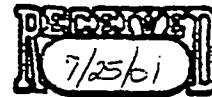




**Metropolitan
St. Louis Sewer
District**

Office of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
(314) 436-8710
FAX (314) 436-8753



July 23, 2001

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: St. Louis Airport Site

Dear Ms. Cotner:

We have reviewed your application dated April 16, 2001 requesting approval to discharge treated wastewater to the Metropolitan St. Louis Sewer District. This wastewater is stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Airport FUSRAP Site located at 110 McDonnell Boulevard, Hazelwood, Missouri. We have also reviewed your June 15, 2001 response to our request for additional information concerning the radioactive materials in the discharge.

Based on the application and the June 15, 2001 submittal, the proposed wastewater discharge to the sanitary sewer onsite is approved when the treatment system is installed, maintained and operated to produce an effluent meeting the standards of MSD Ordinance 8472, the Nuclear Regulatory Commission in 10 CFR 20, and the Missouri Department of Health in 19 CSR 20-10. The annual allocation for radioactivity from the St. Louis Airport Site discharging to the MSD Coldwater treatment plant is 50 milliCuries (50 mCi/year). A maximum of 100,000 gallons of wastewater is allowed to be discharged in a 24-hour period. The treatment system includes the use of sediment separation, a 5-micron filter, and ion exchange resin, as needed, to remove radioactive and toxic metals in the discharge to meet applicable standards, as follows:

<u>Pollutant</u>	<u>Discharge Limit</u>
Uranium-234	3,000 pCi/L
Uranium-235	3,000 pCi/L
Uranium-238	3,000 pCi/L
Thorium-228	2,000 pCi/L
Thorium-230	1,000 pCi/L
Radium-226	10 pCi/L
Radium-228	30 pCi/L
Gross Alpha	3,000 pCi/L
Barium	10.0 mg/L
Lead	0.4 mg/L
Selenium	0.2 mg/L

For the first two batches from each investigation area, we will require that analytical results be obtained and reviewed against applicable standards prior to discharge for the radioactive materials and toxic metals listed above. Subsequent batches must be analyzed and shown to meet applicable limits for total Uranium (KPA), Gross Alpha, Gross Beta, and Total Suspended Solids prior to discharge. Gross Alpha results that are significantly higher than levels indicated by the total Uranium result will require isotopic analysis to be reviewed against applicable standards prior to the discharge for all radionuclides listed above plus Actinium-227 and Protactinium-231. When toxic metals concentrations exceed MSD Ordinance 8472 limits in one of the first two wastewater batches, subsequent batches must also be analyzed for the toxic metals, unless the treatment system and an alternate verification methodology for the treatment of metals is approved by the District.

The isotopic analysis of radioactive materials will be required for each batch discharged. A monthly sum of the ratios (SOR) must be calculated for all radionuclides listed above, and the result must be less than 1.0 according to regulations in 10 CFR 20. The limit for Radium-226 and Radium-228 in the SOR calculation is 600 pCi/L.

To demonstrate the solubility of the radioactive materials, as required by 10 CFR 20, you will need to install a two micrometer (2 micron) filter in the treatment process, or provide the Gross Alpha results for the Suspended Solids portion of the wastewater. If the Gross Alpha analysis of suspended solids is used, the solubility test must be performed prior to any discharge from each new investigation area.

This approval is in effect for a period of five years from the date of this letter. The discharge into the sewer must be controlled at a rate that will not surcharge the lines in that area. This letter does not authorize any discharge to a separate storm sewer, or to any watercourse, as any such discharge must comply with the regulations of the Missouri Department of Natural Resources. This discharge authorization letter does not pertain to other wastes generated at the site including, but not limited to, spent filter media, or sludges or settled solids from wastewater treatment onsite.

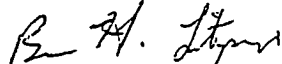
You must submit quarterly self-monitoring reports that provide the analytical results and calculations required in this approval. In addition to including the batch results for each required parameter and the SOR calculations, the MSD Radioactive Materials Discharge Report (attached) must also be completed and signed. This report lists the total radioactivity discharged during the current calendar quarter to ensure compliance with the 50 milliCurie per year limit. The reports are due 28 days after the end of the calendar quarter.

For billing purposes, you must also report the metered discharge volume. You will be billed for the volume discharged at the rate in effect at the time of discharge. The current rate, contained in MSD Ordinance 10177, is \$1.05 per hundred cubic feet. The discharge volumes should be included with the self-monitoring reports.

This discharge has been approved based upon the information and sample analysis you provided, and is subject to the conditions stated above. This approval may be revoked by the District at any time if any of the information is found to be incorrect, or if the conditions of this approval are violated. Also, if the discharge causes any operational or maintenance problem within the District's collection or treatment system, or results in violations of any conditions of the District's NPDES permit, the U.S. Army Corps of Engineers will be considered responsible for damages.

If you have any questions, please contact me at (314) 436-8757.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT


Bruce H. Litzsinger, P.E.
Civil Engineer

dh

Enclosure

Pc: Bernie Rains
Doug Mendoza
Fabian Grabski
Roland Biehl
Ken Clark

File: SD – St. Louis Airport FUSRAP Site, 110 McDonnell

PART I: IDENTIFYING INFORMATION

Permit No: _____

Reporting Period: ☐ (JAN-MAR) ☐ (APR-JUNE) ☐ (JULY-SEPT) ☐ (OCT-DEC)

RADIONUCLIDE	ACTIVITY DISCHARGED (millicuries)
TOTAL ACTIVITY DISCHARGED:	

Place your initials in the box under item A.
Everyone must complete the information under items A & B and sign this report.

I certify that to the best of my knowledge & belief, all requirements of 10 CFR Part 20.2003 and 19 CSR Part 20-10.090 governing disposal by release into sanitary sewage for material regulated by the Nuclear Regulatory Commission and the Missouri Department of Health, respectively, have been met for the period covered by this report.

I certify under penalty of Law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. , Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Title: _____ Telephone: _____

Signature: _____ Date: _____



Metropolitan St. Louis Sewer District

Office of Environmental Compliance
10 East Grand Avenue
St. Louis, MO 63147-2913
(314) 436-8710
FAX (314) 436-8753

July 23, 2001

Sharon R. Cotner
DEPARTMENT OF THE ARMY,
CORPS OF ENGINEERS
8945 Latty Avenue
Berkeley, MO 63134

Re: St. Louis Downtown Site

Dear Ms. Cotner:

We have reviewed your request dated April 10, 2001 requesting allocation of a portion of the one-Curie annual limit for the discharge of radionuclides to the Bissell Point Treatment Plant. This request concerns your current approval, originally granted by MSD on October 30, 1998, to discharge treated wastewater to the Metropolitan St. Louis Sewer District. The wastewater is stormwater and groundwater that accumulates in excavations of radioactively contaminated soils at the St. Louis Downtown FUSRAP Site located at the Mallinckrodt facility, 3600 N. 2nd Street, St. Louis, Missouri. We have also reviewed your June 15, 2001 response to our request for additional information concerning the radioactive materials in the discharge.

Your request for allocation of a portion of the one-Curie limit into the Bissell Point Treatment Plant is granted. The St. Louis Downtown Site may discharge up to 50 milliCuries per calendar year of radioactivity to the Bissell Point Treatment Plant during the years 2001, 2002, and 2003. During subsequent years, the St. Louis Downtown Site may discharge up to 25 milliCuries per calendar year. This approval is in effect for a period of five years from the date of this letter.

The wastewater discharged to the sanitary sewer onsite, at MSD Manhole 17D3-022C, must meet the standards of MSD Ordinance 8472, the Nuclear Regulatory Commission in 10 CFR 20, and the Missouri Department of Health in 19 CSR 20-10. A maximum of 100,000 gallons of wastewater is allowed to be discharged in a 24-hour period. The applicable discharge standards are as follows:

<u>Pollutant</u>	<u>Discharge Limit</u>
Uranium-234	3,000 pCi/L
Uranium-235	3,000 pCi/L
Uranium-238	3,000 pCi/L
Thorium-228	2,000 pCi/L
Thorium-230	1,000 pCi/L
Radium-226	10 pCi/L
Radium-228	30 pCi/L
Gross Alpha	3,000 pCi/L

As required by the current approval letter, we will require submittal of analytical results for the isotopic radioactive materials listed above and that written approval be obtained for the first two batches from each investigation/plant area. Subsequent batches must be analyzed and shown to meet applicable limits for total Uranium (KPA), Gross Alpha, Gross Beta, and Total Suspended Solids prior to discharge. Gross Alpha results that are significantly higher than levels indicated by the total Uranium result will require the isotopic analytical results to be reviewed against applicable standards prior to the discharge for all radionuclides listed above. To demonstrate the solubility of the radioactive materials as required by 10 CFR 20, you will need to install a two micrometer (2 micron) filter in the treatment system, or provide the Gross Alpha results for the Suspended Solids portion of the wastewater at each new plant area.

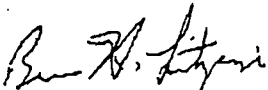
The isotopic analysis of radioactive materials will continue to be required for each batch discharged. A monthly sum of the ratios (SOR) must be calculated for all radionuclides listed above, and the result must be less than 1.0 according to regulations in 10 CFR 20. The limit for Radium-226 and Radium-228 in the SOR calculation is 600 pCi/L.

You must submit quarterly self-monitoring reports that provide the analytical results and calculations required in this approval. In addition to including the batch results for each required parameter and the SOR calculations, the MSD Radioactive Materials Discharge Report (attached) must also be completed and signed. This report lists the total radioactivity discharged during the current calendar quarter to ensure compliance with the 50/25 milliCurie per year limit. For billing purposes, you must also report the metered discharge volume. The reports are due 28 days after the end of the calendar quarter. All other conditions of the existing approval shall remain in effect.

This discharge revision has been approved based upon the information you provided, and is subject to the conditions stated above. This approval may be revoked by the District at any time if any of the information is found to be incorrect, or if the conditions of this approval are violated. Also, if the discharge causes any operational or maintenance problem within the District's collection or treatment system, or results in violations of any conditions of the District's NPDES permit, the U.S. Army Corps of Engineers will be considered responsible for damages.

If you have any questions, please contact me at (314) 436-8757.

Sincerely,
METROPOLITAN ST. LOUIS SEWER DISTRICT



Bruce H. Litzsinger, P.E.
Civil Engineer

dh

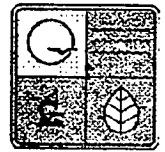
Enclosure

Pc: Bernie Rains
Doug Mendoza
Fabian Grabski
Roland Biehl
Ed Cope

File: IU - Mallinckrodt, 21120596-00



Missouri Department of Natural Resources
Hazardous Waste Program Federal Facilities Section
FUSRAP St. Louis Downtown Site
General Report on Project Facts; July 25, 2001



Project Background

Mallinckrodt Chemical Company (currently owned by Tyco Healthcare Products) located at Broadway and 2nd Streets in downtown St. Louis is a current producer of a variety of chemicals including active ingredients to pharmaceuticals. This site's involvement in Uranium production for MED and AEC dated from 1942 to 1957 and included products such as uranium trioxide, uranium dioxide, uranium tetrafluoride, uranium hexafluoride, uranium metal, and high uranium alloys.

This briefing pertains to remedial actions underway at Mallinckrodt and related vicinity properties as a result of operations pertaining to MED and AEC

Contaminates Driving Removal Actions as Specified within the Engineering Evaluation/Cost Analysis and Responsiveness Summary for the St. Louis Airport Site and Action Memorandum

- Radium 226, 228
- Thorium 230, 232
- Uranium 234, 235, & 238
- Arsenic
- Cadmium

CERCLA and Other Primary Documents Issued

- St. Louis Remediation Task Force Report (September 1996)
- Baseline Risk Assessment for the Exposure to Contaminants at the St. Louis Site (DOE 1993)
- The Remedial Investigation Addendum for the St. Louis Site (DOE 1995)
- The Feasibility Study for the St. Louis Downtown Site (USACE 1998a)
- The Proposed Plan for the St. Louis Downtown Site (USACE 1998b)
- Record of Decision for the St. Louis Downtown Site (USACE Oct. 1998)

Tasks designated within the Engineering Evaluation/Cost Analysis and Responsiveness Summary for the St. Louis Airport Site and Action Memorandum

Excavate soils to ARAR based composite criteria for Radium and Thorium (see Contaminates of Concern and Cleanup Criteria) for perimeter vicinity properties, Mallinckrodt Plant 7, and Mallinckrodt Plant 10 (removal action pre-dates the ROD)¹. A site-specific supplemental standard was prepared for Uranium.

Excavate soils to ARAR based composite criteria for the top 6' and a site specific deep soil criteria below 6' at portions of the Mallinckrodt property west of the St. Louis Terminal Railroad Association tracks.

Excavate soils to ARAR based composite criteria for the top 4' and a site specific deep soil criteria below 4' at portions of Mallinckrodt property not previously mentioned.

Backfill all excavations with 'clean' offsite soil except at the locations and depths where the deep soils cleanup criteria was applied. These can be backfilled with on-site material having contaminant concentrations less than the deep soil criteria.

Control potential groundwater degradation through removal of contaminated soil, implementing institutional controls, and groundwater monitoring in Unit B to assure post remediation compliance.

Note: a separate and future Record of Decision will have to be prepared addressing cleanup or institutional controls for inaccessible soils (those under production facilities and railroads) and areas deemed critical to operations by Mallinckrodt, specifically buildings 25 and 101. Soils and contaminated rubble to date not used as on-site backfill have been disposed of at either Envirocare of Utah or Enviro-safe in Idaho.

¹ Page 45 and 46 of the Record of Decision provides of summary of USACE's review of the Plant 10 cleanup. It states "remediation to a criteria of 5/15 for radium and thorium resulted in residual site contamination below 5 pCi/g."

Cleanup Criteria²

- Top 15cm (6 inches) of soil.

$$\frac{\text{Ra 226 or Th 230}}{5 \text{ pCi/g}} + \frac{\text{Ra 228 or Th 232}}{5 \text{ pCi/g}} + \frac{\text{U 238}}{50} > \text{or} = 1$$

- Below 15cm.

$$\frac{\text{Ra 226 or Th 230}}{5 \text{ pCi/g}} + \frac{\text{Ra 228 or Th 232}}{5 \text{ pCi/g}} + \frac{\text{U 238}}{50} > \text{or} = 1$$

Notes.

1. The sum of ratio methodology depicted above is based on net values having site-specific background concentrations subtracted from the sample results.

- Chemical Criteria³

Arsenic = 60 mg/kg in the surface.
Cadmium = 17 mg/kg in the surface.

Removal Action Status

An estimate provided by the USACE of the volume of accessible contaminated soil to be removed from the St. Louis Downtown Site was 191,420 cubic yards (FS for SLDS, Jan. 1998). This number is based upon approximate excavation dimensions. The resulting estimate of the volume of soil to be disposed, after accounting for fluffing due to disturbance is 239,275 cubic yards. Total removed and shipped to date is 27,124 cubic yards. All structures used for MED and AEC operations were demolished above floor grade except for buildings 25 and 101. Removal of subgrade structures is dependent upon USACE's assessment of contamination or interference with contaminant removal.

² Page 45 of the Record of Decision gives an explanation of the sum of ratio computation methods.

³ Page 49 of the Record of Decision gives an explanation of chemical criteria.

Long Term Stewardship

- Long Term Stewardship (LTS) has not been identified at either the St. Louis Downtown Site or North St. Louis County Vicinity properties.
- Controls will be needed to support owners and utility companies due to property use limitations or contamination left behind due to inaccessibility. Note: The St. Louis Downtown Site is being remediated to an industrial use only standard for accessible soils in portions of the Mallinckrodt Chemical Works.
A Record of Decision establishing the remedial action goals has not been drafted for the North St. Louis County Properties, however an "unrestricted release" scenario for accessible soils has been the anticipated action. Some debate exists regarding cleanup criteria that would correlate to "unrestricted use".
- Groundwater monitoring will be required to make sure source removal was effective and contaminants were not mobilized.
- Meetings by the USACE have been initiated to plan for LTS. Two meetings were held related to introducing participants to the sites, key issues, and the extent of contamination to be considered inaccessible. Future discussions should pertain to specific goals and tasks of LTS. To date the invitees have included:
 - the St. Louis FUSRAP Oversight Committee
 - the regulators
 - the utility companies
 - the railroads
 - FUTURA
 - Mallinckrodt Chemical Company
 - St. Louis County Highways and Traffic
 - City of St. Louis Street Department

ATTACHMENTS

- Chronology of Events related to the St. Louis FUSRAP sites. (Excerpted from the St. Louis Site Remediation Task Force Report, September 1999.)
- Map of contamination in North St. Louis County Properties sketched from drawings provided by USACE in Aug. 2000. (Based on Thorium-230.)
- Map of contamination to be considered inaccessible. (Drafted from the above while taking into account structures considered to make contamination inaccessible.)

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 <i>← same thing?</i>
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.

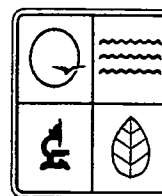
1981	An AEC report states that, based on the 1977 survey, Mallinckrodt plant is still contaminated
1982	DOE proposes disposing of SLAPS / Latty waste at Weldon Springs
1984	Congress (PL 98-360) directs DOE to reacquire SLAPS from the City of St. Louis for disposal of SLAPS, Latty and Vicinity property 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

Source: St. Louis Site
Remediation Task Force
Report. Sept. 1996

Missouri Department of Natural Resources Hazardous Waste Program



Federal Facilities Section
FUSRAP
SLDS-Plant Processing History Report



From: Jill Gruboski
Date: May 24, 2001

Background

- Most of the activities involved with MED/AEC contracts occurred at Plants 1, 2, 10, 6 and 7. Mallinckrodt began uranium production in 1942 and ended in 1957.
- The uranium products were produced from the several different uranium-processing techniques performed at Mallinckrodt were the following:
 1. Uranium trioxide (orange oxide)
 - a. Comes from uranyl nitrate
 - b. Two major steps
 - 1) Concentrating the uranyl nitrate solution by evaporation to get uranyl nitrate hexahydrate
 - 2) Heating the uranyl nitrate hexahydrate further in order for more dehydration and denitration take place that will give the end product of uranium trioxide.
 2. Uranium dioxide (brown oxide)
 - a. Uses
 - 1) Starting material in manufacturing uranium tetrafluoride
 - 2) As a component of fuel elements
 - b. Chemical reaction
$$\text{UO}_3(s) + \text{H}_2(g) \longrightarrow \text{UO}_2(s) + \text{H}_2\text{O}(g)$$
 3. Uranium tetrafluoride (green salt)
 - a. Uses
 - 1) Fluorinated to make uranium hexafluoride
 - 2) Reduced to make uranium metal by reaction with magnesium
 - b. Produced through pyrolysis of uranyl nitrate liquor at a controlled temperature
 4. Uranium metal by reduction and casting
 - a. Reduction via uranium fluoride with magnesium
 - b. Reactor vessel is used; called a bomb shell
 - 1) lined with a refractory material
 - 1942-1954 – liner made from low-boron dolomite oxide
 - 1954 – liner made from recycled magnesium slag
 5. Dingt (direct ingot) uranium metal
 - a. Larger scale of reduction process along with press forging produced metal that was suitable for rolling without remelting and casting

6. High uranium alloys - production and fabrication
7. Uranium hexafluoride (hex)
8. Enriched uranium compounds

List of plants and various processes that went on in each of them

Plant 1 (no dates could be found)

- Development of uranium-processing techniques
- Uranium compounds and metal production
- Uranium metal recovery from residues and scrap
- Lab, research and development
- Research and development in extraction
- Pilot plant with pitchblende ore
- General mechanical plant processes
- Main Plant
(Location = Second and Mallinckrodt Street)

Plant 2 (no dates could be found)

- Development of uranium-processing techniques
- Uranium compounds and metal production
- Uranium metal recovery from residues and scrap
- Uranium tetrafluoride experiments
- Digestion and treatment of U_3O_8 feeds
- Denitrate and hydrogen reduction
- Ether extraction
- Outside for extraction of pitchblende liquor
- Temporary storage of residues
- Shotgun laboratory

Plant 4 (now Plant 10) (no dates could be found)

- Development of uranium-processing techniques
- Uranium compounds and metal production
- Uranium metal recovery from residues and scrap
- Produced green salt
- Metal slag handling
- Used as storage area
 - Slag, dolomite, potassium hydroxide, ammonia, hydrogen fluoride, and others
- Used as pilot plant and lab
- Metallurgical pilot plant for processing uranium metal
- Movement of materials

Information came from:

Remedial Investigation Report for the St. Louis Site, January 1994
Uranium Production Technology, Mallinckrodt Chemical Works, 1959
Fuel for the Atomic Age-Completion Report on St. Louis Area Uranium Processing Operations 1942-1967
Sept. 1967

Plant 5 (no dates could be found)
Columbium-tantalum operations

Plant 6, 6E (1946-1957)

- Used in the production of uranium dioxide from pitchblende ore starting in 1946
- Produced a more effective nitric acid recovery system
- Process pitchblende uranium ore
- Metal plant-uranium metal processing
- Ended in 1957
- Pilot plant for fluid bed denitrification (1957)
- Decontamination (trace pitchblende)
- Research and development lab
- Ore handling and milling of pitchblende
- Ether house (extraction, trace pitchblende)
- Housed the main warehouse for bag goods, ore, concentrate (pitchblende)
- Automobile repair
- Housed the Ledoux lab (pitchblende)
- Maintenance shop
- Temporary storage of residues (pitchblendes)
- Housed a steam plant
- Housed uranium metal dissolver, miscellaneous digest and recovery operations of pitchblende
- Slag grinding and packaging
- Improvements from main plant (1950)
 - Increased the size of derbies and cast ingots
 - Casting operations to encourage vaporization of impurities from remelting the crucible contents and promoting "hot topping" of the ingot mold
 - Recycle slag as refractory liner instead of dolomite lime

Plant 7, 7E, 7N, 7S, 7W (use began in 1950)

- Called the "green salt plant"
- Designed to produce green salt
- Manufactured uranium dioxide
- Stored reactor cores
- Stored uranium dioxide, uranium trioxide, and uranium tetrafluoride (green salt)
- Used in the removal of metallic uranium from slag via wet grinding/mill flotation process
- Housed the hydrogen fluoride tank farm and pump house
- Manufactured hydrogen gas and nitrogen gas from ammonia
- Plant 7W
 - Magnesium storage and packaging
 - Some core machining

Information came from:

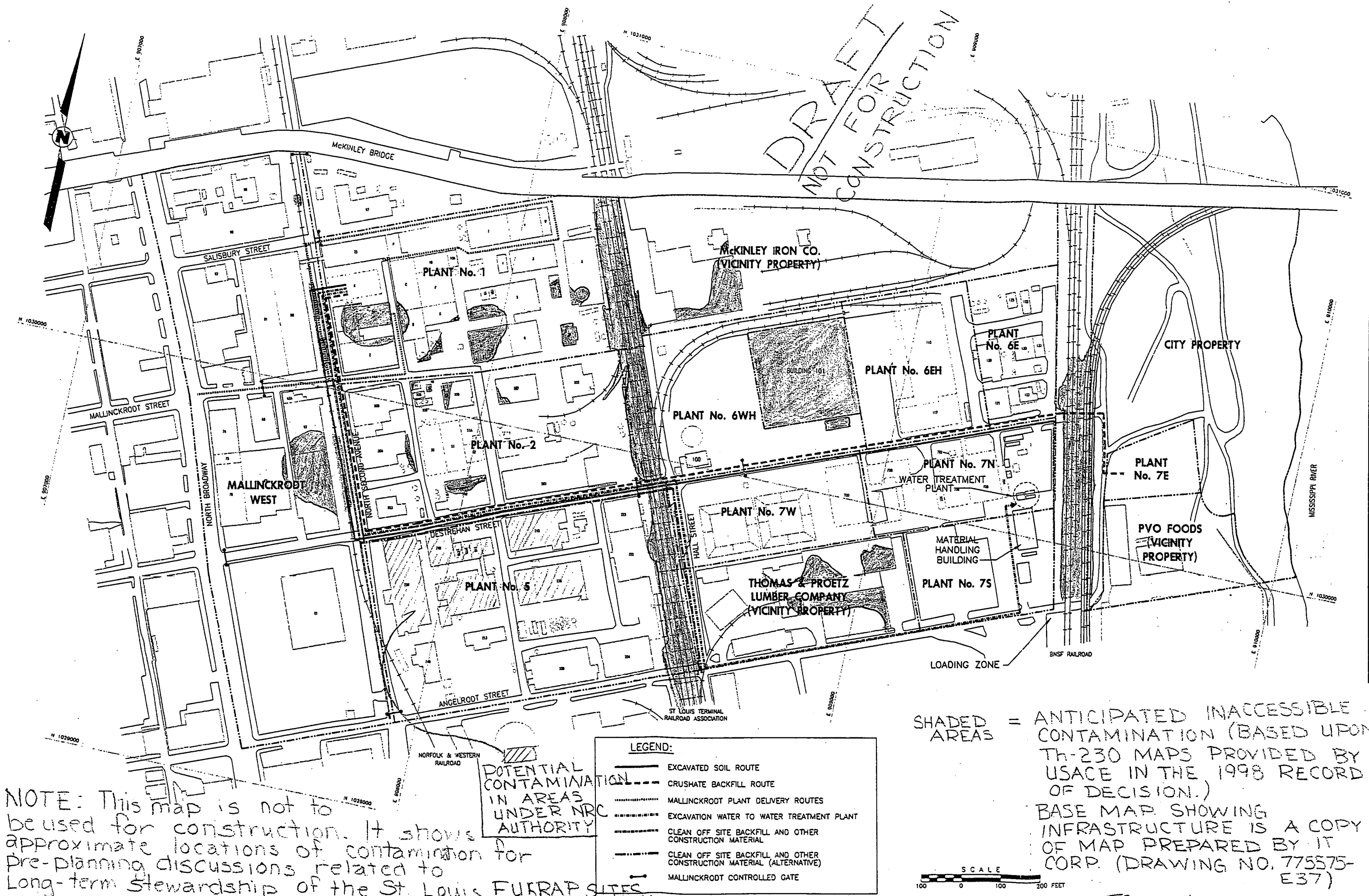
Remedial Investigation Report for the St. Louis Site, January 1994

Uranium Production Technology, Mallinckrodt Chemical Works, 1959

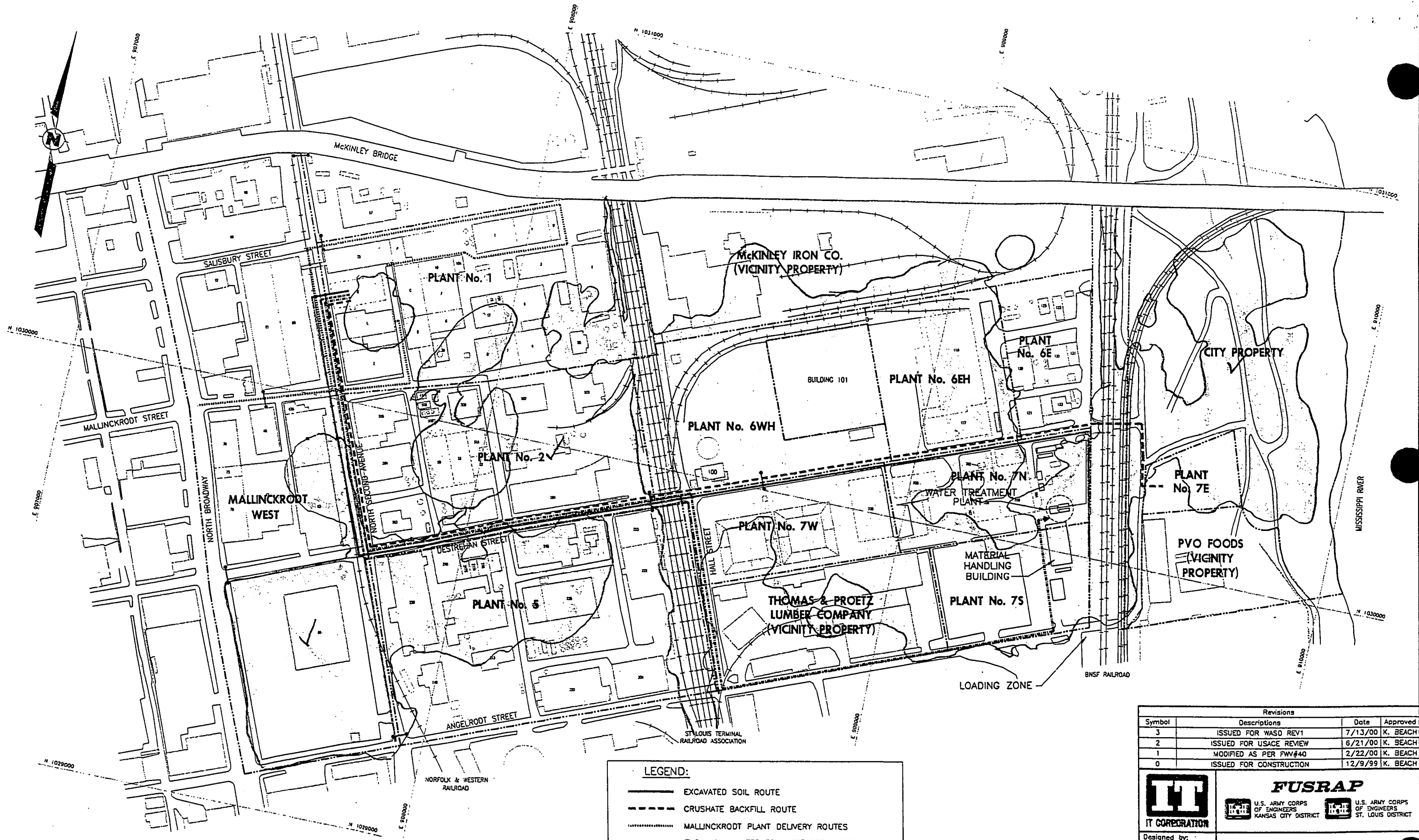
Fuel for the Atomic Age-Completion Report on St. Louis Area Uranium Processing Operations 1942-1967
Sept. 1967

Mechanical storage
Thorium-230 extraction
Slag treatment for uranium metal recovery

Information came from:
Remedial Investigation Report for the St. Louis Site, January 1994
Uranium Production Technology, Mallinckrodt Chemical Works, 1959
Fuel for the Atomic Age-Completion Report on St. Louis Area Uranium Processing Operations 1942-1967
Sept. 1967



EG 05/10/01



LEGEND:

- EXCAVATED SOIL ROUTE
- CRUSHATE BACKFILL ROUTE
- MALLINCKRODT PLANT DELIVERY ROUTES
- EXCAVATION WATER TO WATER TREATMENT PLANT
- CLEAN OFF SITE BACKFILL AND OTHER CONSTRUCTION MATERIAL
- CLEAN OFF SITE BACKFILL AND OTHER CONSTRUCTION MATERIAL (ALTERNATIVE)
- MALLINCKRODT CONTROLLED GATE



Revisions			
Symbol	Descriptions	Date	Approved
3	ISSUED FOR WADO REV1	7/13/00	K. BEACH
2	ISSUED FOR USAGE REVIEW	6/21/00	K. BEACH
1	MODIFIED AS PER FW#40	2/22/00	K. BEACH
0	ISSUED FOR CONSTRUCTION	12/9/99	K. BEACH

ITT CORPORATION

FUSRAP
U.S. ARMY CORPS OF ENGINEERS
KANSAS CITY DISTRICT

U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS DISTRICT

Designed by:
Kerri Matsumoto

Drawn by:
Red Culligan

Checked by:
Ken Beach

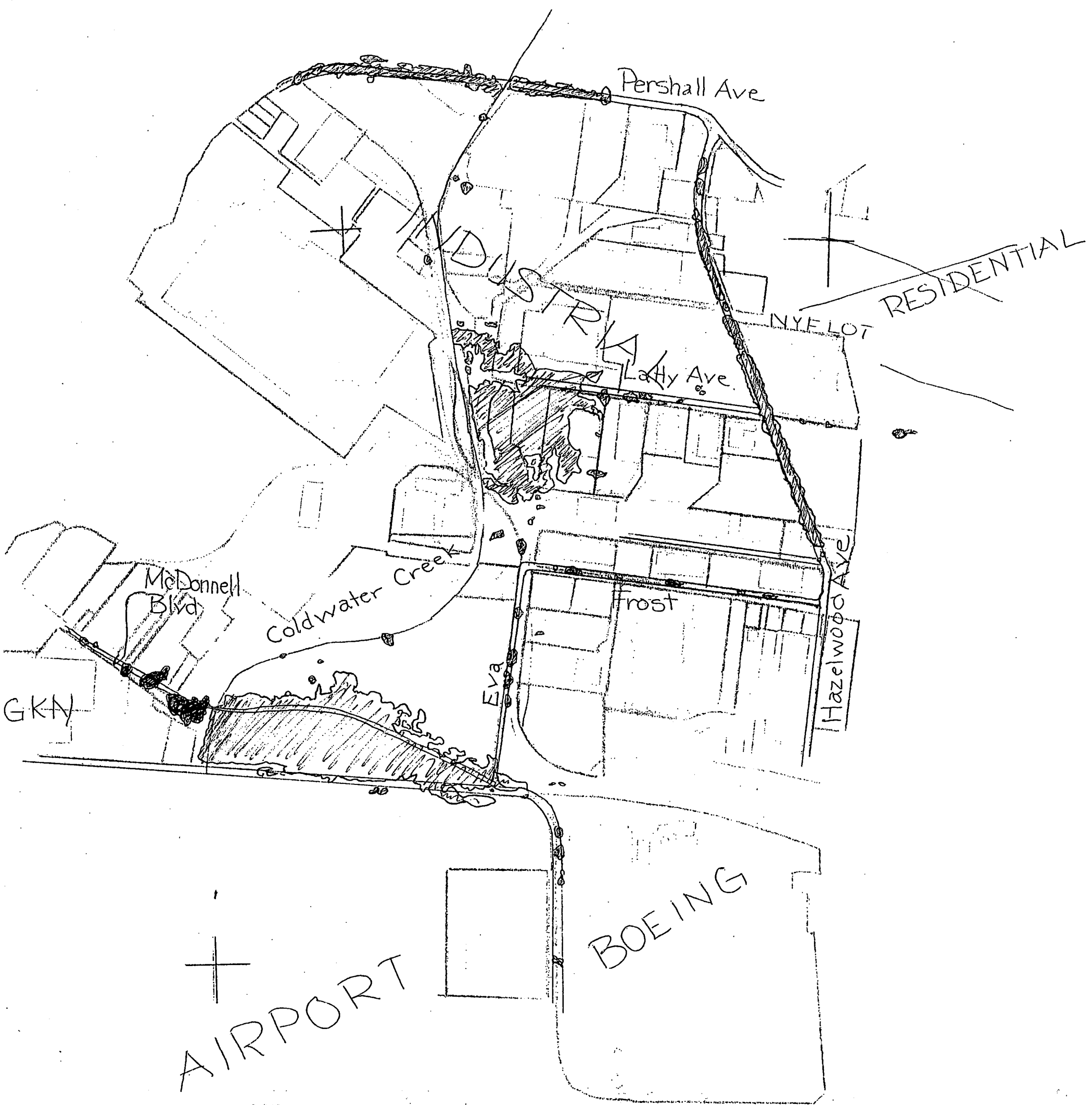
Approved by:
John Eberlin

HAUL ROUTES
PLANT NO. 1
ST. LOUIS DOWNTOWN SITE
ST. LOUIS, MISSOURI

Scale: AS SHOWN
Date: 7/12/99
Drawing Number: 775575-E37

Sheet reference number:
P1-8

Spec No.
Contract No.
OACH41-98-D-9006

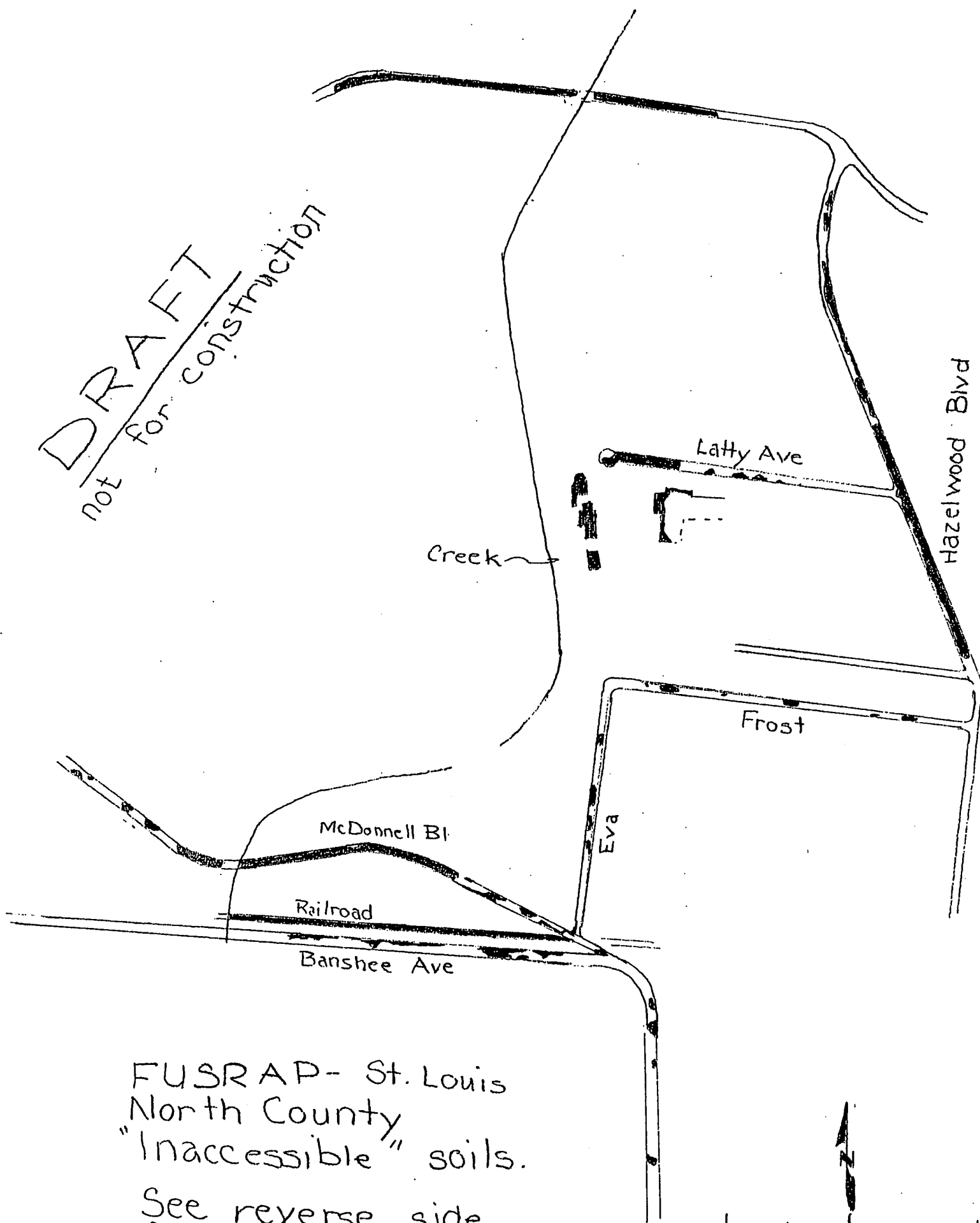


SHADING DENOTES
CONTAMINATION
AS PER USACE
DRAFT FS

0 1000' 2000'

FIG 2-38

DRAFT
not for construction



FUSRAP- St. Louis
North County
"Inaccessible" soils.
See reverse side
for St Louis Downtown
properties.

Note: Shading denotes
contamination considered
to be inaccessible.
(Based on draft FS/ PP 2000)
EG 5/8/01



Missouri Department of Natural Resources
Hazardous Waste Program Federal Facilities Section
FUSRAP North St. Louis County
General Report on Project Facts, July 25, 2001



Project Background

The storage of MED and AEC process wastes and residues on a 21.7-acre tract of land north of the St. Louis Lambert International Airport began in 1946. This facility became known as the St. Louis Airport Site or SLAPS. Selling of the material to private companies for reprocessing resulted in material being transported, staged, and handled a half mile north of SLAPS at Latty Ave, known as the Hazelwood Interim Storage Site or HISS, and finally transporting a majority of material west to a processing facility in Colorado. Portions of the material that were deemed unusable by the owner were blended with soil and illegally disposed of at the West Lake Landfill, also in St. Louis County, Missouri.

The properties in North St. Louis County being addressed under FUSRAP include all sites previously mentioned, with the exception of West Lake Landfill which is a Superfund Site, plus properties contaminated through disposition from wind, rain, and spillage during transportation by private companies. The latter includes Coldwater Creek, the Ballfields on McDonnell Boulevard, approximately 78 other vicinity properties, plus railroads and roads used for transportation. This report pertains to remedial actions currently underway.¹

Contaminates Driving Removal Actions as Specified within the Engineering Evaluation/Cost Analysis and Responsiveness Summary for the St. Louis Airport Site and Action Memorandum

- Radium 226, 228²
- Thorium 230, 232
- Uranium 238

¹ Site information is based upon the contents of the St. Louis Site Remediation Task Force Report, September 1996. Please see attached excerpt from said report depicting Chronology of Events.

² Most references within the EE/CA to contaminants do not mention Radium 228 or Thorium 232. However, page C-1 of the Appendix to the SLAPS EE/CA point out their presence and include them as factors within the cleanup criteria computations.

CERCLA and Other Primary Documents Issued

- St. Louis Remediation Task Force Report (September 1996)
- Baseline Risk Assessment for the Exposure to Contaminants at the St. Louis Site (DOE 1993)
- The Remedial Investigation Addendum for the St. Louis Site (DOE 1995)
- Engineering Evaluation /Cost Analysis (EE/CA) and Environmental Assessment for the Property in the Vicinity of the Hazelwood Interim Storage Site (DOE, March 1992. Action Memorandum finalized in June 1995.)
- St. Louis Airport Site Interim Action Engineering Evaluation /Cost Analysis (EE/CA) (DOE, 1997. This relates to the west end removal action and clay plug installation initiated but not completed.)
- Engineering Evaluation /Cost Analysis (EE/CA) and Responsiveness Summary for the St. Louis Airport Storage Site (SLAPS) and Action Memorandum (USACE, March 1999)
- Draft Ecological Risk Assessment for the North St. Louis County Site (USACE, July 1999)
- SLAPS Implementation Report (USACE, June 2001)

Cleanup Criteria³

- Top 15cm (6 inches) of soil.

$$\frac{\text{Ra 226 or Th 230}}{5 \text{ pCi/g}} + \frac{\text{Ra 228 or Th 232}}{5 \text{ pCi/g}} + \frac{\text{U 238}}{50} > \text{or} = 1$$

- Below 15cm.

$$\frac{\text{Ra 226 or Th 230}}{5 \text{ pCi/g}} + \frac{\text{Ra 228 or Th 232}}{5 \text{ pCi/g}} + \frac{\text{U 238}}{50} > \text{or} = 1$$

Notes:

1. The sum of ratio methodology depicted above is based on net values having site-specific background concentrations subtracted from the sample results.
2. Criteria proposed by the USACE in the Feasibility Study/Proposed Plan will differ from that shown above.

- Chemical Criteria

None is specified within the EE/CA's. The SLAPS document states "...chemical data for SLAPS and the ballfields are limited resulting in an inability to draw reasonable conclusions on nature and extent. Because radionuclides are believed to drive the risk at these properties and due to the limited volume of data, chemical risk was not evaluated. The fact that chemical risk is not estimated in this document does not discount the fact that risks may exist from residual contamination traced back to MED/AEC activities in St. Louis."

Removal Action Status

An estimate provided by the USACE of the volume of accessible contaminated soil to be removed from the North St. Louis County Properties was 371,879 cubic yards. This number is based upon approximate excavation dimensions. The resulting estimate of the volume of soil to be disposed, after accounting for fluffing due to disturbance is 464,849 cubic yards. Total removed and shipped to date is 159,880 cubic yards.

³ Page C-1 of the Appendix to the SLAPS EE/CA provides an explanation of the sum of ratio methodology for cleanup criteria computations.

Tasks designated within the Engineering Evaluation/Cost Analysis and Responsiveness Summary for the St. Louis Airport Site and Action Memorandum

- Excavate soils at the St. Louis Airport Site and Ballfields on McDonnell Boulevard to ARAR based criteria for radionuclides.
- Disposal of the previously said materials.

Tasks designated within the Engineering Evaluation/Cost Analysis and Responsiveness Summary for the Hazelwood Interim Storage Site and Action Memorandum

- Remove stockpiles of contaminated soil located at the Hazelwood Interim Storage Site.
- Disposal of the previously described materials. (This necessitated the task of constructing a railspur and subsequently storing and then shipping the excavated soils.)

Note: DOE and subsequently the USACE did remove and dispose of some of the soils at scattered locations through the vicinity properties AND conducted groundwater monitoring. A Feasibility Study and Proposed Plan that addresses all of the FUSRAP North St. Louis County properties is currently being drafted for regulator review. The latter includes conditions for removal of accessible soils and monitoring groundwater. Soil considered inaccessible is that which are located under buildings, railroads, bridges, and roads.

Long Term Stewardship

- Long Term Stewardship (LTS) has not been identified at either the St. Louis Downtown Site or North St. Louis County Vicinity properties.
- Controls will be needed to support owners and utility companies due to property use limitations or contamination left behind due to inaccessibility. Note: The St. Louis Downtown Site is being remediated to an industrial use only standard for accessible soils in portions of the Mallinckrodt Chemical Works.
A Record of Decision establishing the remedial action goals has not been drafted for the North St. Louis County Properties, however an "unrestricted release" scenario for accessible soils has been the anticipated action. Some debate exists regarding cleanup criteria that would correlate to "unrestricted use".
- Groundwater monitoring will be required to verify source removal was effective and contaminants were not mobilized.
- Meetings by the USACE have been initiated to plan for LTS. Two meetings were held related to introducing participants to the sites, key issues, and the extent of contamination to be considered inaccessible. Future discussions should pertain to specific goals and tasks of LTS. To date the invitees have included:
 - the St. Louis FUSRAP Oversight Committee
 - the regulators
 - the utility companies
 - the railroads
 - FUTURA
 - Mallinckrodt Chemical Company
 - St. Louis County Highways and Traffic
 - City of St. Louis Street Department

ATTACHMENTS

- Chronology of Events related to the St. Louis FUSRAP sites. (Excerpted from the St. Louis Site Remediation Task Force Report, September 1999.)
- Map of contamination in North St. Louis County Properties sketched from drawings provided by USACE in Aug. 2000. (Based on Thorium-230.)
- Map of contamination to be considered inaccessible. (Drafted from the above while taking into account structures considered to make contamination inaccessible.)

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 <i>← same thing?</i>
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

Source: St. Louis Site
Remediation Task Force
Report. Sept. 1996