation actions provide an increase in protection by moving material from the current location to a more controlled location. The least benefit in terms of risk and hazard reduction is from areas where the potential for exposure is limited. This includes the deeper areas at SLAPS and HISS/Futura, areas under roads, bridges, railroads, and other permanent structures, and material below the mean water gradient in Coldwater Creek.

Alternatives 5 and 6 allow use without restrictions at SLAPS and HISS/Futura, while Alternatives 2, 3, and 4 impose institutional controls at SLAPS and/or HISS/Futura.

Compliance with ARARs: All alternatives except Alternative 1 (No Action) and Alternative 4 (Institutional Controls with No Further Excavation) comply with ARARs. Alternative 4 does not achieve the 40 CFR 192, Subpart A, B, or C standards.

Long-term Effectiveness and Permanence: Removal of contamination results in the greatest long-term effectiveness and permanence for Alternative 6 followed by Alternative 5. Next are Alternatives 2 and 3 because more contaminated materials are left under institutional control. Alternative 4 involves the use of institutional controls with no further excavation. This alternative is less permanent and effective than alternatives 2, 3, 5, and 6. Alternative 1 has the least long-term effectiveness and permanence.

Reduction in Mobility, Toxicity, and Volume Through Treatment: Alternative 3 provides a reduction in contaminant volume and mobility through treatment.

Short-term Effectiveness: The biggest difference in short-term effectiveness is due to the increased potential for construction and traffic-related accidents if soil is removed from beneath roads and railroads, and the increased risk of construction and transportation-related accidents due to additional shipment of materials. Comparing Alternatives 5 and 6 shows the impacts of this variation. The increase in operational risk is very large for removals from areas under major traffic corridors. The implementation of Alternatives 2, 3, 5, and 6 may temporarily impact wetlands, temporarily affect surface drainage in the floodplain, and create non-point source surface water discharges, but all of these impacts will be managed in compliance with the substantive requirements of applicable laws and regulations, and therefore are not considered to be significant obstacles to the implementation of these remedial alternatives. Materials and services are readily available and implementable for all of the alternatives.

Implementability: The most implementable alternative is Alternative 5, followed by 6 and 2 then 3. Alternative 4 is the least implementable of the alternatives due to the expressed lack of State and community support.

Costs: Costs are greatest for Alternative 6, which removes the largest volume of soil to an off-site disposal facility. Similarly, costs are lowest for the No Further Action Alternative, Alternative 1. Costs are shown in the Table below.

Costs of the Alternatives in 2003 Dollars (Includes Monitoring if Required During 30 Year Evaluation Period)

Alternative	Cost (Million $)
Alternative 1, No-Further-Action	1.5
Alternative 2, Containment at SLAPS and HISS/Futura	205
Alternative 3, Treatment at SLAPS	284
Alternative 4, Institutional Controls (with no further excavation)	129
Alternative 5, Excavation with Institutional Controls Under Roads, Bridges, Railroads, and Other Permanent Structures	223
Alternative 6, Excavation at All Properties	286

Modifying Criteria

State and community acceptance have been considered in the CERCLA process and will be further evaluated following review of comments received during the public comment period on the North County

Site FS and PP. The state and community have expressed strong opposition to on-site remedies and alternatives that restrict future land use.

ST. LOUIS NORTH COUNTY SITE PREFERRED ALTERNATIVE

USACE recommends Alternative 5, with the option to use treatment, as the preferred alternative. Institutional controls are used to ensure protectiveness for alternatives at areas in which the residual soil contamination exceeds the concentrations specified in ARARs for residential use (beneath roads, bridges, railroads, and other permanent structures).

At all properties except under roads, bridges, railroads, other permanent structures, and the mean water gradient in Coldwater Creek, soils and sediments would be excavated if they exceed the RG described below.

Soils in the surface 6 inch layer would be removed if the radionuclide concentrations averaged over any area of 100 m^2 exceed:

- 5 pCi/g of Ra-226 above background, or
- 14 pCi/g of Th-230 above background, or
- 50 pCi/g of U-238 above background.

Subsurface soils would be removed where the subsurface concentrations averaged over any area of 100 m^2 and averaged over a 6-inch thick layer of soil exceed:

- 15 pCi/g of Ra-226 above background, or
- 15 pCi/g of Th-230 above background, or
- 50 pCi/g of U-238 above background.

Floodplain soil and sediments above the mean water gradient of Coldwater Creek will be treated the same as soils.

This alternative would remove soils and sediments of Coldwater Creek that exceed the limit defined in Table 4 for the creek.

Inaccessible soils (i.e., soils beneath roads, bridges, railroads, and other permanent structures) are not addressed by this remedial action. These areas will be deferred for action to such time that they become accessible as a result of decisions by the entities that control their accessibility. Inaccessible areas would be excavated at a future date when they become available for remediation to achieve the RGs for unrestricted use. New decision documents will identify the response actions to address the inaccessible soils as appropriate. This alternative requires institutional controls to ensure that roads are not excavated without appropriate oversight and safety procedures and constraints. Conditional release of roads includes final status surveys using the MARSSIM or similar methodology to ensure that construction workers, utility workers, and members of the public will not receive a dose of over 100 mrem/yr.

Soils will be excavated using conventional techniques. Soil sources of TCE will be addressed as an integral part of remedial design. Field screening surveys will be used, as appropriate, to ensure removal of contamination while reducing over excavation of clean soils. Limited dredging may be used for Coldwater Creek. Size reduction would be used for materials, such as concrete debris. Grading will be performed to provide for acceptable surface water drainage. Material handling would be performed using conventional techniques.

The excavated material would be shipped primarily from the rail spurs at HISS/Futura and SLAPS to off-site licensed or permitted disposal facilities.

Treatment is not proposed under this alternative except where needed for release water. State-of-the-art treatment relative to radioactively-contaminated soil is advancing rapidly and, while current treatment costs for the North County Site soils are greater than excavation and off-site disposal costs, technological advances could narrow or reverse this comparison. Implementation of soil washing and/or phytoremediation may be considered under this alternative during the remedial design phase. If implementation of these technologies is determined to be appropriate based on new developments, a change to the selected remedy may be recommended and appropriate environmental documentation would be issued. Notwithstanding the limitation, soils may be shipped off-site to a properly permitted disposal site, including sites where uranium is recovered.

Water treatment may be required if surface water contacts contaminated soils during remediation work, or if ground water enters an excavation. The water collected during the remedial action will be treated if found to be contaminated and, after treatment, will be released to an appropriate outfall in compliance with applicable standards for that location.

No remediation of surface waters or ground water is required or included. The final remedy for ground water and surface water is no action. The source removals will improve water quality.

Any wetland areas will be designated using the 1987 Corps of Engineers Wetlands Delineation Manual. Wetland areas impacted during remediation actions would be restored, or equivalent wetland areas would be created.

Institutional controls increase protection of human health and the environment over baseline conditions by limiting direct access to contamination. Most of the institutional controls are needed to limit activities that could disturb inaccessible areas under roads, bridges and railroad right of ways as well as under buildings. These areas already have institutional controls in place in the form of easements for these uses, or deed ownership by the public or utility entities for the road or utility uses. The type of institutional control necessary includes a notification process by the managing public or utility entities whenever they decide to undertake maintenance or construction in the affected areas so that the government may conduct the necessary remedial action work prior to or in conjunction with the performance of their work. Response agreements with local utility companies, visual observations and incorporation of Missouri One-Call system for proposed site excavation and digging are methods currently employed to monitor site changes at active FUSRAP locations. Post-FUSRAP necessitates emplacement of ICs inasmuch as landowners where residual contaminants exist would not be expected to adhere to agreement (verbal or written) without community/governmental oversight. Controls could also include zoning restrictions and deed notices to ensure that future owners are made aware of the presence of residual contamination. These controls would involve continuation of current land-use restrictions to limit use of roads, bridges, and railroad beds as transportation/utility corridors. Specific ICs for each property, a detailed communication plan and enforcement responsibilities will be incorporated into the site long-term stewardship plan

A long-term stewardship plan would be developed by USACE in cooperation with stakeholders to address notification for property owners as well as monitoring and maintenance requirements into the future. This plan would include provisions addressing how property owners should contact the agency responsible for long-term control of impacted areas and how these areas will be reviewed, maintained, and monitored by the Federal government. This plan would also identify areas where and how the use of restrictive covenants; declaration of restrictions; lease provisions; and/or other institutional controls will be implemented. Such covenants, restrictions, or lease provisions would be enforced by the federal government or its designee.

The institutional controls would:

- Be enforceable against any owner of the affected property and any person who subsequently acquires the property or acquires any rights to use the property;
- Be enforceable by parties, other than the landowner, who have the legal authority to enforce the restriction;
- Include provisions to delegate or transfer enforcement authority;
- Indicate procedures for enforcement of restrictions;
- Remain in place for the duration they are needed; and
- Be recorded, including in the deed and in land records, as appropriate.

These recorded documents will include:

- The name of the property owner;
- A description of the property including nature and extent of contamination;
- A statement of the terms of the covenant, restrictions or lease, including provisions for the restrictions to run with the lands and to bind all successor grantees, lessees, subleases, occupants, and lienors; and
- Agency point of contact.

Five-year reviews would be conducted for only those areas where COCs remain above unrestricted use criteria (i.e., roads, bridges, railroads, and other permanent structures). The overall site management would be transferred to DOE for long-term stewdship in accordance with the memorandum of understanding between DOE and USACE.

For those areas where contaminants are present at levels that allow for unlimited use and unrestricted exposure, short-term monitoring is proposed to ensure the effectiveness of the source removal, and to verify that no significant migration of contamination is occurring. Short-term monitoring of Unit 4 of HZ-C is proposed to ensure continued protection of the limestone aquifer (HZ-E). Short-term monitoring of surface water, sediment, and HZ-A (Unit 2) ground water is proposed to assess whether the remedial action is significantly impacting contaminant transport through HZ-A ground water into Coldwater Creek. The results of the short-term monitoring would also be used to determine whether long-term monitoring is required to assess potential contaminant migration from contaminated soils remaining beneath roads, railroads, and other permanent structures. HZ-A long-term monitoring is not anticipated. Monitoring could be performed at those areas where contamination remains above unrestricted levels (roads, bridges, railroads, and other permanent structures) until authorized to be discontinued or modified pursuant to the 5-year reviews.

Based on information currently available, the USACE believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other

alternatives with respect to the balancing and modifying criteria. USACE expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA 121(b):

1) be protective of human health and the environment;
2) comply with ARARs (or justify a waiver);
3) be cost-effective;
4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and
5) satisfy the preference for treatment as a principal element or justify not meeting the preference.

SUMMARY OF COMMENTS RECEIVED FROM EPA AND THE STATE OF MISSOURI

Earlier drafts of the North County FS and PP were submitted to EPA and the State for review. A complete list of their comments and USACE's responses are contained in the site administrative record file. A brief summary of several significant comments is provided below. USACE has taken EPA and State recommendations into consideration and where appropriate revised the documents to address their concerns. All additional comments received during the public review period will be addressed in the responsiveness summary portion of the ROD for the North County Site.

EPA and the State have not objected to the selection of Alternative 5, excavation and off-site disposal of soils with institutional controls under roads, bridges, railroads and structures that are not remediated, as the preferred remedial alternative in the Proposed Plan. However, EPA and the State requested that additional text be provided to clarify and revise some aspects of the alternative, particularly the ground-water monitoring component, institutional controls, and cost information. Specific information has been added to identify the ground-water zones that will be monitored, the scope and purpose of the monitoring, and the duration of monitoring. The RAOs were modified to clarify that removal of the soil sources would minimize the potential for contaminant migration off-site via ground water. The PP and FS have also been revised to provide more information concerning the purpose of and potential types of institutional controls. Costs were updated and a more detailed breakdown of the component costs and costing assumptions were provided.

In addition, EPA and the State provided comments on the proposed list of ARARs and the derivation of the remediation goals (RGs). The most significant comments dealt with derivation of the proposed unrestricted release criteria for radionuclides. The State recommended against use of the benchmark dose limit specified in 10 CFR 40, Appendix A, Criterion 6(6), for the development of RGs. The State also recommended that the Th-230 surface soil criteria of 14 pCi/g be lowered to 5 pCi/g. EPA recommended the 5 pCi/g surface soil Ra-226 RG be used for the benchmark dose calculation and that the dose be limited to 15 mrem per year. After considering the comments and re-evaluating the proposed cleanup standards, USACE revised the sections describing the derivation of the cleanup criteria to more clearly explain the rationale for the proposed soil standards for radiological COCs. Text was added to specify that the site-specific remediation goal for Th-230 in subsurface soils will be constrained to 15 pCi/g to ensure that, in the future, the concentration of Ra-226 does not exceed 5 pCi/g as a result of ingrowth of Th-230.

The FS and PP designate ARARs consistent with the requirements of

CERCLA Section 121 for the identification of cleanup standards. Additional laws and regulations proposed by the State as potential ARARs, although not relevant to the development of cleanup standards, may be applicable during implementation of the remedial action. To the extent they are applicable, the requirements will be described in the remedial action workplans to ensure compliance by USACE and its contractors during implementation. The list of ARARs proposed by the State are in Appendix A of the FS. USACE evaluation of proposed ARARs and response to the State are included in the Administrative Record File.

COMMUNITY ROLE IN THE SELECTION PROCESS

USACE encourages public input to ensure that the remedy selected for the North County Site meets the needs of the local community. All of the documentation used to support the preferred alternative is available at the following locations:

USACE Public Information Center
8945 Latty Avenue
Berkeley, Missouri 63134

St. Louis Public Library
Gov. Information Room
1301 Olive Street
St. Louis, Missouri 63103

The public is encouraged to review and comment on all alternatives described in this PP and in the supporting FS. Comments on the proposed remedial action at the North County Site will be accepted for 30 days following issuance of the FS and PP. A public meeting will be held during the comment period to receive any oral comments from the public. Written comments regarding the preferred alternative, or any other aspect of the FS and PP, will be received either at the meeting or during the 30-day comment period.

USACE will respond to all significant comments submitted during the comment period in a Responsiveness Summary. After considering these comments, USACE, in coordination with EPA, will make a final decision on the cleanup remedy for the site, which will be outlined in the ROD. The Responsiveness Summary will be an attachment to the ROD.

All written comments should be addressed to:

Ms. Sharon Cotner, Program Manager
U.S. Army Corps of Engineers
St. Louis District
8945 Latty Avenue
Berkeley, Missouri 63134

Table 1. RME Receptors Risk Summary

Carcinogens

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult
Receptor Location: SLAPS

Medium	Exposure Medium	Exposure Route-Pathway	Contaminant of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Route Total
Soil	Soil	Soil On-Site – Direct Contact	None [a]	Note b	Note b	Note b	Note b	Note b
	Dust	Soil On-Site – Inhalation of Soil as Dust	None [a]	Note b	Note b	Note b	Note b	Note b
							Chemical Soil Risk Total	Note b

Medium	Exposure Medium	Exposure Route-Pathway	Contaminant of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Route Total
Soil	Soil/Dust	Soil On-Site – Direct Contact and Inhalation of Soil as Dust	Radionuclides	Note c	Note c	-	Note c	4.8E-05
							Radiological Soil Risk Total	4.8E-05

Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/Child
Receptor Location: SLAPS

Medium	Exposure Medium	Exposure Route-Pathway	Contaminant of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Route Total
Soil	Soil	Soil On-Site – Direct Contact	Arsenic [d]	8.0E-05	doesn't apply to direct contact	6.6E-07	doesn't apply to direct contact	8.1E-05
	Dust	Soil On-Site – Inhalation of Soil as Dust	Arsenic [d]	doesn't apply to inhalation	4.6E-08	doesn't apply to inhalation	doesn't apply to inhalation	4.6E-08
							Chemical Soil Risk Total	8.1E-05

Medium	Exposure Medium	Exposure Route-Pathway	Contaminant of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Route Total
Soil	Soil/Dust	Soil On-Site – Direct Contact and Inhalation of Soil as Dust	Radionuclides	Note c	Note c	-	Note c	3.7E-03
							Radiological Soil Risk Total	3.7E-03
							Total Risk	Note e

Table 1. RME Receptors Risk Summary (Cont'd)

Non-Carcinogens

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult
Receptor Location: SLAPS

Medium	Exposure Medium	Exposure Route-Pathway	Chemical of Concern [f]	Primary Target Organ(s)	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Soil	Soil On-Site – Direct Contact	Arsenic	Cardiovascular, Skin/Hair	1.1E-01	doesn't apply to direct contact	1.1E-04	1.1E-01
		Soil On-Site – Direct Contact	Nickel	Lungs, Immune System	4.2E-02	doesn't apply to direct contact	6.5E-05	4.3E-02
		Soil On-Site – Direct Contact	Thallium	CNS, Skin/Hair	2.0E-03	doesn't apply to direct contact	4.2E-06	2.0E-03
		Soil On-Site – Direct Contact	Vanadium	Lungs	2.0E-02	doesn't apply to direct contact	8.4E-04	2.1E-02
	Dust	Soil On-Site – Inhalation of Soil as Dust	Arsenic	Cardiovascular, Skin/Hair	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site – Inhalation of Soil as Dust	Nickel	Lungs, Immune System	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site – Inhalation of Soil as Dust	Thallium	CNS, Skin/Hair	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site – Inhalation of Soil as Dust	Vanadium	Lungs	doesn't apply to inhalation	-	doesn't apply to inhalation	-
Chemical Soil Hazard Index Total								1.7E-01
Cardiovascular System Total Hazard Index								1.1E-01
Central Nervous System (CNS) Total Hazard Index								2.0E-03
Immune System Total Hazard Index								4.3E-02
Respiratory System (Lungs) Total Hazard Index								6.3E-02
Skin/Hair Total Hazard Index								1.1E-01
					Ingestion	**Inhalation**	**Dermal**	**Exposure Route Total**
Soil	Soil/Dust	Soil On-Site – Direct Contact and Inhalation of Soil as Dust	Radionuclides	Note g	Note g	Note g	Note g	Note g
Radiological Soil Total Dose (mrem/yr)								2.2E+01

Table 1. RME Receptors Risk Summary (Cont'd)

Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult/Child
Receptor Location: SLAPS

Medium	Exposure Medium	Exposure Route-Pathway	Contaminant of Concern [h]	Primary Target Organ(s)	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Soil	Soil On-Site - Direct Contact	Arsenic	Cardiovascular, Skin/Hair	4.2E-01	doesn't apply to direct contact	3.4E-03	4.2E-01
		Soil On-Site - Direct Contact	Barium	Cardiovascular	9.8E-02	doesn't apply to direct contact	4.7E-03	1.0E-01
		Soil On-Site - Direct Contact	Chromium	Lungs	3.8E-01	doesn't apply to direct contact	6.4E-02	4.5E-01
		Soil On-Site - Direct Contact	Nickel	Lungs, Immune System	1.6E-01	doesn't apply to direct contact	2.0E-03	1.6E-01
		Soil On-Site - Direct Contact	Thallium	CNS, Skin/Hair	7.7E-02	doesn't apply to direct contact	1.3E-03	7.8E-02
		Soil On-Site - Direct Contact	Vanadium	Lungs	7.7E-02	doesn't apply to direct contact	2.6E-02	1.0E-01
		Soil On-Site - Direct Contact	Zinc	Blood	5.2E-03	doesn't apply to direct contact	8.8E-05	5.3E-03
	Dust	Soil On-Site - Inhalation of Soil as Dust	Arsenic	Cardiovascular, Skin/Hair	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site - Inhalation of Soil as Dust	Barium	Cardiovascular	doesn't apply to inhalation	2.7E-03	doesn't apply to inhalation	2.7E-03
		Soil On-Site - Inhalation of Soil as Dust	Chromium	Lungs	doesn't apply to inhalation	2.3E-03	doesn't apply to inhalation	2.3E-03
		Soil On-Site - Inhalation of Soil as Dust	Nickel	Lungs, Immune System	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site - Inhalation of Soil as Dust	Thallium	CNS, Skin/Hair	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site - Inhalation of Soil as Dust	Vanadium	Lungs	doesn't apply to inhalation	-	doesn't apply to inhalation	-
		Soil On-Site - Inhalation of Soil as Dust	Zinc	Blood	doesn't apply to inhalation	-	doesn't apply to inhalation	-
Chemical Soil Hazard Index Total								1.3E+00
Blood Total Hazard Index								5.3E-03
Cardiovascular System Total Hazard Index								5.2E-01
Central Nervous System (CNS) Total Hazard Index								7.8E-02
Immune System Total Hazard Index								1.6E-01
Respiratory System (Lungs) Total Hazard Index								7.1E-01
Skin/Hair Total Hazard Index								5.0E-01

Table 1. RME Receptors Risk Summary (Cont'd)

Medium	Exposure Medium	Exposure Point	Contaminant of Concern	Primary Target Organ(s)	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Route Total
Soil	Soil/Dust	Soil On-Site - Direct Contact and Inhalation of Soil as Dust	Radionuclides	Note g	Note g	Note g	Note g	Note g

Radiological Soil Total Dose (mrem/yr) 3.2E+02

Notes:

[a] No Contaminants of Concern (COC) were identified for this property or any other property for the Maintenance Worker receptor.

[b] Not applicable since there are no COCs.

[c] The risk for radionuclides was calculated based only as a total across applicable exposure pathways and are not presented for each individual pathway.

[d] Although not a COC for this property, this contaminant was identified as a COC for another property for the Resident receptor. Risks are shown here for all carcinogenic residential COCs.

[e] The total risk (e.g., sum of chemical and radionuclide risks) may not be directly additive but the risk from exposure to radionuclides far exceeds the risk from exposure to non-radionuclides. Therefore the total risk is approximately the same as the radiological risk.

[f] Although none of the chemicals listed are COCs at this site, these chemicals have been identified as COCs for another property for the Maintenance Worker receptor. Hazards are shown here for all non-carcinogenic maintenance worker COCs.

[g] Radionuclide exposure is not presented in terms of hazard quotient (see dose in mrem/yr).

[h] Although none of the chemicals listed are COCs at this site (since all target organs produce a total HI < 1), these chemicals have been identified as COCs for another property for the Resident receptor. Hazards are shown here for all non-carcinogenic residential COCs except for antimony, which was not evaluated for risk at this site since it was eliminated in the soil screening process.

\- Toxicity criteria are not available to quantitatively address this route of exposure

Table 2a. Supplemental Human Health Risk Summary Table

Radiological Reasonable Maximum Exposures - Current Receptors							
Properties [a]	RME [b] Receptor	Minimum Dose (mrem/yr)	Maximum Dose (mrem/yr)	Average Dose [c] (mrem/yr)	Minimum Risk [d]	Maximum Risk [d]	Average Risk [c]
IAs 1-13	Maintenance	0.0	233	21	6E-10	5E-04	5E-05
HISS & Futura	Industrial	2.7	79	25	4E-05	8E-04	3E-04
Coldwater Creek	Construction	2.9	8.6	5.8	2E-06	3E-06	3E-06
Buildings/Roads/Bridges/Railroads	Construction	5.4	31	17	2E-06	1E-05	6E-06
VPs (worst-case) [d]	Industrial	15	18	17	2E-04	2E-04	2E-04
VPs (average) [e]	Industrial	0.8	1.3	1.1	2E-05	2E-05	2E-05
Radiological Reasonable Maximum Exposures - Future Receptors							
Properties [a]	RME [b] Receptor	Minimum Dose (mrem/yr)	Maximum Dose (mrem/yr)	Average Dose [c] (mrem/yr)	Minimum Risk	Maximum Risk	Average Risk [c]
IAs 1-13	Resident	0.0	3407	311	1E-07	4E-02	4E-03
HISS & Futura	Resident	9.3	294	91	1E-04	3E-03	1E-03
Coldwater Creek	Construction	2.9	8.6	5.8	2E-06	3E-06	3E-06
Buildings/Roads/Bridges/Railroads	Construction	5.4	31	17	2E-06	1E-05	6E-06
VPs (worst-case) [d]	Resident	51	60	56	7E-04	9E-04	8E-04
VPs (average) [e]	Resident	2.7	4.3	3.5	6E-05	7E-05	7E-05
Non-radiological Reasonable Maximum Exposures - Current Receptors [f]							
Properties [a]	RME [b] Receptor	Minimum HI [g]	Maximum HI	Average HI	Minimum Risk	Maximum Risk	Average Risk
IAs 1-13	Maintenance	< 0.1	0.5	< 0.2	2E-8	2E-5	3E-6
HISS & Futura	Industrial	1.4	3.5	2.5	9E-5	3E-4	2E-4
Coldwater Creek	Construction	-	-	-	-	-	-
Buildings/Roads/Bridges/Railroads [h]	Construction	1.3	1.3	1.3	2E-6	2E-6	2E-5
VPs [h]	Industrial	< 0.1	< 0.1	< 0.1	-	-	-
Non-radiological Reasonable Maximum Exposures - Future Receptors [f]							
Properties [a]	RME [b] Receptor	Minimum HI	Maximum HI	Average HI	Minimum Risk	Maximum Risk	Average Risk
IAs 1-13	Resident	< 0.1	2.5	< 0.8	5E-7	3E-4	5E-5
HISS & Futura	Resident	4.7	13	9	4E-4	1E-3	7E-4
Coldwater Creek	Construction	-	-	-	-	-	-
Buildings/Roads/Bridges/Railroads [h]	Construction	1.3	1.3	1.3	2E-6	2E-6	2E-6
VPs [h]	Resident	0.2	0.2	0.2	-	-	-

[a] VP = vicinity property; IA = investigation area (includes SLAPS)

[b] RME = reasonable maximum exposure

[c] Averaged over year 0.0 and year 1,000 estimates for listed properties

[d] Minimum and maximum values listed for VP with worst-case source term

[e] Results when averaging across all VPs

[f] Results for all non-radionuclides including those that are non-FUSRAP-related

[g] HI = hazard index; only maximum values provided because total risks are dominated by radionuclides

[h] No non-radiological available data except where property also falls under an IA

Table 2b. Supplemental Human Health Risk Evaluation Summary Table

Property Name	RESIDENTIAL SCENARIO				INDUSTRIAL SCENARIO				CONSTRUCTION SCENARIO			
	Dose Year = 0.0	Dose Year = 1000	Risk Year = 0.0	Risk Year = 1000	Dose Year = 0.0	Dose Year = 1000	Risk Year = 0.0	Risk Year = 1000	Dose Year = 0.0	Dose Year = 1000	Risk Year = 0.0	Risk Year = 1000
VPs (highest value)	60	51	9E-04	7E-04	18	15	2E-04	2E-04	47	42	2E-05	2E-05
VPs (average value)	2.7	4.3	6E-05	7E-05	0.8	1.3	2E-05	2E-05	2.3	3.2	9E-07	2E-06
Coldwater Creek	not applicable				not applicable				8.6	2.9	3E-06	2E-06
Railroad	not applicable				not applicable				6.7	5.4	3E-06	2E-06
Road Right-of-Way	29	37	4E-04	5E-04	8.0	11	1E-04	1E-04	25	31	9E-06	1E-05
HISS	42	9.3	5E-04	1E-04	12	2.7	1E-04	4E-05	34	7.4	1E-05	3E-06
Futura	294	18	3E-03	3E-04	79	5.3	8E-04	7E-05	251	14	8E-05	6E-06
IA-1	3407	78	4E-02	1E-03	946	24	9E-03	3E-04	2801	56	1E-03	3E-05
IA-2	382	180	5E-03	3E-03	105	51	1E-03	7E-04	322	149	1E-04	6E-05
IA-3	492	65	6E-03	9E-04	144	18	2E-03	2E-04	369	54	2E-04	2E-05
IA-4	1159	315	2E-02	4E-03	337	90	4E-03	1E-03	890	262	4E-04	1E-04
IA-5	179	89	2E-03	1E-03	48	25	5E-04	3E-04	156	73	5E-05	3E-05
IA-6	84	68	9E-04	1E-03	21	20	2E-04	3E-04	80	55	2E-05	2E-05
IA-7	621	256	6E-03	4E-03	164	72	2E-03	9E-04	557	213	2E-04	8E-05
IA-8	341	221	3E-03	3E-03	87	63	8E-04	8E-04	325	184	8E-05	7E-05
IA-9	24	16	2E-04	2E-04	6.0	4.5	6E-05	6E-05	22	13	6E-06	5E-06
IA-10	24	5.0	3E-04	8E-05	6.5	1.5	7E-05	2E-05	20	3.6	7E-06	2E-06
IA-11	0.0	0.0	1E-07	4E-07	0.0	0.0	2E-08	1E-07	0.0	0.0	5E-10	1E-08
IA-12	30	42	4E-04	6E-04	7.6	12	9E-05	2E-04	30	35	7E-06	1E-05
IA-13	10	4.8	1E-04	8E-05	2.8	1.5	3E-05	2E-05	8.8	3.3	3E-06	2E-06
SLAPS	321	110	4E-03	2E-03	89	31	1E-03	4E-04	267	91	1E-04	4E-05

Property Name	MAINTENANCE SCENARIO				RECREATIONAL/TRESPASSER SCENARIO				UTILITY WORKER SCENARIO			
	Dose Year = 0.0	Dose Year = 1000	Risk Year = 0.0	Risk Year = 1000	Dose Year = 0.0	Dose Year = 1000	Risk Year = 0.0	Risk Year = 1000	Dose Year = 0.0	Dose Year = 1000	Risk Year = 0.0	Risk Year = 1000
VPs (highest value)	3.8	3.4	1E-05	8E-06	0.9	0.8	5E-06	4E-06	1.9	1.7	8E-07	7E-07
VPs (average value)	0.2	0.3	5E-07	7E-07	0.0	0.1	3E-07	3E-07	0.1	0.1	3E-08	6E-08
Coldwater Creek	0.7	0.2	1E-06	8E-07	0.1	0.1	5E-07	4E-07	0.3	0.1	1E-07	6E-08
Railroad	0.5	0.4	2E-06	1E-06	0.1	0.1	8E-07	6E-07	0.3	0.2	1E-07	1E-07
Road Right-of-Way	2.1	2.5	5E-06	6E-06	0.4	0.6	2E-06	3E-06	1.0	1.2	4E-07	5E-07
HISS	2.8	0.6	7E-06	2E-06	0.6	0.1	3E-06	7E-07	1.3	0.3	6E-07	1E-07
Futura	21	1.1	4E-05	3E-06	4.0	0.3	2E-05	1E-06	10	0.6	3E-06	2E-07
IA-1	233	4.2	5E-04	1E-05	49	1.3	2E-04	7E-06	112	2.2	4E-05	1E-06
IA-2	27	12	6E-05	3E-05	5.4	2.7	2E-05	1E-05	13	6.0	5E-06	2E-06
IA-3	29	4.3	8E-05	1E-05	7.6	1.0	4E-05	5E-06	15	2.1	7E-06	8E-07
IA-4	71	21	2E-04	5E-05	18	4.7	9E-05	2E-05	36	10	2E-05	4E-06
IA-5	13	6.0	3E-05	1E-05	2.5	1.3	1E-05	6E-06	6.2	2.9	2E-06	1E-06
IA-6	6.9	4.5	1E-05	1E-05	1.1	1.0	4E-06	5E-06	3.2	2.2	8E-07	9E-07
IA-7	48	17	8E-05	4E-05	8.3	3.8	3E-05	2E-05	22	8.5	7E-06	3E-06
IA-8	28	15	4E-05	4E-05	4.3	3.3	2E-05	2E-05	13	7.4	3E-06	3E-06
IA-9	1.9	1.0	3E-06	3E-06	0.3	0.2	1E-06	1E-06	0.9	0.5	2E-07	2E-07
IA-10	1.7	0.3	3E-06	9E-07	0.3	0.1	1E-06	4E-07	0.8	0.1	3E-07	7E-08
IA-11	0.0	0.0	6E-10	5E-09	0.0	0.0	2E-10	2E-09	0.0	0.0	2E-11	4E-10
IA-12	2.6	2.8	4E-06	7E-06	0.4	0.6	2E-06	3E-06	1.2	1.4	3E-07	5E-07
IA-13	0.7	0.3	1E-06	9E-07	0.1	0.1	6E-07	4E-07	0.4	0.1	1E-07	7E-08
SLAPS	22	7.4	5E-05	2E-05	4.6	1.6	2E-05	8E-06	11	3.6	4E-06	1E-06

Results for dose in mrem/yr.
VP = vicinity properties
IA = investigation area.

Table 3. Remedial Action Objectives for Remediation of the North County Site

Media	Remedial Action Objectives
Soils and Sediments	Eliminate or minimize potential human exposure to soils and sediments contaminated with FUSRAP-related COCs at levels that exceed the standards established in the ARARs or the site-specific remediation goals. Prevent exposures from residual contamination in soils and sediments with concentrations greater than remediation goals Eliminate or minimize volume, toxicity, and mobility of contaminated soils and sediments Eliminate or minimize the potential migration of contaminants off-site including the potential for migration to ground water and surface water, by removing the sediment and soil sources.

Table 4. ARARs for the North County Site Alternatives

ARAR	Citation	Specific Requirements	Applicability or Relevance and Appropriateness to North County Site Alternatives					
CHEMICAL SPECIFIC				**2**	**3**	**4**	**5**	**6**
40 CFR Part 192 **Subpart A:** Uranium Mill Tailings Radiation Control Act (UMTRCA), Standards for Control of Residual Radioactive Materials from Inactive Uranium Processing Sites	*40 CFR 192.02 (a), (b)*	The standards in 192.02 (a) and (b) require a cover design that will "be effective for up to 1000 years, to the extent reasonably achievable, and, in any case, for at least 200 years..." and "provide reasonable assurance that release of Ra-222 from residual radioactive material to the atmosphere will not exceed an average release rate of 20 picocuries per square meter per second (pCi/m^2/sec) nor increase the annual average concentration of Ra-222 in the air at or above any location outside the disposal site by more than 0.5 picocuries per liter (pCi/L)."	**Relevant and appropriate.** Provides design standards for areas where residual radioactive materials remain above the soil cleanup levels. The 1000-year time period specified in 192.02(a) is relevant and appropriate for the development of soil RGs.	X	X	X	X	X
40 CFR Part 192 **Subpart B:** UMTRCA, Standards for Cleanup of Land and Buildings Contaminated with Residual Radioactive Materials from Inactive Uranium Processing Sites	*40 CFR 192.12 (a), (b)*	*192.12 (a)* specifies that Ra-226 concentrations shall not exceed 5 pCi/g above background in top 15 cm and 15 pCi/g above background in lower 15 cm layers averaged over 100 m^2 areas. *192.12 (b)* specifies limitations for gamma radiation in occupied or habitable buildings.	**Relevant and appropriate.** Provides the basis for the RGs for radium in soil under unrestricted land use: 5 pCi/g Ra-226 above background in surface soils 15 pCi/g Ra-226 above background in subsurface soils	X	X	X	X	X
40 CFR Part 192 **Subpart C:** UMTRCA, Implementation	*40 CFR 192.20 (a) (1,3); (b) (1, 2, 3); 192.21 (a-f, h); 192.22 (a-c)*	Subpart C allows the use of supplemental standards for establishing alternate limits in lieu of the standards of Subparts A or B if it is determined that circumstances set forth in 40 CFR 192.21 exist. Supplemental standards for subsurface soils used with institutional controls are appropriate under the circumstance set forth in 40 CFR 192.21 (c) which allows the use of supplemental standards if "the estimated cost of remedial action to satisfy § 192.12(a) is unreasonably high relative to the long-term benefits, and the residual radioactive materials do not pose a clear present or future hazard."	**Relevant and appropriate.** Provides basis for development of supplemental standards for subsurface soils used with institutional controls at SLAPS and HISS/Futura: 25 pCi/g Ra-226 above background 70 pCi/g Th-230 above background 250 pCi/g U-238 above background	X	X			

Table 4. ARARs for the North County Site Alternatives (Cont'd)

ARAR	Citation	Specific Requirements	Applicability or Relevance and Appropriateness to North County Site Alternatives					
				2	3	4	5	6
10 CFR 40 Appendix A Criterion 6(6) Criteria for Disposal of Wastes from Processing Source Material	*10 CFR 40 Appendix A Criterion 6(6)*	Criterion 6(6) requires that byproduct material containing concentrations of radionuclides other than radium in soil, and surface activity on remaining structures, must not result in a total effective dose equivalent (TEDE) exceeding the dose from cleanup of radium contaminated soil to the above standard (benchmark dose), and must be at levels which are as low as is reasonably achievable. If more than one residual radionuclide is present in the same 100-square-meter area, the sum of the ratios for each radionuclide of concentration present to the concentration limit will not exceed "1" (unity).	**Relevant and appropriate.** Provides basis for the derivation of RGs for radionuclides other than Ra-226. RGs other than Ra-226 (above background): 14 pCi/g Th-230 in surface soils 50 pCi/g U-238 in surface soil U-238 is surrogate for U-234, U-235, and uranium decay products .	X	X	X	X	X
40 CFR Part 122, Clean Water Act – National Pollutant Discharge Elimination System (NPDES)	*40 CFR 122 Subpart C: δ122.41(d, e) δ122.44(a, d, e, i)*	Establishes limits for discharge of pollutants into waters of the state. Any water discharged from a point source into waters of the state must meet any limits that would have been established in the NPDES permit.	**Relevant and appropriate.** The effluent limits (daily maximum and monthly average concentrations) addressing site COCs at SLAPS are: 100 ug/L total recoverable arsenic 94 ug/L total recoverable cadmium 280 ug/l total recoverable chromium	X	X	X	X	X

Table 5. Summary of Proposed Remediation Goals

Remediation Goals for Unrestricted Land Use	Remediation Goals for Use with Institutional Controls at SLAPS and HISS/Futura
Surface soils would be remediated if the radionuclide concentrations above background averaged over 100 m^2 exceed 5 pCi/g of Ra-226, 14 pCi/g of Th-230, or 50 pCi/g of U-238 in the top 15 cm (6 in). Subsurface soils would be remediated if the radionuclide concentrations above background averaged over 100 m^2 exceed 15 pCi/g of Ra-226, 15 pCi/g of Th-230, or 50 pCi/g of U-238 in any subsequent 15 cm (6 in) layer. Soils and sediments below the mean water gradient of Coldwater Creek would be remediated if the radionuclide concentrations above background averaged over 100m^2 exceed 15 pCi/g of Ra-226, 43 pCi/g of Th-230, or 150 pCi/g of U-238. Soil remediation goals apply to soils above the mean water gradient of Coldwater Creek. Confirmation would include surveys and residual risk calculations to ensure that total residual site risk is within the CERCLA risk range. Final status surveys compatible with MARSSIM would be used to document achievement of the remediation goals for radiological COCs.	Supplemental standards are developed for Alternatives 2 and 3 in accordance with 40 CFR 192, Subpart C. These supplemental standards are used in conjunction with institutional controls at SLAPS and HISS/Futura (the primary areas used for storage of FUSRAP materials). Supplemental standards are appropriate for the primary storage areas under the containment and treatment alternatives because excavation to the RGs for unrestricted use would result in excessive remediation costs relative to the long-term benefits, and because the residual materials will not pose a present or future hazard. The supplemental criteria constrain doses so that public exposure limits would not be exceeded should the institutional controls be lost. The supplemental criteria for subsurface soil limit contamination to average above background concentrations of 25 pCi/g of Ra-226, 70 pCi/g of Th-230, and 250 pCi/g of U-238 or combinations of radionuclides. Institutional controls are implemented to ensure that future land use is fully protective. Supporting information concerning the derivation of these RGs is presented in Appendix D of the Feasibility Study (Section D.2.2).

Table 7. Summary of Technology Screening at the North County Site

Response Action	Technologies	Process Options	Used in the North County Alternatives				
			Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Access Controls	Site security	Signs	X	X	X	X	
		Physical barriers, e.g., fencing		X			
Institutional Controls	Land use restrictions and notices	Land use restrictions	X	X	X	X	
		• SLAPS • HISS/Futura • Buildings, roads, bridges, and railroads • Creek (within banks) • Remaining VPs	Indust. Indust. Utility Rec. None	Indust. None Utility None None	Indust. Indust. Utility Rec. All	None None Utility None None	None None None None None
		Deed notices	X	X	X	X[b]	
		Well drilling prohibitions	X	X	X		
		Commercial/industrial zoning	X	X	X	X[b]	
Monitoring	Long-term monitoring[a]	Air, sediment, ground water, surface water	Ground water	Ground water	Ground water	Ground water (unlikely)	
Containment	Cap	Multi-media cap	SLAPS, HISS/Futura				
		Asphalt or concrete	Roads	Roads	Roads	Roads	
Removal	Excavation		Limited for SLAPS, HISS/Futura, roads, bridges, railroads and other permanent structures	Limited for SLAPS, roads, bridges, railroads, and other permanent structures	None	Limited for roads, bridges, railroads, and other permanent structures	All Areas
Treatment	Soil sorting			X		Option	
	Soil washing	Enhanced soil washing		X			
	Phytoremediation	Rhizofiltration, phytoaccumulation		X			
Technologies Common to Alternatives 2 through 6							
Monitoring	Short-term monitoring (During remedial action)	Air, sediment, ground water, surface water	X	X		X	X
Containment	Revegetation		X	X		X	
	Dust mitigation	Water spray, foam	X	X		X	X
	Storage pile covers	Geotextile, spray coatings, tarps	X	X		X	X
Removal	Dredging	Hydraulic	Creek	Creek		Creek	Creek
Treatment	Recycle to uranium mill	Permitted facilities	Option	Option		Option	Option
	Size reduction	Crushing, cutting	X	X		X	X
	Dewatering	Evapotranspiration, filters, drying	X	X		X	X
Transportation	Rail	Covered rail cars, containers	X	X		X	X
	Truck	Covered trucks, containers	X	X		X	X
Disposal	Licensed or permitted off-site facility	Radioactive wastes, hazardous wastes, solid wastes	X	X		X	X

[a] In areas where contamination remains above unrestricted levels in sufficient quantities to significantly impact ground-water quality, ground-water monitoring could continue until terminated as part of the 5-year reviews. Long-term monitoring of HZ-A and long-term monitoring of Unit 4 in HZ-C (as a surrogate for HZ-E) is proposed for Alternatives 2, 3, and 4. For Alternative 5, the results of short-term monitoring would be used to determine if long-term ground-water is required to access potential contaminant migration from contaminated soils remaining beneath roads, bridges, railroads, and other permanent structures.

[b] May be needed until areas under buildings at Futura are made available by the owner.

Table 8. Removals Included in the Site-wide Alternatives

	Alternative 1, No-Further-Action	Alternative 2, Containment at SLAPS and HISS/Futura	Alternative 3, Treatment at SLAPS	Alternative 4, Institutional Controls (with no further excavation)	Alternative 5, Excavation with Institutional Controls Under Buildings, Roads, Bridges, and Railroads	Alternative 6, Excavation at All Properties
Total Soil Removal, Thousands of Cubic Yards						
[a]Impacted volume to be excavated, yd^3	0	150	190	0	230	300
Excavation volume, yd^3	Excavation volume: the in-situ volume of soil plus the excavation allowance needed to remove the impacted volume; (about 20%) i.e., the size of the hole; generally 20% larger than impacted volume.					
Ex-situ, yd^3	Ex-situ volume: the volume after soil swelling as a result of excavation; generally 25% larger than the excavation volume.					

[a] Impacted volume to be excavated, in-situ volume of soil above the cleanup criteria rounded to two significant figures.

Table 9. Land Use by Property

Property ID [a]	Current Receptor	RME Receptor	Removal Status
Primary Areas Used for Storage			
Futura	Industrial	Industrial	
HISS	Construction	Industrial	Piles removed
IA-1 (Part of SLAPS)	Construction	Industrial	Partial Removal
IA-2 (Part of SLAPS)	Construction	Industrial	Partial Removal
IA-3 (Part of SLAPS)	Construction	Industrial	Partial Removal
IA-4 (Part of SLAPS)	Construction	Industrial	Removal Action
IA-5 (Part of SLAPS)	Construction	Industrial	Partial Removal
IA-6 (Part of SLAPS)	Construction	Industrial	Removal Action
IA-7 (Part of SLAPS)	Construction	Industrial	Removal Action
Areas Immediately Adjacent to Storage Areas			
VP-1(L)[c]	Industrial	Industrial	
10K530087, west of VP-1(L)	Industrial	Industrial	
VP-2(L)[c]	Industrial	Industrial	Removal Action
IA-9	Construction	Recreational	Partial Removal
IA-11	Industrial	Industrial	
IA-13	Industrial	Industrial	
VP-40(A)	Industrial	Industrial	
Properties with Small Amounts of Contamination			
VP-1 (C)[b]	Industrial	Industrial	
VP-2(C)[b]	Industrial	Industrial	
VP-3 (C)[b]	Industrial	Industrial	
VP-4 (C)[b]	Industrial	Industrial	
VP-5 (C)[b]	Industrial	Industrial	
VP-7	Industrial	Industrial	
VP-8 (C)[b]	Industrial	Industrial	
VP-9	Industrial	Industrial	
VP-10	Industrial	Industrial	
VP-11	Industrial	Industrial	
VP-12	Industrial	Industrial	
VP-13	Industrial	Industrial	
VP-15	Industrial	Industrial	
VP-35(A)	Construction	Industrial	
VP-38	Industrial	Industrial	Partial Removal
VP-57	Industrial	Industrial	
VP-58	Industrial	Industrial	
VP-59	Industrial	Industrial	
IA-10	Recreational	Recreational	
10K620452, south of Latty East	Industrial	Industrial	
Coldwater Creek, inside banks	Recreational	Recreational	
Roads, Bridges, Railroads			
Norfolk Southern	Industrial	Industrial	
Roads, bridges and railroads	Utility	Utility	
IA-8	Utility	Utility	Partial Removal
VP-14(A)	Utility	Utility	

Table 9. Land Use by Property (Cont'd)

Property ID [a]	Current Receptor	RME Receptor	Removal Status
Properties with No Expected Removal Volume			
10k620412, north of Latty east	Industrial	Industrial	
11k630221, NE of McDonnell rail siding	Industrial	Industrial	
11L520011, airport south of IA-13	Industrial	Industrial	
10k530076, north of VP-1(L)	Industrial	Industrial	
10k520165, southeast of VP-3(L)	Industrial	Industrial	
10k240182, north of VP-23	Industrial	Industrial	
10k240207, west of VP-27	Industrial	Industrial	
09k220029, east of VP-44	Residential	Residential	
VP-1	Industrial	Industrial	
VP-2	Industrial	Industrial	
VP-3	Industrial	Industrial	
VP-4	Industrial	Industrial	
VP-5	Industrial	Industrial	
VP-6	Industrial	Industrial	
VP-6 (C)[b]	Industrial	Industrial	
VP-7 (C)[b]	Industrial	Industrial	
VP-8	Industrial	Industrial	
VP-9 (C)[b]	Industrial	Industrial	
VP-10(C)[b]	Industrial	Industrial	
VP-14	Industrial	Industrial	
VP-16	Industrial	Industrial	
VP-17	Industrial	Industrial	
VP-18	Industrial	Industrial	
VP-19	Residential	Residential	Removal Action
VP-20	Residential	Residential	Removal Action
VP-21	Industrial	Industrial	Removal Action
VP-22	Industrial	Industrial	Removal Action
VP-23	Industrial	Industrial	Removal Action
VP-25	Industrial	Industrial	
VP-26	Industrial	Industrial	Removal Action
VP-27	Industrial	Industrial	Removal Action
VP-28	Industrial	Industrial	
VP-29	Residential	Residential	
VP-30	Industrial	Industrial	Removal Action
VP-31	Industrial	Industrial	
VP-36	Industrial	Industrial	Removal Action
VP-37	Industrial	Industrial	Removal Action
VP-41	Residential	Residential	Removal Action
VP-45	Industrial	Industrial	Removal Action
VP-46	Industrial	Industrial	
VP-48(A)	Industrial	Industrial	Removal Action
VP-49	Residential	Residential	
VP-50	Industrial	Industrial	
VP-51	Industrial	Industrial	
VP-52	Industrial	Industrial	
VP-54	Industrial	Industrial	

Table 9. Land Use by Property (Cont'd)

Property ID [a]	Current Receptor	RME Receptor	Removal Status
VP-55	Industrial	Industrial	
VP-56	Industrial	Industrial	Removal Action
VP-60	Industrial	Industrial	
VP-61	Industrial	Industrial	
VP-62	Industrial	Industrial	
VP-63	Industrial	Industrial	
VP-63(A)	Industrial	Industrial	
Properties with previous DOE removal actions that will require additional investigation			
VP-3(L)[c]	Industrial	Industrial	Removal Action
VP-4(L)[c]	Industrial	Industrial	Removal Action
VP-5(L)[c]	Industrial	Industrial	Removal Action
VP-6(L)[c]	Industrial	Industrial	Removal Action
VP-24	Industrial	Industrial	Removal Action
VP-31(A)	Industrial	Industrial	Removal Action
VP-32	Industrial	Industrial	Removal Action
VP-33	Industrial	Industrial	Removal Action
VP-34	Construction	Industrial	Removal Action
VP-35	Construction	Industrial	Removal Action
VP-39	Industrial	Industrial	Removal Action
VP-40	Industrial	Industrial	Removal Action
VP-42	Industrial	Industrial	Removal Action
VP-43	Residential	Residential	Removal Action
VP-44	Residential	Residential	Removal Action
VP-47	Industrial	Industrial	Removal Action
VP-48	Industrial	Industrial	Removal Action
VP-53	Industrial	Industrial	Removal Action

[a] All properties designated into FUSRAP and any additional property for which analytical data are available.

[b] Coldwater Creek VP

[c] Latty Avenue VP

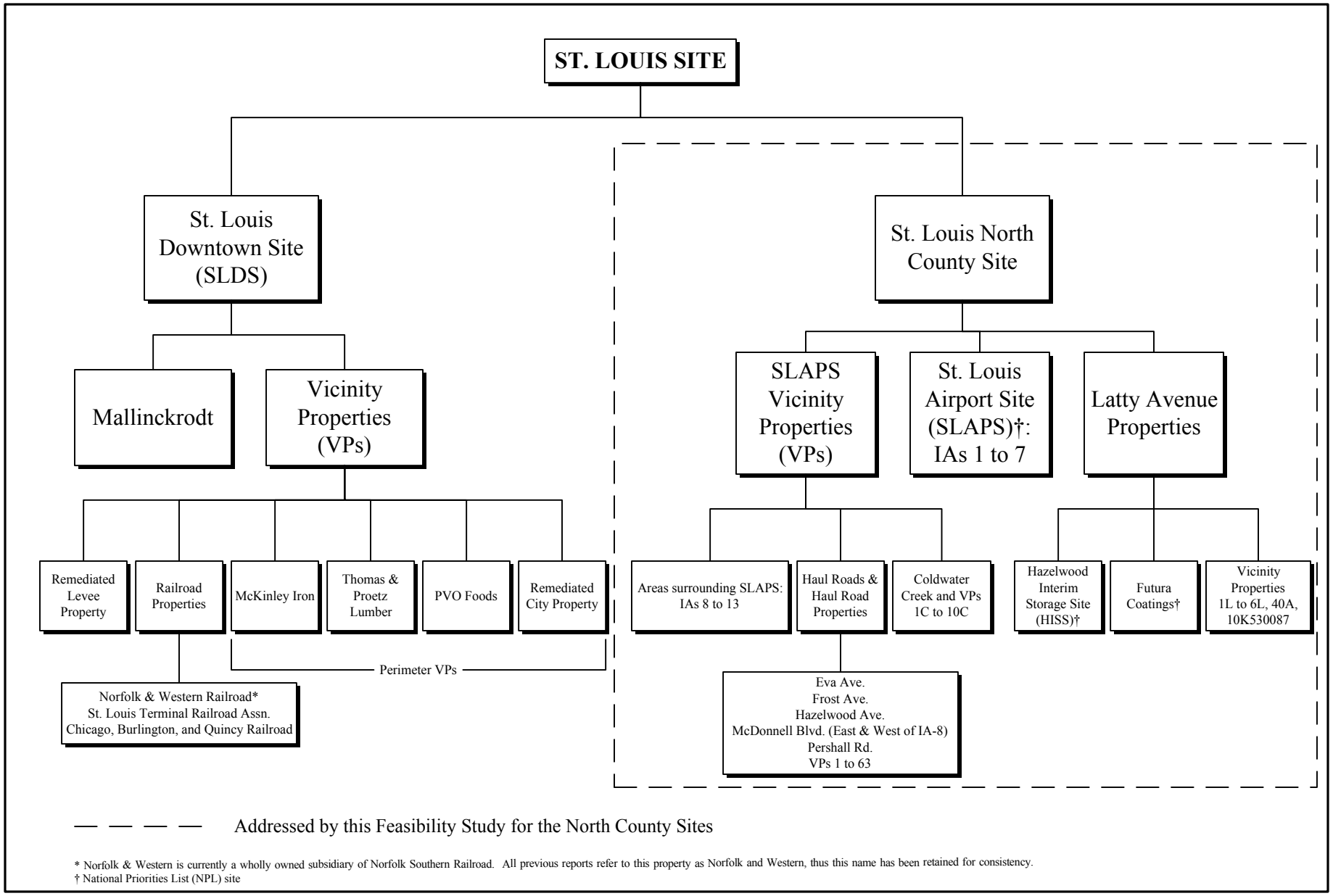

Figure 1. Schematic Representation of the FUSRAP St. Louis Site

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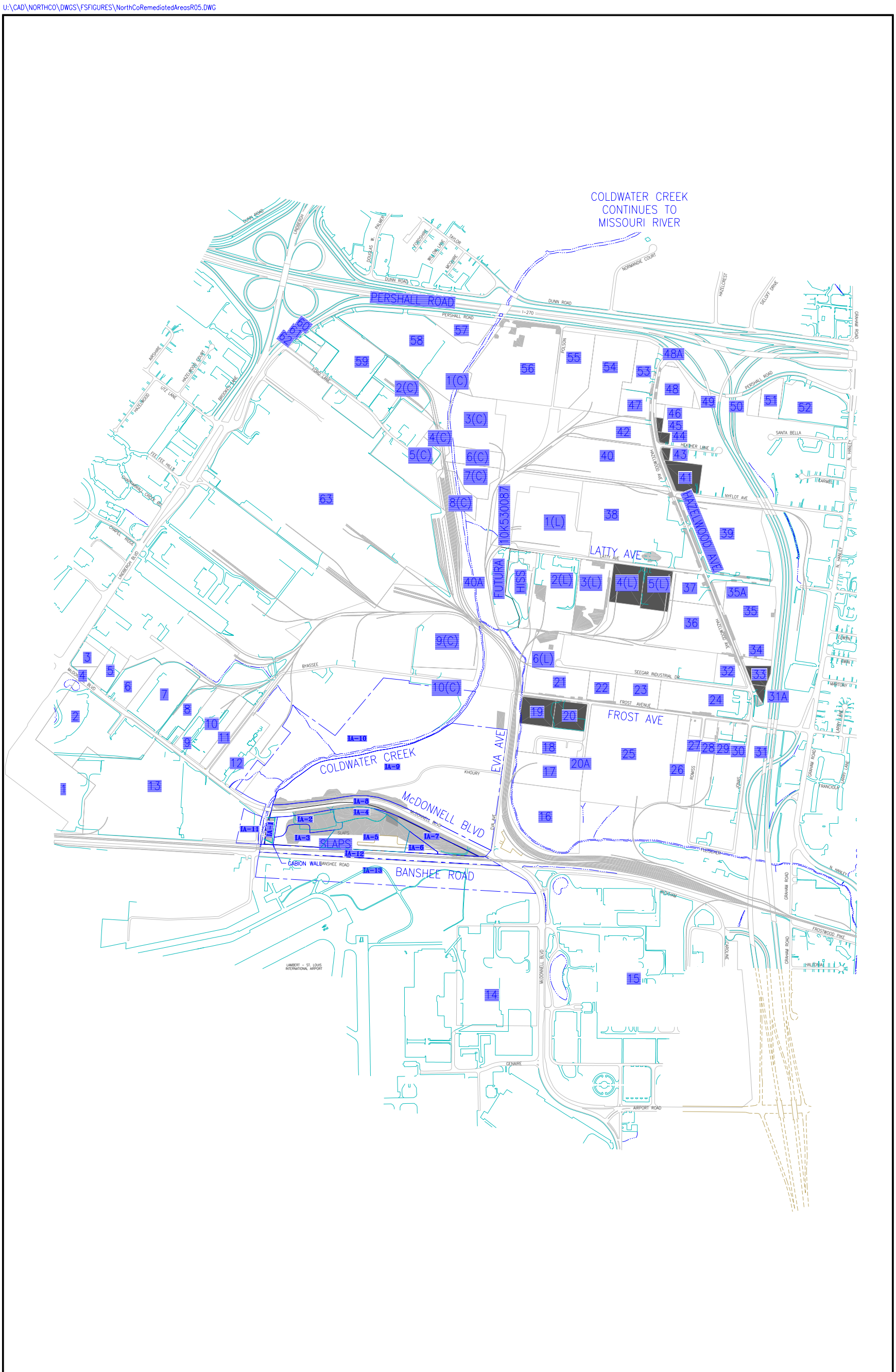

Figure 5. Location of Prior Response Actions within the North County Site

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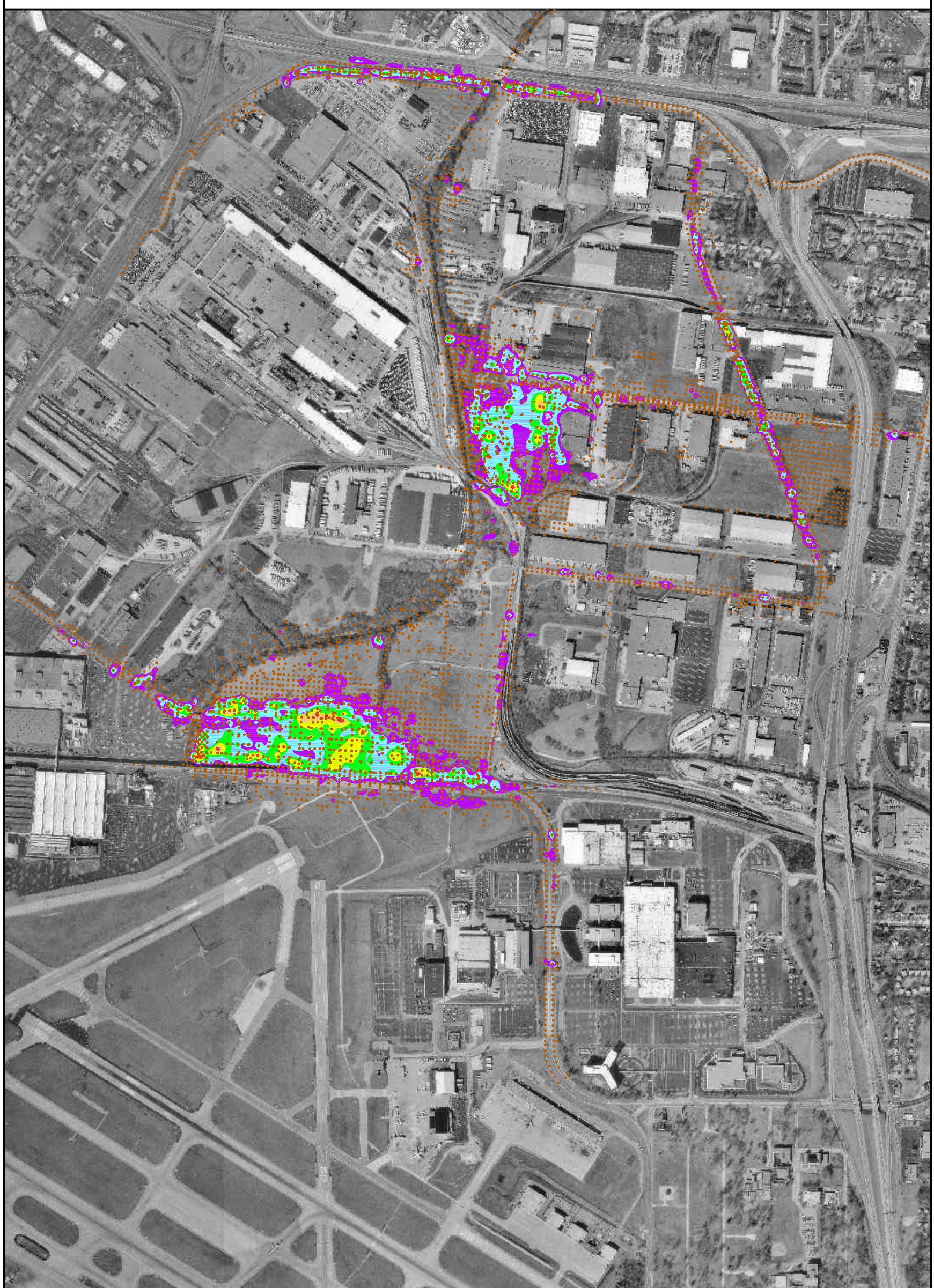

LEGEND:

$\frac{\text{Ra} - \text{background}}{5 \text{ or } 15} + \frac{\text{Th} - \text{background}}{15 \text{ or } 15} + \frac{\text{U} - \text{background}}{50 \text{ or } 50}$

Multiples of Sum of Ratios (SOR)

- 1 – 3
- 3 – 10
- 10 – 30
- 30 – 100
- 100 – 300
- >300
- SOIL SAMPLE LOCATION

NOTE: AERIAL PHOTOS CIRCA 1995–1997, PROVIDED BY MSD

0 500 1000 2000

SCALE: 1" = 1000'

FUSRAP

St. Louis Airport Site
Projected SOR 15, 15, 50
Distribution St. Louis, Missouri

DRAWN BY: R. Smith / S. Kitchings

REV. NO./DATE: 0 – 7/3/00

Figure 4. Projected Radioactivity Exceeding 5 pCi/g of Radium-226, 14 pCi/g of Thorium-230, 50 pCi/g of Uranium-238 or Combinations Such That the Sum of the Ratios =1 in Surface Soil and Exceeding 15 pCi/g of Radium-226, 15 pCi/g of Thorium-230, 50 pCi/g of Uranium-238 or Combinations Such That the Sum of the Ratios =1 in Subsurface Soil

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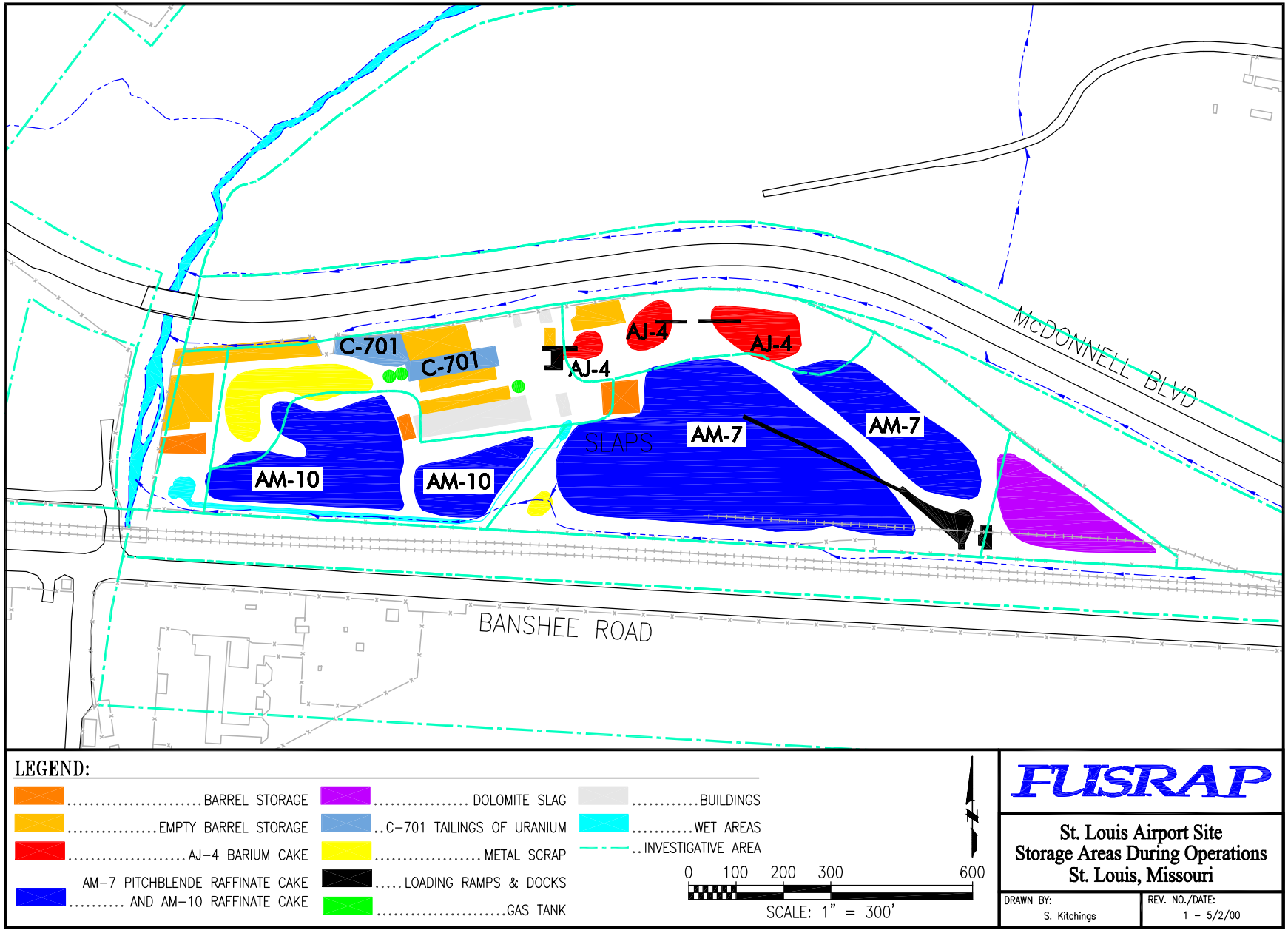

Figure 3. Schematic of Storage Areas During Active Operations at SLAPS - Circa 1958

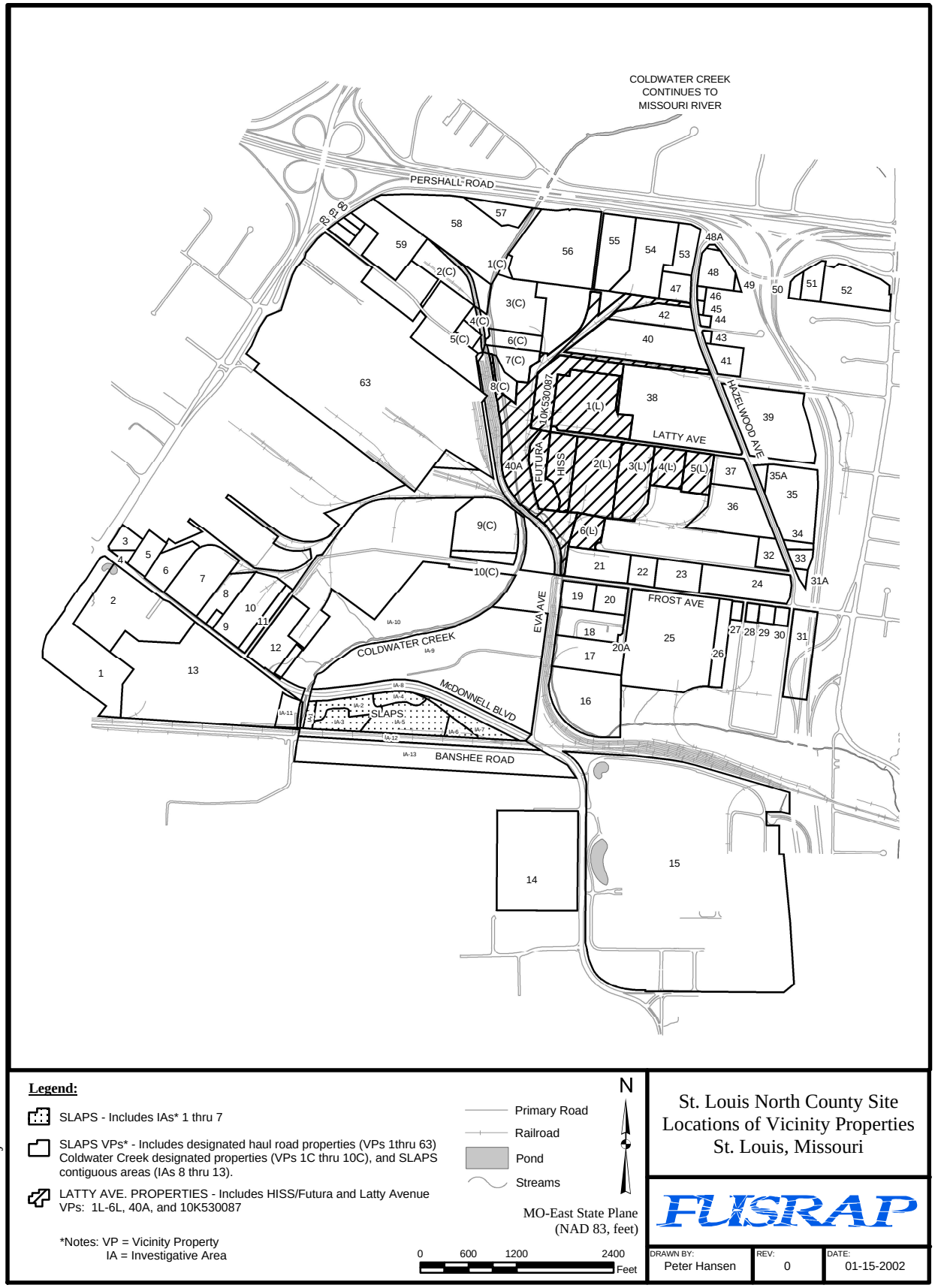

Figure 2. Locations of Vicinity Properties

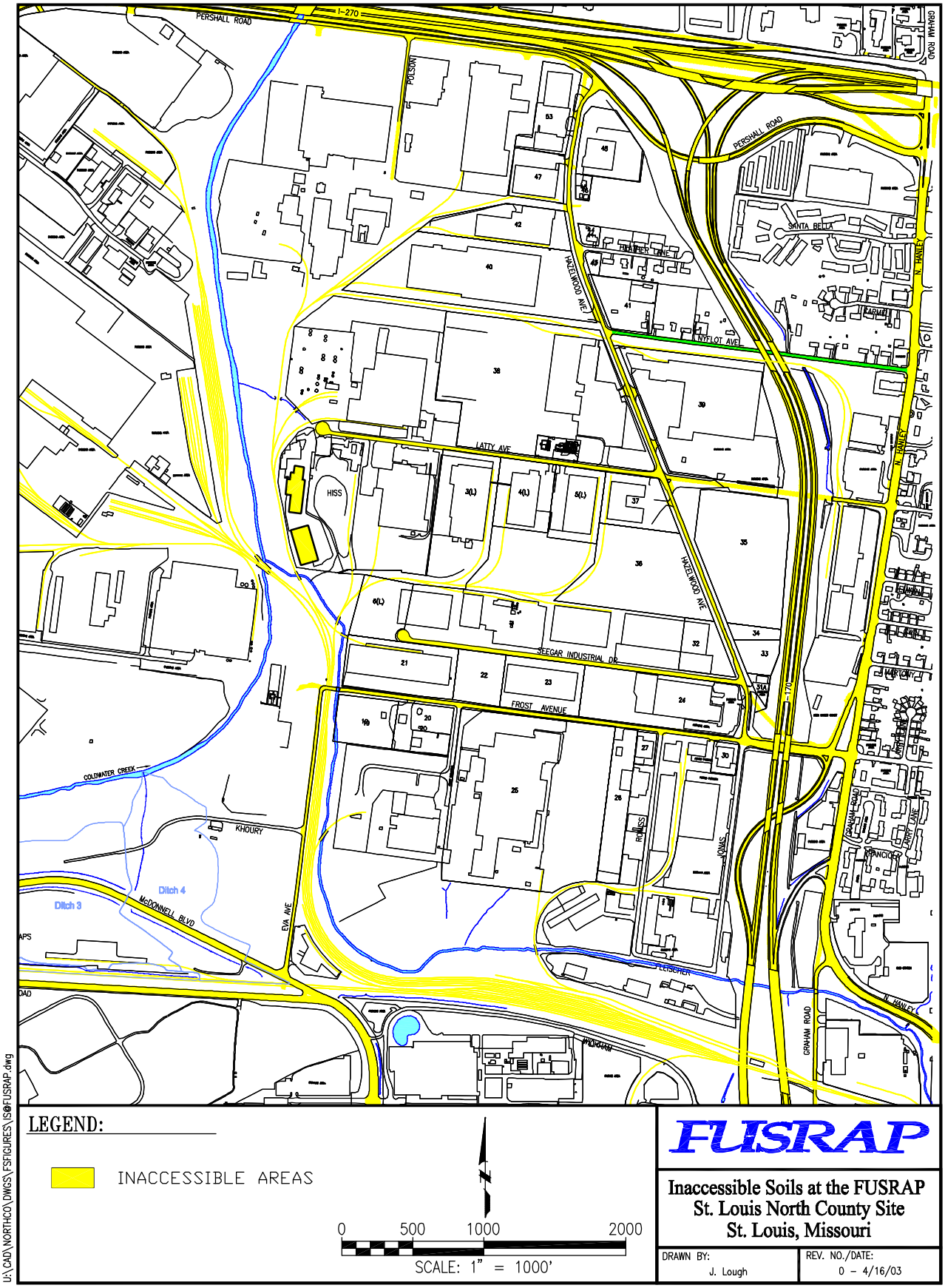

Figure 6. Inaccessible Soils at the North County Site.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the North County Site is important to USACE and the EPA. Your comments are valuable in helping select a final cleanup remedy for the site.

You may use either the space below to record your comments or a separate sheet of paper. When you have finished, please return your comments to the FUSRAP Project Office at 8945 Latty Avenue in Berkeley, Missouri 63134 by mail or fax to (314) 260-3941 no later than _____. Comments may also be submitted by email to the FUSRAP Project Manager, Ms. Sharon Cotner, at _____. If you have any questions about the comment period, please contact Ms. Cotner at _____.

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Name:_____
Address:_____
City:_____
State:_____Zip:_____