St. Louis Site Remediation Task Force Report

September 1996

Mission Statement

The St. Louis Site Remediation Task Force is a broadly based representative body formed in September 1994 to identify and evaluate remedial action alternatives for the cleanup and disposal of radioactive waste materials at the St. Louis FUSRAP Site and at West Lake Landfill, and to petition the U.S. Department of Energy to pursue a cleanup strategy that is environmentally acceptable and responsive to public health and safety concerns.

Sally P. Price
Chair

Anna Ginsburg
Vice Chair

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EXECUTIVE SUMMARY

For over 50 years, a long-term environmental, health and safety issue has existed in the St. Louis community due to radioactive contamination created by the development of the world's first atomic bomb. As World War II began to escalate a sense of need and urgency motivated the U.S. government to find the expertise to develop a process for extracting and purifying uranium for nuclear weapons production. Mallinckrodt Chemical Works located in downtown St. Louis had the experience base to undertake the challenge. This national defense project known as *The Manhattan Project* and ongoing nuclear weapons production, left St. Louis with a legacy of environmental, health and safety problems.

From concept through the early years of the Cold War, St. Louis was the only source of processed uranium in the entire country. The aftermath of The Manhattan Project has left St. Louis with the largest Site in the Department of Energy's (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP) in both acreage and volume of radioactive waste material. The complexity of remediating the Site is magnified by a unique set of factors existing in St. Louis:

- Contaminated sites are located in a densely populated metropolitan area of 2.4 million people
- Industrial, residential, and recreational activities have occurred and continue to occur in and around the contaminated sites
- Evidence indicates that extensive migration of radioactive contaminants by air, surface water and ground water transport has occurred and current evaluations suggest ongoing migration
- Contaminated properties, primarily single family residential and commercial developments, are in an urban flood plain
- Coldwater Creek, within a 47-square-mile urban watershed, contains radioactive sediment
- The Post Maquoketa aquifer, which lies beneath the St. Louis Airport Site (SLAPS) and extends north through St. Louis County and under many of the radiologically-contaminated properties, is the only bedrock aquifer yielding potable water in northern St. Louis County
- NO community acceptance exists for a permanent repository at SLAPS or in St. Louis

In 1990, voters in St. Louis City and County voted NO on a referendum to establish a permanent radioactive waste bunker at the St. Louis Airport Site (SLAPS) or any at other property in the St. Louis area. In response to the public's outrage over the permanent repository plan proposed by the Department of Energy (DOE) for the St. Louis FUSRAP site, Thomas Grumbly, then DOE Assistant Secretary for Environmental Management, came to St. Louis to meet with St. Louis Mayor Freeman Bosley Jr., the Mayor's Advisory Task Force on Radioactive Waste, St. Louis County Executive Buzz Westfall, and the St. Louis County Radioactive & Hazardous Waste Oversight Commission. He proposed the creation of a Task Force made up of the city and county commissions and other community stakeholders.

Grumbly asked the Task Force to develop a community-based vision concerning remediation of the radioactively contaminated sites in St. Louis City and County as an alternative to the permanent repository strategy. The challenge for the community was to devise an environmentally sound, financially responsible and implementable approach that best met the needs of St. Louis and its citizens.

After two years of studying DOE data and some, though limited, input from independent sources, the St. Louis Site Remediation Task Force and the constituents it represents reached consensus on 1) future use of the land, 2) level of cleanup most desirable and 3) a creative, cost effective remediation approach using technology developed in DOE facilities with taxpayer dollars.

Risk, groundwater considerations, land use, cost, and other issues were considered individually for each of the affected properties. The unanimous decision of the Task Force and the community was as follows:

Unrestricted Use Guidelines	Commercial, Industrial, Recreational Use
St. Louis Airport Site (SLAPS)	Mallinckrodt Plant (SLDS)
SLAPS Vicinity Properties	Riverfront Trail
Coldwater Creek Properties	West Lake Landfill (fully encapsulated cell)
HISS/Futura Coatings	
SLDS Vicinity Properties	
Ballfields	

The Task Force agreed to use the Department of Energy's cleanup standard it applies to land designated for unrestricted use -- thorium / radium concentrations not to exceed 5 picocuries per gram (5 pCi/g) averaged over the first 15 cm of soil and 15 picocuries per gram (15 pCi/g) averaged over 15 cm thick layers of soil more than 15 cm below the surface. To clean the properties for unrestricted use to a lesser standard would not meet Applicable or Relevant, and Appropriate Requirements (ARARs) for nuclear weapons production waste remediation.

The Task Force's sensitivity to cost issues motivated a deliberate and detailed evaluation of disposal sites for the St. Louis FUSRAP radioactive waste. Existing sites in Missouri (and the possibility of fabricating a site in Missouri), commercial and DOE reservations were all considered. The short list of suitable sites included: licensed commercial disposal facilities and DOE reservations. SLAPS, the original repository site suggested by DOE, was immediately eliminated from further consideration because it exists in a floodplain and in unconsolidated sediments providing recharge to the Post Maquoketa aquifer. Any activity by DOE to develop this site as a bunker would be in violation of Executive Order 11988. Other disposal sites in the St. Louis area were eliminated for the following reasons: located in a densely populated metropolitan area, proximity to groundwater, unsuitable geologic substrata, proximity to heavily traveled roads, the threat of contaminant migration, uncontrolled accessibility, negative impact on real estate values and economic development, and the absence of an appropriate disposal facility.

According to the DOE, the estimated cost for complete excavation and commercial disposal is $778 million; the estimated cost for complete excavation and on-site disposal is $490 million. Based on information given to the Task Force by commercial disposal facilities, the transportation cost used in the DOE calculation is inflated. The Task Force also takes exception with the DOE's costs for on-site or in-state disposal because it does not take into account the cost of constructing a properly engineered (RCRA Subtitle C Standard) and monitored disposal cell nor the cost of transportation to the disposal site. It is the general view of the Task Force that the difference in cost between on-site disposal and disposal in a licensed commercial facility is not significant.

Further, the Task Force has determined that a remedial action program based on technology developed by DOE (on-site analytical characterization, selective soil sorting, and ex-situ microwave vitrification) has the potential of reducing overall cost by reducing volume and stabilizing the radioactive waste. It should be noted that the costs associated with the risk of transporting radioactive

waste are minimized by using the ex-situ microwave vitrification technology. Risk costs (contamination of haul routes by spillage or accident) are not factored into the DOE's removal and transport cost numbers.

Regardless of the cleanup methodology selected by the DOE, the St. Louis community wants the St. Louis Site cleaned to the standards specified by the Task Force for each of the FUSRAP properties.

The community – St. Louis city and county stakeholders – has agreed upon an appropriate strategy for the cleanup and removal of radioactive contaminants in St. Louis. And in response to Thomas Grumbly's request for direction on how to proceed, St. Louis wants DOE to:

1. Commit sufficient funding to continue and accelerate the cleanup of the St. Louis FUSRAP site as recommended in this report
2. Remediate and remove radioactive contaminated soil in accordance with the St. Louis Remediation Task Force's recommended cleanup performance standards and implementation strategy
3. The St. Louis Airport Site (SLAPS) should be cleaned up first
4. Establish and staff a DOE field office in St. Louis
5. Consider the use of recommended technologies to clean up the site to specified standards
6. Accelerate and expand the cleanup effort in FY 1997

Chronology of Events

1941	U.S. Army acquires by condemnation 17,000 acres in St. Charles County for TNT and DNT production -- Weldon Spring
1942, April	Mallinckrodt begins experiments using an ether extraction process to refine uranium ore
1942, May - November	Mallinckrodt refines the first 40 tons of uranium needed for the world's first self-sustained and controlled nuclear chain reaction
1942, December	The first self-sustained nuclear chain reaction is achieved by the Manhattan Engineer District (MED) at the University of Chicago. All the uranium used in the experiment was in the form of uranium oxide produced by Mallinckrodt or uranium metal produced by others using intermediate, purified uranium compounds produced by Mallinckrodt.
1942 - 1957	Mallinckrodt refines uranium at its downtown St. Louis facility
1945, August 6 & 9	Atomic bombs detonated at Hiroshima and Nagasaki, Japan
1946	MED condemns 21.74 acres near St. Louis Airport to store process wastes and residues from the Mallinckrodt plant
1946	Atomic Energy Commission (AEC) created
1947, January 3	MED acquires SLAPS site by condemnation
1946 - 1957	MED & AEC operate SLAPS to store wastes and residues - pitchblende raffinate, radium bearing wastes, barium cake residue and other process wastes
1948 - 1950	AEC finances cleanup at Mallinckrodt
1953	Fernald plant built in Ohio to meet the country's increasing processed uranium needs
1957	Mallinckrodt ceases uranium processing at the Downtown site; production activities are transferred to Weldon Springs
1957 - 1962	AEC finances cleanup at Mallinckrodt
1966, February	Uranium residues and process wastes purchased by Continental Mining and Milling from AEC
1966 - 1969	Transferring waste from SLAPS to Latty Avenue contaminates properties along haul routes
1967	AEC consolidates all its uranium processing at Fernald
1973	Radioactive barium sulfate wastes disposed of illegally in West Lake Landfill.
1973, May 15	21.7 acre SLAPS site is transferred to the City of St. Louis by Quitclaim Deed
1974	AEC establishes the Formerly Utilized Sites Remedial Action Program (FUSRAP) for cleanup of sites not owned by AEC / DOE but contaminated from past nuclear weapons activities involving radioactive materials.
1977	E. Dean Jarboe purchased 3.5 acres of land in the 9000 block of Latty Avenue to build Futura Coatings, Inc.
1980	Jarboe purchased another 7.0 acres of land adjacent to his 3.5 acres to store the radioactive waste from his original building site. The consolidated waste site is known as the Hazelwood Interim Storage Site.

Chronology of Events cont.

1981	An AEC report states that, based on the 1977 survey, Mallinckrodt plant is still contaminated
1982	DOE proposes disposing of SLAPS / Latty waste at Weldon Springs
1984	Congress (PL 98-360) directs DOE to reacquire SLAPS from the City of St. Louis for disposal of SLAPS, Latty and Vicinity property wastes
1985	Bechtel National, Inc. develops for DOE design options for disposal of SLAPS / Latty wastes at SLAPS
1988	The City of St. Louis continues to refuse to transfer the property back to the DOE as authorized under PL 98-360
1989	EPA places SLAPS and Latty on National Priorities List
1990	EPA and DOE sign the Federal Facilities Agreement governing cleanup of the St.Louis FUSRAP Site
1990, November	Defeat of general election referenda regarding consolidation and storage of radioactive waste at SLAPS -- 85.6% of St. Louis County and 80.7% of the St. Louis City residents vote NO
1992	St. Louis County Radioactive & Hazardous Waste Oversight Commission and the Mayor's Advisory Task Force on Radioactive Waste were established
1994	DOE establishes the St. Louis Site Remediation Task Force

INTRODUCTION

In August 1994, the U.S. Department of Energy (DOE) requested that the St. Louis community create the St. Louis Site Remediation Task Force to develop recommendations for the cleanup performance standards, for an implementation strategy and for investigation of specific technologies that show promise for achieving the cleanup standards.

This report was prepared by the St. Louis Site Remediation Task Force to communicate its formal recommendations to the U.S. Department of Energy regarding cleanup and removal of radioactive contaminants located at the St. Louis Formerly Utilized Site Remedial Action Program sites. The recommendations presented in this report are based in part upon the characterization data and information provided to the Task Force by DOE and its contractors.

The report also includes background information on the St. Louis FUSRAP sites. This information has been included to provide readers with an understanding of the rationale behind the Task Force's recommendations and the reasons why DOE must implement and complete the cleanup in a timely manner.

Section 1. OVERVIEW OF THE ST. LOUIS FUSRAP SITE

During the development of the nuclear weapons program beginning in the 1940s, the St. Louis community worked closely with the Atomic Energy Commission and the Manhattan Engineer District to ensure that the country's military objectives were achieved. Because timing was critical, the U.S. government placed a low priority on finding ways to treat the radioactive waste generated in the process. Beginning in the 1970s, the veil of secrecy surrounding the government's programs to advance the understanding and use of atomic energy was lifted. At that time the St. Louis community, like others throughout the country, began to raise questions and voice concerns about public health risks and environmental impacts associated with the government's radioactive waste disposal practices and policies.

For five decades an arsenal of nuclear weapons was produced leaving an unprecedented and distressing environmental legacy. At all the facilities in the United States involved in the nuclear weapons program, some environmental contamination occurred. In some cases, like St. Louis, the contamination was extensive enough to pollute not only the surrounding soil but also groundwater and surface water.

Many people are familiar with the "Manhattan Project", but few are aware of the pivotal role the St. Louis community and Mallinckrodt Chemical Works played in the production of uranium for the atomic bomb and the development of technology for more efficient refining and commercial processing. Mallinckrodt operated the only production plant for refining uranium from 1942 until 1951, when the Feed Materials Production Center was established by the Atomic Energy Commission (a predecessor of the Department of Energy) in Fernald, Ohio.

From 1942 to 1957, Mallinckrodt's development and production efforts were conducted at the company's production facilities located north of the downtown St. Louis area. In 1957, production was moved to a new facility that the Atomic Energy Commission built at the former U.S. Army TNT

Refuse From Atomic Ore Stored Here
Condemnation Suit Reveals War Use Of Tract Near Airport

A 21.74 acre tract of land north of Lambert-St. Louis Municipal Airport has been used secretly for several months for storage of "certain residue materials from the refining of uranium ores" at the Manhattan District atomic plants at the Mallinckrodt Chemical Works it was disclosed today.

The disclosure was made after a condemnation suit was filed in federal court here in behalf of the War Department to acquire possession of the land, on which the government already has an option.

Company officials and security officers refused "for security reasons" to disclose the exact nature of the stored materials, but they declared they are not radio-active and not dangerous. The material, they asserted, is the "type of refuse that any ordinary commercial firm of this type would store there." They asserted no complaints have been received on use of the land for that purpose.

There is a "remote possibility of future use" for the material, it was said, and for that reason it is being stored. A statement issued in Washington by the Manhattan District headquarters said, "Because of the long-term storage demand and possible future value of the material, it is necessary that the government own the land."

The tract is west of the Brown Rd. and north of the Wabash Railroad tracks.

The petition seeks immediate possession of the land, which is owned by Elizabeth Callaway and Mary Callaway Porcher, whose address was given as N.S Wood, Inc., real estate firm at 706 Chestnut St.

The War Department estimates value of the land at $20,000. Named as co-defendants in the condemnation proceedings are Drainage District No. 2A, St. Louis County and the St. Louis County collector of revenue.

St. Louis Post Dispatch, September 1946

production facility at Weldon Spring in St. Charles County, Missouri. In 1946 the Manhattan Engineer District condemned the 21.7 acres of land adjacent to the St. Louis municipal airport for the purposes of storing residues from the uranium processing at the Mallinckrodt facility. The site, known as the **St. Louis Airport Storage Site (SLAPS or SLAPSS)**, lies approximately 15 miles northwest of downtown St. Louis and is bounded by McDonnell Blvd. to the north and east, Banshee Road on the south, and Coldwater Creek on the west.

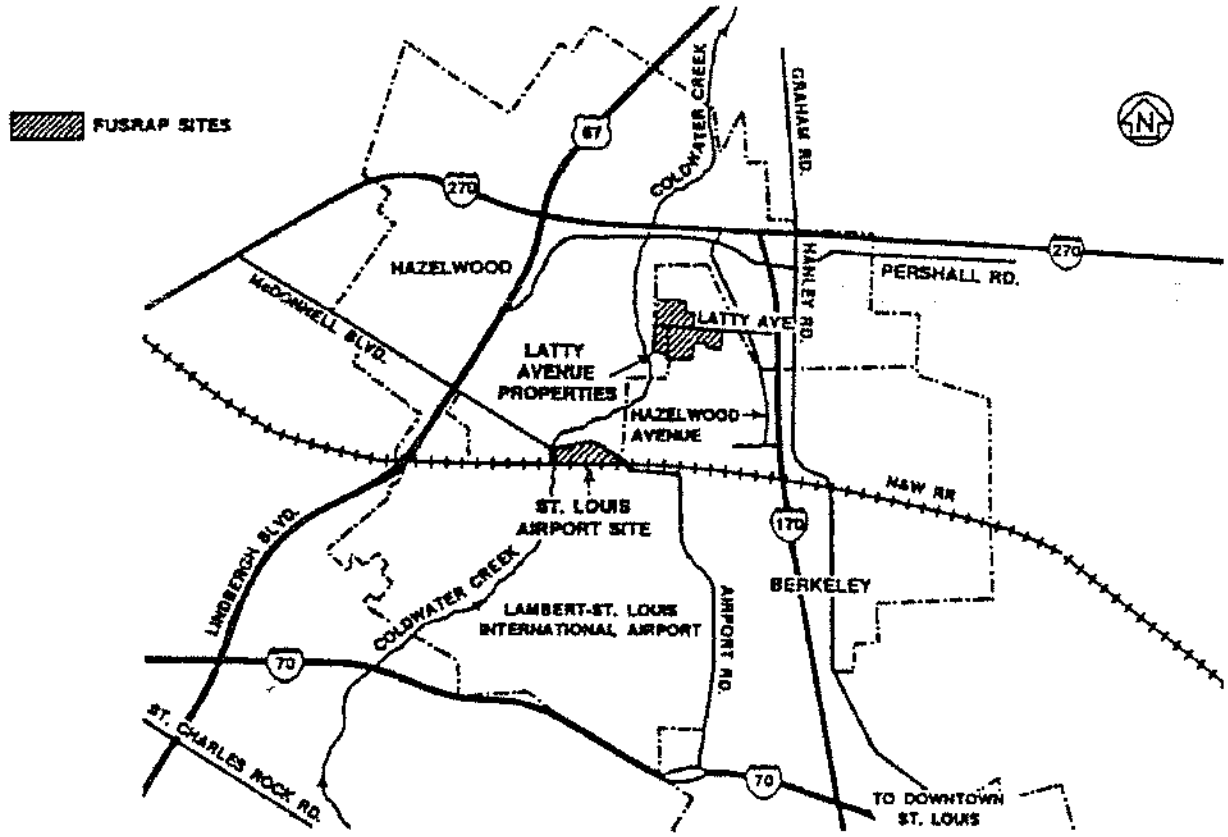


Figure 1

Pitchblende raffinate (from the former Belgian Congo), radium bearing waste, barium cake residue, dolomite liners and other process wastes were disposed of at SLAPS during processing and cleanup projects at the downtown Mallinckrodt facility undertaken from 1946 to 1962. Much of the waste that was transported to SLAPS was hauled in uncovered dump trucks. This was the primary cause of the contamination of the land along the haul routes (**Vicinity Properties**).

In 1973 ownership of SLAPS was transferred to the City of St. Louis via Quitclaim Deed. This transfer was made without knowledge of the extensive contamination at the site.

The original SLAPS ground acquired (via condemnation) by the Manhattan Engineer District was very uneven and contained a low drainage area on the western section of the site. The land had a

drainage slope from east to west, with all surface and groundwater drainage directed to Coldwater Creek at the western end of the property. In the early 1980s, it was discovered that waste was eroding into Coldwater Creek. To reduce further erosion, DOE constructed a gabion wall in 1985. Subsequent sampling, however, has uncovered elevated concentrations of thorium in sediments in the creek and in 20 foot deep monitoring wells north of SLAPS. Stormwater runoff, flooding, wind erosion and groundwater discharge into Coldwater Creek also contribute to the contamination of the creek and sediment migrating to downstream properties.

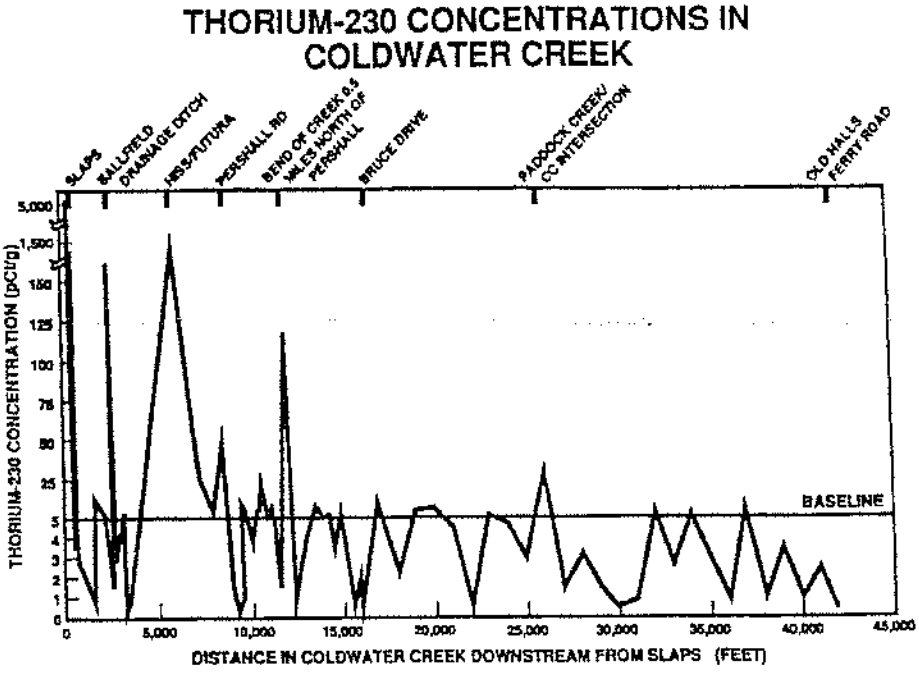


Figure 2

In 1966 the Atomic Energy Commission, after several earlier offerings, finally sold the waste at SLAPS to Continental Mining and Milling Company, which moved some of the waste from SLAPS to 9200 Latty Avenue in Hazelwood. The half-mile journey from SLAPS to 9200 Latty Avenue created additional property (**Vicinity Properties**) contamination due to spillage and inappropriate hauling protocols during transit.

The radioactive waste at SLAPS was later acquired by the Commercial Discount Corporation through a bad debt foreclosure. In 1969, Cotter Corporation assumed ownership and began shipping materials from SLAPS to its processing plant in Colorado. One year later, Cotter started drying the process waste at Latty Avenue and shipping it to Colorado. The drying process left an estimated 8,700 tons of barium sulfate at the Latty Avenue Site. In an effort to dispose of this material Cotter mixed it with 39,000 tons of topsoil and shipped it to **West Lake Landfill**. On November 1, 1974 the AEC notified Cotter Corporation that the disposal material did not meet the intent of the Commission's regulation (10 Code of Federal Regulations Part 40) concerning alteration/dilution of radioactive source material to obtain a mixture no longer subject to licensing. No further action was taken because the AEC was told that the material was buried under 100 feet of municipal waste and was unrecoverable -- it was later revealed that the material was buried under only three feet of waste.

Over the years, careless management and inadequate containment of the radioactive waste during transportation caused spills and spread the contamination to the banks of the Mississippi River, Coldwater Creek, numerous roads and railways, and about 90 vicinity properties.

In 1974, DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) to remediate sites not owned by DOE but contaminated by the government's activities involving radioactive materials. Of the 46 FUSRAP sites across the country, the St. Louis Site is the largest both in terms of acreage and quantity of radioactive waste material.

In 1977, E. Dean Jarboe purchased 3.5 acres of land in the 9000 block of Latty Avenue Three days after closing the deal, federal officials told Jarboe that his newly acquired property was contaminated with radioactive material and that he could not use the land. In order to build his company's headquarters, Jarboe purchased another 7.0 acres of land (adjacent to the 3.5 acres) in 1980. The newly acquired parcel of land was to be an interim storage site for the contaminated soil and demolished building rubble cleared from the land where he originally intended to build his company, Futura Coatings, Inc.. Jarboe expected to expand his operations on this land after the federal government removed the radioactive waste. The consolidated waste at the **Hazelwood Interim Storage Site (HISS)** is still in place awaiting removal.

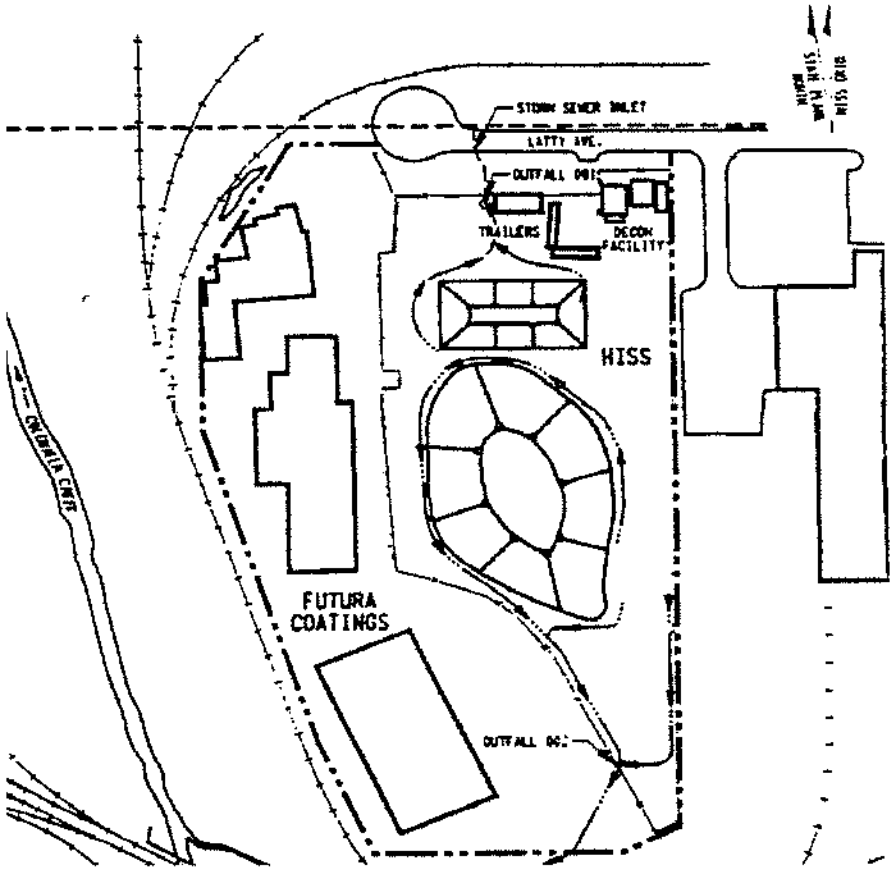


Figure 3

Formerly Utilized Sites Remedial Action Program
St. Louis, Missouri Contaminated Properties

St. Louis Downtown Site (SLDS or SLUPP) is located on the Mallinckrodt and vicinity properties in an industrial area in St. Louis city near the McKinley Bridge which crosses the Mississippi River. The total waste volume at this site is estimated to be 246,000 cubic yards. Waste is tailings and residues from high grade uranium ore processing.

St. Louis Airport Storage Site (SLAPS or SLAPSS) is about 15 miles northwest of downtown St. Louis and adjacent to the northern boundary of the Lambert-St. Louis International Airport. The waste volume at this site is estimated to be 250,000 cubic yards. Waste composition consists of radium, thorium, uranium and by-product material. This site is on the U.S. Environmental Protection Agency's *National Priorities List*.

St. Louis Airport Site Vicinity Properties consist of 78 properties along the haul routes, the Norfolk and Western Railroad, the Ballfields, and Coldwater Creek, which flows 1500 feet along the western border of the St. Louis airport site. The vicinity properties are located in the cities of Hazelwood and Berkeley. The waste volume at this site is estimated to be 90,000 cubic yards. Waste composition consists of radium, thorium, uranium and by-product material.

Latty Avenue Properties are located on Latty Avenue in Hazelwood in an industrial / commercial area approximately 0.75 miles north of the St. Louis airport. There are three buildings on the site and the Hazelwood Interim Storage Site (HISS). The waste volume at this site is estimated to be 211,000 cubic yards. Waste composition consists of radium, thorium, uranium and by-product material. HISS is on the U.S. Environmental Protection Agency's *National Priorities List*.

West Lake Landfill is located at 13570 St. Charles Rock Road in Bridgeton. It is approximately 4 miles west of the St. Louis Airport, west of the intersection of I-70 and I-270 and approximately 1.2 mile east of the Missouri River. The estimated waste volume is 48,000 cubic yards (47,700 **tons**). (Note: Although West Lake Landfill is not a FUSRAP site, the Task Force decided in the Fall of 1994 to include this property in its discussions of radioactive waste cleanup.)

The severity of the radioactive contamination's impact on the environment and the St. Louis community was acknowledged in the late 1980s when both SLAPS and the Latty Avenue Properties were placed on the Environmental Protection Agency's National Priorities List (NPL). NPL sites require that the cleanup process be in compliance with The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and that the remedy selection meet the guidelines of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

CERCLA, often referred to as Superfund, mandates the cleanup of hazardous substances that could endanger public health or the environment. CERCLA provides authority for ***cleaning up past mistakes*** that have created existing waste problems.

NPL is a list of the ***nation's worst hazardous waste sites*** determined by the U.S. Environmental Protection Agency (EPA) and targeted for long-term cleanup and evaluation as established by CERCLA.

During the first 25 years of the nuclear weapons program, the potential long-term health and environmental impacts of the program were relatively unknown. Yet, transporting waste material in uncovered trucks -- whether household trash or industrial waste – raises serious questions about past waste management practices. What cannot be questioned is that those actions left serious environmental, health and safety issues in the St. Louis region.

"The ultimate ***disposal of contaminated waste*** -- subsurface, surface and airborne – needs much more thorough study. Even the simplest of such data – recorded periodic measurements of stream pollution below the (production) plants – are almost wholly lacking. Even with such records, present knowledge of radiation and chemically toxic effects on animal and vegetable life is so limited that water supply inlets below (production) plant disposal outlets cannot be unqualifiedly recommended. The disposal of contaminated waste in present quantities and by present methods (in tanks or burial grounds or at sea) if continued for decades, ***presents the gravest of problems***."

U.S. Atomic Energy Commission Report of the Safety and Industrial Health Advisory Board
April 2, 1948

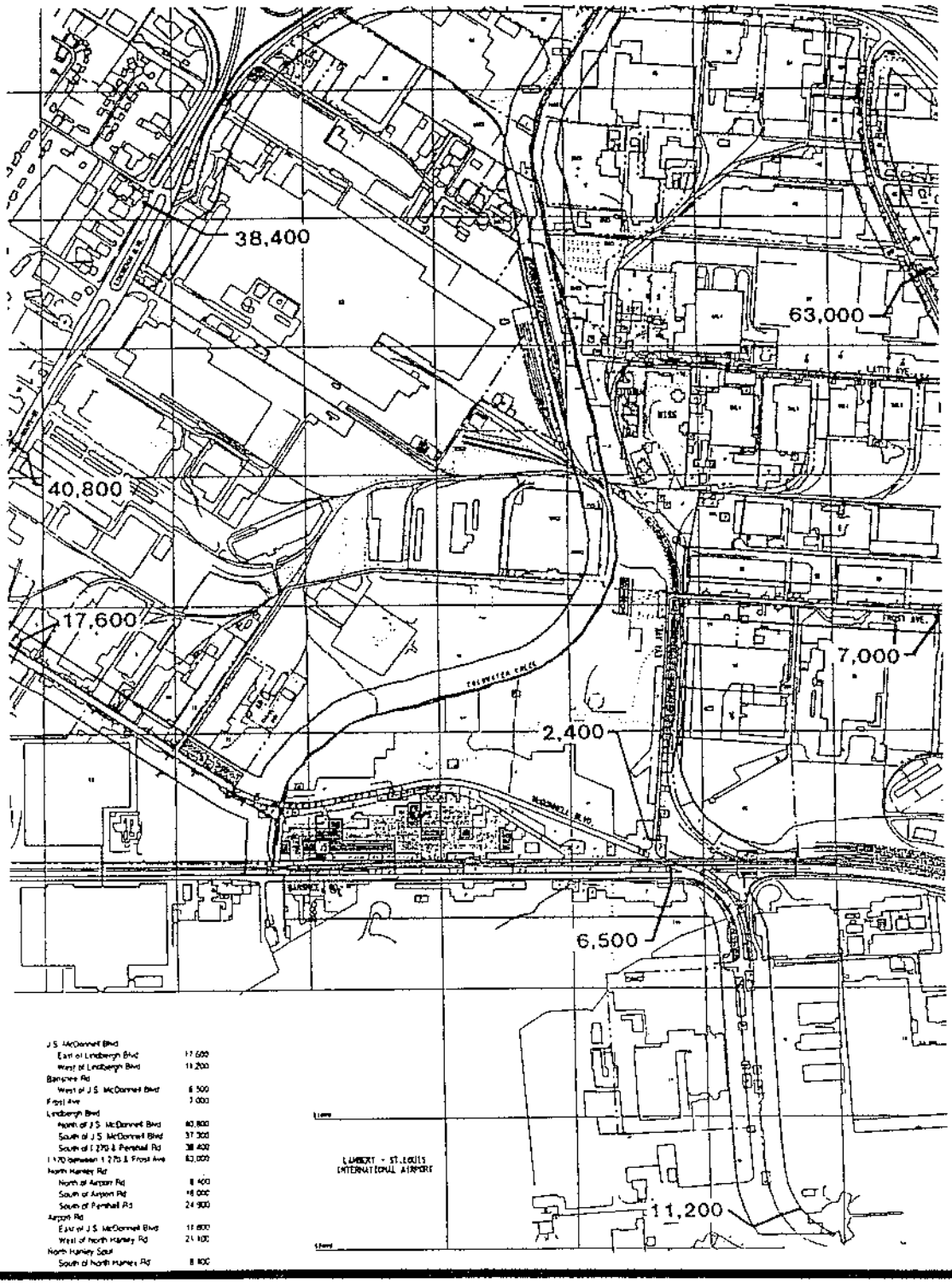
The risk from nuclear waste is measured as a combination of two factors: the chance that exposure will occur, and the consequences or harm that can result from exposure. The potential for harm or hazard from exposure to low-level radioactive waste depends on whether people, plants and animals are actually exposed to radiation and at what levels. The relationship between low radiation doses and the incidence of somatic (physical effects), genetic and teratogenic (impact on fetus and embryos) changes is difficult to trace because the latency period -- the time between exposure and effect -- is long. Other environmental factors also can confuse the issue and make it difficult to statistically trace human health conditions to radioactive exposure. However, since 1957 when the federal government first began setting allowable radiation exposure standards, cumulative data continue to suggest that progressively more stringent limits are required. (Committee on the Biological Effects of Ionizing Radiation of the National Academy of Sciences).

In the absence of certainty on radiological effects, the trend is clearly to adopt the more stringent standards. New Jersey, for example, has established a 15 millirem per year "Total Effective Dose Equivalent" (TEDE) from external radiation and intake for both unrestricted and restricted sites. New York, too, has stated that the "Total Effective Dose Equivalent" to the maximally exposed individual of the general public, from radioactive material remaining at a site after cleanup, shall be as low as reasonably achievable and less than 10 millirem above that received from background levels of radiation in any one year.

Even the Nuclear Regulatory Commission (September 29,1995 Part 20 Proposed Rule Making) has proposed a dose limit for release of a decommissioned site of 15 millirem per year "Total Effective Dose Equivalent" (TEDE) for residual radioactivity distinguishable from background. This dose level was selected to provide both a substantial margin of safety below the NRC's dose limit for members of the public and an appropriate limit for the acceptability of release of a facility which would no longer be subject to regulatory control.

The fact that the St. Louis FUSRAP site is located in a densely populated metropolitan area where the community lives, works and plays dictates that the most conservative view of health effects be adopted in making decisions affecting the cleanup options. The uncontrolled access to many parts of the St. Louis FUSRAP site and the surrounding properties increases the potential health and safety risks for a significant number of St. Louis residents – people who drive into the area to work as well as the number of families that live in North County and the number of adults and children who have access to Coldwater Creek. (See Figure 4) Similar conditions exist in North St. Louis City and around the Riverfront Trail.

Average Weekly Traffic Counts



Map courtesy of St. Louis County Planning Department

Figure 4

Coldwater Creek flows through Overland, Breckenridge Hills, St. Ann and under the St. Louis Airport. It then passes through Hazelwood, the city of Florissant and the entire Florissant Basin (a shallow oval shaped depression), unincorporated St. Louis county and along the northern edge of Black Jack before joining the Missouri River. The 47-square-mile urban watershed has an elongated shape, with a 19.5 mile channel and relatively short tributary streams. North of the airport the floodplain is essentially fully developed with single family residential and commercial development. Another noteworthy feature of the Coldwater Creek basin is the Karst sinkhole area which drains directly into the groundwater system.

A bedrock aquifer known as the Post Maquoketa aquifer lies beneath SLAPS and extends north of the site. It meets the legal definition of an aquifer and it is the only bedrock aquifer that yields potable water in the area. The water quality of the aquifer is acceptable for most domestic uses – meeting state and federal minimum drinking water requirements for purity. Other bedrock units in the general area are unacceptable potable water sources because of the high levels of total dissolved solids. Well records maintained by the Missouri State Geologist document the use of the Post Maquoketa aquifer by local residents and businesses (See Appendix E).

In addition to the potential for direct contact, opportunities for increased exposure due to the transport of contaminated material off-site by wind and surface water run-off also are increasing the health risks to the St. Louis public.

Concerns of St. Louis-based utility companies mirror the concerns of the community. St. Louis County Water Company, Laclede Gas Company, St. Louis Metropolitan Sewer District and Union Electric Company have field personnel who must periodically work in and around radioactive contaminated soils. These companies must have access to their facilities and equipment for repair and maintenance purposes. To ensure the safety of their workers, the utilities have jointly petitioned DOE to make available trained specialists to excavate, backfill and dispose of contaminated soils during utility construction, maintenance, and repair activities. Because the utilities service both residential and commercial customers in the area, including the St. Louis airport, they have asked that these specialists be available on a 24-hour emergency response basis.

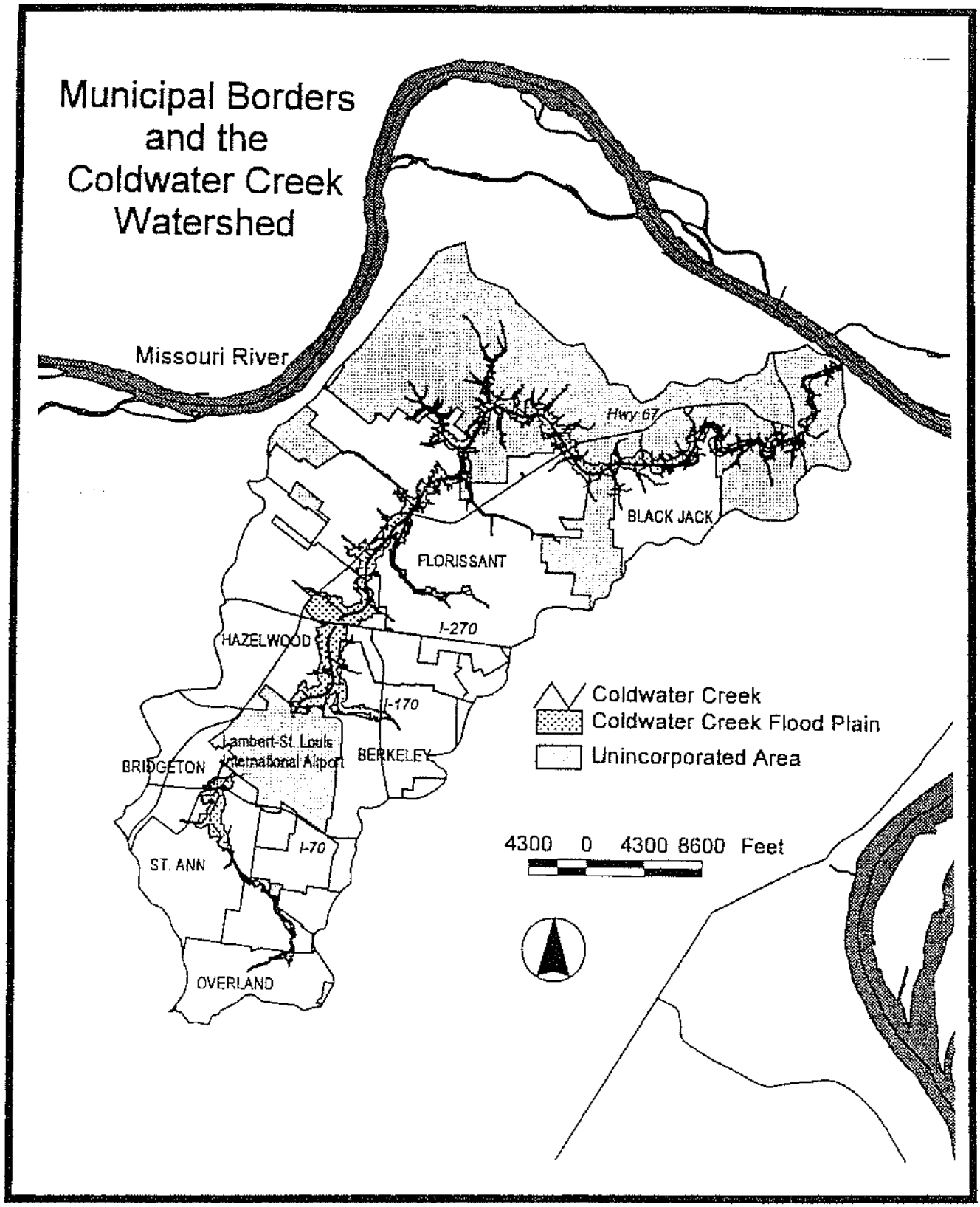
The U.S. EPA Region V's rationale in setting cleanup standards for the Kerr-McGee National Priorities List properties in West Chicago, Illinois is applicable to the St. Louis FUSRAP Site. In the case of the Kerr-McGee cleanup, there were no established regulatory requirements directly applicable to thorium mill tailings contamination (containing thorium, uranium, radium and heavy metals). So, relevant and appropriate cleanup criteria were extracted from appropriate and relevant federal and state regulations -- Title 40, Part 192 of the Code of Federal Regulations (40 CFR 192) titled "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings", Title 10, Part 20 of the CFR entitled "Standards for Protection Against Radiation", U.S. Nuclear Regulatory Commission's Regulatory Guide 8.37, Department of Energy Order 5400.5 titled "Radiation Protection of the Public and the Environment" and the associated state regulations of Title 32 Chapter II Subchapter b Part 332 of the Illinois Administrative Code titled "Licensing Requirements for Source Material Milling Facilities." In accordance with these guidelines, Kerr-McGee is required to excavate and transport to a permanent disposal facility all of the radioactive contaminated material in excess of 5 pCi/g above background of total radium at any depth. (When the federal standards in 20 CFR 192 were developed, the 5 pCi/g standard was established as a health based standard. The 15 pCi/g standard for subsurface soil was technology based, reflecting instrument limitations in locating subsurface deposits.) Additionally, use of the concept of "As Low As Reasonably Achievable" (ALARA) is being

applied for the residential properties included in the Kerr-McGee Sites cleanup. These criteria would allow the Kerr-McGee Sites to be released for unrestricted use. In the opinion of state and federal regulators, cleanup of the Kerr-McGee Site to less restrictive criteria would not provide adequate long-term protection of public health and the environment.

According to the DOE, the estimated cost for complete excavation and commercial disposal for the St. Louis FUSRAP Site is $778 million; the estimated cost for complete excavation and on-site disposal is $490 million. Based on information given to the Task Force by commercial disposal facilities, the transportation cost used in the DOE calculation is inflated. The Task Force also takes exception with the quoted cost for on-site or in-state disposal because it does not take into account the cost of constructing a properly engineered (RCRA Subtitle C Standard) and monitored disposal cell nor the cost of transporting the material to the disposal site. The general opinion of the Task Force is that cost of complete excavation and removal to a commercial facility are reasonable and affordable based on commercial assessments of current and long-term cost projections.

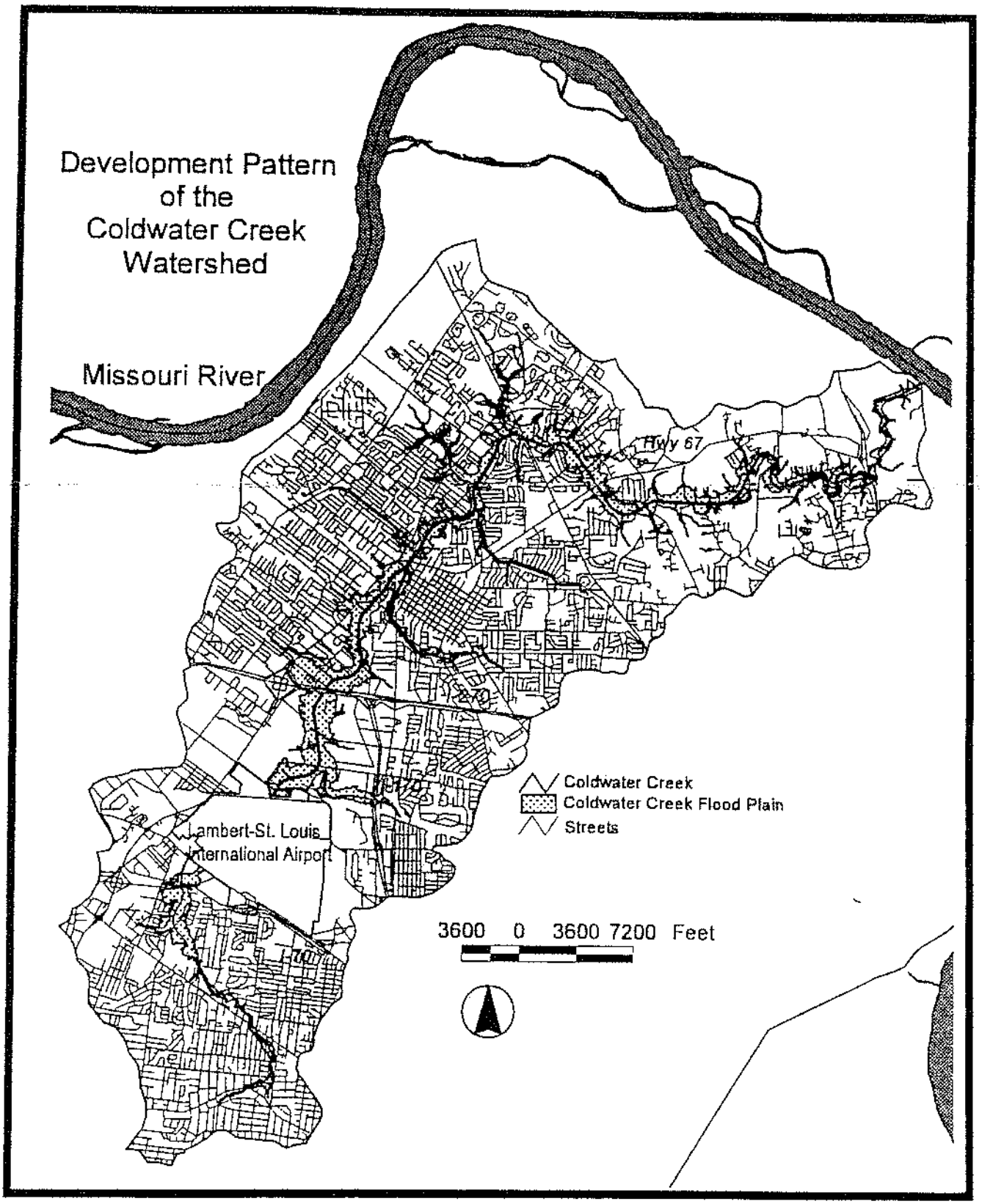
Further, the Task Force has determined that a remedial action program based on technology developed by DOE (on-site analytical characterization, selective soil sorting, and with ex-situ microwave vitrification) has the potential of reducing overall cost by reducing volume and stabilizing the radioactive waste. It should be noted that the costs associated with the risk of transporting radioactive waste are minimized by using the ex-situ microwave vitrification technology. Risk costs (contamination of haul routes by spillage or accident) are not factored into the DOE's removal and transport cost numbers.

Regardless of the cleanup methodology selected by the DOE, the St. Louis community wants the St. Louis Site cleaned to the standards specified by the Task Force for each of the FUSRAP properties.



Map courtesy of St. Louis County Planning Department

Figure 5



Map courtesy of St. Louis County Planning Department

Figure 6

Section 2. TASK FORCE ORGANIZATION AND PROCESS

Since 1990, the St. Louis community has expressed ongoing opposition to DOE's proposal to consolidate and store radioactive waste from the St. Louis Site at the airport. A Stakeholder's Summit meeting was called which resulted in the creation of the St. Louis Site Remediation Task Force. Thomas Grumbly[1], former DOE Assistant Secretary for Environmental Management, proposed an open, collaborative process involving all identifiable stakeholders to develop a community-based vision concerning remediation of radioactively contaminated sites in St. Louis City and County, collectively known as the St. Louis FUSRAP Site. He proposed that this process integrate scientific and social concerns and that an effective, cost-sensitive solution be developed that would be "substantively the best one for this community."

Citizen opposition results in November 1990 General Election Referenda regarding consolidation and storage of radioactive waste at SLAPS

St. Louis County – Advisory Proposition No.1
Should the United States use what is commonly called the Airport site for the construction of a permanent radioactive waste bunker?
Electorate response: 85.6% voted NO

St. Louis City – Non-Binding Preferential Proposition
Should a radioactive waste bunker be constructed on real property owned by the City of St. Louis, commonly known as the St. Louis Airport Storage Site ("SLAPS"), or on any site within the corporate limits of the City of St. Louis for the purpose of permanently storing radioactive waste generated by production of nuclear weapons, which waste is currently located at SLAPS, at 9200 Latty Avenue in the City of Hazelwood, at the Mallinckrodt Chemical Works facility at Second and Destrehan Streets in the City of St. Louis, and at related sites?
Electorate response: 80.7% voted NO

The first meeting of the Task Force occurred on September 13, 1994. It was attended by members of the St. Louis County Radioactive and Hazardous Waste Oversight Commission (County Commission) and the St. Louis City Mayor's Advisory Task Force on radioactive waste (City Commission), both of which were organized in 1992. The Task Force also included representatives of the St. Louis County Executive, the Mayor of St. Louis City, the Cities of Hazelwood, Berkeley, Bridgeton and Florissant, the Missouri Department of Natural Resources, the U.S. Environmental Protection Agency, Offices of U.S. Congressmen James Talent and William Clay, St. Louis Lambert International Airport, Mallinckrodt, and utility companies. Property owners, civic and environmental groups, and other concerned citizens also were participants. DOE's site manager served as ex-officio.

At meetings held during the fall of 1994, the Task Force discussed and agreed upon a mission to identify and evaluate feasible remedial action alternatives for the cleanup and disposal of radioactive waste materials at the St. Louis FUSRAP site and at West Lake Landfill. The St. Louis community's primary concern was the development of a long-term cleanup strategy that first and foremost protected the health and well-being of the citizens and the environment, and ultimately provided DOE with a plan of action for implementation. In deliberating possible strategies the Task Force identified

[1] Currently, Thomas Grumbly serves as Under Secretary of the Department of Energy

issues/criteria that they would consider in weighing what cleanup strategy was most appropriate. (Figure 7)

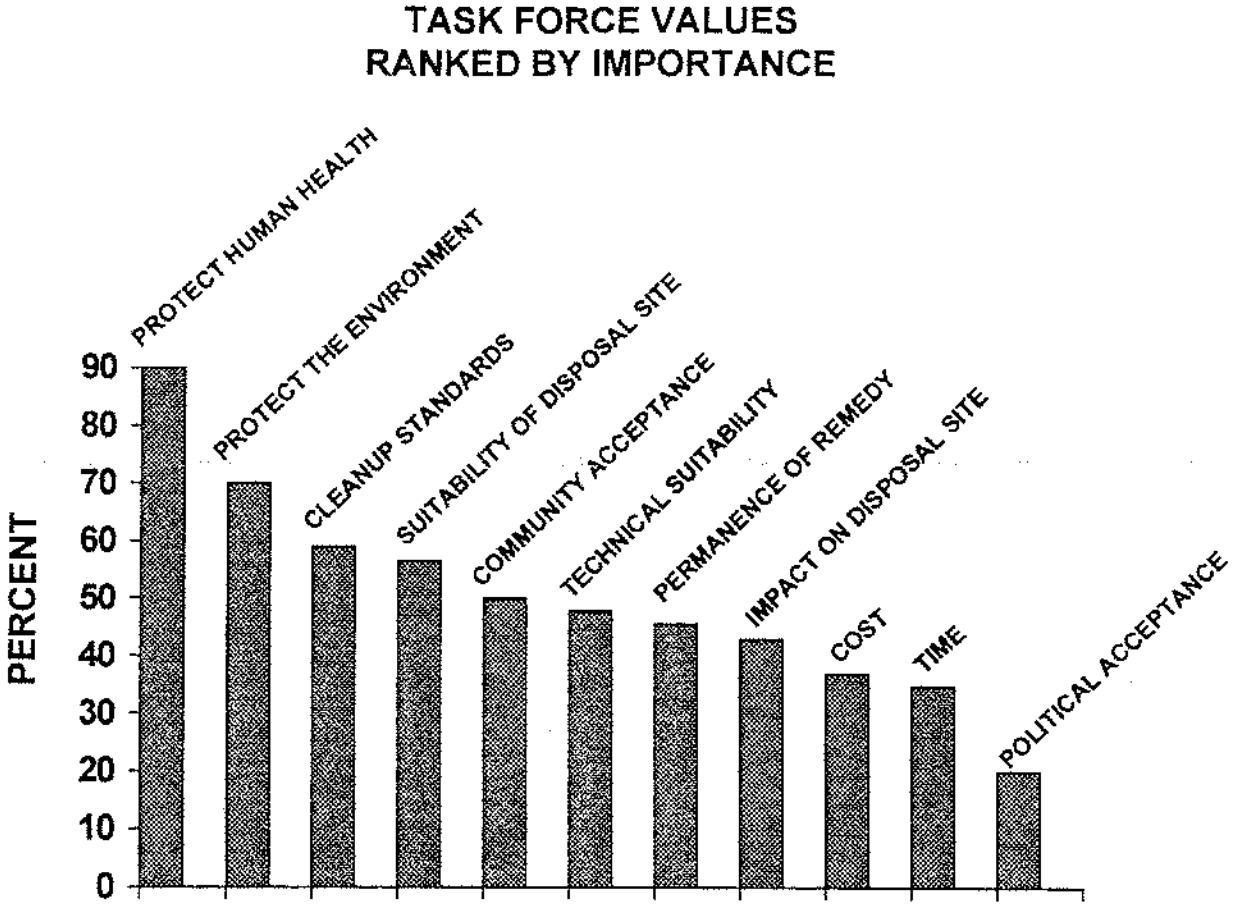


Figure 7

The Task Force agreed that working groups would be established to provide an ongoing forum for focused in-depth analysis and discussion of specific issues because of the number, diversity and complexity of the issues to be considered. (See Working Group Summaries, Chapter III Section 5 for details). Each working group met as needed between the regular monthly meetings of the Task Force and reported findings and recommendations for consideration and action by the Task Force. While substantial responsibility was delegated to these groups, final decision-making authority remained with the Task Force.

Other interested parties were provided an opportunity to speak during the public comment period at each of the Task Force meetings and/or to participate in the working groups.

Section 3. FACTORS AFFECTING RECOMMENDATIONS

The Task Force considered many relevant factors in developing recommendations for the cleanup performance standards, implementation strategy and technology preferences. Key to the recommendations were matters related to protection of human health and the environment cost of cleanup versus institutional controls, current and future land uses, socio-economic development and environmental justice. The following is a detailed list of factors considered:

- Evidence of radioactive contaminants in numerous uncontrolled and accessible settings in a highly populated metropolitan area
- Worker health and safety risks – those who have unavoidable contact with and exposure to contaminated soils in performing their jobs
- Elevated health risks to residents and workers including increased risk of cancer, leukemia and other life-shortening afflictions and potential for cell damage leading to endocrine, immune and reproductive system disorders, genetic defects and hereditary birth defects
- Ongoing contamination of Coldwater Creek via groundwater migration and surface water runoff
- Improperly deposited waste in an urban flood plain
- Contamination of numerous commercial and residential properties in a densely populated metropolitan area of 2.4 million people
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) dictating a maximum allowable radioactivity (above background) of 5 picocuries per gram of thorium and radium at the surface and 15 picocuries per gram in subsurface cleanup standard for unrestricted property use
- Concern that capping would not offer sufficient protection against potential exposure to subsurface contamination
- Information that other states including Illinois, New Jersey and New York have adopted and applied stringent exposure guidelines for cleanup of radioactive waste
- Evidence of contaminant migration via air, surface water and groundwater
- Impact on real estate values
- Contamination from waste generated by federal nuclear weapons development and production in excess of DOE contamination restricts present and future land use
- Potential liability issues and other economic, social and physical hardships presently imposed on affected property owners and municipalities
- Need for long-term (in perpetuity) use of institutional controls including monitoring, management support, and possible additional environmental assessments

- Need for complete cost estimates for excavation and removal to a commercial facility; commercial entities suggest DOE cost estimates are inflated -- in-state disposal costs do not include cost of constructing an appropriate facility or the cost of transporting the material to the site

- Consensus of the community

State regulatory factors that influenced the selection of recommended disposal options included:

- Missouri Department of Natural Resource's (MDNR) requirement that radioactive contaminants be exhumed from beneath the water table and removed from flood plains

- MDNR's not allowing disposal of radioactive contaminants in a 100-year flood plain

- MDNR's requirement that any radioactive contaminants that remain in Missouri be stored above ground at a suitable site in a fully engineered (RCRA Subtitle C standards) and monitored cell

- The absence of any qualifying facility in Missouri with capacity to accept radioactively contaminated material from the St. Louis FUSRAP Site

U.S. Environmental Protection Agency factors (CERCLA requirements) that influenced the selection of recommended disposal options included:

- Overall protection of human health and the environment
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction of toxicity, mobility and volume
- Implementability
- Cost
- State acceptance
- Community acceptance

Other factors considered in the development of recommendations included:

- Estimated cost and time required to design and construct a storage cell in Missouri

- Existence of licensed facilities outside of Missouri with adequate disposal capacity

- Competitive pricing from licensed commercial disposal facilities

Section 4. CONCLUSIONS AND RECOMMENDATIONS

- **Cleanup Performance Standards**

The specific cleanup performance standards for implementation at the St. Louis FUSRAP site, adopted by consensus of the Task Force are:

Remediate the properties listed below for unrestricted use -- thorium / radium concentrations not to exceed 5 picocuries per gram (5 pCi/g) above background levels averaged over the first 15 cm (6 inches) of soil, and 15 picocuries per gram (15 pCi/g) averaged over 15 cm thick layers of soil more than 15 cm below the surface.

St. Louis Airport Site
Ballfield Site (north of McDonnell Blvd.)
North County and St. Louis City Vicinity Properties and Haul Routes
Hazelwood Interim Storage Site / Futura Coatings
Coldwater Creek

Clean the properties listed below for site-specific use -- specific cleanup levels to be determined

St. Louis Downtown Site - industrial and commercial use standards
West Lake Landfill - industrial and commercial use standards (fully encapsulated cell)
City Levee (Riverfront Trail) - recreational use standards

- **Implementation Strategy**

The Task Force adopted the following resolution on July 23, 1996:

"The St. Louis Site Remediation Task Force hereby notifies the U.S. Department of Energy that the St. Louis Airport Site (SLAPS) ranks as our highest priority for remediation. We request that the DOE start the cleanup of the site in Fiscal Year 1997 for its eventual release for 'unrestricted use' – that is, with excavation and removal from surface soils of thorium/radium concentrations above 5 picocuries per gram, and from below-surface soils, above 15 (Task Force Option 4).

"Further, the Task Force requests that remediation for 'unrestricted use' continue or begin at all North County and St. Louis City vicinity properties and haul roads, including utility corridors; the Hazelwood Interim Storage Site / Futura Coatings, the Ballfields on McDonnell Blvd., and Coldwater Creek (not necessarily in that order).

"Further, the Task Force requests that remediation at the St. Louis Downtown site and the City Levee continue or begin with cleanup to 'site specific' standards for industrial or recreational use, respectively.

"And finally, with respect to those radioactive wastes at West Lake Landfill which were also generated at the St. Louis Downtown Site for nuclear weapons production, from 1942-1957; the Task Force requests that the DOE, in consultation with the U.S. Environmental Protection Agency (lead agency at West Lake) and the Missouri Department of Natural Resources, develop a plan for the excavation and removal of these wastes to a minimum of the Option 3 [hot spot removal and implementation of ongoing institutional controls] Cleanup Level."

- **Technology Preferences**

The Task Force adopted the following resolution on August 20, 1996

> "After reviewing the U.S. Department of Energy's database of remediation technologies, the St. Louis Site Remediation Task Force has determined that the use of ex-situ microwave vitrification coupled with gamma ray spectroscopy and laser ablation nebulization spectroscopy in a continuous field process shows promise for (1) achieving the cleanup standards specified by the Task Force, (2) reducing volume, and (3) stabilizing the radioactive waste.
>
> "We request that the DOE evaluate the merits and field protocols of the aforementioned technologies in a field demonstration on the 21.7 acres at SLAPS during FY 1997.
>
> "Further the Task Force requests that the remediation demonstration include appropriate engineering controls to prevent [any further] contamination of the water beneath SLAPS and ensure that air quality is not compromised by the emission of radon gas, volatile contaminants or particulates present in the soil and that worker health and safety guidelines are strictly adhered to during the demonstration.
>
> Finally the Task Force would like the stabilized waste resulting from the demonstration shipped to a facility licensed for the disposal of radioactive waste."

- **Funding**

The U.S. Department of Energy should secure sufficient funding to continue and accelerate the cleanup of the St. Louis FUSRAP Site as recommended in this report. The St. Louis community and its leaders want DOE to expand the cleanup program starting in 1997.

Section 1. Working Group Summaries

ALTERNATIVE SITES WORKING GROUP

The Alternative Sites Working Group met initially on December 28, 1994 and on 17 subsequent occasions for the purpose of identifying and evaluating potential sites for disposal of the radioactive wastes present at the St. Louis FUSRAP Site and related wastes at West Lake Landfill.

The group studied the technical requirements (site suitability and design criteria) for land disposal facilities as recited in the Code of Federal Regulations and analyzed available data concerning estimated volumes and characteristics of contaminants present at the St. Louis FUSRAP Site.

The group initially identified 10 potential disposal sites (later expanded to 11) and developed a set of assumptions and definitions to be used in evaluating the suitability of each site for the disposal of St. Louis radioactive waste. Each disposal site was ranked using a scale of 1 to 5 (1 = nonconforming site and 5 = site closely fitting criteria) in four main categories and 10 subcategories. The ratings were then weighted in each category to reflect the values and priorities established by the Task Force. (See Task Force Summary Section III) For example, factors relating to protection of human health and the environment were assigned greater weight than those of timing and cost. Aggregate scores were then compiled and the sites were ranked in order of preference.

The 11 disposal sites evaluated were:

Hazelwood Interim Storage Site (HISS)
St. Louis Airport Site (SLAPS)
St. Louis Downtown Site (SLDS)
Weldon Spring Site Remedial Action Project (WSSRAP)
Union Electric Surplus Property - Callaway County, MO
"New" Missouri Site[2]
Dawn Mining Co. Site (Ford, Washington)
Envirocare Site (Clive, Utah)
DOE Nevada Test Site
DOE Oak Ridge Reservation (Tennessee)
DOE Hanford Reservation (Washington)

The criteria used to evaluate the relative merits of each site were:

- Site Suitability – geology / hydrogeology, local area impact, capacity, current status
- Timing – approval, construction
- Cost -- transportation, disposal
- Community Issues – acceptance, economic impact

[2] A disposal site that currently does not exist but might be found by a comprehensive study – a hypothetical site.

Each site was graded in each category using a numerical rating system:

0 - Unacceptable / Infeasible
1 - Bad site
2 - Poor site
3 - Neutral site
4 - Satisfactory site
5 - Good site
? - Unknown

Based on this ranking system (Figure 9), the Working Group concluded that the 11 sites fell into three distinct categories of suitability:

Suitable Sites:	Dawn Mining Site - licensed commercial disposal facility Envirocare Site - licensed commercial disposal facility Hanford Reservation - DOE site Nevada Test Site - DOE site Oak Ridge Reservation - DOE site
Potentially Suitable Sites:	"New" Missouri Site Weldon Spring Site Union Electric Surplus Property – Callaway County, MO
Unsuitable Sites:	Hazelwood Site (HISS) St. Louis Airport Site (SLAPS) St. Louis Downtown Site (SLDS)

The Working Group presented its draft report to the Task Force on April 18, 1995 and supplemented that information with an oral report on the suitability of the Dawn Mining Site on May 21, 1996. In general, the sites that were determined to be suitable shared characteristics that distinguish them from the others on the list. These include remote locations away from population centers, adequate distance from flood plains, adequate protection of groundwater, generally favorable climatic conditions, the existence of radioactive contaminants and controlled, monitored facilities.

The unsuitable sites, all of which are in St. Louis City or St. Louis County, were eliminated from consideration for the following reasons: they are located in a densely populated metropolitan area, within a flood plain, proximity to groundwater, proximity to heavily traveled roads, ease of accessibility, the threat of migration of contaminates via air, soil and water, unsuitable geologic substrata, negative impact on real estate values and economic development, and the absence of appropriate disposal facilities.

Within the State of Missouri, several sites exhibited physical characteristics that rendered each potentially suitable for the disposal of radioactive waste. They were excluded, however, from further consideration because of the absence of political support and a willing host. In particular, Union Electric Company did not agree with the inclusion of its land in Callaway County on the list of potentially suitable sites for several reasons. First, about 500 acres of the Callaway site are used for the generation of electricity by a nuclear power plant. The adjacent 6500 acres is under lease to the

Missouri Department of Conservation for use as a wildlife refuge and nature preserve. Under the Low-level Radioactive Waste Policy Amendments Act of 1985 and the Midwest Low Level Radioactive Waste Compact, DOE waste cannot be commingled with Callaway Plant waste and the DOE waste cannot be deposited at a Midwest Compact site. The Nuclear Regulatory Commission also discourages locating a low level radioactive disposal facility near nuclear power plant sites. Union Electric clearly indicated that it will oppose any effort to move contaminated wastes to the site. It is Union Electric's opinion that a thorough study of other sites in Missouri ("New" Missouri Site) would reveal that other locations meet or exceed the minimum standards established by the Alternative Sites Working Group and would rank higher in suitability than Callaway.

There were others in the Working Group who disagreed with Union Electric's view. Some members of the Working Group felt that the geology and hydrology of the Callaway site are adequate for the construction of an above-ground low-level radioactive waste facility. In the event that the Midwest Compact is unable to find a willing host state, the Union Electric surplus Callaway property might be a reasonable site to store all of Missouri's low-level radioactive waste because it is located in the center of the state, away from major population areas and surface water. Since the Callaway nuclear power plant produces over 90% of the state's nuclear waste, it would be reasonable to consolidate all Missouri's radioactive waste in one location.

It is important to note that the Working Group, in general, favored shipping the FUSRAP waste to an existing licensed commercial disposal site. The Callaway property or any other Missouri site should only be considered if no other options are available.

While the primary task of the Working Group was to identify and evaluate potential disposal sites, the Group also considered the challenges of the remediation and disposal process. The Group discussed cost/benefit issues, availability, risk and funding in the context of implementing a long-term, cost-sensitive solution.

Finally, the working group concluded that it would not recommend a specific site as being appropriate for disposal of the St. Louis wastes.

Members participating in this group included:

Sally Price, County Commission
Kay Drey, County Commission
Jack Frauenhoffer, City Commission
Donovan Larson, St. Louis County Water
Eileen O'Connor, Union Electric
Tom Binz, Laclede Gas Company
Jan Titus, St.Louis Lambert Airport
Dan Tschirgi, Missouri Department of Natural Resources
Bob Geller, Missouri Department of Natural Resources
Mitch Scherzinger, Missouri Department of Natural Resources
Dan Wall, EPA
Tom Horgan, Office of U.S. Representative Talent

Other participants included:

Glenn Carlson, Attorney

HEALTH RISKS/CLEANUP STANDARDS WORKING GROUP

The Health Risks/Cleanup Standards Working Group met on March 13, 1995 for the purposes of evaluating the potential for human health and environmental risks and to define cleanup standards.

David Adler presented an overview of current DOE cleanup standards for radioactive contamination in soil and how they evolved over the years. Following Adler's presentation there was extensive discussion concerning the risks to human health and the environment by the radioactive materials and their decay products found throughout the St. Louis FUSRAP Site.

It was agreed unanimously that the radioactive cleanup guidelines used by DOE for the release of properties for unrestricted use (as specified in DOE Order 5400.5 - Radiation Protection of the Public and the Environment) are appropriate and applicable to the St. Louis Site and were recommended to the Task Force on April 18, 1995.

> Guidelines for residual concentrations of Ra-226 and -228 and Th-230 and -232 in soil are: 5 picocuries per gram (5 pCi/g) averaged over the first 15 cm of soil and 15 picocuries per gram (15 pCi/g) averaged over 15 cm thick layers of soil more than 15 cm below the surface.

Any cleanup level less protective would not meet the Applicable or Relevant and Appropriate Requirements (ARARs)

Members participating in this group included:

Dave Adler, DOE
Kay Drey, County Commission
Barry Siegel, M.D., County Commission
Jim Grant, Mallinckrodt
Dan Tschirgi, Missouri Department of Natural Resources

Other participants included:

Michael Hutcheson
Chuck Jenkins, Bechtel National, Inc.
Andrei Laszlo, Washington University
Henry Royal, M.D., Washington University

PRIORITIES WORKING GROUP

The Priorities Working Group met for the first time on March 8, 1995 and on thirty-four subsequent occasions for the purpose of identifying and evaluating all the contaminated sites in St. Louis and recommending cleanup priorities to the Task Force. While the principal objective of this group was to develop long-term cleanup priorities for each component of the St. Louis Site, it also served as a forum for discussion and debate concerning near-term cleanup actions, whether proposed by the Task Force or DOE, and requests for immediate action by property owners and other affected parties.

For example, Clark Food Service, Quaker State, Rykopf-Sexton, Inc. and Alfred Fleischer each had real estate deals pending and requested site characterization and cleanup actions in order to complete the transaction. To handle future requests of this nature, the Working Group established a standardized procedure and questionnaire for evaluating and prioritizing cleanup activities.

Evaluation Criteria

1. Is there documentation of an internally approved project (e.g., property sale, proposed improvements, new installation) by the proponent?
2. Is the proposed action technically feasible?
   a) Is the property subject to recontamination from another source?
   b) What is the estimated cost to remediate?
   c) Are reliable chemical and radioactive characterization data available?
   d) Will the proposed action result in release of the subject property without use restrictions?
3. If it is not cleaned up, would contamination on this property potentially contaminate other properties?
4. Is the proposed action consistent with Task Force values (social and economic benefits)?
5. Is adequate lead time for planning provided?

The group devoted time and effort in determining the appropriate use of funds allocated by DOE to St. Louis FUSRAP in fiscal year 1996 – approximately $15 million. Those recommendations were presented to the Task Force and adopted in September, 1995.

Allocations	Fiscal Year 1996 Recommendations
$ 200,000	Evaluate use of local disposal facilities for minimally contaminated soils
$ 200,000	Identify and evaluate suitable location(s) for a new in-state disposal or interim storage facility
$ 4,000,000	Remove contaminated soils from haul route properties located in North County
$ 5,500,000	Restore and stabilize airport-owned properties, including Ballfields
$ 4,000,000	Continue cleanup efforts of the St. Louis Downtown Site (SLDS)
$ 100,000	Continue treatability investigations

The recommendations were amended in June 1996 as follows: continue cleanup of vicinity properties in North County; continue monitoring SLAPS; set up procedures for utility emergency response; perform maintenance at SLAPS; and clean up the Riverfront Trail for recreational use.

Expenditures	1996 Activities / Projects
$1,900,000	St. Louis FUSRAP project operations, maintenance, monitoring
$5,500,000	Restore and stabilize a portion of the haul routes; build a RR staging area
$6,500,000	Continue cleanup efforts of the St. Louis Downtown Site (SLDS)
$500,000 (est.)	Riverfront Trail - work in progress
$350,000*	Coldwater Creek Panel

* Previous communications indicated the total cost for the Coldwater Creek panel was $700,000. Subsequent correspondence from Bechtel National, Inc. states that the number was in error – $350,000 for overall Task Force support , not Panel support only.

Before meaningful progress could be made on the development of cleanup strategies or priorities, the Working Group felt that issues associated with both surface water runoff and groundwater beneath the SLAPS site must be addressed.

Using the report from the Coldwater Creek Panel proved to be significant in the debate regarding both appropriate remedial actions (at SLAPS and elsewhere) and overall cleanup priorities. It indicated that insufficient data exist to make any judgments regarding the long-term health and environmental effects of the contamination. Thus, the group recommended that Coldwater Creek be cleaned up to the most stringent levels to minimize health and safety risks and to halt ongoing contamination of Coldwater Creek and downstream properties. (See IV-6 for more detailed information on the panel and its findings.)

While the Coldwater Creek Panel was deliberating, the Priorities Working Group continued to gather information and discuss other issues related to the prioritization of cleanup efforts in FY 96.
The final cleanup priorities (1 = highest priority) recommendation presented to the Task Force was as follows:

1. St. Louis Airport Site / Ballfields
2. St. Louis Downtown Site / St. Louis Downtown Vicinity Properties / Riverfront Trail
3. North County haul routes / Latty Avenue Vicinity Properties
4. Hazelwood Interim Storage Site / Futura Coatings
5. Coldwater Creek
6. West Lake Landfill

Members participating in this group included:

Kay Drey, County Commission
Sally Price, County Commission
Art Jackson, County Commission
Anna Ginsburg, City Commission
Jack Frauenhoffer, City Commission
Bob Boland, Mallinckrodt
Tom Manning, Hazelwood
Lori Batton, Berkeley
Josh Richardson, Berkeley
Christina Flynn, Berkeley
Jean Montgomery, Berkeley
Norm Erickson, Berkeley resident
Mitch Scherzinger, Missouri Department of Natural Resources
Bob Geller, Missouri Department of Natural Resources
Jan Titus, St. Louis Lambert Airport
Dan Wall, U.S. EPA
David Adler, DOE
Michael Garvin, City Commission
Donovan Larson, St. Louis County Water
Tom Binz, Laclede Gas Company
Tim Venverloh, Laclede Gas Company
Dennis Henson, Union Electric
David Braun, Union Electric
George Eberle, Grace Hill Neighborhood Assoc

REMEDIATION ALTERNATIVES WORKING GROUP

At the February 20, 1995 Task Force meeting it was proposed and agreed that a series of meetings, open to all Task Force members and other interested parties, would be held for the purpose of organizing and defining a range of potential remediation options for each component of the St. Louis FUSRAP Site in order to enable the Task Force to consider detailed options and select preferred cleanup plans for each contaminated area.

Over the course of five working sessions, the Working Group segregated the St. Louis FUSRAP Site into 11 discrete component sites based on distinguishing characteristics such as degree of contamination, estimated volume of contaminants, current land use, accessibility and anticipated future land use. The recommended remediation plans and objectives by component site are listed below:

St. Louis Downtown Site (SLDS)

Objective:	Release of land for full use as factory, warehouse, offices
Remediation Plan:	Decontaminate and/or dismantle buildings; hotspot removal & protective cover; removal of contaminants to depth permitting general excavation for maintenance without concern
Cleanup Level(s):	Clean up to standards suitable for industrial or commercial use
Interim Measures:	Establish interim storage plan for handling contaminated material generated during remediation activities; control incoming and outgoing migration of air/surface water/soil; maintain fencing; add signs; ongoing public and employee awareness and educational programs
Long Term Management:	Fence, signs; maintain cover of asphalt or rock; compensation for damages and loss of use of property; public and employee awareness and education programs (ongoing); monitoring: a) access to property b) environmental conditions; prevention of migration (soil and water); flood control measures; DOE accepts responsibility for soil excavated during maintenance and development; suitable aesthetics; compensate for economic benefits foregone (opportunity costs); DOE retains responsibility, liability (perpetual caretaker status); financial provision for future needs; coordinate waste handling and site development plans and maintenance requirements; obtain local and state permits; provide clean access to utility lines; fully staffed DOE Area Office including project manager; institutional controls; demolition of contaminated buildings and encapsulation of site to control contamination

St. Louis Downtown Site Vicinity Properties (SLDS)

Objective:	Total release of land for unrestricted use
Remediation Plan:	Dismantle contaminated buildings; exhumation of contaminated soil to standards; clean up groundwater as feasible; ensure no recontamination
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	Control surface soil; control incoming and outgoing migration of air/surface water/soil; maintain fencing and signs; ongoing public awareness and education programs
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production-related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

Riverfront Trail

Objective:	Release of land for **limited** use *e.g.*, access permitted for brief periods (recreation) or in controlled environment (factory, warehouse)
Remediation Plan:	Hotspot removal & protective cover; removal of contamination to standards suitable to user scenario; reduce contaminant concentration; ensure no recontamination
Cleanup Level(s):	Clean up to standards suitable for industrial, commercial and recreational uses
Interim Measures:	Control surface soil; control incoming and outgoing migration of air/surface water/soil; fencing and signs (immediately); ongoing public awareness and education programs
Long Term Management:	Public awareness and education programs (ongoing); monitoring: a) access to property and b) environmental conditions; prevention of soil migration; maintain flood control measures; provide clean access to utility lines; fully staffed DOE Area Office including project manager on site; obtain local and state permits; suitable aesthetics; institutional controls; DOE retains responsibility, liability (perpetual caretaker status); financial provision for future needs

Coldwater Creek

Objective:	Total release of creek and banks for unrestricted use
Remediation Plan:	Exhumation of contaminated soil and sediment and recontouring with clean fill; clean up groundwater to standards; ensure no recontamination
Cleanup Level(s):	In the areas where there is potential for movement of existing soils and sediments, the cleanup levels for radium and thorium will be 5 picocuries per gram to depth of potential creek flow
Interim Measures:	Address sources of radiological contamination; comprehensive monitoring of Coldwater Creek water to evaluate impact from other FUSRAP sites and influence of all aquifers; control incoming and outgoing migration of water and soil; fencing and signs (immediately) on both sides of creek; ongoing public awareness and education programs
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production-related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

St. Louis Airport Site (SLAPS)

Objective:	Total release of land for unrestricted use
Remediation Plan:	Exhumation and remote disposal of all contaminated material from upper and deep aquifer systems; recontour with clean fill; erosion and flood control; revegetation
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	Fully staffed DOE Area Office including project manager on site; reroute McDonnell Boulevard traffic during remediation; minimal site improvements to control erosion (to protect public and worker health)
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production-related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

Ballfields

Objective:	Total release of land for unrestricted use; unrestricted use of groundwater (*i.e.*, residential-gardener scenario)
Remediation Plan:	Exhumation of contaminated soil to standards; clean up groundwater to standards; ensure no recontamination
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	Control surface soil; control incoming and outgoing migration of air/water/soil; fencing and signs (immediately); ongoing public awareness and education programs
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production-related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

Latty Avenue Vicinity Properties

Objective:	Total release of land for unrestricted use
Remediation Plan:	Dismantle contaminated buildings; exhumation of contaminated soil to standards; clean up groundwater as feasible; ensure no recontamination
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	DOE provide documentation for field use showing locations of contamination; establish interim storage plan for handling contaminated material generated during remediation activities; provide support to utilities for routine and emergency activities in contaminated areas as necessary; provide suitable location for interim storage of contaminated soil
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production-related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

North County Haul Routes

Objective:	Total release of land for unrestricted use
Remediation Plan:	Dismantle contaminated buildings; exhumation of contaminated soil to standards; clean up groundwater as feasible; ensure no recontamination
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	DOE provide documentation for field use showing locations of contamination; establish interim storage plan for handling contaminated material generated during remediation activities; provide support to utilities for routine and emergency activities in contaminated areas as necessary; provide suitable location for interim storage of contaminated soil
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production-related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

Futura

Objective:	Total release of land for unrestricted use
Remediation Plan:	Exhumation of all contaminated soil, and groundwater; ensure no recontamination; recontour with clean fill; revegetation
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	Coordination and compensation for business interruption and/or relocation; implement remediation plan immediately; control surface soil; control incoming and outgoing migration of air/water/soil; fencing and signs (immediately); ongoing public awareness and education programs; flood control measures; expedite pump and treat of groundwater
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production/related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

Hazelwood Interim Storage Site (HISS)

Objective:	Total release of land for unrestricted use
Remediation Plan:	Exhumation of all contaminated soil, and groundwater; ensure no recontamination; recontour with clean fill; revegetation
Cleanup Level(s):	Clean up radioactive contamination to 5/15 picocuries per gram for radium and thorium, per DOE Order 5400.5, "Radiation Protection of the Public and the Environment"
Interim Measures:	Control surface soil; control incoming and outgoing migration of air/water/soil; fencing and signs (immediately); ongoing public awareness and education programs; flood control measures; expedite pump and treat of groundwater
Long Term Management:	DOE maintain perpetual responsibility for subsequent discovery of nuclear weapons production and related waste; DOE maintain responsibility for subsequent discovery of contaminants and/or more stringent cleanup standards or other similar changes; compensation for damages and loss of use (in the past)

West Lake Landfill

Objective:	Release of land for limited use
Remediation Plan:	Fully encapsulated cell
Cleanup Level(s):	Isolate contaminated material from surrounding soil
Interim Measures:	Contain air, water and soil migration; treat contaminated water; fencing and signs (immediately); ongoing public and employee awareness and education programs
Long Term Management:	Fence, signs; revegetate, maintain vegetation or cover; public awareness and education programs (ongoing); monitoring: a) access to property and b) environmental conditions, especially groundwater; prevention of migration (soil and surface water); flood control measures; fully staffed DOE Area Office including project manager on site; obtain local and state permits; suitable aesthetics; institutional controls; DOE retains responsibility, liability (perpetual caretaker status); financial provision for future needs

Remediation Options (Special) Working Group

The Task Force created a special Working Group to develop a formal list of cleanup alternatives for each of the component sites. The discussion was started with presentations by Dan Wall of the U.S. EPA and Elsa Steward and Mitch Scherzinger of the Missouri Department of Natural Resources concerning the perspective of the two regulatory agencies on the cleanup objectives.

Dan Wall described the process and values used by EPA to evaluate proposed remediation plans for properties on the National Priorities List (Superfund sites). He reviewed the nine CERCLA evaluation criteria with the group :

1. Overall protection of human health and the environment
2. Compliance with ARARs - Applicable or Relevant and Appropriate Requirements
3. Long-term effectiveness and permanence
4. Short-term effectiveness
5. Reduction of toxicity, mobility and volume
6. Implementability
7. Cost
8. State acceptance
9. Community acceptance

He also pointed out that any remediation plan must be protective of human health and the environment and must also balance cost and risk considerations.

Elsa Steward, Deputy Director, Division of Environmental Quality, Missouri Department of Natural Resources, outlined the state's guidelines for remediation of the St. Louis Site:

1. Groundwater must be remediated and measures taken to ensure that there is no further deterioration of groundwater quality. Interim actions to remove contaminants from groundwater may be acceptable as temporary measures.
2. Owners of contaminated property should not have to be responsible for cleanup costs or for negative economic impact resulting from contamination.
3. The overall objective is to protect human health and the environment.
4. Exhumation of contaminated material and off-site disposal is the preferred method of remediation.
5. On-site storage in a properly engineered (RCRA Subtitle C standards) and monitored cell is a possibility, but is not preferred.

She also noted that EPA and DOE criteria do not necessarily constrain or determine the Task Force's recommendations.

To facilitate discussions on the appropriate cleanup strategies for each of the sites, the Working Group classified the cleanup options as outlined below.

OPTION	CORRESPONDING ACTIONS
I	**No action** – Maintain existing conditions
II	**Controlled, restricted access to property**; deed restrictions for limited use Apply institutional controls and monitoring
III	**Release of land for limited use as industrial/commercial/recreational** Hot spot removal and installation of a protective cover. Cleanup standards should be appropriate for specific end use. Ensure no recontamination.
IV	**Release of land for unrestricted use – "free of radiological restrictions"** Exhumation and removal of all contaminated soils to a licensed commercial facility. Cleanup standards: Removal of all contaminated material exceeding 5 picocuries per gram (5 pCi/g) above background levels in the top 15 cm (6 inches) of soil, and 15 picocuries per gram (15 pCi/g) in each 15 cm layer below the top layer. Ensure no recontamination.

Cost, risk, groundwater considerations and other issues were integrated into the selection of preferred remediation options.

Highlighted below are comments from several of the meeting participants –
Anna Ginsburg reported that the objective of the City of St. Louis and the St. Louis Airport Authority is to achieve complete remediation of both SLAPS and the Ballfields to conditions that would allow total release of the land for unrestricted use (Option IV).

Jack Frauenhoffer proposed that the Mallinckrodt plant site (SLDS) be remediated to standards that would be protective of human health and would allow continued use of the property for industrial purposes (Option III). He also proposed that the Riverfront Trail area be remediated to standards suitable for recreational use (Option III) and that the SLDS Vicinity Properties be remediated to Option IV standards due to their accessibility to the general public and the modest volume of contaminated material.

Peggy Hermes, speaking for the Missouri Coalition for the Environment, would support an Option III cleanup for Mallinckrodt, the Riverfront Trail and West Lake Landfill and Option IV for the entire length of Coldwater Creek and for all of the other component sites.

A polling of the group participants indicated a strong preference for Options III and IV -- little or no support was expressed for Options I or II.

Option IV Remediation	Option III Remediation
SLAPS	Mallinckrodt Plant (SLDS)
SLAPS Vicinity Properties	Riverfront Trail
HISS	West Lake Landfill
SLDS Vicinity Properties	Lower portion of Coldwater Creek
Ballfields	
Upper portion of Coldwater Creek	

At the July 23, 1996 Task Force meeting it was decided that the entire length of Coldwater Creek should be cleaned to Option IV level. The Task Force also asked DOE to exercise special care when excavating the lower end of the creek in order to preserve the integrity of the natural habitat.

Members participating in this group included:

Dave Adler, DOE
Barbara Cooper, Office of Congressman Talent
Sally Price, County Commission
Kay Drey, County Commission
Conn Roden, County Commission
Jack Frauenhoffer, City Commission
Anna Ginsburg, City Commission
Lou Jearls, City of Florissant
Tom Binz, Laclede Gas Company
Dan Wall, EPA
Donovan Larson, St. Louis County Water
Bob Marchant, St. Louis Metropolitan Sewer District
Roger Pryor, Missouri Coalition for the Environment
Peggy Hermes, Missouri Coalition for the Environment
Mitch Scherzinger, Missouri Department of Natural Resources
Elsa Steward, Missouri Department of Natural Resources
Jan Titus, St. Louis Lambert Airport
Jim Grant, Mallinckrodt
Doug Eller, Grace Hill Neighborhood Association/Riverfront Trail

TECHNOLOGIES WORKING GROUP

The Technologies Working Group was formed in July 1995 to screen known technologies and recommend to the Task Force those technologies that might have potential application for the St. Louis FUSRAP site.

The Oak Ridge National Laboratory Technology Logic Diagram and associated database (developed for the Office of Technology Development, Department of Energy, September 1993) were used to identify and review potential technologies to reduce volume and immobilize the radionuclides. Size separation, density separation and attrition scrubbing were immediately eliminated as possible remediation alternatives because of St. Louis County soil characteristics.

Soil washing and chemical extraction were identified as technologies for further investigation. Bench scale testing revealed that a single stage extraction process at elevated temperatures was acceptable for removing 95-97% of U-238. However, removal of Th-230 and Ra-226 required multiple extractions (3-5) to achieve acceptable concentration levels. Additional laboratory investigations would be required to design and assess the economics of the downstream processes -- dewatering of extraction slurry, recovery and recycle of the extraction reagents, and concentration of the radionuclide residual stream and other process waste streams -- which are costly and time-intensive activities.

Several other technologies, not in the database, were reviewed – ex-situ microwave vitrification (treatment process) coupled with gamma ray spectroscopy, laser ablation nebulization spectroscopy (characterization technology) in a continuous field process – and identified as having promise for cleaning up the St. Louis FUSRAP Site. The group also discussed the use of barrier technology to prevent contamination of underground and surface water. It was agreed that a recommendation be forwarded to DOE to further evaluate these technologies in a field demonstration.

It was also decided that physical soil washing should be evaluated for use at the downtown site.

In addition, the Working Group developed a list of characteristics to be used when evaluating any applicable technologies for the St. Louis FUSRAP Site.

1. Volume reduction either through treatment of soils and/or through use of analytical tools to minimize materials for disposal or treatment
2. Stability of final waste
3. Management of groundwater and surface water
4. Control of contaminated emissions – air and water
5. Engineering controls – temporary enclosures, frozen barriers
6. Cost effectiveness

Members participating in this group included:

Tom Binz, Laclede Gas Company
Kay Drey, County Commission
Sally Price, County Commission
Bob Geller, Missouri Department of Natural Resources
Mitch Scherzinger, Missouri Department of Natural Resources
Dan Wall, EPA
Jim Grant, Mallinckrodt
Bob Wester, R.M. Wester & Associates
Clarence Styron, R.M. Wester & Associates
Laurie Peterfreund, National Center of Environmental Information and Technology

COMMUNICATIONS WORKING GROUP

The Communications Working Group was formed in July 1995 to develop a strategy to increase public awareness about the St. Louis Site Remediation Task Force and to encourage participation in the process.

The group met on seven occasions and produced the following list of activities and tools for information dissemination:

1. Task Force letterhead
2. General information sheet
3. Standardized meeting notices
4. Standardized format for summary highlights of Task Force Meetings
5. Media distribution list
6. General mailing list
7. Media strategy
8. Standardized press release format
9. Proposed public meeting plan
10. Proposed distribution plan for draft and final versions of Task Force Report and Recommendations

Draft documents were presented to the Task Force for review and comment in September 1995.

In November 1995 the Task Force considered and approved a proposed communication plan for:

1. mailing information to stakeholders and media on a monthly basis
2. producing and distributing special issue fact sheets
3. conducting routine publicity activities, such as notices and summary highlights.

In December 1995 the Task Force approved the proposed public meeting plan for public input into the Task Force report and recommendations.

Members participating in this group included:

Jack Frauenhoffer, City Commission
Nancy Lubiewski, County Commission
Sally Price, County Commission
Jean Montgomery, Berkeley

MEMBERSHIP WORKING GROUP

It was understood from the outset of the process that the effectiveness of the Task Force and the authority of its recommendations to DOE were dependent on the quality of stakeholder representation and participation.

In October 1995 it was agreed that a Membership Working Group would be formed to review the roster of participants and to identify potential additions to the list of stakeholders. This new group met for the first time on November 7, 1995 and identified seven stakeholders that should be asked to participate on the Task Force -- McDonnell Douglas, U.S. Army Corps of Engineers, City of Bridgeton, Southwestern Bell Telephone, St. Louis Metropolitan Sewer District, City of Florissant, and City of Black Jack. That list was presented to the Task Force and it was agreed that invitations would be extended to all seven. Invitations were extended on November 16, 1995 and follow-up calls were made to each invitee. Of the seven, three agreed to be on the Task Force – City of Florissant, City of Bridgeton and the St. Louis Metropolitan Sewer District. Southwestern Bell Telephone, U.S. Army Corps of Engineers and the City of Black Jack declined the invitation but asked to be included on the Task Force mailing list.

It also was agreed that the cities of Berkeley and Hazelwood would each be represented by two voting participants, the mayor and one other to be named by each city.

Each new participant was provided with background information, including a complete set of key documents, and was offered the opportunity of an orientation session.

Members participating in this group included:

Kay Drey, County Commission
Sally Price, County Commission

Section 2. COLDWATER CREEK PANEL

In summer 1995, it was determined that critical issues concerning the impact of radioactive contaminants at the St. Louis Airport Site (SLAPS) on groundwater and surface water must be addressed to enable the Task Force to continue its work. A panel of geologists and hydrogeologists was assembled to review existing data, to identify any additional information required to complete its assignment and to report its observations, conclusions and recommendations regarding current and likely future conditions at the site.

A list of qualified and available candidates was developed by SAIC, a DOE contractor, and presented to the Priorities Working Group for approval:

David W. Miller, Chairman	Geraghty & Miller, Inc.
John D. Rockaway, Ph.D.	University of Missouri - Rolla Department of Geological and Petroleum Engineering
Thomas Aley	Ozark Underground Laboratory, Inc.
James Cox	Walsh Environmental Scientists and Engineers, Inc.,
Mimi R. Garstang, P.G.	Missouri Department of Natural Resources Division of Geology and Land Survey
Angel Martin	U.S. Geological Survey

The panel, known formally as the St. Louis Site Expert Geohydrological Panel, held its first meeting in St. Louis on September 15, 1995.

St. Louis Site Expert Geohydrologic Panel -- Key Issues

The St. Louis Site Expert Geohydrologic Panel was asked to review existing information regarding geology, hydrogeology, surface water hydrology and contaminant transport for the St. Louis Airport site. They were asked to address the following questions:

1. Is shallow groundwater contamination at the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

2. Is surface water runoff from the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

3. Is contamination present at the St. Louis Airport Site expected to have any environmentally significant impact on the "deep" bedrock groundwater within the foreseeable future, i.e., the next 100 years?

The initial meeting was devoted to a briefing by SAIC on the following topics:

- Site history and timeline
- Surface and subsurface distribution of radionuclides
- Nature of the material deposited at the site
- Regional and local geology
- Water resources
- Land use patterns
- Earthquake analysis
- Hydrologic pathways of radionuclide transport
- Stratigraphy underlying the site
- Groundwater modeling data
- Soil loss estimates
- Well monitoring data
- Sampling results
- Estimates of radionuclide loading to Coldwater Creek by surface and groundwater pathways

A second meeting was held on October 15, 1995 to review additional technical information regarding the site and to answer questions from the panelists regarding the previous presentation. At the third and final meeting on December 13, 1995 SAIC presented data concerning dose and risk assessments and the results of a flow and transport modeling study for the SLAPS groundwater system.

The panel reported that, while there did not appear to be any imminent threat of consequence to either the groundwater beneath the site or to Coldwater Creek from contaminants buried at the site, there was ongoing migration of contaminants via surface water runoff, which impacts Coldwater Creek and downstream properties. After reviewing available data and the modeling study the panel concluded that:

- Radionuclides are present in shallow groundwater at SLAPS. Modeling indicates there will continue to be off-site migration of contaminants through the upper groundwater system toward Coldwater Creek.
- Radionuclides from SLAPS have impacted sediment quality in the stream channel and banks of Coldwater Creek. This was caused by both stream bank erosion and sheet and gully erosion across the site. Stormwater flow and flooding along Coldwater Creek also have resulted in periods of accelerated erosional activity.
- Modeling studies indicate that the presence of radionuclides in the soil and upper aquifer system will not have a significant impact on the bedrock aquifer within the foreseeable future (100 years). The deep ground water system has not been sufficiently characterized; however, *characterization could change the conclusions* drawn from the modeling studies.
- The site is underlain by hydrogeological features that do not meet criteria for a storage or disposal facility for radioactive wastes. Such features include a shallow water table, a flood-plain setting, the absence of a continuous confining layer, the unknown bedrock conditions and the accessibility of the site to the public.

Additional data will be required to develop a more complete hydrogeological assessment of the deep groundwater system and a more comprehensive analysis of contaminated sources. This information is considered critical for a more thorough assessment of potential off-site contamination and to verify the results of the groundwater modeling. Listed below are the issues related to data gaps that were identified.

- Little is known about the areal extent of or thickness of the potential clay-rich unit that may serve as a barrier to groundwater movement beneath the site.
- True separation of the groundwater above and below the potential unit is unknown. Aquifer tests were not conclusive.
- Historically, wells within a three-mile radius of SLAPS have produced drinking water from the upper bedrock aquifer. A current door-to-door survey to document present day groundwater use is needed to identify users at risk.
- The true relationship between the creek and shallow groundwater is unknown.
- Vertical flow gradients indicated by monitoring wells are inconclusive. It is important to understand where steep vertical gradients truly exist to identify where shallow contamination may more readily move to depth.
- The vertical extent of groundwater is unknown beneath the middle portion of SLAPS. Detailed data to simulate the groundwater model are not available.
- One bedrock well completed in the coal and shale unit at the site sporadically shows elevated radionuclide levels. It needs to be determined whether this is a natural phenomenon or if this is an indication that radionuclides are moving downward.
- Characterization of the materials and groundwater flow below 50 feet is poor.
- The nature and distribution of both organic (TCE, DCE, and toluene) and inorganic chemicals are needed to better understand the hydraulic relationship between the various geologic units and their potential to enhance the migration of radionuclides.

The panel's findings were presented to the Task Force on January 13, 1996, followed by a draft written report dated February 15, 1996. The final report of the panel was distributed to the Task Force in mid-April 1996.

Mimi Garstang, Deputy Division Director of Missouri's Department of Natural Resources - Division of Geology and Land Survey, and Angel Martin, Chief, Investigations Section of the U.S. Geologic Survey (both members of the Panel) prepared addendum reports to provide more detailed examples and documentation of concern over potentially premature conclusions made in the panel's report. (Report dated April 22, 1996)

FINAL REPORT
ST. LOUIS AIRPORT SITE
EXPERT GEOHYDROLOGIC PANEL
FEBRUARY 15, 1996

Prepared for

St. Louis Area Task Force

Prepared by

The St. Louis Airport Site
Expert Geohydrologic Panel

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FINAL REPORT
ST. LOUIS AIRPORT SITE
EXPERT GEOHYDROLOGIC PANEL
FEBRUARY 15, 1996

INTRODUCTION

An Expert Geohydrologic Panel was established by the St. Louis Area Task Force in late 1995 to review pertinent site information regarding hydrogeology, surface-water hydrology, and contaminant transport at the St. Louis Airport site. This report describes the results of that review. The first meeting of the panel was on September 15, 1995, and preliminary results of the panel's review were provided in an oral presentation to the St. Louis Area Task Force on January 16, 1996. The St. Louis Area Task Force is a citizens' group created to evaluate the options available for remediation of the sites in the St. Louis area that are contaminated with low-level radioactive waste. These locations include the Mallinckrodt Plant, the Hazelwood Interim Storage Site, the St. Louis Airport Site (SLAPS), and various vicinity properties.

The panel consisted of the following members:

Mr. David W. Miller (Chairman),	Geraghty & Miller, Inc.
Dr. John D. Rockaway,	University of Missouri
Mr. Thomas Aley,	Ozark Underground Laboratory Inc.
Mr. James Cox,	Walsh Environmental Scientists and Engineers, Inc.
Ms. Mimi Garstang,	Missouri Department of Natural Resources
Mr. Angel Martin, Jr.,	U.S. Geological Survey

The first four members listed above are professionally representing only themselves in a private capacity with regard to the various issues. Mr. Angel Martin, Jr., as an employee of the U.S. Geological Survey (USGS), can comment on the technical aspects of the work. The USGS cannot make any recommendations regarding remediation of the site or alternatives or recommendations for the possible closure of the site. Also, the USGS will not comment on criteria for the disposal of additional contaminated soil and debris and the nature of immediate or long-term actions and site modifications.

Ms. Garstang, who is employed by the Missouri Department of Natural Resources as Deputy Division Director, has provided the Task Force with a separate report.

The questions provided to the panel for their analysis were as follows:

1. Is shallow groundwater contamination at the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

2. Is surface water runoff from the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

3. Is contamination present at the St. Louis Airport Site expected to have any environmental significant impact on the "deep" bedrock groundwater within the foreseeable future (e.g., next 100 years)?

The charge given to the panel was to restrict its review to the analysis of geologic and hydrologic issues related to SLAPS. These issues represent only some of the many factors that are typically considered with regard to decisions on future activities at Superfund sites.

During its deliberations, the panel also developed opinions on the following issues:

1. Adequacy of available data on which to base future decisions on potential risk.

2. Suitability of the site for disposal of additional wastes contaminated at low levels of radioactivity.

3. Immediate activities that might be considered for increased monitoring and for minimizing potential environmental impacts.

BACKGROUND

The SLAPS is a 21.7 acre property adjacent to the Lambert-St. Louis International Airport. The property is bounded to the west by Coldwater Creek, to the south by the Norfolk and Western Railroad and to the north and east by McDonnell boulevard. From 1946 to 1966, residues from the processing and production of various forms of uranium compounds were placed in the area. In the mid 1960's an unknown quantity of the residues were removed from the property and the entire property was covered with up to 3 feet of clean fill. Additional fill and rubble were placed at the site in

the 1970's and a gabion wall was constructed to minimize erosion by Coldwater Creek. Stormwater runoff from the SLAPS property presently flows in surface ditches and a pipe that all drain to Coldwater Creek. The property is fenced and is environmentally monitored and routinely maintained.

Radioactive contamination of soil at SLAPS has been characterized and extends to a depth of about 18 feet, with the majority of contamination between 4 and 8 feet below land surface (bls). Levels of uranium-238, radium-226, thorium-230, and thorium-232 in soil samples from these depths exceed background levels. Results of groundwater analyses in some monitoring wells, stormwater, and Coldwater Creek sediment also indicate elevated uranium levels. However, measured levels of radionuclides in surface water from Coldwater Creek were consistent with background levels and lower than proposed Department of Energy (DOE) guidelines.

The results of sampling and monitoring at SLAPS are summarized in numerous reports on the property. In addition, a current environmental program at SLAPS involves obtaining samples on a semi-annual basis for air, surface water, sediment, groundwater, and stormwater. The most recent sampling results, based on 10 monitoring wells, 8 surface-water sites, and two stormwater discharge points appear to be consistent with earlier investigations at SLAPS.

In the various investigations carried out at SLAPS, the geologic formations underlying the site have been divided into upper and lower aquifer systems, which are separated by confining unit composed of dense clay. The confining unit is greater than 25 feet thick along the western portion of the property, thins in an easterly direction, and pinches out near the eastern edge of SLAPS. The upper aquifer system consists of about 30 feet of clayey silt, fine sands, and silty clays. The lower aquifer system includes an unconsolidated unit of mostly silty clay and clayey gravel, up to 30 feet thick, and the underlying bedrock. The bedrock beneath the western portion of SLAPS consists of limestone. Shale overlies the limestone along the eastern portion of the site. Depth to bedrock ranges from 55 feet on the east side of SLAPS to a maximum of 90 feet toward Coldwater Creek.

PROCEDURES

To address the issues, the panel members reviewed the data, analyzed the conclusions drawn from previous DOE investigations and participated in a series of meetings focused on reviewing the available site data. At these meetings, presentations were made by the technical personnel who had

been associated with previous and ongoing studies. Requests from the panel members for supplementary information, explanation of assumptions or processes and further analysis of available data were submitted to the appropriate technical personnel. The responses to these requests were included as part of the panel review process.

The panel members independently evaluated the data and reports provided and developed preliminary conclusions. Subsequently, the panel met as a group to identify those conclusions upon which a general concurrence was made and outlined the concepts upon which this report is based.

The panel especially wants to thanks David S. Miller of Science Applications International Corporation for his efforts in providing background information on the site to the panel and in responding to the panel's many requests for additional data and analyses. Mr. Miller and the other DOE contractors involved in this process greatly simplified the panel's review through their thorough and timely presentations.

ANALYSIS

A number of factors were considered to be of major importance in supporting the conclusions and recommendations of the panel's review. These factors included:

1. Radionuclides are present in groundwater at SLAPS with higher activity levels identified near Coldwater Creek. Groundwater movement is a potential avenue for direct discharge of radionuclides to Coldwater Creek.

2. Groundwater monitoring has shown the migration of radionuclides in the direction of groundwater flow across from McDonnell Boulevard and under the formerly used ballfields property to the north. Low levels of radionuclides are present in at least one monitoring well adjacent to Coldwater Creek in the ballfields area. This factor raises concern over potential shallow discharge of radionuclides to Coldwater Creek to the west and the north, and potential vertical migration to the lower aquifer system.

3. Soil contaminated with radionuclides is present below the water table.. Therefore, groundwater is in contact with a source of radionuclides.

4. Significant levels of radionuclides are present in the soil at very shallow depths, less than 0.5 foot bls along McDonnell Boulevard on the northern boundary of SLAPS and the railroad tracks along the southern boundary. Much of the area is easily accessed by the public.

5. Coldwater Creek sediments containing radionuclides extend downstream from the site. Although this condition may have resulted from historic erosion at the SLAPS before the present gabion wall was constructed, it may also be indicative of contaminated stormwater discharging from the present SLAPS drainage system. As late as the fourth quarter of 1994, one stormwater sample collected at SLAPS exceeded the DOE reference value of "Radiation Protection of the Public and the Environment."

6. Volatile organic chemicals have been found in groundwater at SLAPS. These are not only serious environmental contaminants; they can provide the potential for facilitating transport of less mobile chemicals through the groundwater system.

7. Total carcinogenic risks from radionuclide exposure at SLAPS, as estimated in the baseline risk assessment prepared by Argonne National Laboratory in 1993, were 9.4×10^{-5}, 1.1×10^{-3}, and 1.1×10^{-1} for a SLAPS trespasser, maintenance worker, and future resident, respectively. Although these are relatively high values, the report points out that conservative, worst case scenarios were assumed in arriving at these estimates, especially with regard to future land use.

In its evaluation of data the panel also took into account some very important characteristics of the SLAPS that are favorable in the potential to minimize adverse effects to the creek and groundwater. Most important of these is the fine-grained nature of the unconsolidated sediments underlying the area. These deposits overlie the lower aquifer system. Horizontal and vertical flow of groundwater through fine-grained sediments is slow, and the potential rate of discharge of groundwater to Coldwater Creek is low. In addition, radionuclides typically have low mobility in groundwater. The fine-grained nature of the geologic units would indicate a high potential for adsorption, further limiting the migration of radionuclides. Available water-quality data indicate the lack of a widespread plume of heavily contaminated groundwater after 50 years of the presence of the source. In addition, surface-water monitoring of Coldwater Creek has consistently shown radionuclide values both within DOE guidelines and below background levels. Finally, there is no groundwater in use in the immediate area, which would affect natural groundwater flow.

Because the issues raised by the St. Louis Task Force involved future impacts, the panel relied heavily in its deliberations on a groundwater modeling study carried out by the DOE contractors. During several meetings with the contractors, the model parameters were reviewed and suggestions were made for modification of some of the parameters. The panel also recommended the expansion of the model to provide a more complete picture of potential migrations of radionuclides to Coldwater Creek and to the lower aquifer system. The results of the modeling support the assumed very slow movement of the contaminants in groundwater. Also, little environmental impact on Coldwater Creek was simulated in the model, well beyond the 100-year time period the panel was asked to consider. The model indicates that most groundwater flow is above the primary low permeability clay confining unit, and that vertical migration into the lower aquifer system would not be significant for more than 100 years.

The panel concluded that the three-dimensional groundwater flow model completed to this point was technically sound, and the hydrologic units underlying the site were simulated reasonably with the available data. The calibration results based on simulating measured water levels, especially in the upper aquifer system were acceptable. However, model calibration was completed with only a limited data set especially for the lower aquifer system. The stratigraphy underlying SLAPS has not been fully characterized, and significant gaps in various data sets are present. For example, the extent and thickness of the clay confining layer across the site is not known. This unit restricts vertical flow between the upper and lower aquifer systems and, therefore, the possible movement of contamination. This is important in defining the hydrology and possible movement of contamination.

The hydrology of the limestone and shale is not fully understood because of the lack of wells open to the bedrock at the site. The flow model has not been verified in that the model has not been run with an independent set of data. This should be done so that the model can be utilized with confidence in the simulation of the distribution of activity of radioactive constituents underlying the site. Comparison of streamflow in Coldwater Creek with simulated groundwater discharge to the creek is recommended in future calibrations.

CONCLUSIONS

As a result of the review of available data, analysis drawn from previous DOE investigations, and the modeling studies, the panel has developed a number of conclusions regarding present levels,

distribution and effect of contamination at the site as well as conclusions regarding projected levels and distribution of contamination in the future (100 years).

1. Radionuclides already are present in shallow groundwater at SLAPS, and the results of the groundwater modeling study indicate that there will continue to be off-site migration of contaminants through the upper groundwater system toward Coldwater Creek. However, results of the groundwater modeling also indicate that the levels of contamination that might eventually reach the creek would not impact surface water or sediments so that DOE guidelines would be exceeded for at least 100 years. The model results are consistent with available water quality data.

2. The presence of radionuclides at the SLAPS has impacted sediment quality in Coldwater Creek. Sediment quality has been impacted as a result of both stream bank erosion adjacent to the SLAPS and from sheet and gully erosion across the site. Stormwater flow and flooding along Coldwater Creek has resulted in periods of accelerated erosional activity. Contaminant migration from soil erosion appears to have been more significant in the past. Current rates of erosion have been reduced from previous levels as a result of the natural re-establishment of vegetation over parts of the site and the construction of a gabion wall to control bank erosion along Coldwater Creek. Neither of these features has completely eliminated the contribution of radionuclides into the surface waters of Coldwater Creek. Although the impact of these sources is not acute at this time, it does present a chronic problem to environmental quality along Coldwater Creek and should be corrected.

3. Results of the groundwater modeling study indicate that the presence of radionuclides in the soil and upper aquifer system at SLAPS will not have a significant impact on the lower aquifer system within the foreseeable future (100 years). However, the panel concluded that the deep groundwater system has not yet been sufficiently characterized, and that both the model and the conclusions drawn from the model will require verification as additional data become available.

4. The site is underlain by hydrogeological features that do not meet criteria for the location of a storage or disposal facility for radionuclide wastes. Given that the wastes are already present, it nevertheless is the conclusion of the panel that the site should not be used for the disposal of additional contaminated soil or other waste products. Physical, geological, and hydrological

aspects of the site that do not meet present criteria for disposal of wastes include a shallow water table, a flood-plain setting, the absence of a continuous and relatively thick confining layer, the presence of limestone that may be karstic in nature, and finally, the accessibility of the site. It should be noted that the model and risk assessment assumed no additional waste material would be placed at the site.

IMMEDIATE ACTIONS

Although the results of previous studies indicate that the impact of radionuclide contamination from the SLAPS into Coldwater Creek and the deep groundwater system is not acute at this time, there are a number of actions that the panel believes should be implemented immediately. These actions would be designed both to mitigate the present situation and to facilitate future investigations of contaminant migration and remedial action studies.

SITE MODIFICATIONS

The actions suggested do not represent a conclusion from the panel with respect to a recommended level or method of remediation, but are actions the panel feels could be implemented to reduce the off-site migration of radionuclide contamination from the present site.

1. The gabion wall which was constructed to prevent sediment erosion along the western creek bank appears to be accomplishing this purpose based on a cursory visual observation. However, the proximity of the radioactive contamination to the creek and the presence of contaminated material within the flood plain and the stormwater runoff ditches and pipe provide a rapid pathway for potential contaminant migration into the creek. There continues to be direct discharge of impacted material into the creek as indicated by the water-quality samples collected from one on-site stormwater- sampling site. Therefore, at a minimum, a site drainage control and prevention program should be designed and implemented to eliminate discharge of contaminated stormwater to Coldwater Creek.

2. The need for additional flood-protection facilities should be evaluated in order to maximize protection of the site from erosion during periods of flooding along Coldwater Creek.

3. The shallow soils contaminated with radionuclides found along McDonnell Road and the railroad right-of-way should be considered for removal as part of the ongoing remediation activities.

ADDITIONAL DATA ACQUISITION

The panel concluded that additional data will be required to develop a more complete hydrogeological assessment of the deep groundwater system and a more comprehensive analysis of contaminant sources. This information is considered necessary to more thoroughly assess potential off-site contamination and to verify the results of groundwater modeling.

1. Two deep monitoring wells should be installed that extend into the limestone bedrock. These wells should be designed to provide additional information on the deeper subsurface stratigraphy and the hydrologic continuity between the geologic units included within the lower aquifer system. They should be included in the ground-water monitoring program.

2. Consideration should be given to installation of a well of large enough diameter so that it could yield enough water to stress the lower aquifer system. A controlled aquifer test would provide data that could be used to better characterize the various aquifer systems and the confining unit.

3. Continuously recording stream gages should be installed upstream and downstream of the site. These would be useful in providing data for model simulation and determination of flow characteristics in Coldwater Creek.

4. Additional information should be acquired on the levels and types of groundwater contamination in the central region of the site. In this area, high concentrations of contaminants are present in the soil, yet data on the underlying groundwater quality are limited and the extent of contamination is poorly defined.

5. Additional information should be obtained on the nature and distribution of inorganic chemicals at the site. These data would be useful in helping to understand the hydraulic relation among the various geologic units.

LONG-RANGE PLANNING

The panel suggests that a comprehensive long-range program be established for the implementation of future hydrogeologic assessment studies at the site. To date, the continuity of monitoring has been interrupted from time to time. Data collection and analysis should address surface and groundwater quality, erosion, sedimentation and contaminant migration through and from the site. For example, additional wells on the ballfields property adjacent to Coldwater Creek should be included in future sampling. The data-collection program should be designed to provide the information necessary for groundwater modeling and risk assessment studies that will provide the basis for future decisions regarding the most appropriate remedial actions to be implemented at SLAPS and other sites in the St. Louis area.

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STATE OF MISSOURI
Mel Carnahan, Governor • David A. Shorr, Director
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY
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(573) 368-2100
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March 18, 1996

Mr. Jim Dwyer
Facilitator, St. Louis Area Task Force
4515 Maryland Avenue
St. Louis, MO 63108

Dear Mr. Dwyer:

I appreciated the opportunity to serve as a member of the Expert Geohydrologic Panel chosen to evaluate the potential groundwater and surface water impacts from the contamination associated with the St. Louis Airport Site (SLAPS). As a geologist working for the Missouri Department of Natural Resources (MDNR), Division of Geology and Land Survey (DGLS); I have worked on this site since the late 1980's. My office has been involved with the site since the 1960's. I am very familiar with the site characterization, site conditions and past site investigations.

I am submitting a report separate from the majority of the geohydrologic panel members. I regret that my comments were not able to be included in the panel's original draft. I believe that it is vitally important to provide the St. Louis Area Task Force with a clear outline of what information is agreed to by the panel; what information is questionable and why; and what additional information will allow for better technical decisions to be made regarding the site. I believe the St. Louis Area Task Force needs specifics to support the conclusions and recommendations as stated so that they can formulate their final recommendation for the site as well informed as possible.

It is important to note that the conclusions in both my report and the panel's final report are basically the same. The three questions that were asked of the panel are essentially responded to in the same manner. However, additional background information, data documentation, and specific information supporting the final conclusions has been provided in my report. I have outlined the specific differences in geohydrological conditions from the eastern to western ends of the site. Also, a

separate section on inconclusive data and data inadequacies has been prepared. It is my intent that the St. Louis Area Task Force will fully understand where conclusions have been formulated or where the data is still inconclusive at this point and conclusions may be only implied at this time.

If you have any questions, please feel free to call.

Sincerely,

DIVISION OF GEOLOGY AND LAND SURVEY

Mimi R. Garstang, P.G.
Deputy Division Director

MRG/dsb

FINAL REPORT
ST. LOUIS AIRPORT SITE
EXPERT GEOHYDROLOGIC PANEL
March 12, 1996

Report
Prepared for
St. Louis Area Task Force

Addendum Report
Prepared by
Mimi Garstang, member of the
The St. Louis Airport Site
Expert Geohydrologic Panel

FINAL REPORT
ST. LOUIS AIRPORT SITE
EXPERT GEOHYDROLOGIC PANEL
March 12, 1996

INTRODUCTION

An Expert Geohydrologic Panel was established by the St. Louis Area Task Force in late 1995 to review pertinent site information regarding geology, hydrogeology, surface water hydrology, and contaminant transport at the St. Louis Airport Site. This report describes the results of that review. The first meeting of the panel was on September 15, 1995, and preliminary results of the panel's review were provided in an oral presentation to the St. Louis Area Task Force on January 16, 1996. The St. Louis Area Task Force is a citizen's group created to evaluate the options available for remediation of the sites in the St. Louis area that are contaminated with low-level radioactive waste. These locations include the Mallinckrodt plant, the Hazelwood Interim Storage Site, the St. Louis Airport site (SLAPS) and various vicinity properties.

The panel consisted of the following members:

Mr. David W. Miller (Chairman,) Geraghty & Miller, Inc.
Dr. John D. Rockaway, University of Missouri
Mr. Thomas Aley, Ozark Underground Laboratory Inc.
Mr. James Cox, Walsh Environmental Scientists and Engineers, Inc.
Ms. Mimi Garstang, Missouri Department of Natural Resources
Mr. Angel Martin, Jr., U.S. Geological Survey

The first four members listed above are professionally representing only themselves in a private capacity with regard to the various issues. Mr. Angel Martin, Jr., as an employee of the U.S. Geological Survey (USGS), can comment on the technical aspects of the work. The USGS cannot make any recommendations regarding remediation of the site or alternatives or recommendations for the possible closure of the site. Also, the USGS will not comment on criteria for the disposal of additional contaminated soil and debris and the nature of immediate or long-term actions and site modifications.

Ms. Mimi Garstang, currently is employed by the Missouri Department of Natural Resources, Division of Geology and Land Survey (MDNR/DGLS), as Deputy Division Director. Working as a geologist for the department since 1978, her participation of the panel also provided a historical perspective on many of the technical investigations and documents.

The questions provided to the panel for their analysis were as follows:

1. In shallow groundwater contamination at the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

2. Is surface water runoff from the St. Louis Airport Site having, or expected to have, any environmentally significant impact on water or sediment quality in Coldwater Creek?

3. Is contamination present at the St. Louis Airport Site expected to have any environmental significant impact on the "deep" bedrock groundwater within the foreseeable future (e.g., next 100 years)?

The charge given to the panel was to restrict its review to the analysis of geologic and hydrologic issues related to SLAPS. These issues represent only some of the many factors that are typically considered with regard to decisions on future activities at Superfund sites.

1. Adequacy of available data on which to base future decisions on risk.

2. Suitability of the site for disposal of additional wastes contaminated with low-level radioactivity.

3. Immediate activities that might be considered for increased monitoring and for minimizing potential environmental impacts.

BACKGROUND

The SLAPS is a 21.7-acre property adjacent to the Lambert-St. Louis International Airport. The property is bounded to the west by Coldwater Creek, to the south by the Norfolk and Western Railroad and to the north and east by McDonnell Boulevard. From 1946 to 1966, residues from the processing and production of various forms of uranium compounds were placed in the area. In the mid 1960's an unknown quantity of the residues were removed from the property and the entire property was covered with up to 3 feet of clean fill. Additional fill and rubble were placed at the site in the 1970's and in the late 1980's a gabion wall was constructed to minimize erosion by Coldwater Creek. Stormwater runoff is presently uncontrolled. Surface ditches and a pipe all drain in the site directly into Coldwater Creek. The property is fenced and is subject to environmental monitoring and routine maintenance.

Radioactive contamination of soil at SLAPS has been characterized and extends to a depth of about 18 feet, with the majority of contamination between 4 and 8 feet below land surface (bls). Levels of uranium-238, radium-226, thorium-230, and thorium-232 in soil samples from these depths significantly exceed background levels. Analytical results of groundwater samples from some monitoring wells, stormwater samples, and sediment samples from Coldwater Creek also indicate elevated uranium levels. However, measured levels of radionuclides in surface water from Coldwater Creek were consistent with background levels and lower than proposed Department of Energy (DOE) clean-up guidelines. The results of sampling and monitoring at SLAPS are summarized in numerous reports on the property as referenced in the bibliographic attachment.

The SLAPS ground surface is essentially flat. It lies on the southeastern edge of a topographic depression known as the Florissant Basin. The Florissant Basin was created through bedrock erosion by a Mississippi River tributary. Sand, silt, gravel, and clay-rich materials filled this basin as glaciers blocked the tributary millions of years ago creating a quiet lake environment. The SLAPS lies essentially on the edge of this now sediment-filled ancient lake.

The stratigraphy on the western portion of the site depicts silty materials at ground surface that grade into fine sand and silty clay. At the 40-50 feet depth, a clay-rich unit is present that has been inferred to hydrologically separate the saturated lake deposits into two

groundwater systems in this area. The lake deposits below clay-rich unit on the western portion of the site consist mostly of silty clay and clayey and sandy gravel. Limestone, the uppermost bedrock formation, exists at depths of approximately 90 feet. Static water levels are usually about 8-10 feet below ground surface.

Beneath the eastern portion of the site lies one continuous sequence of saturated unconsolidated material. The materials grade from clayey silt to clayey and sandy gravel. This is the true edge of the ancient lake where bedrock erosion left weathered shale and coal exposed until subsequently covered by the deposits of the glacial lake to depths of 55 feet. The weathered coal and shale overlie the deeper limestone unit that is the upper bedrock on the western part of the site. No clay-rich potential confining clay-rich layer has been identified as present in the glacial lake sediments in this area. Static water levels are as shallow as 2-5 feet below ground surface. Due to limited drilling, true stratigraphic conditions between the eastern and western edge of the site are unknown.

Minimal characterization of the bedrock beneath the site has occurred. A single well has been completed in the limestone bedrock aquifer. This bedrock aquifer has historically been utilized for potable water in the Florissant Basin Area. Eight producing wells are known to have a existed within 3 miles of the site. Water quality is good in the limestone. This is characteristic of the glacial lake sediment area due to larger and more rapid recharge than in much of the St. Louis area geologic settings. The limestone is expected to produce enough water for private water usage and possibly some commercial usage.

PROCEDURES

To address the issues, the panel members reviewed the data, analyzed the conclusions drawn from previous DOE investigations and participated in a series of meetings focused on reviewing available site data. At these meetings, presentations were made by the technical personnel who had been associated with many of the previous studies. Panel members often requested supplementary information, explanation assumptions of processes and further analysis of available data. The responses to these requests were included as part of the panel review process. The panel members independently evaluated the data. There were meetings

and discussions to determine if a general concurrence existed relative to answers for the three questions reviewed by panel members.

The panel especially wants to thank David S. Miller of Science Applications International Corporation for his efforts in providing background information on the site to the panel and in responding to the panel's many requests for additional data analysis. Mr. Miller and the other DOE contractors involved in this process greatly simplified the panel's review through their thorough and timely presentations.

ANALYSIS

A number of factors were considered to be of major importance in supporting the conclusions and recommendations of the panel's review. The following listing describes conclusive information that the panel concurred upon:

1. Radionuclides are present in groundwater with higher concentrations identified near Coldwater Creek. A potential avenue exists for direct groundwater discharge of radionuclides to the creek.

2. Soil contaminated with radionuclides is present below the water table. Groundwater is in contact with a source of radionuclides under portions of SLAPS.

3. Significant levels of radionuclides are present in the soil at very shallow depths (i.e., less than 0.5 feet bls along McDonnell Boulevard on the northern boundary of SLAPS and the railroad tracts along the southern boundary). Much of the area is easily accessed by the public.

4. Groundwater monitoring has shown the migration of radionuclides in the direction of shallow groundwater flow across McDonnell Boulevard and under the formerly used ballfields property to the north. This factor raises concern over potential shallow discharges of radionuclides to Coldwater Creek to the west and the north. Low concentrations of radionuclides have been regularly detected in monitoring well B53W075. This well is approximately 800 feet north of the SLAPS property boundary

and is adjacent to Coldwater Creek. This might be expected, given the physical properties of the lacustrine (glacial lakebed) sediments.

5. Coldwater Creek sediments containing radionuclides extend downstream from the site for 7-8 miles. Although this condition may have resulted from historic erosion at the SLAPS before the present gabion wall was constructed, it may also be indicative of contaminated stormwater discharging from the present SLAPS drainage system. As late as the fourth quarter of 1994, one stormwater sample collected at SLAPS exceeded the DOE reference value for "Radiation Protection of the Public and the Environment."

6. Volatile organic chemicals have been found in groundwater at SLAPS. This poses two risks elements. These chemicals are individually important environmental contaminants. Second, they can provide the potential for facilitating transport of less mobile chemicals and other substances through the groundwater system.

7. Total carcinogenic risks from radionuclide exposure at SLAPS, as estimated in the baseline risk assessment prepared by Argonne National Laboratory in 1993, were 9.4×10^{-5}, 1.1×10^{-3}, and 1.1×10^{-1} for a SLAPS trespasser, maintenance worker, and future resident, respectively. Although these are relatively high values, the report points out that conservative, worst case scenarios were assumed in arriving at these estimates, especially with regard to future land use.

8. Most of the unconsolidated lacustrine sediments beneath the site are fine-grained and exhibit moderate horizontal permeabilities with lower vertical permeabilities. They also tend to absorb radionuclides.

9. There is limited groundwater use in the immediate SLAPS area. Also, most potable water used for public water supplies is from surface water sources (the Missouri and Mississippi Rivers).

10. The unconsolidated lakebed sediments are serving as a reservoir of fresh water recharge to the bedrock beneath the site. Potable water is present in the limestone bedrock aquifer that is normally saline in this general area.

Inconclusive data and information lead the panel to identify the following concerns and inadequacies:

1. Little is known about the areal extent of thickness of the potential clay-rich unit due to limited drilling to depth.

2. True separation of the groundwater above and below the potential confining unit is unknown. Aquifer tests were not conclusive. Only one field permeability test was completed on the potential confining unit. This test was made off-site and varied considerably from laboratory results.

3. The vertical extent of groundwater contamination is unknown beneath the middle portion of SLAPS. The stratigraphy beneath the center of the site also is not clearly defined. It is important to understand the conditions in this area.

4. Characterization of the materials and groundwater flow below approximately 50 feet is poor. Only one well has been completed in the limestone near SLAPS. Potentiametric maps for the lower units cannot be created due to lack of information.

5. Vertical flow gradients indicated by monitoring wells are inconclusive. Sediment accumulation has impacted water levels in wells. Steep downward gradients have been indicated on the southern SLAPS boundary. It is important to understand where steep vertical gradients truly exist to identify where shallow contamination may more readily move to depth.

6. Historically groundwater within a 3 mile radius of SLAPS has been utilized for industrial and private consumption. A current door-to-door survey to document present day groundwater use will identify any users at risk and any water production that may influence contaminant migration.

7. Sampling programs at SLAPS have not been consistent. Organic and inorganic analysis has not been regularly documented. No sampling occurred from 1992-1995.

8. Stream gauging information for Coldwater Creek at SLAPS is minimal. A true relationship between the creek and shallow groundwater is unknown.

9. The source and extent of TCE, DCE, and toluene contamination at the site is unknown.

10. One bedrock well sporadically shows elevated uranium levels. This well is completed in the coal and shale units that may contain naturally-occurring radiation. This well also is at the eastern edge of the site where the potential confining unit is known to be absent. It is important to understand if this is evidence of radionuclides moving to depth or if it is a natural phenomena.

MODEL PROJECTIONS

Because the issues raised by the St. Louis Task Force involved future impacts, the panel included in its deliberations the groundwater modeling study conducted by the DOE contractors. During several meetings with the contractors, the model parameters were reviewed and suggestions were made for modification of some of the parameters. The results of the modeling projected little environmental impact on Coldwater Creek or the bedrock aquifer for over 100 years. Conservatives assumptions were utilized even if they were not totally representative of the true site conditions. The panel recommended expansion of the model to provide a move complete picture of potential migration of radionuclides to Coldwater Creek and to the bedrock groundwater system as more data are obtained.

The panel concluded that the three-dimensional groundwater flow model completed to this point is reasonably sound. The calibration results based on simulation measured water levels in the upper groundwater system were acceptable. However, model calibration was completed with only a limited data set for the lower groundwater system. Limitations of that data include the fact that the stratigraphy underlying SLAPS has not been fully characterized, and significant gaps in various data sets are present. For example, the continuity and thickness of

the potential clay-confining layer across the site is not know. This unit has been thought to restrict vertical flow between the upper and lower groundwater systems; and therefore, also possibly restrict the movement of contamination. Determination of where this unit exists and its true permeability characteristics is important in defining the hydrology and possible movement of contamination at this sit. Also, the hydrology of the limestone and shale are not fully understood because of the lack of wells open to the bedrock at or near the site.

The flow model has not been verified in that the model has not been run with an independent set of data. This should be done so that the model can be utilized with confidence in the simulation of the distribution of concentration of radioactive constituents underlying the site. The current distance that radionuclides have already moved off-site must be simulated by the model with realistic assumptions. Comparison of streamflow in Coldwater Creek with simulated groundwater discharge to the creek is recommended in future calibrations.

CONCLUSIONS

As a result of the review of available data, analysis drawn from previous DOE investigations, and the modeling studies, the panel has developed a number of conclusions regarding existing levels, distribution and impact of contamination at the site as well as conclusions regarding projected levels and distribution of contamination in the future (100 years).

1. Radionuclides are present in shallow groundwater at SLAPS, and the result of the groundwater modeling study indicate that there will continue to be off-site migration of contaminants through the upper groundwater system toward Coldwater Creek. However, groundwater modeling indicates that levels of contamination would not exceed DOE guidelines for at least 100 years. The model results are consistent with the creek sampling data available for SLAPS, but not with shallow groundwater monitoring data.

2. The presence of radionuclides at the SLAPS has impacted sediment quality in the stream channel and banks of Coldwater Creek. This has been caused by stream bank erosion adjacent to the SLAPS and from sheet and gully erosion across the site.

Also, stormwater flow and flooding along Coldwater Creek has resulted in periods of accelerated erosion activity. Contaminant migration from soil erosion appears to have been more significant in the past. Current rates of erosion have been reduced from previous levels as a result of the natural re-establishment of vegetation over parts of the site and the construction of the gabion wall to control bank erosion along Coldwater Creek. However, neither of these features has completely eliminated the contribution of radionuclides into the surface waters of Coldwater Creek. Although the impact of these sources is not acute at this time, it does present a chronic problem to environmental quality along Coldwater Creek and should be corrected or mitigated.

3. Results of the groundwater modeling study indicate that the presence of radionuclides in the soil and upper aquifer system at SLAPS will not have a significant impact on the bedrock aquifer within the foreseeable future (100 years). However, the panel concluded that this deep groundwater system has not yet been sufficiently characterized, and that both the model and the conclusions drawn from the model will require verification as additional data becomes available.

4. The site is underlain by hydrogeological features that do not meet criteria for the location of a storage or disposal facility for radionuclide wastes. It is the conclusion of the panel that the site should not be used for the disposal of additional contaminated soil or other waste products. Physical, geological, and hydrological aspects of the site that do not meet present criteria for disposal of wastes include a shallow water table, a flood plain setting, the absence of a continuous and relatively thick confining layer, the unknown bedrock conditions, and finally, the accessibility of the site. It should be noted that the model and risk assessment assumed no additional waste material would be placed at the site.

IMMEDIATE ACTIONS

Although the results of previous studies indicate that the impact of radionuclide contamination from the SLAPS into Coldwater Creek and the deep groundwater system are not acute at this time, there are a number of actions that the panel believes should be implemented immediately. These actions would be designed both to mitigate the existing situation and the

facilitate future investigations of contaminant migration and remedial action studies. The actions suggested do not represent a conclusion from the panel with respect to a recommended level or method of remediation, but are actions the panel considers could be implemented to reduce the off-site migration of radionuclide contamination from the present site.

1. The gabion wall, which was constructed to prevent sediment erosion along the western creek bank, has resulted in significant reduced sediment contamination in Coldwater Creek. However, the proximity of the radioactive contamination to the creek, the presence of contaminated material within the floodplain, the stormwater runoff ditches and direct discharge pipe provide a rapid pathway for potential contaminant migration into the creek. There continues to be direct discharge of impacted material into the creek as indicated by the water-quality samples collected from one on-site stormwater sampling location. There is an immediate need to establish a site drainage control and prevention program to eliminate discharge of contaminated stormwater to Coldwater Creek.

2. The need for additional flood-protection facilities should be evaluated in order to maximize protection of the site from erosion during periods of flooding along Coldwater Creek.

3. The uncontrolled shallow soils contaminated with radionuclides found along McDonnell Road and the railroad right-of-way should be considered for removal as part of the ongoing remediation activities.

ADDITIONAL DATA ACQUISITION

The panel concluded that additional data will be required to develop a more complete hydrogeological assessment of the deep groundwater system and a more comprehensive analysis of contaminant sources. This information is considered necessary to more thoroughly assess potential off-site contamination and to verify the results of groundwater modeling.

1. Two deep monitoring wells should be installed that extend into the limestone bedrock. These wells should be designed to provide additional information on the deeper

subsurface stratigraphy and the hydraulics of the lower groundwater system. They should be included in the groundwater monitoring program.

2. Consideration should be given to installation of a (larger diameter) well so that it could yield sufficient water to stress the groundwater deeper than the 50 foot depth. A controlled aquifer test should be done to provide data that could be used to better characterize the various groundwater system and the potential confining unit.

3. Continuously recording stream gages should be installed upstream and downstream of the site. These would be useful in providing data for model simulation and determination of flow characteristics in Coldwater Creek. More water quality sampling of creek water should be implemented.

4. Additional information should be acquired on the levels and types of groundwater contamination in the central region of the site. In this area high concentrations of contaminants are present in the soil, yet data on the underlying groundwater quality are limited and the extent of contamination is poorly defined. The known extent of the potential confining unit in this area is also limited.

5. Additional information should be obtained on the nature and distribution of both organic and inorganic chemicals at the site. The data would be useful in helping to understand the hydraulic relation between the various geologic units and potential to enhance the migration of radionuclides.

6. A comprehensive long-range program should be established for the implementation of continued hydrogeologic assessment studies at the site. To date, the continuity of monitoring has been interrupted several times. Data collection and analysis must address surface and groundwater quality, static water levels, erosion, sedimentation, and contaminant migration through and from the site without continual interruption.

7. A door-to-door well survey documenting water use in the area will verify safety for the public and any potential influence on groundwater flow in the area.

8. Additional modeling of the site should be done. Once additional data are acquired on the lower unconsolidated units and bedrock beneath the site, projections on the vertical extent of contamination can be made. Modeling must also include the fate and migration of organic contaminants at the site as well as their impact on migration of radionuclides.

LONG RANGE PLANNING

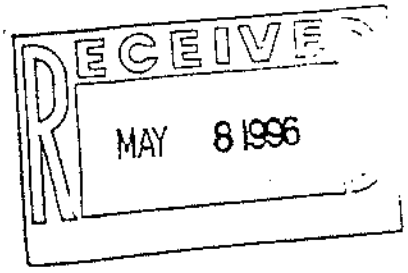
The panel suggests that a comprehensive long-range program be established for the implementation of future hydrogeologic assessment studies at the site. To date, the continuity of monitoring has been interrupted from time-to-time. Data collection and analysis should address surface and groundwater quality and flow, erosion, sedimentation and contaminant migration through and from the site. Water dating, aquifer testing, permeability testing and flow analysis are just a few of the investigations to consider as future plans are made.

Refinements in appropriate actions can be made as additional data are compared to the anticipated results and model predictions. If changes in site conditions are made which invalidate the model assumptions (i.e., additional waste is stored at the site or excavation of the waste occurs) then additional characterization of the impact and a re-evaluation of additional data needed will be necessary.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
1400 Independence Road
Mail Stop 100
Rolla, Missouri 65401

May 6, 1996



Mr. David Miller
Geraghty & Miller, Inc.
North Region
125 East Bethpage Road
Plainview, New York, 11803

Dear Mr. Miller:

At my request, Angel Martin prepared a summary of his input to the Expert Geohydrologic Panel for the records of the U.S. Geological Survey, Missouri District. A copy of his summary is enclosed for your information. We will be happy to participate in future activities of the St. Louis Airport Site.

James H. Barks
District Chief

cc: Jim Dwyer
Sally Price

Enclosure

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

WATER RESOURCES DIVISION
102 EAST MAIN STREET, 4TH FLOOR
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MEMORANDUM

April 22, 1996

To: Jim Barks 4-29-96
District Chief, WRD, Rolla, Missouri

From: Angel Martin, Jr.
Chief, Investigations Section, WRD, Urbana, Illinois

Subject: PROGRAMS AND PLANS: St. Louis Airport Site Review

As per our telephone conversation on Thursday, April 18, attached is a copy of the final report on the St. Louis Airport Site prepared by the Expert Geohydrologic Panel for the St. Louis Area Task Force. Also, per our conversation, I will summarize my participation in the panel and highlight specific comments primarily concerning the ground-water-flow modeling aspects of the material the panel reviewed.

I commented on all technical aspects of the work that had been performed at the site during all the meetings that I attended with the other panel members and the task force. I will briefly detail some of the most important comments I made during the review process.

1. From the beginning of my participation in the panel, I indicated the lack of streamflow information for Coldwater Creek. The last available streamflow data for the creek was in the 1960's. Continuously recording streamgages should be installed, as soon as possible, upstream and downstream of the site. Information from these gages will be useful in the understanding of the general hydrology of the site and in the calibration and verification of ground-water-flow modeling.

2. Concerning the ground-water-flow modeling aspects of the work, I would like to emphasize some key points. The three-dimensional ground-water-flow modeling completed to this point appears to be technically sound. The modelers have

completed model simulations utilizing a very conservative approach in describing the hydrologic characteristics of the ground-water system in order to estimate possible travel times of contaminants. It should be made clear that the modeling completed so far has involved the simulation of advective flow. No radionuclide or organic compound has been simulated in the ground-water system. It has been assumed that these compounds will move no faster than the advective flow of water particles in determining the lengths of travel times and possible discharge to Coldwater Creek.

Calibration of the three-dimensional model was accomplished with a minimum amount of data, especially for the lower aquifer system. In the U.S. Geological Survey, the model simulations completed so far would be considered, in my opinion, as "preliminary". A complete calibration, verification, and sensitivity analysis has not been performed. More data would need to be incorporated into the model as part of the additional data acquisition as described in the final report. This would include additional water levels, lithologic information, and hydrologic characteristics of the aquifers and confining units. After this process is completed, consideration can be given, if desired, for simulating solute transport of radionuclides or organic compounds in the ground-water system.

Please contact me at (217) 344-0037, extension 3030 if you have any questions or need additional information.

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ACRONYMS

AEC	Atomic Energy Commission
ALARA	As Low As Reasonably Achievable
ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWC	Coldwater Creek
DCE	Dichloroethylene
DOE	U.S. Department of Energy
DNT	Dinitrotoluene
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration
FUSRAP	Formerly Utilized Sites Remedial Action Program
HISS	Hazelwood Interim Storage Site
INEL	Idaho National Engineering Laboratory
LLRW	Low-Level Radioactive Waste
LLW	Low-Level Waste
MDNR	Missouri Department of Natural Resources
MED	Manhattan Engineer District
MREM	millirem
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
ORO	Oak Ridge Office, U.S. Department of Energy
PRP	Potentially Responsible Parties
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation and Feasibility Study
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SLAPS	St. Louis Airport Site
SLAPSS	St. Louis Airport Storage Site
SLDS	St. Louis Downtown Site
SLUPP	St. Louis Uranium Processing Plant
TCE	Trichlorethylene
TNT	Trinitrotoluene
TEDE	Total Effective Dose Equivalent
UMTRAP	Uranium Mill Tailings Remedial Action Project
USGS	U.S. Geological Survey
U.S. EPA	U.S. Environmental Protection Agency
WSCP	Weldon Spring Chemical Plant
WSOW	Weldon Spring Ordnance Works

GLOSSARY

ALARA - As Low As Reasonably Achievable, or keeping radiation emissions and exposures to levels set as far below regulatory limits as is reasonably possible in order to protect public health and the environment.

alpha radiation - The most energetic but least penetrating form of radiation. It can be stopped by a sheet of paper and cannot penetrate human skin. However, if an alpha-emitting isotope is inhaled or ingested, it will cause highly concentrated local damage.

aquifer - A permeable body of rock capable of yielding quantities of groundwater to wells and springs.

ARARs - Applicable or relevant and appropriate requirements, a comprehensive set of laws and regulations that are relevant to guide the selection of cleanup activity at a particular site.

background radiation - The natural radioactivity in the environment. Natural radiation consists of cosmic rays, filtered through the atmosphere from outer space, and radiation from the naturally radioactive elements in the earth (primarily uranium, thorium, radium and potassium). Also known as natural radiation.

beta radiation - High-energy electrons (beta particles) emitted from certain radioactive material. Can pass through 1 to 2 centimeters of water or human flesh and can be shielded by a thin sheet of aluminum. Beta particles are more deeply penetrating than alpha particles but, because of their smaller size, cause less localized damage.

biological effects - The early or delayed results of biological damager caused by nuclear radiation (alpha, beta gamma).

carcinogen - A cancer-causing agent.

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund), the federal law that guides cleanup of hazardous waste sites.

CERCLA process - A process of site investigation and remediation as outlined in CERCLA regulations and guidance which include a remedial investigation, feasibility study, proposed plan, and record of decision, followed by remedy design and construction.

characterization - Facility or site sampling, monitoring and analysis activities to determine the extent and nature of a release. Characterization provides the basis for acquiring the necessary technical information to develop, screen, analyze, and select appropriate cleanup techniques.

cleanup - The general term for environmental restoration, the process designed to ensure that risks to the environment and to human health and safety from waste sites either are eliminated or reduced to prescribed, safe levels.

curie - A unit of measurement that represents the amount of radioactivity associated with one gram of Ra-226. One curie of any radioactive material emits radiation at the rate of 3.7 billion times a second.

daughter product - An element formed by the radioactive decay of another element; often daughter products are radioactive themselves

decay - The process whereby radioactive particles undergo a change from one form, or isotope, to another, releasing radioactive particles and/or energy.

decontamination - The removal of unwanted material (typically radioactive material) from facilities, soils, or equipment by washing, chemical action, mechanical cleansing or other techniques.

defense wastes - Radioactive wastes resulting from weapons research and development, the operation of naval reactors, the production of weapons materials, the reprocessing of defense spent fuel, and the decommissioning of nuclear-powered ships and submarines.

disposal - Waste emplacement designed to ensure isolation of waste from the biosphere, with no intention of retrieval for the foreseeable future.

dose - Quantity of radiation or energy absorbed; measured in rads. (See **rad**).

dose equivalent - A term used to express the amount of effective radiation received by an individual. A dose equivalent considers the type of radiation, the amount of body exposed, and the risk of exposure. Measured in rems. (See **rem**).

effluent - A waste discharged as a liquid.

element - Any of the 109 substances that cannot be broken down further without changing its chemical properties. Singly or in combination, the elements constitute all matter.

environmental restoration - The process of environmental cleanup designed to ensure that risks to the environment and to human health and safety from waste sites either are eliminated or reduced to prescribed, safe levels.

erosion control - Methods to control land surface features to prevent erosion by surface water or precipitation runoff.

EWMF - An engineered waste management facility, designed to store low-level radioactive wastes.

exposure - A measurement of the displacement of electrons from atoms caused by x-rays or by gamma radiation. Acute exposure generally refers to a high level of exposure of short duration; chronic exposure is lower-level exposure of long duration.

final disposition - Methods for permanent disposal of waste or contaminated media residuals following excavation/treatment.

gamma rays - Penetrating electromagnetic waves or rays emitted from nuclei during radioactive decay, similar to x-rays. Dense materials such as concrete and lead are used to provide shielding against gamma radiation.

geohydrologic - Pertaining to groundwater and its movements through the geologic environment.

geohydrology - The science dealing with underground water, often referred to as hydrogeology.

groundwater - Water beneath the earth's surface that fills pores between materials such as sand, soil or gravel. Groundwater is a major source of water for agricultural and industrial purposes and is an important source of drinking water for about half of all Americans.

half-life - The time required for a radioactive substance to lose 50 percent of its radioactivity by decay. The half-life of the radioisotope thorium-230, for example, is about 75,000 years. Starting with a pound of thorium-230, in 75,000 years there will be one-half pound of thorium-230, in another 75,000 years there will be one-fourth pound, and so on.

hazardous waste - A solid waste or combination of solid wastes that, because of quantity, concentration or physical, chemical or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness or pose a substantial hazard to human health or the environment when improperly treated, stored, transported, disposed or otherwise managed. About 290 million tons of hazardous wastes are generated in the United States each year. A small percentage (about 4 percent) is recycled. The rest is treated, stored or disposed. Of the hazardous wastes disposed, most are injected as a liquid into the ground in specially designed injection wells. A large quantity is placed in surface impoundments (pits, ponds and lagoons). A small portion is placed directly on the land or buried.

heavy metals - Metals that are dense. Examples include mercury, lead, silver, gold and uranium.

isotopes - Atoms of the same element that have equal numbers of protons, but different numbers of neutrons. Isotopes of an element have the same atomic number by different atomic mass. For example, uranium-238 and uranium-235.

leachate - The solution formed when soluble components have been removed from a material.

leaching - To remove a soluble substance from a material by dissolving it in a liquid, and then removing the liquid from what is left.

LLW - Low-level waste, discarded radioactive material such as rags, construction rubble, glass, etc., that is only slightly or moderately contaminated. This waste usually is disposed of by land burial.

millirem - A unit of radiation dosage equal to one-thousandth of a rem.

mixed waste - Contains both radioactive and hazardous components.

mobility - The ability of radionuclides to move through food chains in the environment.

monitoring well - A hole drilled into the ground with a pipe inserted to allow for the collection of groundwater samples.

natural radiation - Radiation that is always present in the environment from such sources as cosmic rays and radioactive materials in rocks and soils. Also known as background radiation.

NPL - National Priorities List, the list of the nation's worst Superfund sites. SLAPS and the Latty Avenue properties were added to the NPL in October 1989.

nuclear radiation - Ionizing radiation originating in the nuclei of atoms; alpha, beta, and gamma radiation.

pathways - The means by which contaminants move. Possible pathways include air, surface water, groundwater, plants and animals.

picocuries (p/Ci) - Measurement of radioactivity. A picocurie is one million millionth, or a trillionth, of a curie, and represents about 2.2 radioactive particle disintegrations per minute.

pitchblende - A major ore of uranium and radium. Pitchblende from the former Belgium Congo contains extremely high percentages of uranium.

plume - A defined area of groundwater containing contamination that originates from a particular source such as a waste unit.

rad - Radiation absorbed dose, a measurement of ionizing radiation absorbed by any material. A rad measures the absorption of a specific amount of work (100 ergs) in a gram of matter.

radiation - Fast particles and electromagnetic waves emitted from the nucleus of an atom during radioactive disintegration.

radioactive - Giving off, or capable of giving off, radiant energy in the form of particles (alpha or beta radiation) or rays (gamma radiation) by the spontaneous disintegration of the nuclei of atoms. Radioisotopes of elements lose particles and energy through the process of radioactive decay. Elements may decay into different atoms or a different state of the same atom.

radioactive waste - A solid, liquid or gaseous material of negligible economic value that contains radionuclides in excess of threshold quantities except for radioactive material form post-weapons-test activities.

radioisotope - An unstable isotope of an element that eventually will undergo radioactive decay (i.e., disintegration). Radioisotopes with special properties are produced routinely for use in medical treatment and diagnosis, industrial tracers, and for general research.

radionuclide - A radioactive species of an atom.

radon - A radioactive gas produced by the decay of one of the daughters of radium. Radon is hazardous in unventilated areas because it can build up to high concentrations and, if inhaled for long periods of time, may cause lung cancer.

RCRA - Resource Conservation and Recovery Act, the federal environmental law designed to account for and ensure proper management of hazardous wastes, from creation to disposition

rem - Roentgen equivalent man, a unit used in radiation protection to measure the amount of damage to human tissue from a dose of ionizing radiation.

remedial action - Long-term cleanup activities

remediation - Those activities performed to remove or treat hazardous waste sites or to relieve their effects.

removal action - Interim cleanup activities that are identified as needed to protect public health and the environment

restoration - (See **environmental restoration**)

RI - Remedial investigation, the CERCLA process of determining the extent of hazardous substance contamination and, as appropriate, conducting treatability investigations.

RI/FS - Two distinct, but related studies, the remedial investigation and feasibility study. Together, they characterize environmental problems and outline remedial actions to solve those problems.

Risk Assessment (RA) - Risk assessment, the study and estimation of risk from a current or proposed activity. Involves estimates of the probability and consequence of an action.

risk management - The process of evaluating alternative regulatory and non-regulatory responses to risk and selecting among them. The selection process necessarily requires the consideration of legal, economic and social factors.

sludge - A semi-solid residue from any of a number of air or water treatment processes. Sludge can be a hazardous waste.

Superfund - The program operated under the legislative authority of CERCLA and SARA that funds and carries out the EPA solid waste emergency and long-term removal remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority level on the list, and conducting and/or supervising the ultimately determined cleanup and other remedial actions.

somatic effects - Effects of radiation limited to the exposed individual, as distinguished from genetic effects, which also affect subsequent, unexposed generations.

stable isotope - An isotope of an element that is not radioactive

teratogenic - Effects of radiation on fetus and embryos

thorium - A naturally-occurring radioactive element

threshold dose - The minimum dose of radiation that will produce a detectable effect.

toxic - Relating to a harmful effect by a poisonous substance on the human body by physical contact, ingestion or inhalation.

toxicology - The science that deals with poisons and their effects on plant, animal and human life.

treatment - Any activity that alters the chemical or physical nature of a waste to reduce its toxicity or prepare it for disposal.

uranium - The heaviest element found in nature. Approximately 997 out of every 1000 uranium atoms are uranium-238. The remaining 3 atoms are the fissile uranium-235. The uranium-235 atom splits, or fissions, into lighter elements when its nucleus is struck by a neutron.

UST - Any underground storage tank or associated piping containing hazardous materials.

vitrification - A method of immobilizing waste that produces a glass-like solid that permanently captures the radioactive materials by chemically binding the radionuclides to the glass.

waste minimization - Employing new techniques to reduce the amount of hazardous and radioactive wastes generated to as low a level as possible.

Sources:

Glossary of Environmental Restoration Terms and Acronym List (EPA/OPA-87-017, August 1988)

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APPENDICES

A. Mission and Charter

B. List of Task Force Members

C. The History of the St. Louis Uranium Processing Plant Radioactive Waste Sites

D. Executive Order 11988

E. Post Maquoketa Aquifer Well Records

F. Resolutions

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- Task Force - Implementation Strategy - July 23, 1996
- Task Force - Technology Preferences - August 20, 1996
- City of Hazelwood Resolution # 9610
- St. Louis Board of Aldermen Resolution # 67
- St.Louis County Resolution # 3991
- City of Florissant Resolution # 797

G. Letter of Request

- St. Louis Utilities - St.Louis County Water, Laclede Gas Company, St. Louis Metropolitan Sewer District and Union Electric

H. Governance Support

- Senator Bond -- June 3, 1996
- County Executive Westfall and Mayor Bosley – June 13, 1996
- Richard Fleming (Regional Commerce and Growth Association) and Dennis Coleman (St. Louis County Economic Council) – June 13, 1996
- Govenor Carnahan – June 24, 1996
- County Executive Westfall and Mayor Bosley – July 19, 1996
- Congressman Talent -- August 13, 1996
- Congressmen Clay and Gephardt – August 29, 1996

Appendix A

Mission and Charter

Appendix A
St. Louis Site Remediation Task Force
Mission and Charter

Mission Statement

The St. Louis Site Remediation Task Force is a broadly representative body formed in September 1994 to identify and evaluate feasible remedial action alternatives for the cleanup and disposal of radioactive waste materials at the St.Louis FUSRAP Site and at West Lake Landfill, and to petition the U.S. Department of Energy to pursue a cleanup strategy that is environmentally acceptable and responsive to public health and safety concerns. In the event consensus is not achieved, the task force report will include alternative recommendations to ensure that the points of view of all members are expressed.

Scope and Purpose

The primary focus of the Task Force is to 1) develop, 2) evaluate and 3) prioritize options for the cleanup and disposal of contaminated materials present at the St. Louis Site. At the conclusion of this process, the group will submit recommendations to the Assistant Secretary for Environmental Management.

Policy issues to be covered by the Task Force will include, but may not be limited to, cleanup priorities, soil treatment, inaccessible soils, and permanent disposal options.

Responsibilities and Expectations

Task Force members will:

- Be informed of site history and site related issues
- Consider multiple points of view and relevant factors as a means of fostering problem solving and consensus building
- Make concerted efforts to keep their respective constituencies/stakeholder groups informed about task force activities and recommendations
- Attend and actively participate in regular meetings, read and be prepared to comment on documents, and be available to work between formal meetings if necessary
- Develop and follow a work plan that schedules and milestones
- Select a facilitator who will be charged with among other things, establishing groundrules, keeping the process on schedule, and the meetings focused and productive
- Elect a chairperson and charge him or her with specific duties and responsibilities

The chairperson will:

- Represent the group in official communications with DOE senior management and with the media
- Preside at the Task Force meetings
- Set the times, location and agendas for meetings
- Appoint committees
- Retain consultants and otherwise be responsible for administrative matters before the Task Force.

The DOE will:

- Assist the Task Force by providing technical expertise and by assuring that information necessary for the Task Force's deliberations is made available in a timely matter
- Honor, respect and give serious consideration to the views, recommendations, and advise of the Task Force
- Work with the Task Force to provide assistance, staff, administrative support, facilitator, and access information deemed necessary to fulfill the mission
- Help the Task Force members develop and distribute informational materials to their constituencies and to the general public
- Provide financial support
- Make no attempt to control the Task Force or its agenda

Membership

The Task Force is comprised of members of the City and County appointed oversight commissions plus members designated by DOE as representatives of additional stakeholder groups. These groups include owners of contaminated residential and commercial properties, civic activists, congressional field staff, and representatives of agencies that have regulatory authority at the site.

Ground Rules

- Task Force meetings will be open to the public. A 10-minute period will be allocated for public comment at the beginning of each meeting. Written comment will be accepted at any time. Address comments to DOE Public Information Center, 9170 Latty Avenue, St.Louis, Missouri 63134
- Beyond the public comment period, only duly appointed Task Force members, invited advisors and others scheduled on the agenda may speak during a meeting
- Task Force members agree to participate fully and consistently in the process unless they withdraw
- A Task Force member may designate a substitute when he/she is unable to attend a meeting
- Each Task Force member agrees to fully explore and consider all issues before reaching conclusions
- Each Task Force member is committed to seeking agreement and agrees to search for creative opportunities to address all the interests and concerns of all participants
- Each participant acknowledges responsibility to other participates, to their constituencies, to the process, and agrees:
  - that meetings shall begin and end on schedule
  - to stay on topic and task
  - to candidly identify and share their interests and those of the constituency they represent and to represent and speak for their constituency
  - to listen carefully and respectfully to other participants and to avoid interrupting other participants
  - to offer suggestions with respect and care
  - to share relevant information regarding the issues under consideration

- to communicate with each other directly, rather than through the news media
- to respect the decision of any participant to withdraw from the consensus-building process at any time and for any reason
- to explain to other participants the reason for withdrawal from the consensus-building process
- to objectively explain and interpret the consensus building process to their constituency, to keep their constituents informed of the activities and the ideas of the process, and to seek the advice of their constituents throughout the process
- to challenge ideas -- not people
- to jointly develop a strategy for dealing with the issues of agreement that cannot be reached

- The chairperson or designee will serve as the spokesperson for the Task Force

Meetings

The Task Force will have regular public meetings as well as working group meetings which may be announced in advanced. Minutes of all meetings will be available. Should scheduling conflicts arise, members may send alternates who would be expected to represent the designated member in discussions and decision-making.

Work Product

Recommendations to DOE will be in the form of written report(s) and will address the concerns listed above under "scope and purpose." Debate on these topics should take into account, among other factors: 1) federal (e.g., CERCLA) requirements 2) state of Missouri regulations and disposal criteria, 3) budgetary constraints, and 4) available data on health effects and risk posed by contaminates at the site.

The Task Force will work toward consensus whenever possible. Where consensus cannot be reached, the report will describe areas of agreement and disagreement as well as the reasons why differences cannot be bridged.

Termination of Task Force

The Task Force will dissolve following fulfillment of its stated purpose, i.e. the submission of site cleanup recommendations to the DOE Assistant Secretary, unless the Task Force agrees to an expansion of its charter.

Appendix B

List of Task Force Members

Appendix B
St. Louis Site Remediation Task Force
Members

County Commission
Sally Price (Chair)
16736 Newbury Crossing
Florissant, MO 63034

Kay Drey
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Art Jackson
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William Conant, Jr.
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St.Louis, MO 63103

Paul Beckerle
City Hall, Room 230
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Tom Manning
City of Hazelwood
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James Grant
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[1] Also on the St. Louis County Commission
County Commission – St. Louis County Radioactive & Hazardous Waste Oversight Commission
City Commission – Mayor's Advisory Task Force on Radioactive Waste

Appendix C

The History of the St. Louis Uranium Processing Plant Radioactive Waste Sites

THE HISTORY OF THE ST. LOUIS URANIUM PROCESSING PLANT RADIOACTIVE WASTE SITES

St. Louis Site
Remediation Task Force

May 13, 1996

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