DOE–LM/GJ688–2004


# Long–Term Surveillance and Maintenance Plan for the Weldon Spring, Missouri, Site

**February 2005**




U.S. Department of Energy

**Office of Legacy Management**

*Work Performed Under DOE Contract No. DE–AC01–02GJ79491*
*for the U.S. Department of Energy Office of Legacy Management.*

**Website: http://www.lm.doe.gov/land/sites/mo/weldon/weldon.htm**

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# Acronyms and Abbreviations

| | |
|---|---|
| AEC | U.S. Atomic Energy Commission |
| ALARA | as low as reasonably achievable |
| ARAR | applicable or relevant and appropriate requirement |
| ANL | Argonne National Laboratory |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 *United States Code* [U.S.C.] 9601, *et seq.*) |
| CFR | *Code of Federal Regulations* |
| COC | contaminant of concern |
| CPOU | Chemical Plant operable unit |
| CSR | *Code of State Regulations* |
| CSS | chemical stabilization/solidification |
| $D_{50}$ | median diameter |
| DCE | dichloroethylene |
| DNB | dinitrobenzene |
| DNT | dinitrotoluene |
| DOE | U.S. Department of Energy |
| dpm/100 $cm^2$ | disintegrations per minute per 100 square centimeters |
| EE/CA | Engineering Evaluation/Cost Analysis |
| EPA | U.S. Environmental Protection Agency |
| ESD | Explanation of Significant Differences |
| FFA | Federal Facility Agreement |
| FS | Feasibility Study |
| ft | foot or feet |
| GWOU | Groundwater operable unit |
| HDPE | high-density polyethylene |
| IC(s) | institutional control(s) |
| ICO | in-situ chemical oxidation |
| IRA | Interim Response Action |
| LCRS | leachate collection and removal system |
| LM | Office of Legacy Management |
| LTS&M Plan | Long-Term Surveillance and Maintenance Plan |
| $m^3$ | cubic meter |

| | |
|---|---|
| MCE | Maximum Credible Earthquake |
| MCL | maximum contaminant level |
| MDC | Missouri Department of Conservation |
| MDNR | Missouri Department of Natural Resources |
| MNA | monitored natural attenuation |
| MOU | Memorandum of Understanding |
| MoDOT | Missouri Department of Transportation |
| MSD | Metropolitan St. Louis Sewer District |
| mg/L | milligram(s) per liter |
| µg/L | microgram(s) per liter |
| NARA | U.S. National Archives and Records Administration |
| NEPA | National Environmental Policy Act (42 U.S.C. 4321, *et seq*.) |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| ORAU | Oak Ridge Associated Universities |
| ORO | Oak Ridge Operations Office, Oak Ridge, Tennessee |
| OU | operable unit |
| PAH | polycyclic aromatic hydrocarbons |
| PCB | polychlorinated biphenyl |
| PCE | tetrachloroethylene (or perchloroethylene) |
| pCi/L | picocurie(s) per liter |
| PMP | probable maximum precipitation |
| QROU | Quarry Residuals operable unit |
| RA | Remedial Action |
| RAGS | Risk Assessment Guidance for Superfund |
| RAR | Remedial Action Report |
| RCRA | Resource Conservation and Recovery Act (42 U.S.C. 6901, *et seq.*) |
| RD | Remedial Design |
| RD/RA | Remedial Design/Remedial Action |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| ROW | right-of-way |
| TCE | trichloroethylene |

| | |
|---|---|
| TNB | trinitrobenzene |
| TNT | trinitrotoluene |
| TSA | temporary storage area |
| UUUE | unlimited use and unrestricted exposure |
| VOC | volatile organic compound |
| WSCC | Weldon Spring Citizens Commission |
| $yd^3$ | cubic yard(s) |

See also definitions in Section 4.0, "Glossary"

End of current text

# 1.0 Basis and Regulatory Requirements

## 1.1 Purpose and Scope

Consistent with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements, remedial actions either have been or are being completed at the U.S. Department of Energy (DOE) Weldon Spring Site (the Weldon Spring Site or the Site) located near Weldon Spring, Missouri. These remedial actions are protective of the anticipated future land use; however, they do not allow for unrestricted use in all areas. This Long-Term Surveillance and Maintenance (LTS&M) Plan explains how the DOE will fulfill its obligation to manage residual hazards at the Site over the long term. Because some of the wastes disposed of at the Site will remain hazardous for several thousand years, this Plan essentially requires management of hazards in perpetuity. As defined by the DOE guidance document, *Long-Term Stewardship Planning Guidance for Closure Sites* (DOE 2002b), long-term stewardship refers to all activities necessary to ensure protection of human health and the environment. These activities include, but are not limited to, "all engineered and institutional controls (ICs) designed to contain or to prevent exposure to residual contamination and waste, such as surveillance activities, record-keeping activities, inspections, groundwater monitoring, ongoing pump and treat activities, cap repair, maintenance of entombed buildings or facilities, maintenance of other barriers and contained structures, access control, and posting signs." The term "stewardship" has been superceded by the term "surveillance and maintenance" in this document and by DOE policy. The term "surveillance and maintenance" now includes the same activities formerly defined by the term "stewardship" and encompasses the activities of an Operations and Maintenance Plan under CERCLA.

The Site consists of the former Weldon Spring Chemical Plant (which includes an on-site disposal cell), the former Weldon Spring Quarry, and all areas, whether on DOE controlled property or other property, where chemical or radiological contamination is located. This plan does not address aspects of the CERCLA remedial action being conducted by the U.S. Department of the Army (Army) at the adjacent Weldon Spring Ordnance Works.

Objectives for performing long-term surveillance and maintenance at the Site include the following:

- Conducting operation, inspection, and maintenance of the engineered controls.
- Conducting maintenance, inspection, and enforcement of the land and groundwater use restrictions and other ICs necessary for the protectiveness of the remedies.
- Conducting long-term monitoring of air, groundwater, biota, or other media necessary to demonstrate the performance, effectiveness, or protectiveness of the remedies.
- Identifying and implementing actions to optimize remedies and long-term stewardship activities.
- Identifying and meeting all regulatory requirements for the post-remedial action site conditions.
- Identifying and meeting all natural, cultural, and historical resource management requirements.

- Ensuring that budgeting, funding, and personnel requirements appropriate to sustain long-term stewardship needs are met.
- Ensuring that public involvement, including education, outreach, notice, and informational systems are appropriate to sustain the long-term effectiveness of the remedies.
- Ensuring that information and records management requirements are appropriate and designed to be sustain over the long term.
- Developing all plans, manuals, and reports, including revisions to these documents, which are either required or appropriate to conduct the long-term maintenance and surveillance activities.

Section 1.0, "Basis and Regulatory Requirements," describes the purpose and scope of this document, site activities leading up to long-term surveillance and maintenance, and the legal and regulatory basis for long-term surveillance and maintenance activities. Section 2.0, "Long-Term Surveillance and Maintenance," provides information regarding the surveillance and maintenance implementation program for the Weldon Spring Site, including stakeholder roles, public participation, inspections, reports, 5-year reviews, routine site maintenance, environmental monitoring, IC monitoring, emergencies, permits, and record keeping. Section 3.0 "Institutional Controls Implementation Plan for the Weldon Spring Site," describes the categories of ICs and the process used to evaluate and implement specific ICs for each use restriction. Section 4.0, "Glossary," includes definitions of relevant terms. The Appendixes are listed below:

- Appendix A—Background Information, Remedial Action Histories, Final Site Conditions
- Appendix B—Risk Assessment Information
- Appendix C—Disposal Cell Contents
- Appendix D—Legal Descriptions of DOE Property and Use Restriction Areas
- Appendix E—Institutional Control Documentation
- Appendix F—Official Contact List
- Appendix G—Distribution List
- Appendix H—Annual Inspection Checklist
- Appendix I—Leachate Collection and Removal System Operating Plan
- Appendix J—LCRS/Train 3 Treatment Contingency Plan
- Appendix K—Disposal Cell Groundwater Monitoring Plan
- Appendix L—Well Field Contingency Plan
- Appendix M—Groundwater Operable Unit Contingency Tree

This LTS&M Plan is in effect upon receipt of concurrence from the U.S. Environmental Protection Agency (EPA) in consultation with the Missouri Department of Natural Resources (MDNR). DOE is responsible for assuring that all LTS&M activities described in this Plan are fully implemented.

## 1.2 Location and Property Ownership

The Weldon Spring Site is located in St. Charles County, Missouri, about 30 miles (48 kilometers) west of St. Louis (Figure 1−1). The Site comprises two geographically distinct DOE-owned properties: the Weldon Spring Chemical Plant Area (Chemical Plant Area) and the Weldon Spring Quarry (Quarry). The Chemical Plant Area is located about 2 miles (3.2 kilometers) southwest of the junction of Missouri State Route 94 and U.S. Highway 40/61. The Quarry is about 4 miles southwest of the Chemical Plant. Both sites are accessible from Missouri State Route 94. Directions to the Site from Lambert-St. Louis International Airport are provided in Table 1−1.

*Table 1–1. Mileage and Directions from the Lambert-St. Louis International Airport to the Weldon Spring, Missouri, Site*

| Mileage | Route |
|---|---|
| 0.0 | At the Airport exit, take the I-70W on-ramp |
| 11.3 | On I-70W, take Exit 228 (Missouri State Route 94 and 1st Capital Drive) |
| 11.9 | Turn left on 1st Capital Drive and continue on South 1st Capital Drive (becomes Missouri State Route 94) |
| 24.4 | On Missouri State Route 94, turn right at the Interpretive Center entrance |

The Chemical Plant Area and Quarry are both located on parts of 17,232 acres (6,974 hectares) of private land acquired by the Army in the early 1940s for construction of the Weldon Spring Ordnance Works facility. The former ordnance works property has since been divided into several areas, in addition to the Chemical Plant Area and Quarry, the U.S. Army Reserve Weldon Spring Training area, two conservation areas managed by the Missouri Department of Conservation (MDC), a segment of the Katy Trail managed by the Missouri Department Natural Resources-Division of State Parks, a Missouri Department of Transportation (MoDOT) maintenance facility, the Francis Howell High School, the St. Charles County water treatment facility and law enforcement training center, the village of Weldon Spring Heights, and a University of Missouri research park. Title search information regarding ownership interests within areas impacted by the Site is included in Appendix D. These areas are depicted in Figure 1−2.

The Chemical Plant and Quarry areas total 228.16 acres (92.33 hectares). The Chemical Plant property is located on 219.50 acres (88.83 hectares); and the Quarry occupies 8.66 acres (3.50 hectares). Legal descriptions of the two parcels are presented in Appendix D. DOE maintains real estate correspondence and instruments at the records repository in Grand Junction, Colorado.

The August A. Busch Memorial Conservation Area, located north of the Chemical Plant, includes about 6,987 acres (2,828 hectares) of actively managed grassland and forest. The Weldon Spring Conservation Area comprises about 7,356 acres (2,977 hectares) of primarily forested land located south and east of the Chemical Plant. The Quarry is located within the Weldon Spring Conservation Area. Both conservation areas are actively managed for fish and wildlife production and are used annually by more than 1,200,000 visitors for fishing, hunting, and hiking (DOE 2002a). MDC currently employs about 50 people in these areas (DOE 2002a).

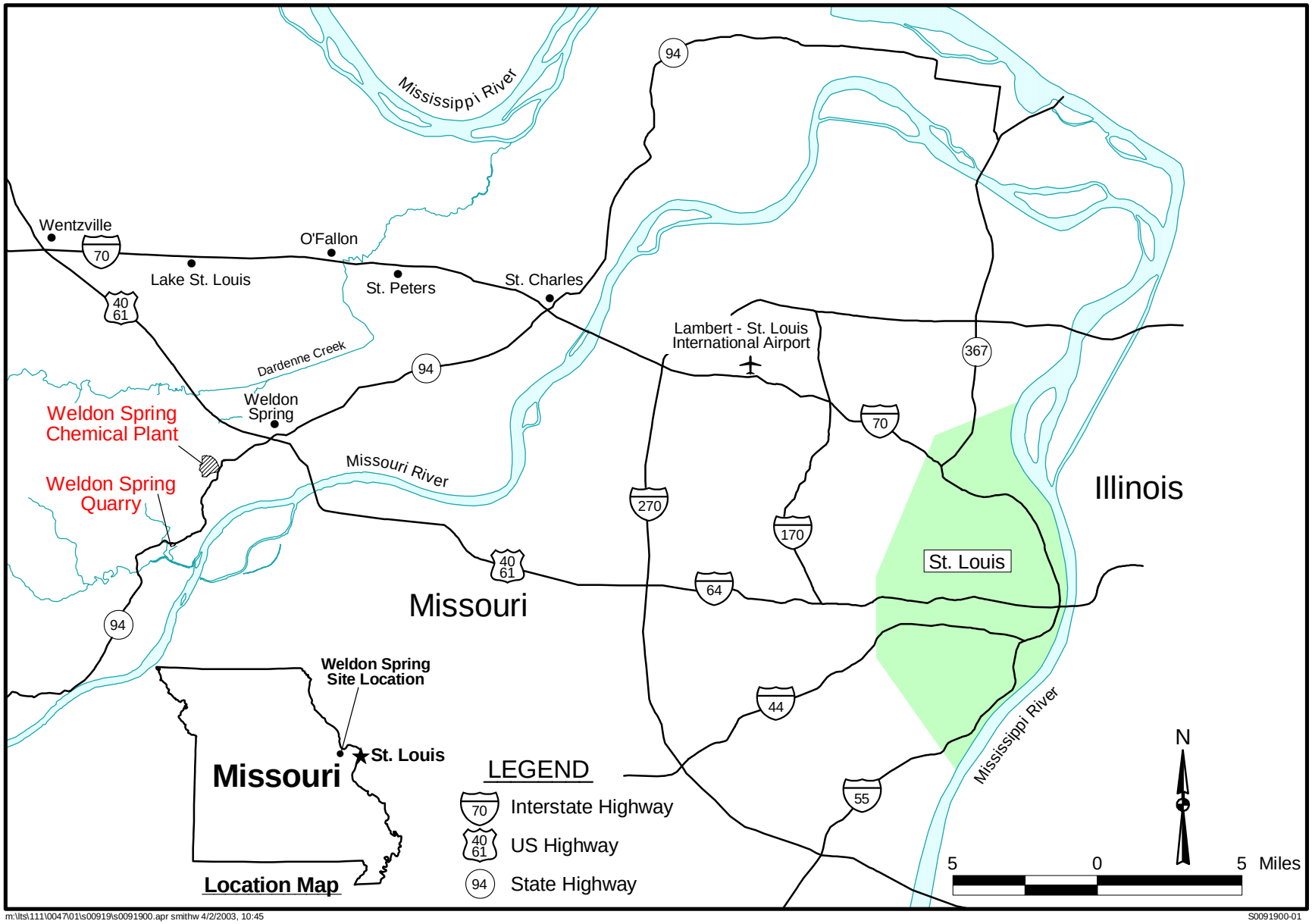


*Figure 1–1. Location of the Weldon Spring, Missouri, Site*

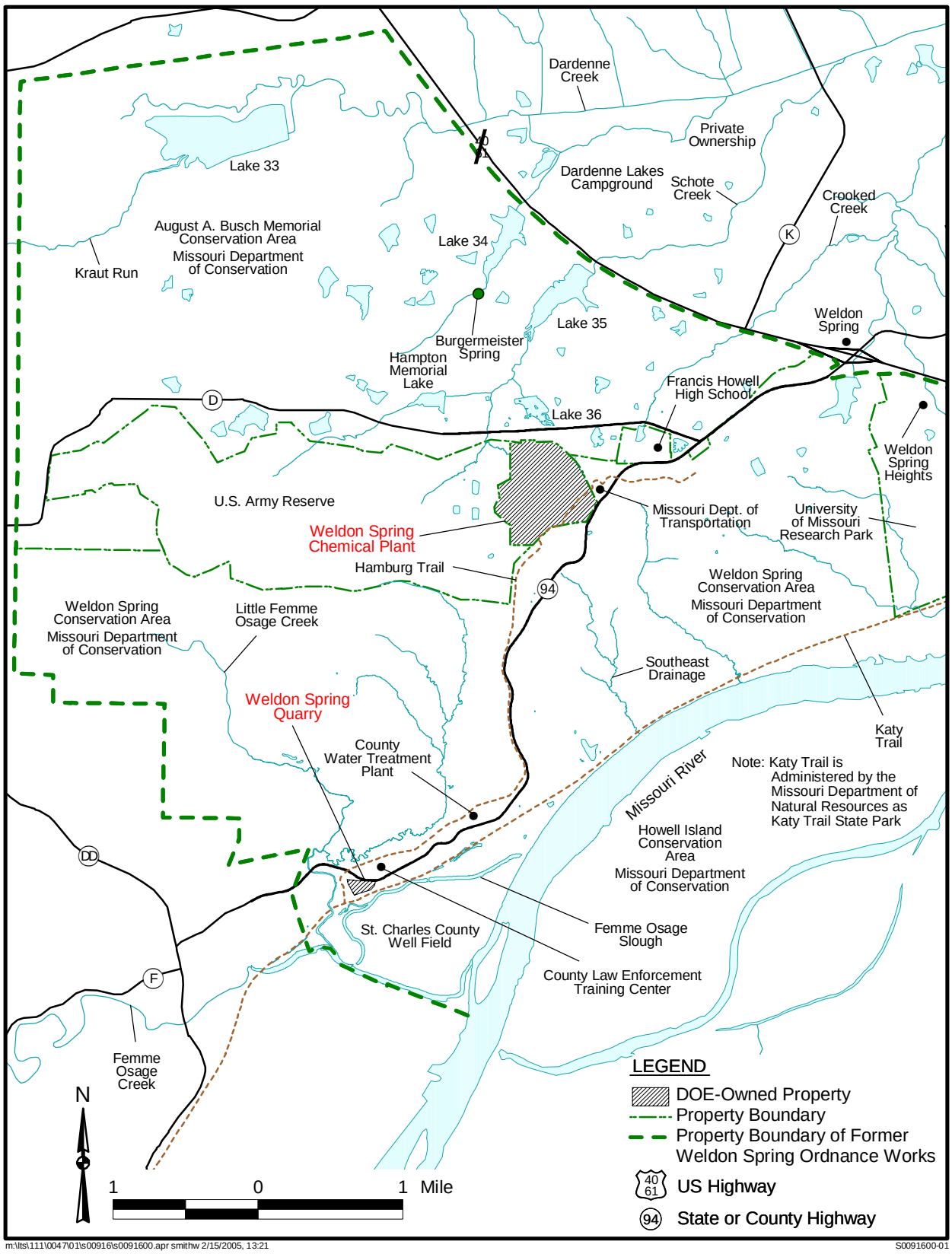


*Figure 1–2. Vicinity Map of the Weldon Spring, Missouri, Site*

Katy Trail State Park is a hiking and biking trail built on the former corridor of the Missouri Kansas Texas Railroad (better known as the Katy). The Katy Trail is open for 225 miles from St. Charles to Clinton, Missouri. As estimated by MDNR, approximately 300,000 people use some portion of the trail on an annual basis. A small portion of the trail runs southeast of the Quarry and through the groundwater restricted IC area (see Section 3.0).

The MoDOT facility adjacent to the northeast side of the Chemical Plant is used for storage of materials and equipment for highway maintenance. The facility is approximately 4.3 acres. MoDOT currently employs about 10 workers at this facility (DOE 2002a).

The Francis Howell High School occupies approximately 61 acres (25 hectares) and is located about 0.6 mile (1.0 kilometer) northeast of the Chemical Plant. The school currently employs approximately 150 faculty and staff, and about 1,600 students attend school.

The two communities closest to the Chemical Plant are Weldon Spring and Weldon Spring Heights, located about 2 miles (3.2 kilometers) to the northeast. The combined population of these two communities is currently approximately 5,000 (DOE 2002a). No private residences are currently located between the Chemical Plant and these two communities; however, two residences owned by MDC are located north of the Chemical Plant. These two residences are connected to the potable water system for the county. The closest private residence to the Quarry is located approximately 1 mile (0.6 kilometer) to the west. Residential and commercial growth is occurring in the communities surrounding the conservation areas, particularly in the city of O'Fallon, an area of growing residential population north of U.S. Highway 40/61.

## 1.3 Site History

### 1.3.1 Operations History

In 1941, the U.S. Government acquired 17,232 acres (6,974 hectares) of rural land in St. Charles County to establish the Weldon Spring Ordnance Works. In the process, the towns of Hamburg, Howell, and Toonerville and 576 citizens of the area were displaced (Army undated). From 1941 to 1945, the Army manufactured trinitrotoluene (TNT) and dinitrotoluene (DNT) at the Ordnance Works site. Four TNT production lines were situated on what was to be the Chemical Plant. These operations resulted in nitroaromatic contamination of soil, sediments, and some off-site springs.

Following a considerable amount of explosives decontamination of the facility by the Army and the Atlas Powder Company, 205 acres (83.0 hectares) of the former ordnance works property were transferred to the U.S. Atomic Energy Commission (AEC) in 1956 for construction of the Weldon Spring Uranium Feed Materials Plant, now referred to as the Weldon Spring Chemical Plant. An additional 14.88 acres (6.02 hectares) were transferred to AEC in 1964. The plant converted processed uranium ore concentrates to pure uranium trioxide, intermediate compounds, and uranium metal. A small amount of thorium also was processed. Wastes generated during these operations were stored in four raffinate pits located on the plant property. Uranium processing operations resulted in radiological contamination of the same locations previously contaminated by former Army operations.

The Quarry was mined for limestone aggregate used in construction of the Ordnance Works site. The Army also used the Quarry for burning wastes from explosives manufacturing and disposal of TNT-contaminated rubble during operation of the Ordnance Works. These activities resulted in nitroaromatic contamination of the soil and groundwater at the Quarry.

In 1960, the Army transferred the Quarry to AEC, who used it from 1963 to 1969 as a disposal area for uranium and thorium residues from the Chemical Plant (both drummed and uncontained) and for disposal of contaminated building rubble, process equipment, and soils from demolition of a uranium processing facility in St. Louis. Radiological contamination occurred in the same locations as the nitroaromatic contamination.

Uranium processing operations ceased in 1966, and on December 31, 1967, AEC returned the facility to the Army for use as a defoliant production plant. In preparation for the defoliant process, the Army removed equipment and materials from some of the buildings and disposed of them principally in Raffinate Pit 4. The defoliant project was canceled before any process equipment was installed, and the Army transferred 50.65 acres (20.50 hectares) of land encompassing the raffinate pits back to AEC while retaining the Chemical Plant. AEC and subsequently DOE managed the site, including the Army -owned Chemical Plant, under caretaker status from 1968 through 1985. Caretaker activities included site security oversight, fence maintenance, grass cutting, and other incidental maintenance. In 1984, the Army repaired several of the buildings at the Chemical Plant, decontaminated some of the floors, walls, and ceilings, and isolated some equipment. In 1985, the Army transferred full custody of the Chemical Plant to DOE, at which time DOE designated control and decontamination of the Chemical Plant, raffinate pits, and Quarry as a major project.

### 1.3.2 Remedial Action History

EPA placed the Quarry and Chemical Plant areas on the National Priorities List (NPL) on July 30, 1987, and March 30, 1989, respectively. A Federal Facility Agreement (FFA) was signed by the EPA and DOE in 1986, and it was amended in 1992. Initial remedial activities at the Chemical Plant, a series of Interim Response Actions (IRAs) authorized through the use of Engineering Evaluation/Cost Analysis (EE/CA) reports, included:

- Removal of electrical transformers, electrical poles and lines, and overhead piping and asbestos that presented an immediate threat to workers and the environment.
- Construction of an isolation dike to divert runoff around the Ash Pond area to reduce the concentration of contaminants going off site in surface water.
- Detailed characterization of on-site debris, separation of radiological and nonradiological debris, and transport of materials to designated staging areas for interim storage.
- Dismantling of 44 Chemical Plant buildings under four separate IRAs.
- Treatment of contaminated water at the Chemical Plant and the Quarry.

Remediation of the Weldon Spring Site was administratively divided into four Operable Units (OUs): Quarry Bulk Waste OU, Quarry Residuals OU (QROU), Chemical Plant area OU (CPOU), and Chemical Plant area Groundwater OU (GWOU). The Southeast Drainage was remediated as a removal action through an EE/CA report (DOE 1996) as part of the CPOU. The selected remedies are described in the following sections.

#### *1.3.2.1 Quarry Bulk Waste OU*

DOE implemented remedial activities for the Quarry Bulk Waste OU set forth in the *Record of Decision for Management of Bulk Wastes at the Weldon Spring Quarry* (DOE 1990).

The selected remedy included:

- Excavation and removal of bulk waste (i.e., structural debris, drummed and unconfined waste, process equipment, sludge, and soil).
- Transportation of the waste along a dedicated haul road to a temporary storage area located at the Chemical Plant.
- Staging of bulk wastes at the temporary storage area.

A detailed description of this remediation is in Section A2.3, "Quarry Bulk Waste OU."

#### *1.3.2.2 Quarry Residuals OU*

The QROU remedy was described in the *Record of Decision for the Remedial Action for the Quarry Residuals Operable Unit at the Weldon Spring Site, Weldon Spring, Missouri* (DOE 1998). The QROU addressed residual soil contamination in the Quarry proper, surface water and sediments in the Femme Osage slough and nearby creeks, and contaminated groundwater.

The selected remedy included:

- Long-term monitoring and ICs to prevent exposure to contaminated groundwater north of the Femme Osage slough.
- Long-term monitoring and ICs to protect the quality of the public water supply in the Missouri River alluvium, and implementing a well field contingency plan.
- Confirming the model assumptions regarding extraction of contaminated groundwater and establishing controls to protect naturally occurring attenuation processes.
- Restoring the Quarry and establishing ICs.

A detailed description of this remediation is in Appendix A, Section A2.4, "Quarry Residuals OU."

#### *1.3.2.3 Chemical Plant OU*

In the *Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site* (DOE 1993), DOE established the remedy for controlling contaminant sources at the Chemical Plant (except groundwater) and disposing of contaminated materials in an on-site disposal cell.

The selected remedy included:

- Removal of contaminated soils, sludge, and sediment.

- Treatment of wastes, as appropriate, by chemical stabilization/solidification.
- Disposal of wastes removed from the Chemical Plant and stored Quarry bulk wastes in an engineered on-site disposal facility.

The remedy included remediation of 17 off-site vicinity properties affected by Chemical Plant operations. The vicinity properties were remediated in accordance with Chemical Plant Record of Decision (ROD) cleanup criteria. Detailed information regarding the vicinity properties is included in Section A2.1.5, "Vicinity Properties" of Appendix A.

A detailed description of this remediation is in Section A2.1, "Chemical Plant OU."

#### *1.3.2.4 Groundwater OU*

DOE implemented an interim ROD to investigate the practicability of remediating trichloroethylene (TCE) contamination in Chemical Plant groundwater, using in situ chemical oxidation (DOE 2000b). DOE issued a final ROD in January 2004, which was signed by EPA in February 2004. This final GWOU ROD specified a remedy of monitored natural attenuation (MNA) with ICs to limit groundwater use during the period of remediation. MNA relies on the effectiveness of naturally occurring processes to reduce contaminant concentrations over time. The ROD establishes remedial goals and performance standards for MNA.

#### *1.3.2.5 Southeast Drainage*

Remedial action for the Southeast Drainage was addressed as a separate action under CERCLA. The *Engineering Evaluation/Cost Analysis for the Proposed Removal Action at the Southeast Drainage near the Weldon Spring Site, Weldon Spring, Missouri* (DOE 1996) evaluated options for addressing contaminated soils and sediments in the Southeast Drainage. The EE/CA recommended that sediment in accessible areas of the drainage should be removed. The excavated materials would be stored temporarily at an on-site storage area until final disposal in the disposal cell. Soil removal was in two phases: 1997-1998 and 1999. Post-remediation soil sampling was conducted. More details are included in Section A2.1.5.7 and the *Southeast Drainage Closeout Report Vicinity Properties DA-4 and MDC-7* (DOE 1999b).

#### *1.3.2.6 Use Restrictions Needed to Maintain Protectiveness of the Remedial Actions*

In addition to the active remedies that have been completed as described in Sections 1.3.2.1 through 1.3.2.5, the RODs also stipulated that use restrictions are needed in order for these remedies to remain protective for the long-term. An Explanation of Significant Differences (ESD) (DOE 2005b) was completed by DOE and approved by EPA to specify use restrictions needed to ensure that remedies in place for the CPOU (including Southeast Drainage), QROU, and the GWOU remain protective for the long term and to restrict land and natural resource uses that are inconsistent with anticipated land uses.

Use restrictions discussed in the ESD are presented in Section 3.0 of this LTS&M Plan. The site areas for which use restrictions were specified include the Chemical Plant disposal cell and buffer area, Southeast Drainage soil and sediment, the Chemical Plant area (including Southeast Drainage) groundwater and springs, the Quarry itself, Quarry area groundwater, and a small

reduction zone north of the Femme Osage Slough and south of the Quarry where soil restrictions have been identified. The use restrictions would be used as performance objectives for identifying appropriate IC mechanisms for implementation. Implementation of these ICs is part of the scope of this LTS&M Plan.

## 1.4 Current Site Conditions

The federal government, through the DOE Office of Legacy Management (LM), is responsible for the radioactive and other hazardous substances released at and from the Weldon Spring Site. The radioactive waste materials generated at the Chemical Plant consisted of radionuclides of the natural uranium and thorium-232 decay series derived from processing uranium and thorium ore concentrates. Contaminated materials disposed of or stored at the Quarry included process wastes from the Chemical Plant and debris from the Mallinckrodt Chemical Company in St. Louis, Missouri.

DOE disposed of the contaminated soils, stabilized sludge, contaminated debris from the Quarry, and the demolished Chemical Plant buildings, and contaminated materials from remediated vicinity properties in the disposal cell. Regulated nonradiological hazardous materials that were encountered during remedial action were treated and disposed of either in the disposal cell or at off-site EPA-approved disposal facilities. A comprehensive list of wastes disposed of in the cell is provided in Appendix C. Contamination remains at the Weldon Spring Site at the following locations:

- The disposal cell contains approximately 1.48 million cubic yards of contaminated materials.
- Residual groundwater contamination remains in the shallow aquifer beneath the Chemical Plant Area, at the Quarry, and at some surrounding areas.
- Several springs near the Chemical Plant Area discharge contaminated groundwater.
- Residual soil and sediment contamination remains in the Southeast Drainage Area.
- Contamination remains at two culvert locations along Missouri State Route 94 and Highway D.
- Residual soil contamination remains at inaccessible locations within the Quarry.

Post-remediation site conditions and risk status at the Weldon Spring Site are described in Section 3.0 and Appendixes A and B.

## 1.5 Current Regulatory Requirements

This section discusses applicable and relevant and appropriate (ARARs) which apply to the post-remediation aspect of the project.

Because contamination remains at the Site at levels above those that allow unlimited use and unrestricted exposure (UUUE), CERCLA requires that that the remedial actions be reviewed at least every 5 years. These reviews are commonly called 5-year reviews. DOE is developing ICs to insure that the remedies remain protective and effective until contaminant levels decrease to levels that allow UUUE.

The disposal cell contents are not regulated under the Resource Conservation and Recovery Act (RCRA), but RCRA postclosure disposal cell monitoring and maintenance requirements are ARARs. The RCRA groundwater protection standard (40 CFR 264 Subpart F) sets forth the general groundwater monitoring requirements for the disposal cell. Generally, the disposal cell groundwater monitoring program must provide representative samples of background water quality, as well as groundwater passing the point of compliance. For a more complete description, see the Disposal Cell Groundwater Monitoring Plan (Appendix K) which was developed to address these requirements. Additional postclosure requirements for the cell are identified in 40 CFR 264 Subpart N and include action leakage rate and leachate collection and removal requirements. These requirements are addressed in Sections 2.7.4, 2.9.2, and Appendixes I and J. Subpart N also includes requirements to maintain the integrity of the final cover, including making repairs as necessary, which is addressed in Section 2.6.

The principal ARARs for the impacted groundwater at the chemical plant are the drinking water standards known as Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act and Missouri water quality standards. These standards, which are established in the Chemical Plant GWOU ROD, are shown in Table 1−2.

*Table 1–2. Federal and State Water Quality Standards for the Chemical Plant GWOU*

| Constituent | Standard | Citation |
|---|---|---|
| Nitrate (as N) | 10 mg/L | 40 CFR 141.62 |
| Total Uranium | 20 pCi/L | 40 CFR 141 |
| 1,3-DNB | 1.0 µg/L | 10 CSR 20-7[a] |
| 2,4-DNT | 0.11 µg/L | 10 CSR 20-7[a] |
| NB | 17 µg/L | 10 CSR 20-7[a] |
| TCE | 5 µg/L | 40 CFR 141.61 |
| 2,6-DNT | 1.3 µg/L | Risk Based[b] |
| 2,4,6-TNT | 2.8 µg/L | Risk Based[c] |

[a]Missouri Groundwater Quality Standard.
[b]Risk-based concentration equivalent to $10^{-5}$ for a resident scenario.
[c]Risk-based concentration equivalent to $10^{-6}$ for a resident scenario.
Key: DNB = dinitrobenzene; NB = nitrobenzene; DNT = dinitrotoluene; mg/L = milligram(s) per liter; pCi/L = picocurie(s) per liter; µg/L = microgram(s) per liter

The Missouri requirements for well construction (10 CSR 23-4.050) will be an ARAR for any newly installed wells or for the abandonment of any wells.

Long-term groundwater monitoring for the QROU consists of two separate programs. Groundwater monitoring is necessary to continue to ensure that uranium-contaminated groundwater has a negligible potential to affect the St. Charles County well field. The first program details the monitoring of uranium and 2,4-DNT south of the slough to ensure that levels remain protective of human health and the environment. The second program consists of monitoring groundwater contaminant levels within the area north of the slough until they attain a predetermined target level indicating negligible potential to affect groundwater south of the slough.

The objective for monitoring groundwater south of the slough is to verify that the groundwater is not impacted. Uranium concentrations south of the slough and in the area of production wells at the St. Charles County well field remain within the observed natural variation within the aquifer, therefore the MCL for uranium of 30 micrograms per liter (μg/L) (20 picocuries per liter [pCi/L]) has been established as a trigger level only in this area. If concentrations in groundwater south of the slough exceed the MCL of 30 μg/L, DOE will evaluate risk and take appropriate action, as discussed in Appendix L.

Under current conditions, groundwater north of the slough poses no imminent risk to human health from water obtained from the well field. A target level of 300 pCi/L for uranium (10 percent of the 1999 maximum) was established to represent a significant reduction in the contaminant levels north of the slough. The target level for 2,4-DNT has been set at the Missouri Water Quality standard of 0.11 μg/L.

# 2.0 Long-Term Surveillance and Maintenance

## 2.1 Surveillance and Maintenance Implementation

This LTS&M Plan implements long-term components of remedies selected for the Weldon Spring Site. The purpose of long-term surveillance and maintenance is to meet the general objectives listed in Section 1.1, "Purpose and Scope." This LTS&M Plan includes the requirements for long-term surveillance and maintenance specified in the *Long-Term Surveillance and Maintenance Program Plan* (DOE 1999a).

DOE will maintain protectiveness at the Weldon Spring Site through a combination of activities, including conducting regular inspections; conducting environmental monitoring, sampling, and other site operation and maintenance activities; maintaining ICs and regulatory compliance; and working with stakeholders and regulators to perpetuate awareness and knowledge of site conditions. Current Site responsibilities are provided in Table 2–1 and described in the following subsections.

*Table 2–1. Current Weldon Spring Site Responsibilities*

| Organization | Function |
|---|---|
| DOE Office of Legacy Management | Formulate policy and provide resources and support. Site LTS&M management; conduct inspections, monitoring, and maintenance; maintain public interpretive center and information repository; provide opportunities for public participation; resolve stakeholder issues, ensure compliance with DOE orders and ARARs, provide records management, oversee ICs. |
| EPA Region VII | Lead regulatory agency. Provide regulatory oversight to assess DOE's compliance with the requirements of this Plan. Review and comment on, and as appropriate approve, documents relating to long-term LTS&M activities, including, but not limited to, LTS&M Plan changes, annual and five-year review reports. |
| Missouri Department of Natural Resources | Provide regulatory review of DOE's compliance with the requirements of this Plan. Review and comment on documents relating to LTS&M activities, including, but not limited to, LTS&M Plan changes, annual and five-year review reports. |
| Weldon Spring Citizens Commission | Public representative, LTS&M planning input, review of LTS&M Plan changes, document review. |
| St. Charles County (Division of Environmental Services, Register of Deeds, Regional Planning Commission, Water Department) | Local Government representative. Compliance with applicable county regulations; preservation of deeds, easements, parcel maps; master planning and zoning. |
| Missouri Department of Health and Senior Services | Public health issues. |
| General Public | Public meeting input, review of LTS&M Plan changes, document review. |

### 2.1.1 Role of DOE

DOE will conduct surveillance and maintenance activities at the Weldon Spring Site in accordance with this Plan to protect human health and the environment and to comply with

applicable legal requirements. DOE is responsible for the radiological and other hazardous substances released at or from the Site. Because of the long-lived nature of the contaminants remaining on site, the DOE will provide surveillance and maintenance services at the Weldon Spring Site in perpetuity. DOE is responsible for the preparation, revision, and implementation of this LTS&M Plan, which includes procedures for inspection, monitoring, and maintenance of the Site, and for managing remaining contamination. Surveillance and maintenance activities also include complying with reporting requirements and maintaining records pertaining to this Site.

### 2.1.2 Role of Regulators

EPA Region VII, currently located in Kansas City, Kansas, is the lead regulatory agency for Weldon Spring Site activities conducted under this Plan. EPA will provide regulatory oversight to assess DOE's compliance with the requirements of this Plan. EPA will review and comment on, and as appropriate approve, documents relating to long-term surveillance and maintenance activities including, but not limited to, LTS&M Plan changes and annual and 5-year review reports.

MDNR in Jefferson City, Missouri, also will provide regulatory review of DOE's compliance with the requirements of this Plan, including review and comment on documents relating to long-term surveillance and maintenance activities, such as LTS&M Plan changes and annual and 5-year review reports.

### 2.1.3 Role of Stakeholders

DOE considers the persons, agencies, and others listed in Appendix G to be stakeholders for the Site. Stakeholders may comment on LTS&M Plan changes, provide review of DOE activities by reviewing documents and attending public meetings, informally monitor the Site and the site surveillance and maintenance program, and report concerns to DOE or regulators. See Section 2.2, "Public Participation" for more details regarding stakeholder involvement.

### 2.1.4 LTS&M Plan Revisions

Revisions to the LTS&M Plan are categorized as either minor changes or major changes. Minor changes are the routine or ministerial sorts of changes necessary to effectively administer the LTS&M Plan and will not result in immediate revision to the LTS&M Plan. Minor changes will be made available to EPA, the State, and stakeholders in an annual summary. All cumulative minor changes will be formally incorporated into the LTS&M Plan at the time it is revised to address a major change.

Examples of minor changes include, but are not limited to, changes to the contact list, changes to the distribution list, modifications to the leachate handling procedures, subordinate modifications to the inspection checklist, and generally accepted changes to sampling methods or quality assurance procedures.

Major changes are the revisions necessary to address changed site conditions or other significant new information. In the case of a major change, DOE will formally submit a revised LTS&M Plan for review and approval by the EPA in consultation with the MDNR. DOE will also solicit public comment on the proposed change.

Examples of major changes include, but are not limited to, updates to include specific ICs pursuant to Section 3.0, changes to ICs, remedy changes, remedy optimizations, and fundamental changes to monitoring programs or objectives.

This procedure applies to the LTS&M Plan and all related site plans incorporated by reference or by inclusion in the appendixes. The related site plans include the following:

- Well Field Contingency Plan
- Remedial Design/Remedial Action Work Plan for the Quarry Residuals Operable
- Remedial Design/Remedial Action Work Plan for the Final Remedial Action for the Groundwater Operable Unit of the Weldon Spring Site
- Annual Inspection Checklist
- Leachate Collection and Removal System Operating Plan
- LCRS/Train 3 Treatment Contingency Plan
- Disposal Cell Groundwater Monitoring Plan

## 2.2 Public Participation

Promoting involvement of the public in the surveillance and maintenance process at the Weldon Spring Site ensures that citizens' concerns are addressed and that relevant public information is provided. Active citizen involvement also promotes understanding of, and encourages informed participation in, the project by the general public. DOE seeks to encourage public participation by providing site information via public contacts, DOE contacts, documents to the public for comment, and public meetings. Decision points requiring public input are shown on Figure 2−1.

### 2.2.1 Regulator, Stakeholder, and Responder Contacts

The purpose of the contact effort is to ensure that public and key community leaders, including federal, state, and local government officials, are kept informed of Site activities and status changes. Contact information is maintained, including

- Legislative and executive branch officials (federal, state, and local).
- U.S. Environmental Protection Agency, Region VII.
- U.S. Department of the Army.
- State of Missouri (Departments of Natural Resources, Conservation, Health, and Transportation).
- St. Charles County.
- Weldon Spring Citizens Commission.
- Francis Howell School District.
- Interested citizens.
- Media (print and electronic).

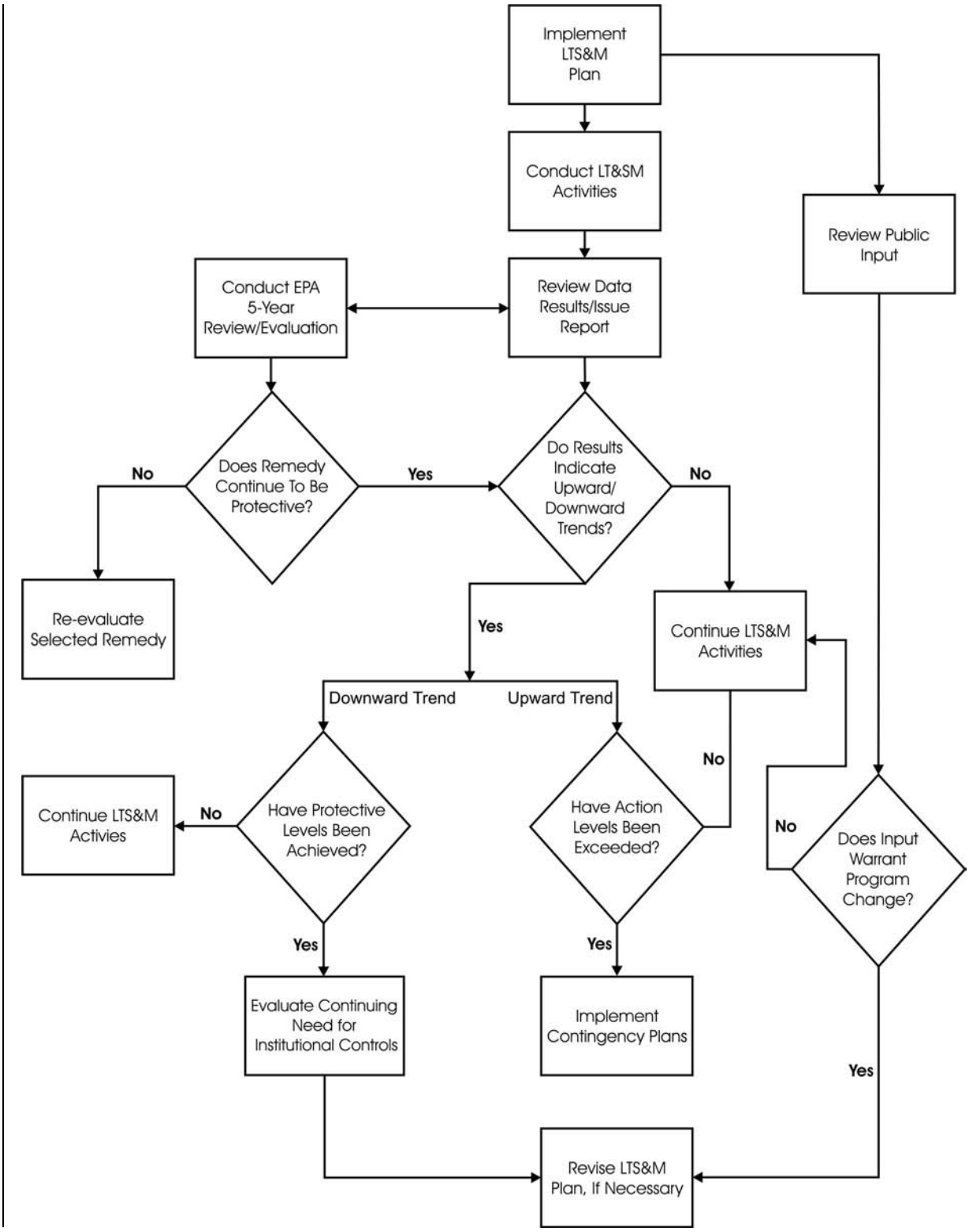


*Figure 2–1. Long-Term Surveillance and Maintenance Flow Chart for the Weldon Spring, Missouri, Site*

The Official Contact List (Appendix F) and the Distribution List (Appendix G) will be reviewed and updated on at least an annual basis, in conjunction with the annual inspections and as part of the 5-year review, and in conjunction with other significant site announcements and notifications.

### 2.2.2 DOE Contacts

Contact information for the DOE staff responsible for implementing the Weldon Spring Site surveillance and maintenance program will be posted at the Interpretive Center and made available via the DOE–LM website. These communications will encourage the public to actively participate with DOE in the surveillance and maintenance process by reporting sightings or concerns such as visible changes to the cell cover, erosion, suspicious land use, damaged monitor wells, or vandalism.

The DOE contact list will also serve an informational purpose by providing a mechanism for the public to submit questions or requests for information if or when there is no continuous on-site DOE presence. The following contact list will be maintained and revised on an annual basis, as necessary, to reflect the most current contact information. Changes to this list will not cause the issuance of a revision to the LTS&M Plan. At times when the LTS&M Plan is reissued to address a major change, these changes will be included within the revision.

- Tom Pauling, Weldon Spring Site Manager
  U.S. Department of Energy
  2597 B 3/4 Road, Grand Junction, CO 81503
  (970) 248-6048

- Ray Plieness, LM-50, Acting Office Director
  U.S. Department of Energy
  2597 B 3/4 Road, Grand Junction, CO 81503
  (970) 248-6001

- Sam Marutzky
  S.M. Stoller Corporation
  2597 B ¾ Road, Grand Junction, CO 81503
  (970) 248-6059

- Yvonne Deyo
  S.M. Stoller Corporation
  7295 Hwy 94 South, St. Charles, MO 63304
  (636) 300-0012

- Grand Junction 24-Hour Monitored Security Telephone Numbers
  (877) 695-5322
  (970) 248-6070

- Website for the Weldon Spring Site
  http://www.lm.doe.gov/land/sites/mo/weldon/weldon.htm

### 2.2.3 Document Review and Public Meetings

Interested stakeholders as discussed in Section 2.2.1, "Regulator, Stakeholder, and Responder Contacts," will be notified of the availability of both annual and each CERCLA 5-year review reports available to the public at the Interpretive Center, the Middendorf-Kredell branch of the St. Charles City-County Library System, and on the DOE website for the Weldon Spring Site. This notification will ensure that the public is aware of site activities and changes. Comments and/or questions can be directed to the DOE contacts listed in Section 2.2.2, "DOE Contacts."

To ensure a mechanism whereby the public can be briefed on and participate in periodic site reviews, a schedule for a public meeting will be included in the notification letter sent with each annual site inspection report and posted on the website. The annual meeting will include discussions of site surveillance and maintenance activities and observations during the previous year, proposed changes to the LTS&M Plan, and public comments and concerns.

### 2.2.4 Interpretive Center Operation

DOE will maintain and operate the Weldon Spring Site Interpretive Center at the Site. The purpose of the Interpretive Center is to inform the public of Site history, remedial action activities, and final conditions. The Interpretive Center also will provide information about the long-term surveillance and maintenance program for the Site, provide access to surveillance and maintenance information, and support community involvement activities. It will serve to communicate the historical legacy of the Site, provide educational and research opportunities for current and future generations, and make available information about contamination present at the Site to guide people in making decisions about appropriate activities at the Site.

Current exhibits in the Interpretive Center present:

- The history of the towns that once occupied this area.
- A timeline of significant events at the Weldon Spring Site from 1900 to the present.
- The legacy of the Weldon Spring Ordnance Plant and Uranium Feed Material Plant and the manufacturing wastes.
- The events and community efforts to cleanup the Site and the people that made it happen.
- The multi-faceted phases of the Weldon Spring Site Remedial Action Project.

These exhibits may be changed as appropriate to changing conditions or emerging issues at and near the Site. The hours of operation of the Interpretative Center are posted at the Site. The current hours of operation are Monday through Friday: 9:00 a.m. to 5:00 p.m., Saturday: 10:00 a.m. to 2:00 p.m., and Sunday: 12:00 p.m. to 4:00 p.m. The Interpretative Center is closed on holidays. These hours are subject to change and current hours will be posted on the website.

DOE will provide staff and funding needed to operate the Interpretive Center. DOE will monitor center usage and public perception of its value, and may discontinue operations, with the concurrence of EPA in consultation with the State, if the Interpretive Center is not utilized in a manner that enhances the purposes discussed above. If and when DOE proposes closing the Interpretive Center, it will propose other activities to serve these purposes, as appropriate. DOE will also consult with the community on this decision through the revision process for this Plan.

### 2.2.5 Howell Prairie and Native Plant Educational Garden

The 150 acres surrounding the disposal cell has been planted with over 80 species of native prairie grasses and wildflowers. Plants such as Prairie Blazing Star, Little Bluestem, and Wild Bergamot will once again dominate this area which was a large native prairie prior to European settlement. Howell Prairie is one of the largest planting of its kind in the St. Louis metropolitan area.

A garden that consists entirely of plants native to the state of Missouri has been designed and planted. The Native Plant Educational Garden will contain extensive planting of species from Howell Prairie as well as other perennials, shrubs, and trees. Walking paths, benches, and markers to identify the various plants are located throughout the 5-acre garden.

The Howell Prairie, Native Plant Educational Garden, and Interpretive Center were designed to serve as ICs. These areas will attract visitors to the Weldon Spring Site, thus ensuring long-term community education about the remediation project and enhancing the overall educational mission of the site.

## 2.3 Routine Site Inspections

### 2.3.1 Frequency of Inspections

DOE will inspect the Weldon Spring Site at least annually to confirm that certain remedial action components, including associated ICs, remain in place and effective, and to determine if maintenance or additional monitoring is needed. DOE will notify EPA and the MDNR of the inspection at least 30 days before the scheduled inspection date. DOE may reassess the inspection process and frequency based on experience and propose modifications as appropriate. Proposed modifications will be submitted as part of the 5-year review report or in a formal revision to the LTS&M Plan.

### 2.3.2 Inspection Procedure

For the purposes of inspection, the Weldon Spring Site will be divided into specific areas (Table 2−2). Each area will be inspected individually. The majority of the annual inspection will be comprehensive and will be conducted within a set period of time, usually a 2-day period. This does not preclude the possibility that additional inspections or observations could contribute to the annual inspection. It is intended to write a single annual inspection report for all areas.

Inspectors will physically inspect the cell top and side slopes, side slope toe, cell and site drainage structures, and the leachate collection and removal system (LCRS). Inspectors will look for modifying processes or threats to disposal cell integrity such as creep, bulging, differential settlement, erosion, or rock degradation. Inspectors also will look for physical evidence of intrusion and violation of ICs. Previous maintenance work will be inspected and maintenance needs will be compiled.

*Table 2–2. Inspection Areas for the Weldon Spring, Missouri, Site*

| Area | Description |
|---|---|
| | **Chemical Plant** |
| Disposal Facility and 300-foot (ft) Buffer Zone | Disposal cell, apron, and 300-ft buffer area, ramp and platform, guard rail, LCRS, leachate treatment building and appurtenances, access and perimeter roads, cell performance monitor wells, and site markers. |
| Chemical Plant Site Boundary | Area between the 300-ft buffer zone and the Chemical Plant property boundary, including access roads, survey monuments, information signage, and groundwater monitor wells. |
| Chemical Plant Outlying Area | Groundwater use restriction area, additional area beyond property boundary where development may affect site integrity, selected off-site areas where erosion might eventually threaten the Chemical Plant, areas overlying contaminated groundwater plumes, culverts at Missouri State Route 94 and Highway D, groundwater monitor wells, Springs 6301, 6303, 5303, and 5304, and the Southeast Drainage. |
| | **Quarry** |
| Quarry and Quarry Outlying Area | Quarry property, area of groundwater use restrictions, area beyond property boundary where development may affect site integrity, survey monuments, and groundwater monitor wells. |

Inspecting the cell cover, clean fill dike cover, and toe apron for settlement or rock degradation will consist of walking 10 random transects across the cell, walking the grade break at the top of the side slopes, and walking along the cell perimeter. Inspectors will look for and map depressions, shifts of cell plane vertices, or other indications of settlement; map concentrations of degraded, split, or weathered pieces of limestone; and estimate a percentage of deteriorated rock exposed within each mapped area. The mapping will address only obvious indications of rock durability concerns. A global positioning system or other method with equivalent accuracy will be used for mapping.

Inspectors will compare results with previous survey results to determine if features are construction artifacts or if additional degradation has occurred. If inspectors identify settlement, or if the percentage of degraded rock appears significant or is noticeably greater than on the remainder of the cover, DOE will determine a course of monitoring and evaluation as described in Section 2.9.2.

Inspectors will note changes to the area surrounding the Chemical Plant and Quarry sites. Significant changes within these areas could include new development or expansion of existing development, erosion, or road building. Near the Quarry, inspectors will note evidence of development that may result in changes to the surface grading, groundwater system, disturbance of the reduction zone, and evidence of inappropriate groundwater extraction. At the Quarry, inspectors also will look for evidence of settling, ponding water, backfill erosion, and highwall instability.

Within each area, the condition of specific site-surveillance features (Section 2.3.5, “Specific Site-Surveillance Features”), such as site markers and monitor wells, will be inspected for change, deterioration, and functionality.

Some observations will be documented with photographs. Such observations may be evidence of vandalism, changed conditions, or maintenance needs. Inspectors will record photograph

information on a Field Photograph Log, which becomes part of the site record maintained at the DOE office in Grand Junction.

Inspectors will verify that the phone numbers remain displayed at the Chemical Plant and Quarry and are listed in local telephone directories.

### 2.3.3 Inspection Checklist and Map

Site inspections are guided by checklists that address the performance of each inspection. The initial annual inspection checklist for the Weldon Spring Site and the 5-year inspection checklist for the cell cover are presented in Appendix H. Initial site inspection maps are shown on Figures 2–2 and 2–3. The maps are used to record field notes, photograph locations, and other annotations of inspection findings. The field maps become a part of the permanent site record.

At the conclusion of a site inspection, inspectors will note revisions to the applicable checklist in anticipation of the next site inspection. The checklists are again reviewed and revised as necessary before each inspection. Revisions to the checklists may include inspection instructions addressing new observations, notes about maintenance conducted since the previous inspection, or progressive changes in site conditions.

DOE believes that the implementation of the inspection through the use of the inspection checklist will provide a means to estimate protocols and procedures necessary to satisfy the requirements of this plan.

Concurrently with each annual inspection, inspectors will review the *Comprehensive Five-Year Review Guidance* (EPA 2001).

### 2.3.4 Institutional Controls Inspection

DOE will conduct a formal annual inspection of the physical locations addressed by ICs. DOE also will evaluate whether the ICs remain effective in protecting human health and the environment and, in coordination with EPA and MDNR, will take appropriate action if evidence indicates the controls are not effective.

DOE will contact property owners and other grantees of real property interests annually to ensure cognizant representatives remain aware of ICs on their property. IC contact information will be maintained in the inspection checklist (Appendix H). The contact will consist of a documented phone conversation to confirm agency contact information. Contacts will be documented and submitted to the site record. Similarly, DOE also will check county records to verify that deed restrictions and other IC instruments remain in place. A list of the agencies and stakeholders to be contacted for the annul inspection is included in Appendix F.

Inspection requirements for specific areas will be performed to identify any noncompliance with the use restrictions.

**Groundwater and Surface Water—**During annual site inspections, inspectors will look for indications of groundwater or surface water withdrawal or use in restricted use areas (see Section 3.0). Indications may include new wells, well points, pumps set on wells or well points,

or new residential or commercial development with no apparent connection to a municipal water supply. Observations will be recorded in the annual report and summarized in the 5-year review report. In preparation for the 5-year review, DOE will contact MDNR to determine if well registrations were issued for the area affected by contaminated groundwater.

**Chemical Plant and Quarry—**During annual inspections, inspectors will look for indications of excavation into soils and bedrock at the DOE-owned property, or in the geochemical reduction zone south of the Quarry (see Section 3.0). If any party has been granted use of portions of the Chemical Plant or Quarry, inspectors will ensure that such use is in accordance with terms of use agreements and that surface drainage has not been modified.

**Southeast Drainage—**During the annual inspections, inspectors will look for indications of residential use or construction in the Southeast Drainage, or other activity that would signify residential use of the area. Also during the annual inspection, DOE will ensure that MDC remains aware of land use restrictions imposed in the affected area of the Southeast Drainage.

**Institutional Controls Enforcement—**DOE will notify EPA and MDNR if ICs have been violated or if enforcement action is necessary. DOE will present the results of ICs monitoring and maintenance in the annual report.

### 2.3.5 Specific Site-Surveillance Features

Specific site-surveillance features at the Weldon Spring Site are shown on Figure 2–2 and Figure 2–3.

### 2.3.6 Access Controls

**Information Signs—**A sign is posted at the Interpretive Center and at various historical marker locations in the area providing the DOE 24-hour and local contact phone numbers. Signs are posted on the LCRS fence to inform the public that trespassing is forbidden, and that persons may call the DOE 24-hour security telephone number (970-248-6070 or 877-695-5322) or the local DOE representatives (636-300-0012) for information.

**Disposal Cell Guard Rail—**A guard rail surrounds the cell at the toe of the side slope. The barricade is designed to prevent vehicular access to the cell.

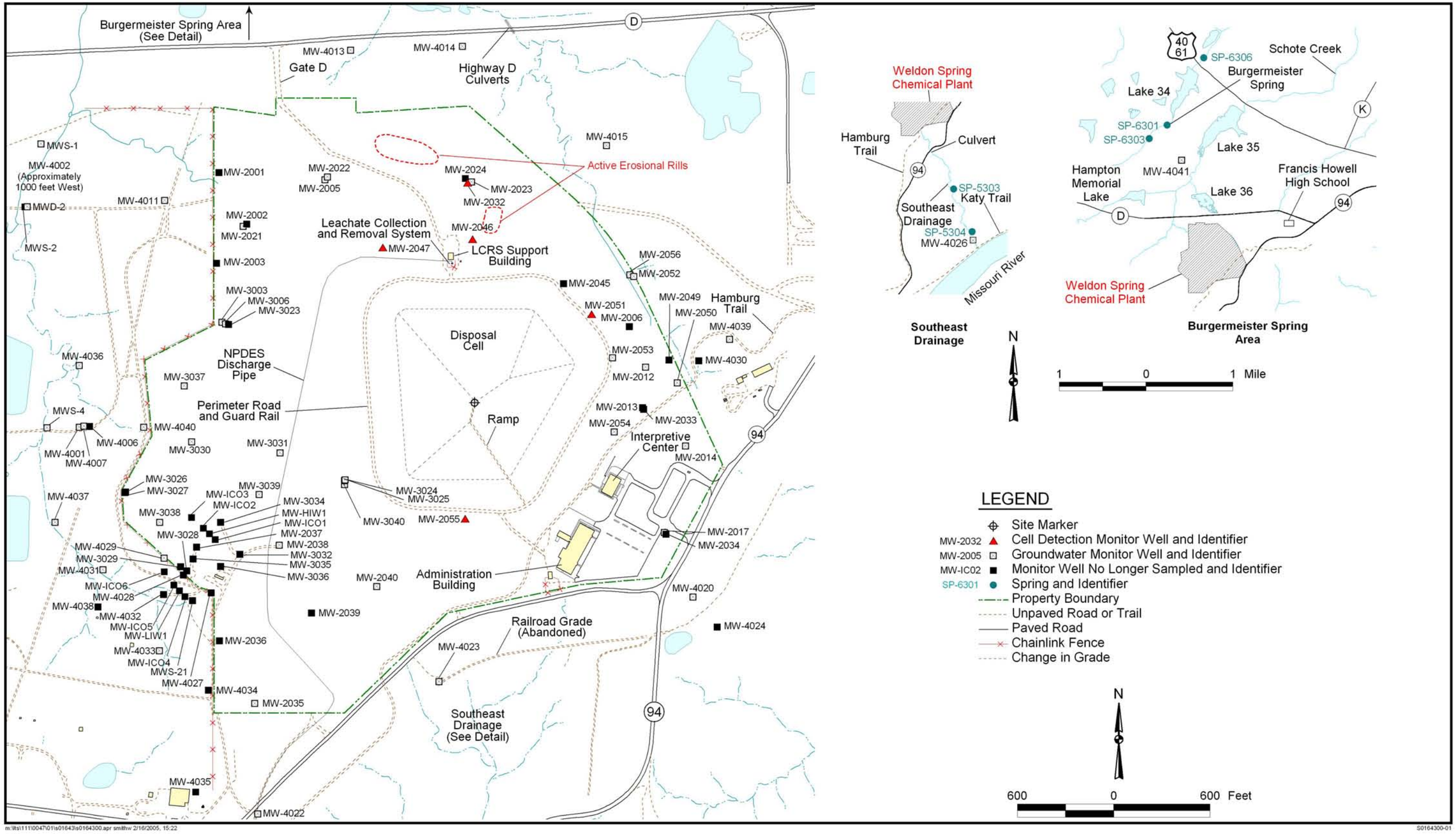


*Figure 2–2. Inspection Base Map for the Chemical Plant Area of the Weldon Spring, Missouri, Site*

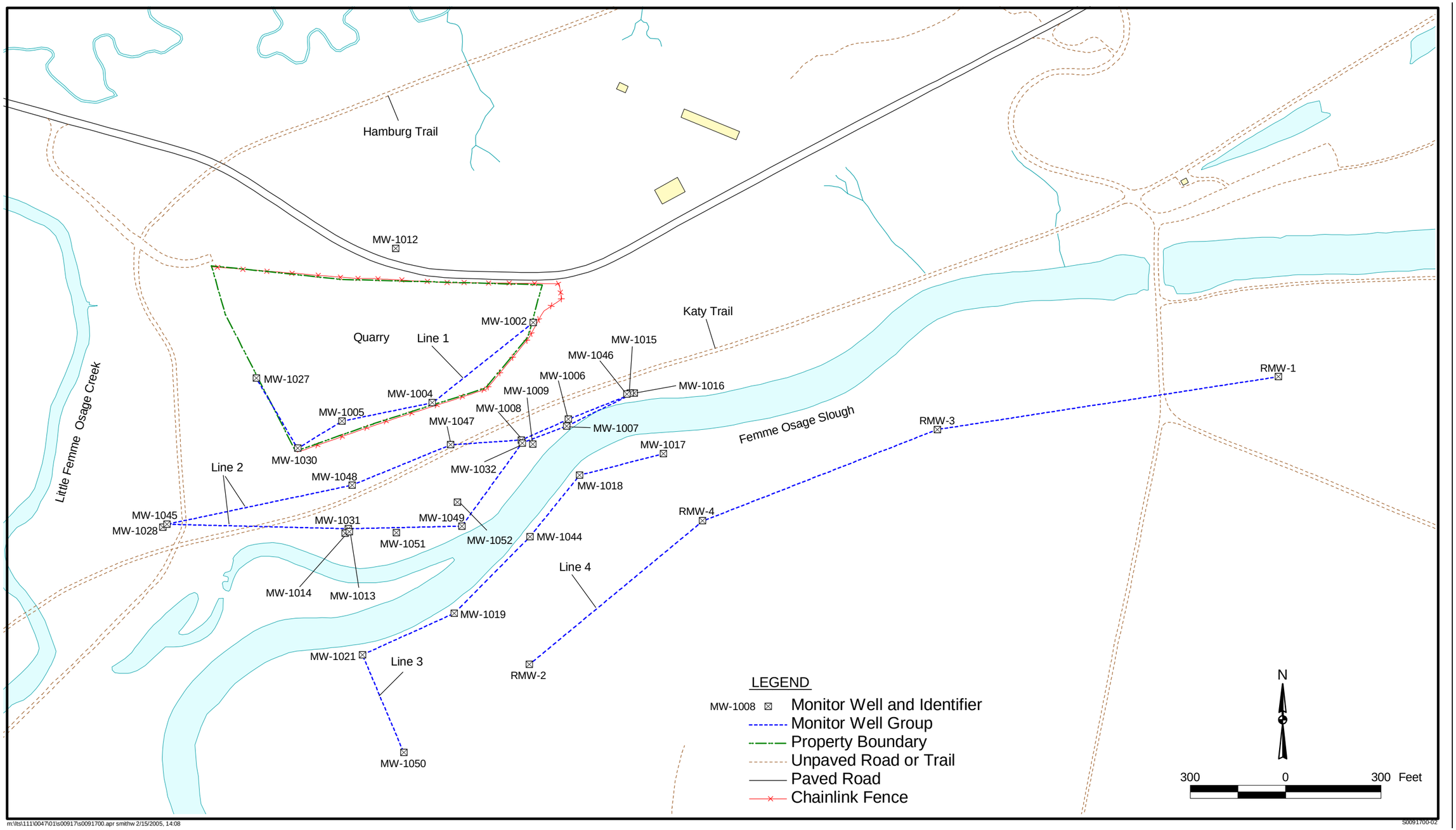


*Figure 2–3. Inspection Base Map for the Quarry Area of the Weldon Spring, Missouri, Site*

**Fencing—**A chain-link security fence encloses the LCRS sump to mitigate unauthorized entry. The reconstructed security fence, located one foot on the Army's side of the common boundary, is owned and maintained by the Army for its security purposes. Historical fencing remains around a portion of the DOE Quarry.

### 2.3.7 Site Markers

Four permanent site markers are installed on concrete pylons on top of the disposal cell. These include general information about the cell cover. The coordinates and elevation for the north monument benchmark are as follows: North: 1,043,145.709; East: 755,063.602; Elevation 734.2267 ft above mean sea level.

### 2.3.8 Monitor Wells

**Chemical Plant—**The groundwater monitor well network will be defined from existing or new monitor wells located inside or adjacent to the Weldon Spring Site property to reflect long-term surveillance and maintenance requirements specified in the ROD for the GWOU. These wells are completed in the Burlington-Keokuk Limestone. Construction details and lithologic logs for the wells will be archived in the Weldon Spring Site records at the DOE office in Grand Junction.

**Quarry—**The groundwater monitor well network consists of approximately 30 monitor wells located primarily downgradient of the Quarry property (Figure 2–3). These wells are completed in the alluvial aquifer or the underlying bedrock units (Kimmswick Limestone, Decorah Group, or Plattin Limestone). Construction details and lithologic logs for the wells are archived in the Weldon Spring Site records at the DOE office in Grand Junction.

### 2.3.9 Personnel

Typically, two inspectors will perform annual inspections. Inspectors will be experienced engineers or scientists who have the required knowledge, skills, and abilities to evaluate site conditions and recognize potential or actual problems.

Inspectors will be assigned for a given inspection of the Weldon Spring Site on the basis of site conditions and inspector expertise. Areas of expertise include civil, geotechnical, and geological engineering; geology, hydrology, biology, and environmental science (e.g., ecology, soils, or range management). If conditions warrant, more than two inspectors may be assigned to the inspection to evaluate serious or unusual problems and make appropriate recommendations.

### 2.3.10 Annual Reports

Results of annual site inspections will be reported to EPA and MDNR. DOE will post the final report on the DOE website for the Weldon Spring Site and submit it to the Weldon Spring Site Interpretive Center, other local information repositories, and stakeholders. In the report, DOE also will address maintenance and surveillance and maintenance monitoring results for the previous 12 months and will include descriptions of the cause and outcome of events that require notification of local, state, or federal officials.

## 2.4 Follow-up Inspections

Follow-up inspections are unscheduled inspections that are conducted in response to threatening or unusual site conditions.

### 2.4.1 Criteria

DOE may conduct follow-up inspections if the following occurs:

- A condition is identified during the routine site inspection, or other site visit, that requires personnel with specific expertise to return to the site to evaluate the condition.
- DOE is notified by a citizen, employee, or federal, state, or local agency that conditions at the site are substantially changed. Notification may be made to the DOE office in Grand Junction using the toll-free phone number posted at the Interpretive Center, to on-site personnel, or to local law enforcement agencies.

Once a condition or concern is identified at the site, DOE personnel will evaluate the information and decide whether to respond with a follow-up inspection. At any time, DOE may request the assistance of local authorities to confirm the seriousness of a condition at the site before scheduling a follow-up inspection. DOE will notify EPA and MDNR of a follow-up inspection upon identifying the need to conduct such an inspection.

Specific conditions that may necessitate a follow-up inspection include intrusion, violation of ICs, vandalism, or the need to revisit the site to evaluate, define, or conduct maintenance tasks. Conditions that may require a more immediate follow-up inspection include extreme weather, seismic events, and disclosure of deliberate human activity that threatens the integrity of waste containment. DOE will evaluate risk when scheduling follow-up inspections. Urgency of the follow-up inspection will be in proportion to the seriousness of the condition.

In the event of an incident or activity that threatens or compromises ICs or poses a risk of exposure to or release of known contaminants, DOE will follow the procedures in Section 2.9, "Emergencies, Contingency Planning, and Corrective Action."

### 2.4.2 Personnel

Inspectors assigned to follow-up inspections will be selected on the same basis as for routine site inspection, which is described in Section 2.3.9.

### 2.4.3 Reports of Follow-up Inspections

Results of follow-up inspections will be included in the next FFA quarterly report and the next annual inspection report. Separate reports will not be prepared unless DOE determines it advisable to notify EPA, MDNR, or another outside agency of a situation at the site that remains uncorrected.

If follow-up inspections are required for more serious reasons, DOE will submit to EPA, MDNR, and St. Charles County a preliminary report of the follow-up inspection within 60 days. These reasons may include situations that could result in a compromise or failure of cell containment or situations that could result in unacceptable risk to the public or the environment. The public will

be notified of the availability of the follow-up report via posting on the Internet. Copies of the report will be available to the public upon request.

## 2.5 5-Year Review

DOE will conduct CERCLA 5-year reviews, including preparing a 5-year review report, in accordance with the National Contingency Plan and EPA guidance for 5-year reviews in effect at the time the review is to be conducted. The purpose of the CERCLA 5-year review is to ensure that the remedies remain protective of human health and the environment. The Weldon Spring Site 5-year review report also will serve as the principle mechanism for monitoring, evaluating, improving, and reporting on all long-term management activities, including operations and maintenance; long-term monitoring; IC monitoring and enforcement; community involvement; information system; contingency actions; and post-ROD changes. Consideration of new science and technology will be addressed during the 5-year review process. The 5-year review report will also include the results of the previous five annual inspections and environmental monitoring results.

In the 5-year review report, DOE will present an evaluation of remedy performance and make any appropriate recommendations for modifying the surveillance and maintenance program, implementing corrective action, optimizing the selected remedies, or making changes to the selected remedies (if necessary).

DOE will consult then current EPA guidance for 5-year reviews and will add essential elements to the inspection that precedes preparation of the 5-year review report to ensure capture of necessary field observations. Additional evaluation of site monitoring data for the review period will be conducted.

During the 5-year review, in addition to annual visual inspections, general or differential settlement of the cell cover will be monitored through the use of terrestrial and/or aerial surveys. Rock gradation changes in the cell cover, clean fill dike cover, and toe apron will be visually assessed and evaluated (Appendix H).

In accordance with EPA guidance, DOE will prepare a single 5-year review report that addresses the four OUs of the Weldon Spring Site, with the Southeast Drainage Area being included in the Chemical Plant Area OUs. The most recent 5-year review was competed in 2001 (DOE 2001b). The next 5-year review report is planned to be released in 2006; therefore, the 2005 inspection will be structured to support the 5-year review.

## 2.6 Routine Site Maintenance and Operations

**Roads and Walkways—**Inspectors will evaluate the condition of the access road, perimeter road, and disposal cell ramp and platform for maintenance needs. Needs may include vegetation control, grading, or adding aggregate. DOE will promptly complete any needed maintenance or repairs. Unless affected by Site activities, DOE will not conduct any maintenance of the Hamburg Trail.

**Wells—**During the routine site inspection, DOE will inspect the disposal cell wells, more than 10 percent of Chemical Plant and Quarry monitor wells, and arrange for needed maintenance or repairs. Groundwater samplers also will note maintenance needs and ensure the wells are kept

secured and in good repair. Monitoring personnel will maintain access to sample locations, which may include maintenance of access routes and vegetation control. Maintenance at off-site locations will be conducted in accordance with access agreements.

**LCRS—**Modeling results predict that the production rate of leachate from the disposal cell will decrease steadily over the 10 years following cap completion until it becomes insignificant. On-site personnel will monitor fluid volume in the LCRS sump and arrange for sampling and disposal in accordance with the *Leachate Collection and Removal System Operating Plan* (Appendix I). DOE will decrease on-site monitoring frequency to reflect diminishing leachate production. A decrease in leachate production automatically will lead to less leachate monitoring, since there will be less volume to ship for treatment and disposal. Ultimately, the system may be monitored from a remote location, with system inspections coinciding with routine site inspections or conducted in response to concerns about remote monitoring information.

The LCRS sump is a confined space, and methane is generated by peat in the liner system. Workers must follow confined space entry procedures before entering the sump, which includes checking the sump atmosphere for oxygen and explosive concentrations of gases.

**Interpretive Center, Administration Building, Sanitary Wastewater Treatment System, and Associated Grounds—**DOE intends to offer use of these structures and associated landscaped areas to another primary building user. DOE will use office space and the laboratory in the administrative building. The primary building user will assume responsibility for building and grounds maintenance and capital improvements within the region shown on the final agreement. DOE will retain responsibility for maintenance of and capital improvements of the Interpretive Center. DOE and the primary building user will enter into a long-term use permit that specifies provisions for shared occupation. Currently this arrangement has been entered into with Lindenwood University for an indefinite term.

**Vegetation—**DOE will control vegetation on the disposal cell and in other rock-armored areas to prevent damage to the cell cover and maintain the proper function of drainage structures. Vegetation control may include cutting trees and shrubs and applying herbicides to their stems. The primary building user will maintain vegetation around the administration building and Interpretive Center.

DOE will establish a demonstration prairie on the remainder of the Chemical Plant (see Section 2.2). The prairie provides high quality erosion protection and a low maintenance cover. Maintenance activities may include periodic cutting, burning, fertilizing, erosion control, and weed control. Prairie maintenance will be conducted by a subcontractor and supervised by a prairie ecosystem consultant, who will direct maintenance activities on the basis of site conditions. A consortium of conservation groups may manage the prairie.

DOE also will be establishing a native plant educational garden that will surround the Interpretive Center. Maintenance activities may include periodic irrigation, mowing, burning, and weed control. Garden maintenance will be conducted by a subcontractor and volunteer labor. Maintenance activities will be supervised by the Interpretive Center manager. The intent of the garden is to assist in attracting and then educating the public about the Weldon Spring Site. Routine maintenance completed during the previous 12 months will be summarized in the next annual inspection report.

## 2.7 Environmental Monitoring

The Remedial Design/Remedial Action (RD/RA) work plans for the Weldon Spring Site specify environmental monitoring requirements for specific OUs, which are implemented through this plan. Results will be reported in the annual site environmental report and summarized in the 5-year review report. Environmental data results are available on the Internet (http://www.gjo.doe.gov/LM/sites/maps/mo/weldon/weldon.htm). In accordance with current laboratory turnaround times and review protocol, the data will be available on the website approximately 90 days after sampling.

DOE may conduct additional site environmental monitoring that is not required as part of an approved remedy but is required under DOE Order 450.1, *Environmental Protection Program*. DOE will report the results of the additional monitoring in the annual site environmental report.

Separate groundwater monitoring programs have been established for the Chemical Plant and Quarry because of geographic separation and differences in the hydrogeologic features that influence groundwater flow. Groundwater monitoring locations will include local springs where groundwater emerges from conduit flow paths (DOE 2003).

Monitoring results are compared to EPA and State of Missouri groundwater quality standards that are identified as ARARs in Table 1−2.

### 2.7.1 Disposal Cell Detection Monitoring

Disposal cell detection monitoring is summarized in Table 2−3. Specific procedures for evaluation of monitoring results and required responses are presented in the "Disposal Cell Groundwater Monitoring Plan" (Appendix K).

DOE will monitor groundwater upgradient and downgradient of the disposal cell and also will monitor Burgermeister Spring (SP–6301) during low flow as part of the disposal cell monitoring program. Burgermeister Spring is a primary localized resurgence point of groundwater from the Chemical Plant and represents surface water hydraulically connected to the Chemical Plant.

*Table 2–3. Detection Monitoring Program for the Disposal Cell at the Weldon Spring, Missouri, Site*

| Sample Locations | Hydrologic Relationship | Sampling Frequency | Analytes (all locations) |
|---|---|---|---|
| MW–2032 | Downgradient | Semiannual | Total uranium, radium-226, radium-228, thorium-228, thorium-230, thorium-232, nitrate (as N), sulfate, chloride, fluoride, arsenic, barium, chromium, cobalt, iron, lead, manganese, nickel, selenium, thallium 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, chemical oxygen demand, total dissolved solids, total organic carbon, polychlorinated biphenyl, polycyclic aromatic hydrocarbon, field parameters (pH, temperature, and conductivity). |
| MW–2046 | Downgradient | | |
| MW–2047 | Downgradient | | |
| MW–2051 | Downgradient | | |
| MW–2055 | Upgradient | | |
| SP–6301 | Downgradient | | |

Note: DNB = dinitrobenzene; DNT = dinitrotoluene; TNB = trinitrobenzene; TNT = trinitrotoluene

### 2.7.2 Groundwater OU

In July 2004, DOE initiated monitoring for monitored natural attenuation (MNA) as outlined in the *Remedial Design/Remedial Action Work Plan for the Final Remedial Action for the Groundwater Operable Unit at the Weldon Spring Site* (DOE 2004b). This network has since been modified as presented in the interim remedial action draft report (DOE 2005a) and is described below.

Contaminants of concern (COCs) for groundwater and springs at the Chemical Plant area are TCE, nitrate, uranium, and nitroaromatic compounds. The set of COCs measured for each of the monitoring locations presented in Table 2−4 depends on the proximity of the particular well or spring to the contaminant plumes.

The objectives specified in the ROD (DOE 2004b) for the MNA monitoring network are:

- Objective 1 is to monitor the unimpacted water quality at upgradient locations in order to maintain a baseline of naturally occurring constituents from which to evaluate changes in downgradient locations. This objective will be met by using wells located upgradient of the contaminant plume.
- Objective 2 is to verify contaminant concentrations are declining with time at a rate and in a manner that cleanup standards will be met in approximately 100 years as established by predictive modeling. This objective will be met using wells at or near the locations with the highest concentrations of contaminants, both near the former source areas and along expected migration pathways. The objective will be to evaluate the most contaminated zones. Long-term trend analysis will be performed to confirm downward trends in contaminant concentration over time. Performance will be gauged against long-term trends. It is anticipated that some locations could show temporary upward trends due to the recent source control remediation, ongoing dispersion, seasonal fluctuations, analytical variability, or other factors. However, concentrations are not expected to exceed historical maximums.
- Objective 3 is to ensure that lateral migration remains confined to the current area of impact. Contaminants are expected to continue to disperse within known preferential flowpaths associated with bedrock lows (paleochannels) in the upper Burlington-Keokuck Limestone and become more dilute over time as rain events continue to recharge the area. This objective will be met by monitoring various downgradient fringe locations that either are not impacted or minimally impacted. Contaminant impacts in these locations are expected to remain minimal or non-existent.
- Objective 4 is to monitor locations underlying the impacted groundwater system to confirm that there is no significant vertical migration of contaminants. This will be evaluated using deeper wells screened and influenced by the unweathered zone. No significant impacts at these locations should be observed.
- Objective 5 is to monitor contaminant levels at the impacted springs that are the only potential points of exposure under current land use conditions. The springs discharge groundwater that includes contaminated groundwater originating at the Chemical Plant area. Presently, contaminant concentrations at these locations are protective of human health and the environment under current recreational land uses. Continued improvement of the water quality in the affected springs should be observed.

*Table 2–4. Monitoring Parameters for MNA Locations*

| Location | Sampling Frequency[a] | Monitoring Parameters | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | TCE | Nitrate (as N) | Uranium | 1,3-DNB | 2,4,6-TNT | 2,4-DNT | 2,6-DNT | NB |
| MW-2012 | S | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-2014 | S | | | | | | ✔ | ✔ | |
| MW-2017 | S | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-2021 | S | | ✔ | | | | | | |
| MW-2022 | Q | | ✔ | | ✔ | ✔ | | | |
| MW-2023 | Q | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-2032 | S | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-2035 | S | ✔ | ✔ | ✔ | | | ✔ | | |
| MW-2038 | S | | ✔ | | | | ✔ | | |
| MW-2040 | S | | ✔ | | | ✔ | | | |
| MW-2046 | S | | | | | ✔ | | | |
| MW-2050 | S | | | | | | ✔ | ✔ | |
| MW-2051 | S | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-2052 | S | | | | | | ✔ | ✔ | |
| MW-2053 | S | | | | | ✔ | ✔ | ✔ | |
| MW-2054 | S | | | | | | ✔ | ✔ | |
| MW-2056 | Q | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-3003 | S | | ✔ | ✔ | | | | | |
| MW-3006 | S | ✔ | ✔ | ✔ | | | ✔ | | |
| MW-3024 | S | | | ✔ | | | | | |
| MW-3030 | S | ✔ | | ✔ | | | ✔ | | |
| MW-3031 | S | ✔ | | ✔ | | | | | |
| MW-3034 | S | ✔ | ✔ | | | | ✔ | | |
| MW-3037 | S | ✔ | | ✔ | | | ✔ | | |
| MW-3039 | S | | | | | | ✔ | | |
| MW-3040 | Q | ✔ | ✔ | ✔ | | | | | |
| MW-4007 | S | ✔ | ✔ | | | | | | |
| MW-4013 | S | | ✔ | | | | ✔ | ✔ | ✔ |
| MW-4014 | S | | ✔ | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-4015 | S | | | | | | ✔ | ✔ | ✔ |
| MW-4022 | S | | ✔ | ✔ | | | | | |
| MW-4023 | S | | ✔ | ✔ | | | | | |
| MW-4026 | S | | | ✔ | | | | | |
| MW-4029 | S | ✔ | ✔ | | | | | | |
| MW-4031 | S | | ✔ | | | | | | |
| MW-4036 | S | ✔ | ✔ | ✔ | | | ✔ | | |
| MW-4039 | S | | | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MW-4040 | Q | ✔ | ✔ | ✔ | | | ✔ | | |
| MW-4041 | Q | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| MWS-1 | Q | ✔ | ✔ | ✔ | | | ✔ | | |
| MWS-4 | Q | ✔ | ✔ | ✔ | | | | | |
| MWD-2 | Q | | ✔ | ✔ | | | | | |
| SP-5303 | S | | | ✔ | | | | | |
| SP-5304 | S | | | ✔ | | | | | |
| SP-6301 | S | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| SP-6303 | S | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| SW-2007 | Q | | | ✔ | | | | | |

[a]Monitoring frequencies may be decreased to annual or biennial on the basis of trends in at least the first 2 years of data.
S = semiannual and Q = quarterly.

- Objective 6 is to monitor for hydrologic conditions at the site over time in order to identify any changes in groundwater flow that might affect the protectiveness of the selected remedy. The static groundwater elevation of the monitoring network will be measured to establish that groundwater flow is not changing significantly and resulting in changes in contaminant migration.

The monitoring network is designed to collect data to show that either natural attenuation processes are acting as predicted or to trigger the implementation of contingencies when these processes are not acting as predicted (i.e., unexpected expansion of the plume or sustained increases in concentrations within the area of impact). The data analysis and interpretation will satisfy the following:

- Baseline conditions (Objective 1) have remained unchanged.
- Performance monitoring locations (Objective 2) indicate that concentrations within the area of impact are decreasing as expected.
- Detection monitoring locations (Objective 3, 4, and 5) indicate when a trigger has been exceeded.

The guidance documents *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tanks Sites* (EPA 1999) and the *Technical Guidance for the Long-Term Monitoring of Natural Attenuation Remedies at Department of Energy Sites* (DOE 1999c) were used during the development of this monitoring program.

The monitoring network consists of 50 wells, four springs, and one surface water location. The locations and the objectives they satisfy are summarized in Table 2−5 and are depicted on Figure 2−4.

*Table 2–5. Monitoring Locations Retained for MNA Monitoring for the GWOU*

| Objective 1 | Objective 2 | Objective 3 | Objective 4 | Objective 5 | Objective 6 |
|---|---|---|---|---|---|
| MW-2017 | MW-2012 | MW-2032 | MW-2021 | SP5303 | MW-2005 |
| MW-2035 | MW-2014 | MW-2051 | MW-2022 | SP5304 | MW-2055 |
| MW-4022 | MW-2038 | MW-3031 | MW-2023 | SP6301 | MW-3025 |
| MW-4023 | MW-2040 | MW-3037 | MW-2056 | SP6303 | MW-3038 |
| | MW-2046 | MW-4013 | MW-3006 | SW-2007[b] | MW-4001 |
| | MW-2050 | MW-4014 | MW-4007 | | MW-4011 |
| | MW-2052 | MW-4015 | MWD-2 | | MW-4020 |
| | MW-2053 | MW-4026 | | | MW-4037 |
| | MW-2054 | MW-4036 | | | |
| | MW-3003 | MW-4039 | | | |
| | MW-3024 | MW-4041 | | | |
| | MW-3030 | MWS-1 | | | |
| | MW-3034 | MWS-4 | | | |
| | MW-3039 | | | | |
| | MW-3040 | | | | |
| | MW-4013[a] | | | | |
| | MW-4029 | | | | |
| | MW-4031 | | | | |
| | MW-4036[a] | | | | |
| | MW-4040 | | | | |

[a]Location is also an Objective 3 location.
[b]Location is on Dardenne Creek immediately upstream of Highway 40/61, approximately 2.1 miles north of the Site.

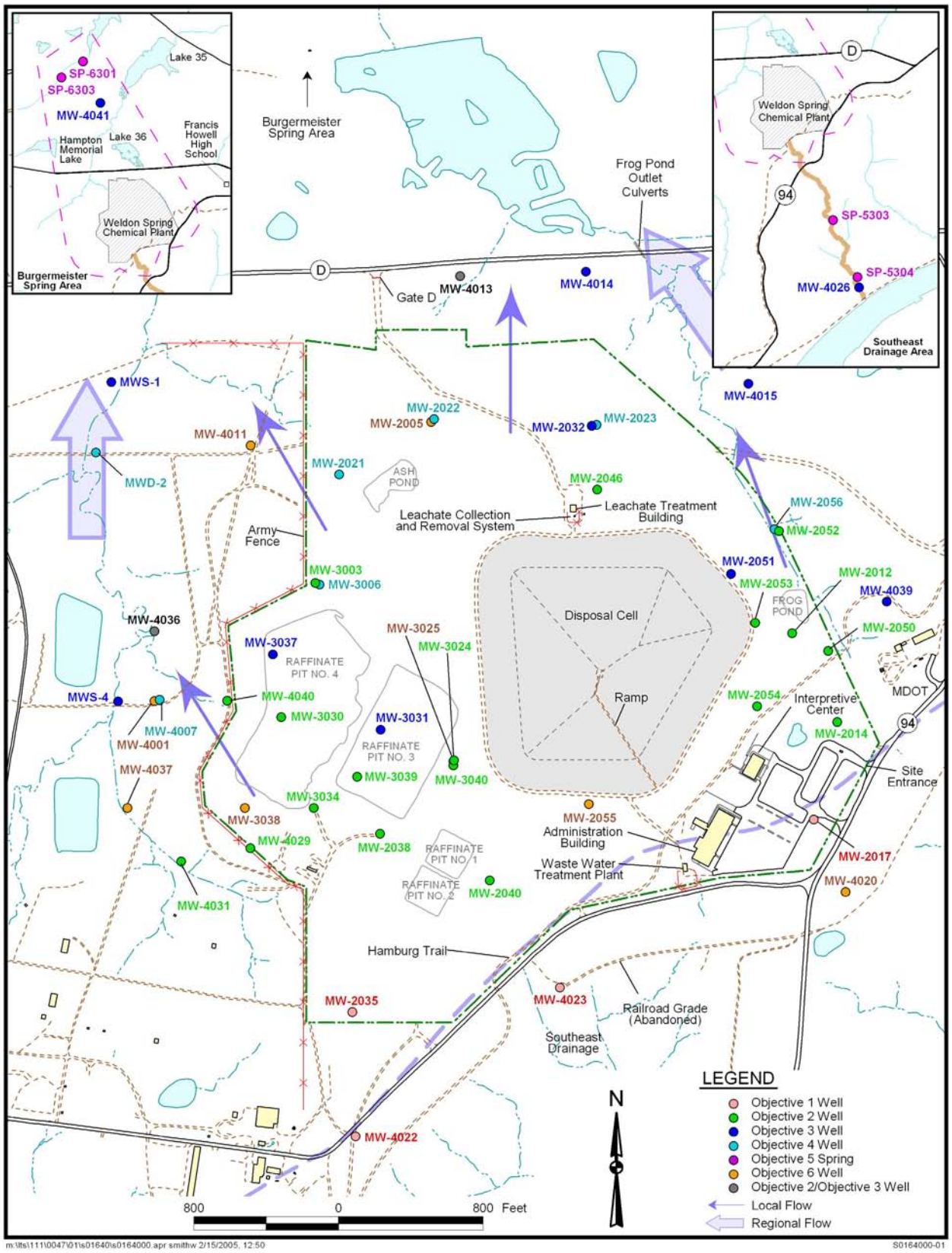


*Figure 2–4. MNA Groundwater Monitoring Locations*

### *2.7.2.1 Upgradient Groundwater Monitoring (Objective 1 Locations)*

Groundwater quality will be monitored at upgradient unimpacted locations (Objective 1) in order to maintain a baseline of naturally occurring constituents to determine if downgradient conditions may be showing natural changes rather than contaminant based changes.

Groundwater data from the upgradient locations will be compared with previously collected data from each respective location. If a statistically significant increase, defined as a concentration that exceeds the mean plus 3 standard deviations for the previous 8 data points, is measured, then investigation of the validity of the data point will be initiated. For those locations that are nondetect, a statistically significant increase is considered to be the respective cleanup standard, measured for two consecutive sampling periods.

### *2.7.2.2 Performance Monitoring (Objective 2 Locations)*

Concentrations of contaminants of concern are expected to decrease to cleanup standards within a reasonable timeframe (i.e., 100 years). Long-term trend analysis will be performed to confirm downward trends in contaminant concentrations over time. Performance will be gauged against long-term trends. It is anticipated that some locations could show temporary upward trends due to source control remediation completed, ongoing dispersion, analytical variability, or other factors. However, concentrations are not expected to exceed historical maximums.

Trigger levels were set for the performance monitoring (Objective 2) locations in the event unexpected increases occur within the area of impact (Table 2−6). These trigger levels will be reconsidered after the baseline period, as appropriate. As currently designed, the first trigger is set as that considered to be a statistically significant increase in contaminant concentrations outside those that have been measured for the previous 8 data points. Concentrations that exceed the mean plus 3 standard deviations for that location will be considered to be a statistically significant increase. The second trigger established for each contaminant will invoke a more vigorous response. Due to the greater concentrations of nitroaromatic compounds in the Frog Pond area (MW-2012, MW-2014, MW-2050, MW-2052, MW-2053, MW-2054, and MW-4015) as compared to the remainder of the site, separate triggers have been established for each of the areas with nitroaromatic impact. Contingency actions associated with trigger exceedences are discussed in Section 2.9.1.2.

*Table 2–6. Trigger Levels for the Performance and Detection Monitoring Programs*

| Parameter | Objective 1 | Objective 2 | Objective 3 (near) | Objective 3 (far) | Objective 4 | Objective 5 |
|---|---|---|---|---|---|---|
| TCE | Mean + 3sd | 1,000 µg/l | 15 µg/l | 5 µg/l | 10 µg/l | 5 µg/l |
| Nitrate | Mean + 3sd | 1,350 mg/l | 30 mg/l | 10 mg/l | 20 mg/l | 20 mg/l |
| Uranium | Mean + 3sd | 100 pCi/l | 50 pCi/l | 20 pCi/l | 40 pCi/l | 150 pCi/l |
| 1,3-DNB | Mean + 3sd | 20 µg/l | 4 µg/l | 1 µg/l | 2 µg/l | 1 µg/l |
| 2,4,6-TNT | Mean + 3sd | 500 µg/l | 11.2 µg/l | 2.8 µg/l | 5.6 µg/l | 2.8 µg/l |
| 2,4-DNT | | | | | | |
| East | Mean + 3sd | 2,300 µg/l | 1.1 µg/l | 0.11 µg/l | 0.22 µg/l | 0.22 µg/l |
| West | Mean + 3sd | 5 µg/l | 0.55 µg/l | 0.11 µg/l | 0.22 µg/l | 0.22 µg/l |
| 2,6-DNT | Mean + 3sd | 2,000 µg/l | 13 µg/l | 1.3 µg/l | 2.6 µg/l | 1.3 µg/l |
| NB | Mean + 3sd | 50 µg/l | 34 µg/l | 17 µg/l | 17 µg/l | 17 µg/l |

#### *2.7.2.3 Detection Monitoring (Objective 3, 4, and 5 Locations)*

Contaminants are expected to continue to disperse within known preferential flow paths associated with bedrock lows (paleochannels) in the upper Burlington-Keokuk Limestone and become more dilute over time. This objective will be met by monitoring various downgradient perimeter locations that are either impacted or minimally impacted. Contamination should not go any deeper than it already has. Slight nitrate, uranium, and nitroaromatic compound impact has been observed in the unweathered Burlington-Keokuk Limestone at the Chemical Plant. No significant impacts at these locations should be observed.

The springs discharge groundwater that includes contaminated groundwater originating from the Chemical Plant. Presently, contaminant concentrations at these locations are protective of human health and the environment under current recreational land uses. Continued improvement of the water quality in these affected springs should be observed.

Maximum trigger levels also have been established for each contaminant for the detection monitoring locations and the springs. These triggers are summarized in Table 2−6.

#### *2.7.2.4 Hydrologic Monitoring (Objective 6 Locations)*

Site hydrologic conditions over time are being monitored using all the wells included in the MNA network (wells listed for Objectives 1 to 4 in addition to those listed as Objective 6 wells) in order to identify any changes in groundwater flow that might affect the protectiveness of the selected remedy. The static groundwater elevation of the monitoring network will be measured to establish that groundwater flow is not changing significantly and resulting in changes in contaminant migration. COC data will not be collected from Objective 6 wells.

Groundwater elevation will be created and evaluated to verify that the groundwater flow directions and rates are sufficient to support the attenuation of the contaminants in the predicted timeframes. Also, groundwater flow directions will be evaluated against the IC boundary to verify that the restricted use area is adequate.

### 2.7.3 Quarry Residuals OU

DOE monitors groundwater wells at the Quarry, and until October 1, 2002, DOE conducted this monitoring in accordance with the Weldon Spring Site *Environmental Monitoring Plan*. After that date, monitoring requirements began to be conducted in accordance with the *Remedial Design/Remedial Action Work Plan for the Quarry Residuals Operable Unit* (DOE 2000a).

The major source of groundwater contamination was removed under the ROD for the Quarry Bulk Waste OU by removal of contaminated soil, debris, and surface water from the Quarry. The QROU remedy prescribes long-term monitoring to confirm that natural processes are effective in attenuating groundwater contaminants before they reach the St. Charles County well field. The remedy also includes ICs to prevent groundwater use or disturbance of a naturally occurring reduction zone. The rationale for the monitoring activities at the Quarry are described in the *Remedial Design/Remedial Action Work Plan for the Quarry Residuals Operable Unit* (DOE 2000a). Contaminants of concern in the Quarry groundwater are uranium and 2,4-DNT.

The Quarry monitoring program has two primary objectives:

- Monitor uranium concentrations in groundwater south of Femme Osage Slough to verify that the groundwater is not impacted.
- Monitor contaminant concentrations within the area of affected groundwater north of the slough until they attain target concentrations, indicating negligible potential to degrade groundwater south of the slough.

Groundwater north of the slough contains elevated concentrations of uranium. Uranium concentrations south of the slough and in the area of production wells at the St. Charles County well field remain within the observed natural variation within the aquifer, ranging from 0.1 pCi/L to 14.3 pCi/L; an average background is 2.77 pCi/L (See Appendix A). DOE detected a maximum uranium concentration of 2,740 pCi/L north of the slough in 1999 and set an administrative target level of 300 pCi/L (90 percent reduction) as the remediation goal for the groundwater in the plume north of the slough. Uranium is attenuated through either precipitation as the groundwater passes through a geochemical reduction zone or adsorption onto aquifer materials. Modeling indicates that recharge from the area of impact north of the slough accounts for less than 1 percent of the total flow through the St. Charles County well field (DOE 2000a). If, after attaining the target level of 300 pCi/L attenuation were to become ineffective, the increase to the well field would be 3 pCi/L. If concentrations in groundwater south of the slough exceed the maximum contaminant level of 20 pCi/L, DOE will evaluate risk and take appropriate action (see Section 2.9.1.3, "Quarry Residuals OU").

North of the slough, 2,4-DNT has been detected at one location in concentrations exceeding the Missouri regulatory limit of 0.11 µg/L. Concentrations have generally decreased since completion of bulk waste removal activities from the Quarry contamination. The target level for 2,4-DNT has been set at the Missouri State Water Quality standard.

The Quarry groundwater monitor well network consists of wells arrayed in four "lines" between the Quarry and the St. Charles County well field (Figure 2−3). The first and second lines are established to monitor the effect of residual Quarry contaminants on groundwater quality within the alluvium and shallow bedrock north of Femme Osage Slough. The third line, consisting of wells completed in the alluvial aquifer south of the slough, is monitored to provide early warning of contaminant migration across the reduction zone and toward the well field. The fourth line of wells, which consists of monitor wells installed by St. Charles County, are completed in the same portion of the aquifer from which the municipal water supply wells withdraw water. The purpose of the fourth line wells is to monitor water quality in the alluvial aquifer and monitor for occurrence of uranium at concentrations outside the range of natural variance.

Monitoring frequencies were established to (1) provide adequate warning of contaminant migration, taking into account travel times from known plume locations to critical locations upgradient of the well field; and (2) provide data adequate for valid statistical analysis of groundwater conditions. Aquifer hydraulic characterization results indicate that groundwater travel time from north of the slough to immediately south of the slough is approximately 1 year. Travel time between Lines 3 and 4 is slower because of a lower hydraulic gradient (DOE 2000a).

Parameters to be monitored include uranium and six nitroaromatic compounds (including 2,4-DNT) (Table 2−7). Uranium and 2,4-DNT were identified as contaminants of concern using the CERCLA process. Geochemical parameters also will be measured (pH, Eh [oxidation-reduction potential], sulfate, and iron oxidation state) to monitor the geochemical properties for the reduction zone and confirm that the reduction zone is capable of ongoing attenuation of uranium in groundwater. These results should correlate with observed uranium concentrations upgradient and downgradient of the reduction zone. DOE will establish ICs to prevent physical disturbance of the reduction zone.

*Table 2–7. Groundwater Monitoring Program for the Quarry at the Weldon Spring, Missouri, Site*

| Monitoring Location Group | Sample Locations[a] | Sampling Frequency | Analytes (all wells) |
|---|---|---|---|
| Line 1 | 1002, 1004, 1005, 1027, 1030 | Quarterly | Total uranium, 1,3,5-TNB, 1,3-DNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, NB, pH, Eh, sulfate, total iron, and iron(+2) |
| Line 2 | 1006, 1007, 1008, 1009, 1013, 1014, 1015, 1016, 1031, 1032, 1045, 1046, 1047, 1048, 1049 | Quarterly | |
| Line 3 | 1017, 1018, 1019, 1021, 1044, 1050 | Semiannually | |
| Line 4 | RMW-1, RMW-2, RMW-3, RMW-4 | Annually | |

[a]Sample location identifiers for Lines 1, 2, and 3 have "MW–" prefixes.
Note: DNB = dinitrobenzene; DNT = dinitrotoluene; NB = nitrobenzene; TNB = trinitrobenzene; TNT = trinitrotoluene, Eh = oxidation-reduction potential

North of the slough, data from wells in Lines 1 and 2 will be analyzed to demonstrate that the target concentration for uranium and the regulatory limit for 2,4-DNT are attained. Data analysis will be conducted in accordance with methods described in *Methods for Evaluating the Attainment of Cleanup Standards, Volume 2: Groundwater* (EPA 1992). Cleanup objectives are met when the uranium target concentration of 300 pCi/L and the 2,4-DNT standard of 0.11 µg/L are not exceeded at the 90th percentile in a 12-month monitoring period, and trend analysis indicates that contaminant levels are decreasing. If either analyte meets these criteria, monitoring of that analyte can be discontinued.

South of the slough, uranium concentrations will be compared to the EPA maximum contaminant level of 20 pCi/L, and analytical results will be evaluated for the presence of nitroaromatic compounds to verify that groundwater is not affected. If elevated uranium levels are detected, DOE will implement the contingency actions presented in Section 2.9.1.3, "Quarry Residuals OU."

DOE backfilled the Quarry and graded the surface to create positive drainage. Therefore, surface water will not accumulate within the Quarry. No surface water monitoring is required as part of remedy implementation for the QROU; however, DOE will monitor surface water at four locations along Femme Osage Slough, as shown on Figure 2–5. These locations are sampled for total uranium. During high groundwater levels, this portion of the slough is recharged by groundwater.

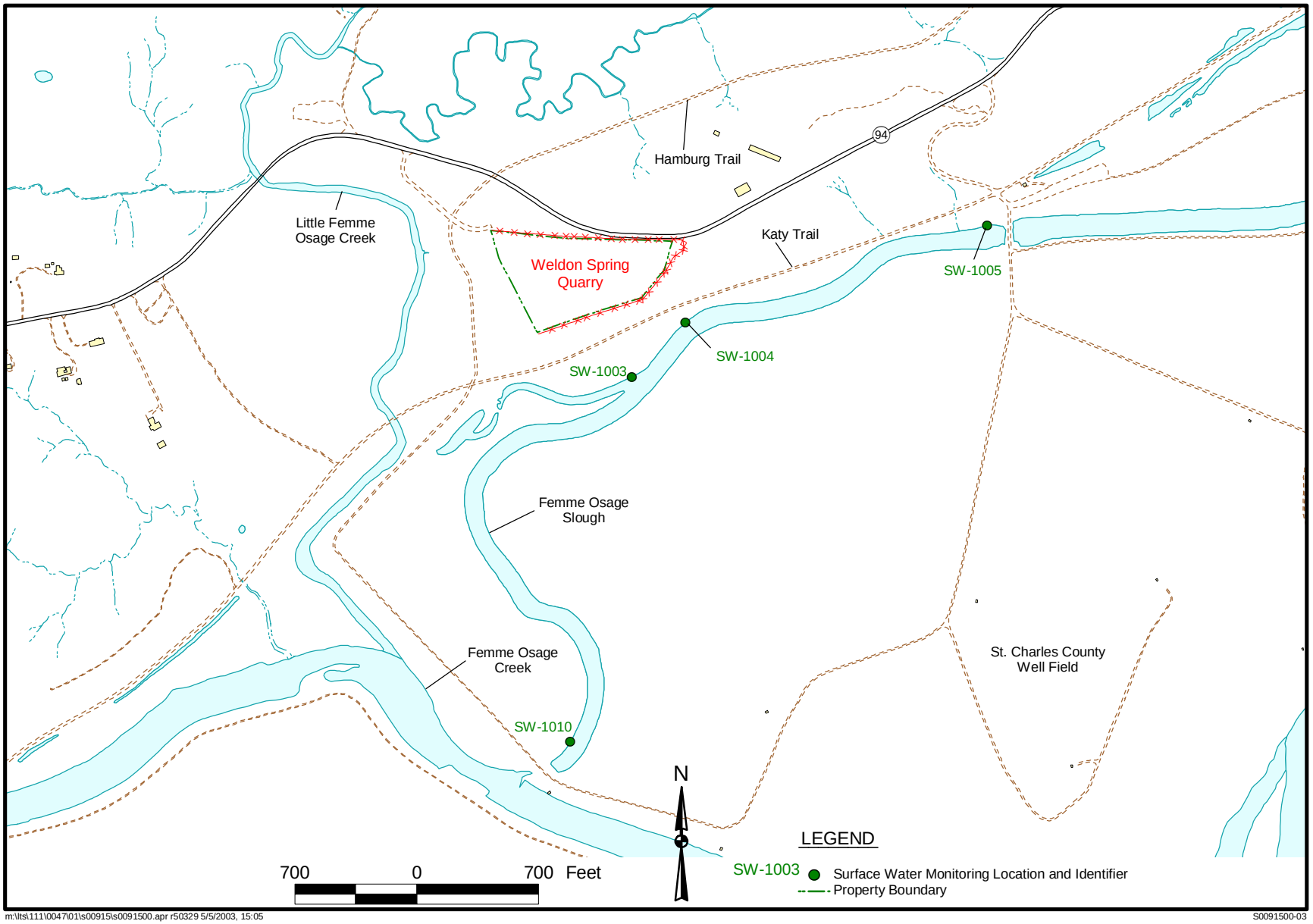


*Figure 2–5. Surface Water Monitoring Locations at the Quarry Area of the Weldon Spring, Missouri, Site*

### 2.7.4 Disposal Cell LCRS Monitoring and Operation

The LCRS requires periodic monitoring to ensure the system is functioning as designed and sump capacity is not exceeded. Monitoring will indicate if the secondary leachate collection system is collecting leachate, either as a result of primary liner leakage or from another source. Liquid 1evels in the secondary sump containment must be monitored. DOE will remove and dispose of leachate at a frequency sufficient to prevent leachate volume from reaching the maximum capacity of the sump. Section 303(c) of 40 CFR 264 (which is relevant and appropriate to this activity) requires that after the final cover is installed, the amount of liquids removed from the sump be recorded at least monthly. If the liquid level in the sump stays below the pump operating level for two consecutive months, the amount of liquids in the sump must be recorded at least quarterly. If the liquid level in the sump stays below the pump operating level for two consecutive quarters, the amount of liquids in the sump must be recorded at least semiannually. If at any time during the postclosure care period the pump operating level is exceeded on quarterly or semiannual recording schedules, the recording of amount of liquids must return to monthly until the liquid level again stays below the pump operating level for two consecutive months. "Pump operating level" for the Weldon Spring Site is defined as the maximum amount of liquid in the sump, which equals 11,200 gallons. Leachate production rates, analytical results, and disposal records will be archived with the site surveillance and maintenance records at the DOE office in Grand Junction and summarized in the annual report. Monitoring and operating procedures are specified in Appendix I.

Leachate level and flow rates will be monitored and recorded weekly at the outset. As a reliable database is generated, DOE may modify the sump level monitoring frequency in accordance with regulations in 40 CFR 264.303(c) which requires only monthly and then quarterly flow recording. Flow rates will be reported in units of gallons per day and compared to the action leakage rate of 100 gallons/acre/day established for the leachate collection system. See Section 2.9.2.2, "Action Leakage Rate" for more information regarding the action leakage rate.

During 2003 and 2004, discharge from the primary leachate collection system has generated approximately 250 gallons per day and 200 gallons per day, respectively. The combined leachate from the secondary leachate collection system has averaged approximately 20 gallons per day for 2003 and 2004. The average leak rate for the secondary leachate collection system for 2003 and 2004 has been approximately 0.75 gallon/acre/day, less than 1 percent of the action leakage rate. This is a result of superior design and construction, as well as operational controls that optimized the moisture content of the compacted soil waste.

#### *2.7.4.1 Leachate Chemistry Monitoring and Disposal*

The leachate has been sampled quarterly since generation for an extensive list of chemical and radiological constituents. Beginning in calendar year 2003, the leachate is sampled semiannually in accordance with Appendix K "Disposal Cell Groundwater Monitoring Plan." The list of analytes is included in the plan. As needed, the leachate is pumped from the sump and transported to the Metropolitan St. Louis Sewer District (MSD) for treatment in their Bissell Point wastewater treatment facility. The approval letter from MSD and subsequent amendments to that letter are included in Appendix I. A sample of leachate is collected and analyzed in accordance with MSD requirements for each hauling event (Appendix I). DOE has an allocation of 0.15 millicuries per year of radioactivity and 25,000 gallons per month. Leachate uranium

activity during 2002 typically was 50 pCi/L, which is equivalent to an annual radioactivity of approximately 0.02 millicuries. The 2003 and 2004 data have shown a continued downward trend to less than 30 pCi/L.

### 2.7.5 Air Monitoring

Because radioactive and asbestos waste handling operations were complete, and waste was encapsulated in the disposal cell, DOE halted air monitoring at the site perimeter and at off-site locations for radon-222, thoron (radon-220), and particulates in 2000. Radon flux measurements collected on the first foot of the 3-foot-thick layer of the radon barrier averaged less than 5 percent of the regulatory limit of 20 pCi per square meter per second (DOE 2001a). Therefore, no postclosure radon monitoring is required.

## 2.8 Regulatory Compliance Monitoring

At the time of the routine site inspection, DOE will evaluate the degree of compliance with regulations governing surveillance and maintenance activities at the Weldon Spring Site. Those regulations are specified in Section 1.5, “Current Regulatory Requirements.”

An evaluation of regulatory compliance may be required at other times as well, in response to unusual or nonroutine occurrences. The results of this monitoring will be presented in the annual report. However, if DOE identifies instances of noncompliance that necessitate corrective action, DOE will inform EPA and MDNR of site conditions as soon as they are assessed.

## 2.9 Emergencies, Contingency Planning, and Corrective Action

Emergency measures are the actions DOE will take in response to "unusual damage or disruption" that threatens or compromises site safety or security, such as exposure or release of cell contents. DOE will contain and manage radioactive or hazardous materials that are the responsibility of DOE in the unlikely event such materials are discovered or released. Certain circumstances may arise during the surveillance and maintenance phase of the Weldon Spring Site that require implementation of contingency actions. To the extent these actions can be anticipated and planned for (e.g., the Quarry well field contingency plan), they have been incorporated into RODs and RD/RA workplans. Unanticipated contingency actions will be subject to CERCLA processes prior to implementation. Certain options under CERCLA, which will be evaluated, include emergency or time-critical actions, IRAs, and changes or amendments to the RODs. DOE is responsible for any future hazards posed by releases from or at the Site and to revise the LTS&M Plan appropriately in light of any additional or revised cleanup required under the terms of the FFA.

Site inspections, monitoring, and maintenance activities are designed to identify potential problems before they develop into a need for corrective action. However, in the unlikely case that extreme natural events, vandalism, or unanticipated events threaten the integrity and operation of the disposal cell, corrective actions that could include temporary emergency measures will be carried out to mitigate the problem. In addition, DOE will evaluate the factors that caused the problem and ensure that the possibility of recurrence is minimized or avoided.

DOE will notify EPA, MDNR, and St. Charles County as soon as an emergency situation is known to exist. The Missouri Department of Health and Senior Services will be notified, if appropriate. Emergency contact information will be maintained in Appendix F of this plan. DOE also will maintain a listing for local DOE contact phone numbers in the local telephone directories.

As soon as practical after initial emergency response notifications have been made and appropriate measures have been initiated, the following stakeholders will be notified of the situation: Weldon Spring Citizens Commission (WSCC), MoDOT (local), MDC (local), Francis Howell High School, and Francis Howell School District. A listing of these emergency notification contacts also will be maintained in Appendix F.

The St. Charles County Sheriff's office will be contacted annually as part of the annual inspection to maintain contact and to determine if they have any concerns or issues regarding the Site. It also will be verified that they have an updated emergency contact list and phone numbers for the Site.

A procedure is in place that requires the U.S. Geological Survey National Earthquake Center to provide email notification to DOE when an earthquake of magnitude 3.0 or greater occurs within 20 miles of the Site.

The public may use the 24-hour security telephone numbers monitored at the DOE office in Grand Junction (970-248-6070 or 877-695-5322), or the telephone number for local site support personnel (636-300-0012) to notify DOE of site concerns.

For the purposes of this plan, corrective action refers to specific occurrences listed below. Minor problems such as filling potholes, repairing drainage structures, and repairing monitoring equipment are completed under normal site maintenance procedures. Occurrences that require corrective action generally will be those that indicate a potential release of contamination from the disposal cell or otherwise threaten the health and safety of the public or the environment.

Occurrences that may require corrective action include, but are not limited to:

- Concentration limits exceeded or sustained upward trends at monitoring locations.
- Damage to the disposal cell that could potentially allow release of contamination and/or threaten the health and safety of the public or the environment.
- Excessive leachate production in the disposal cell.
- Rapid headward erosion of nearby drainages.

### 2.9.1 Groundwater Contingency Actions

#### *2.9.1.1 Disposal Cell Groundwater Corrective Action*

If it is determined that leakage from the disposal cell has resulted in deterioration of the groundwater at the Chemical Plant, a review of the remedy will be necessary. This is based on the condition that the remedy is not behaving as expected and may no longer be protective of human health and the environment. Modifications or actions would be documented under

CERCLA and would be consistent with RCRA 40 CFR 264.100 At this time, a modification of this program would be documented in collaboration with the EPA and MDNR.

#### *2.9.1.2 Groundwater OU*

The monitoring program has been developed to recognize any of the following observations that could lead to reconsideration of the remedy:

- A sustained upward trend in contaminant concentration in groundwater or springwater, indicating that undiscovered sources may be present;
- Trends in contaminant concentrations that are inconsistent with meeting cleanup goals within a reasonable timeframe; or
- Significant increases in the areal or vertical extent of contamination, resulting in new impacts to adjacent (both horizontal and vertical) unimpacted groundwater systems.

Trigger concentrations have been assigned at appropriate locations as indicators of changed conditions or of having a potential for impact outside those areas where migration is expected to occur (i.e., paleofeatures). Responses will range from data verification and increased monitoring to reevaluation of MNA timeframes. Decision trees have been developed for each monitoring program (Appendix M) that outline courses of action for exceeding trigger levels.

In the event that recalculation of the MNA timeframes is required, the methodology to be used is presented in the *Remedial Design/Remedial Action Work Plan for the Final Remedial Action for the Groundwater Operable Unit at the Weldon Spring Site* (DOE 2004b). The original calculations were based on a larger set of wells than the set used to monitor MNA. Collection of data from nearby existing wells will be necessary to complete this task; therefore, it is not expected that recalculation will be performed routinely as a performance measure of MNA.

Should an alternative to MNA be needed, it will be implemented in accordance with the CERCLA process for post-ROD changes. If the remedy requires immediate action, a time-critical removal will be conducted. Alternatives other than MNA will be reevaluated and will include in-situ chemical oxidation (ICO) as well as other treatment or containment technologies that may be available in the future.

#### *2.9.1.3 Quarry Residuals OU*

Groundwater from the St. Charles County well field located south of Femme Osage Slough is used for residential purposes. Monitoring data indicate that uranium concentrations in this area are within the range of background concentrations for the Missouri River alluvium. Because removal of major sources of contamination has been completed, no significant amounts of additional contaminants should be introduced into the groundwater system. However, because of the presence of uranium in groundwater north of the slough, contingency actions have been considered in the event that uranium concentrations increase or uranium from the Quarry is observed in groundwater south of the slough.

During bulk waste removal activities, a well field contingency plan (DOE 1992) was prepared to address concerns about the protection of the well field in the event contaminants were mobilized

due to remedial actions. The monitoring and contingency action portions of the contingency plan have been incorporated into this LTS&M Plan. If an alternate source of drinking water is required, engineering design and construction will proceed based on the design criteria that was presented in the contingency plan (Appendix L). The contingency plan also outlined the preliminary planning and preparation that will be necessary to implement the construction of new wells in the existing well field or a partial or full replacement well field.

The Quarry groundwater monitor well network consists of wells arrayed in four "lines" between the Quarry and the St. Charles County well field. The first and second lines are established to monitor the effect of residual Quarry contaminants on groundwater quality within the alluvium and shallow bedrock north of Femme Osage Slough. The third line, consisting of wells completed in the alluvial aquifer south of the slough, is monitored to provide early warning of contaminant migration toward the well field. The fourth line consists of monitor wells completed in the same portion of the aquifer from which the water supply wells withdraw water and whose purpose is to monitor the water quality in the alluvial aquifer and monitor for occurrence of uranium at concentrations outside the range of natural variance.

If a consistently upward trend in uranium or 2,4-DNT concentrations is observed for three consecutive sampling events in the groundwater north or south of the slough, DOE will investigate the contaminant source and transport mechanism. This may include conducting hydrogeologic and geochemical investigations, installing additional monitor wells, or increasing sampling frequency of the monitoring network.

If uranium concentrations in groundwater south of the slough exceed the trigger level of 20 pCi/L, DOE will notify EPA Region VII, MDNR, and St. Charles County as soon as the condition is confirmed. Confirmation may include reanalyzing samples, if possible, or resampling the locations in question and other potentially affected locations and submitting the samples to analytical laboratories for expedited analysis.

If the elevated uranium concentration is valid, DOE will reevaluate the potential for impacts to the well field and the alluvial aquifer. This evaluation may include

- Increasing the frequency of sample collection.
- Performing hydrogeologic and/or contaminant transport investigations to identify migration pathways.
- Installing additional monitor wells.
- Conducting groundwater modeling to predict long-term impacts.
- Conducting a risk evaluation consistent with methods outlined under CERCLA.
- Determining the need for and feasibility of groundwater remediation.
- Installing new production wells in the existing well field, or partial or full replacement of the well field in an alternate location.

### 2.9.2 Disposal Cell Contingency Actions

#### *2.9.2.1 Leachate Contingency Treatment*

Prior to obtaining approval to dispose of leachate in the regional water treatment system, DOE designed a dedicated water treatment plant (referred to as Train 3) to decrease manganese and uranium levels. DOE constructed a treatment building and installed some of the required equipment. The plant was not completed as an automated system, but DOE will modify the equipment to function as a manually operated batch treatment system, if needed. The circumstances that could lead to the use of the contingency treatment system include shipping the leachate to MSD becoming not available as an option. The system will use chemical precipitation to remove manganese and ion exchange resin columns to remove uranium.

Treated leachate will be sampled before discharge. Leachate will be pumped into a dedicated pipeline and discharged to the Missouri River at National Pollutant Discharge Elimination System (NPDES) Outfall 007 in accordance with DOE's NPDES permit. DOE will maintain the NPDES permit for the discharge point (outfall) of the discharge line, for possible future use.

The *LCRS/Train 3 Treatment Contingency Plan* is included as Appendix J (see also the *Leachate Collection and Removal System Operating Plan* in Appendix I).

#### *2.9.2.2 Action Leakage Rate*

As outlined in the Notice of Final Rulemaking, *Federal Register* Volume 57, Number 19, dated January 29, 1992, EPA recommends 100 gallons/acre/day for land disposal units meeting the minimum required design specifications. However, the final rule allows the owner/operator to calculate an action leakage rate based on site-specific design of the unit. The calculated action leakage rate should be based on calculations of the maximum flow capacity of the leak detection system so as not to exceed one foot head on the bottom liner. Based on the site specific design, the calculated action leakage rate for the Weldon Spring Site disposal cell is 2,640 gallons/acre/day. For the 26.5-acre waste footprint within the disposal cell, this converts to 69,960 gallons per day. As a more practical number, the DOE agreed to use the recommended 100 gallons/acre/day as the action leakage rate for the disposal cell. The actual combined secondary flow rates recorded at the end of December 2002 were less than 1 gallon/acre/day (100 times less than the action leakage rate). The average flow rates for 2003 were approximately 0.6 gallon per acre per day.

In accordance with EPA regulations (40 CFR 264.304), if the action leakage rate is exceeded, DOE will notify EPA and MDNR within 7 days of the determination. A preliminary written assessment of the determination will be submitted within 14 days and will include amount of liquids, likely sources of liquids, and possible location, size, and cause of any leaks, and short-term actions taken and planned. Other actions to be taken will be to:

- Determine any other short-term and longer-term actions to be taken to mitigate or stop any leaks.
- Submit to EPA and MDNR, within 30 days after the original notification, results of the above actions taken and the actions planned. DOE will continue to submit this report monthly to EPA and MDNR as long as the flow rate exceeds the action leakage rate.

To make the above determinations the DOE will

- Assess the source of liquids and amounts of liquids by source.
- Conduct a fingerprint, hazardous constituent, or other analysis of the liquids in the leak detection system to identify the source of liquids, possible location of any leaks, and the hazard and mobility of the liquid.
- Assess the seriousness of any leaks in terms of potential for escaping into the environment.

DOE has considered possible events involving the disposal cell that may require response actions. A summary of event scenarios and corresponding response actions is provided in Table 2−8. If a trigger is met, DOE will notify authorities in accordance with Section 2.9, "Emergencies, Contingency Planning, and Corrective Action."

*Table 2–8. Potential Disposal Cell Event Scenarios for the Weldon Spring, Missouri, Site*

| Event Scenario | Response Action |
|---|---|
| ***Biointrusion*****,** consisting of unwanted, deep-rooted plants invading the cover, or burrowing animals that could compromise proper functioning of the rock cover, drain layer, or radon/infiltration barrier. The riprap rock cover acts as a biointrusion barrier to discourage these occurrences. If the biointrusion accelerates a breakdown of the rock cover, it may not provide sufficient protection against erosion. If the drain layer becomes clogged with plant roots, it may not function properly (drain laterally) and may cause a head buildup with a resulting greater infiltration through the radon/infiltration barrier. Full penetration of the radon/infiltration barrier could result in potential radon emissions or an overall increased infiltration rate through the cover. | Annual maintenance will include spot application of an approved herbicide to kill observed vegetation on all rock-covered surfaces of the cell and the cell perimeter road. Dead vegetation will not require removal. Burrowing animals within the cell footprint will be removed in accordance with an approved method.<br><br>If penetration of the composite liner (geomembrane) has occurred, the damage to the cover material will be evaluated. If necessary, the liner will be repaired using similar materials and construction practices, provided an assessment of the problem does not indicate a design flaw. If the radon/infiltration barrier has been fully penetrated, the barrier will be repaired.<br><br>Air monitoring for radon emissions may be used to evaluate the effect of biointrusion on the radon barrier. Monitoring stations will be established on the disposal cell and at the project boundaries. If a repair is made, air-monitoring stations will be added in the work zone. Monitoring will continue through the response action period until it is determined that the potential for radon exposure is controlled.<br><br>Monitoring frequency for leachate production rate and chemistry may be increased following discovery of the problem. |
| ***Degradation of Radon/Infiltration Barrier*** performance could result from rupture due to differential settlement caused by unexpected deterioration in the waste or cracking from drying of the medium- to high-plasticity clays. The possibility of these scenarios occurring is remote because controlled waste placement limits differential settlement, and the thick layer of rock cover materials over the radon/infiltration barrier reduces the potential for drying. Some desiccation cracking is expected in the radon/infiltration barrier in the bentonite in the geomembrane, but this should be limited to near the surface of the barrier. In addition, the ability of the clayey radon/infiltration barrier to deform plastically allows the disposal cell to accommodate some settlement beyond design- predicted values. | If settlement is observed during an inspection or indicated in evaluation of aerial topographic maps, and the observed settlement might result in ponding or degraded radon/infiltration barrier performance, a professional engineer will perform an analysis to evaluate the potential for reduced performance of the barrier with regard to radon attenuation and resistance to infiltration.<br><br>If the engineering evaluation indicates that the observed settlement has the potential to degrade performance of the radon barrier, monitoring for radon emissions will begin at the suspected areas, and leachate production rates and monitoring results will be evaluated. An evaluation of these data will determine if repair of the radon/infiltration barrier is necessary. |

*Table 2−8 (continued). Potential Disposal Cell Event Scenarios for the Weldon Spring, Missouri, Site*

| Event Scenario | Response Action |
|---|---|
| ***Erosion of the Rock-Covered Areas*** may be caused by slope failure, disruption of the riprap rock armor, or concentrated flows leading to headward cutting and gully formation. If allowed to continue, subsequent erosion of the radon/infiltration barrier may occur. | Should the area of erosion-altered riprap cover exceed 30 ft in length and 3 inches deep, and evaluation indicates a threat to containment integrity, DOE will repair the cover by replacing materials. Repairs of smaller erosional features may be deferred; however, monitoring frequency will double. The root cause of the erosion (e.g., storm, snowfall, extreme temperatures, earthquake event, human intervention) will be analyzed, and appropriate measures will be taken to mitigate the mechanism causing the erosion. |
| ***Erosion of the Site Outside the Disposal Cell*** may occur as rilling or gullying in areas constructed for sheet flow drainage. Rilling is the development of numerous, minute, closely spaced channels resulting from uneven removal of surface soil by streamlets of sufficient discharge and velocity to generate cutting power. If concentrated flows continue, rilling can progress into gullying with associated headward (upstream) cutting. Gullying can occur in areas of concentrated flow such as drainage channels. To prevent this, the final site grading minimizes any concentrated flows and promotes sheet flow. In addition, vegetation and rock armor are used to reduce surface erosion. | Should observed erosional damage threaten cell system integrity or create off-site sediment transport, a repair to the surface will be made. Repairs of smaller erosional features may be deferred; however, monitoring frequency will double. Erosion features oriented toward the disposal cell will require prompt repairs. Methods and materials used in the repair may include regrading, revegetating, erosion mats, rock armor, etc. The cause of the erosion (e.g., storm, snowfall, vegetative growth, human intervention) will be analyzed, and appropriate measures will be taken to mitigate the mechanism causing the erosion. |
| ***Rock Cover Deterioration*** may occur over time as a result of physical and chemical weathering of the limestone cobbles and boulders. Accelerated chemical weathering of the rock can occur if slightly acidic rainwater reacts with the limestone and dissolves the rock. Accelerated physical weathering can occur if the rock has abundant fractures that, after becoming saturated, are exposed to freezing conditions. This causes the water in the fractures to expand and mechanically break the rock apart. | If the percentage of degraded rock appears to increase between two consecutive inspections, DOE may initiate controlled monitoring by point count, photography, gradations, or other method. If controlled monitoring indicates that the median diameter ($D_{50}$) of the rock may be approaching the threshold levels (see below), DOE will conduct an engineering evaluation to determine if rock degradation has or is expected to reduce erosion protection to less than one half of a 24-hour probable maximum precipitation event. If the gradation for the area is still within initial specifications, the area will continue to be monitored as recommended by a professional engineer.<br><br>Degraded rock may be replaced under the following conditions:<br>• The $D_{50}$ of the cell cover rock inside the parietal line halfway between the cell apex and the slope break equals 3 inches.<br>• The $D_{50}$ of the remaining cell cover rock inside the slope break line equals 4 inches.<br>• The $D_{50}$ of the rock in the clean fill dike slopes, except the north slope, equals 4 inches.<br>• The $D_{50}$ of the rock in the north clean fill dike slope equals 6 inches.<br>• The $D_{50}$ of the toe apron rock equals 6 inches. |

*Table 2−8 (continued). Potential Disposal Cell Event Scenarios for the Weldon Spring, Missouri, Site*

| Event Scenario | Response Action |
|---|---|
| ***Abnormal Functioning of the LCRS*** may be potentially caused by the following factors:<br>• *Cover damage or reduced lateral drainage in the cover drainage layer*. Damage to the cover from biointrusion or settlement is discussed above. Reduced lateral drainage in the cover drainage layer may increase the head above the radon/infiltration barrier and result in increased infiltration through the barrier.<br>• *Clogging and reduced flow capacity in the drain piping system.* In the event of clogging of the LCRS drains, a secondary gravel drainage channel is available to prevent leachate buildup in the waste.<br>• *Increase in the permeability of the supporting liners.* Progressive failure due to deterioration of the liners is accounted for in the normal operation during the long and very long term by designing the cell to function as if no synthetic liner is present. A 3-foot-thick compacted clay liner and at least 20 ft of unsaturated low-permeability soils below the LCRS will severely limit vertical migration of any seepage resulting from failure of the LCRS and will function as a geochemical barrier. | If the leachate collection rate increases significantly in the primary system, an evaluation of the cover (including lateral drainage in the drainage layer similar to biointrusion or settlement scenarios) will be implemented. If clogging of the LCRS piping is suspected, measured steps will be taken to isolate and clean out the affected area.<br>If the action leakage rate is exceeded in the secondary system, actions will be taken in accordance with 40 CFR 264.304. These actions are discussed in Section 2.9.2.2, "Action Leakage Rate." |

## 2.10 Permit and Agreement Administration

Certain permits and agreements will be required for DOE to carry out its role as steward at the Weldon Spring Site. These instruments are summarized in Table 2−9. DOE will keep these permits current, comply with conditions of the agreements, and terminate the agreements when they are no longer needed. Other agreements that are part of a selected remedy are discussed as ICs.

*Table 2–9. Permits and Agreements for the Weldon Spring, Missouri, Site*

| Type | Party | Description |
|---|---|---|
| Approval Authority | MSD | Approval to allow hauling and discharge of the leachate and monitor well purge water to the Metropolitan St. Louis Sewer District. |
| NPDES Permit (MO-0107701) | MDNR | Allows discharge of treated leachate and well purge water as a contingency. |
| Federal Facility Agreement (CERCLA-VII-F-0057) | EPA | Enforceable agreement with EPA for completion of remedial action activities and documentation. |
| License Agreement | MDNR | Katy Trail Information Center. |
| Consent Agreement (95-HW-000) | MDNR | Site Treatment Plan for the treatment of Mixed Waste that is stored for longer than one year. |
| Access Agreement | MDNR | To allow vehicles access on the Katy Trail. |
| Monitor Well Registrations | MDNR | Required for existing monitor wells. |

MDNR = Missouri Department of Natural Resources
MSD = Metropolitan St. Louis Sewer District
NPDES = National Pollutant Discharge Elimination System

## 2.11 Budget and Funding

DOE will request adequate funds to maintain the remedies specified in the RODs for the site. DOE will be appropriated funds to conduct long-term surveillance and maintenance at the Weldon Spring Site as part of an annual Congressional appropriation.

The fundamental performance criteria for the Weldon Spring disposal facility were reliable controls on the waste, including redundant cap, bottom liner, and leachate removal systems, which were to be effective for 1,000 years, to the extent reasonably achievable, but for at least 200 years. Some component systems, such as the synthetic materials, were believed to degrade more quickly than the natural materials.

Designing for longevity of the disposal cell was accomplished be relying on redundant synthetic and natural materials. The bottom liners consist of a recompacted 3-ft-thick clay liner, underlain by at least 20 ft of extremely low permeability clay. The LCRS is composed of a double synthetic liner system, a highly transmissive synthetic drainage net, and highly transmissive sand materials. The LCRS drains by gravity through synthetic pipes to a synthetic sump, but these systems have redundant natural drainage materials surrounding them so that in the event of failure of the synthetics, the disposal cell leachate will continue to have a natural drainage flowpath out of the cell. Similarly, the cap systems integrate both synthetic liners and natural materials including compacted clay, drainage sands and gravel, and oversized riprap. Due to the long lifecycles of these natural materials, it is not necessary to include replacement costs in the annual budget estimate.

Groundwater monitoring wells are estimated to last 30 years or longer and, due to the staggered dates of installation, an annual amount for repairs and replacement of one well per year has been included in the annual budget. Whether a well requires replacement in a given year is subject to an evaluation triggered initially by its age or performance issues indicative of problems (e.g., poor recovery, high turbidity, changes in water elevations). Actual well replacement may occur in groups rather than individually for cost efficiency, but the criteria is to maintain, replace, and optimize the well network to support the long-term nature of the remedies.

Approximate total funding to implement the surveillance and maintenance program described in the LTS&M Plan is estimated in 2005 dollars (Table 2−10). Additional funds are available to complete site restoration and implement the final GWOU ROD. Costs for prairie maintenance and leachate disposal should decrease over the next 10 years. Contingency funds, if needed, will be drawn from Congressionally appropriated funds.

## 2.12 Records and Data Management

Site surveillance and maintenance records are maintained at the DOE office in Grand Junction. These records have been selected because they contain critical information needed to ensure the continued management and the follow-on actions and controls (including property management) required to protect public health and the environment and to demonstrate compliance with applicable legal requirements. This surveillance and maintenance record collection does not include information pertaining to employee or public health and safety issues with respect to former site operations. It is planned to review and revise records and data management procedures on a regular basis to make sure current procedures and technologies are employed.

*Table 2–10. Estimated Annual Funding Requirements for Long-Term Surveillance and Maintenance of the Weldon Spring, Missouri, Site—Base Year Fiscal Year 2005*

| Item | Estimated cost |
|---|---|
| Monitoring[a] | |
| Labor | $292,000 |
| Groundwater & surface water analyses | $156,900 |
| Leachate analysis | $14,900 |
| Operations and Maintenance[a] | |
| Labor | $24,000 |
| Disposal Cell | $5,000 |
| Erosion control & roads | $26,500 |
| LCRS & leachate disposal | $33,000 |
| Monitor well replacements/repairs | $101,500 |
| Annual Inspection & Meeting (includes labor) | $20,900 |
| Reporting/Administrative (includes labor) | $39,000 |
| Interpretive Center/Prairie (includes labor) | $160,500 |
| Other Participants[a] | $125,000 |
| Subtotal | $999,200 |
| 10% contingency | $99,900 |
| | $1,099,100 |
| Escalation from 2003 to 2005 @ 2.1%/yr | $46,200 |
| Total (2005 dollars) | $1,145,300 |

[a]These costs are anticipated to decline throughout the surveillance and maintenance period.
Note: LCRS = Leachate Collection and Removal System

**Access and Retrieval—**The records at the DOE office in Grand Junction are available to the site custodian as well as all stakeholders. Key site documents (e.g., closure reports, environmental assessments, fact sheets, RODs, inspections, and long-term surveillance plans) and site mapping/environmental data (e.g., boundaries, structures, and wells) are viewable on the Internet at http://www.lm.doe.gov/land/sites/mo/weldon/weldon.htm.

In addition, DOE will maintain local access at the Weldon Spring Site Interpretive Center and at the Middendorf-Kredell branch of the St. Charles City-County Library System to selected site documents.

The local surveillance and maintenance documents available at the Interpretive Center will include the following (only those documents marked with an asterisk will be maintained at the library):

- The Administrative Record (includes documents supporting site remedy selection).
- *The Administrative Record index.
- *RODs for the Chemical Plant OU, Groundwater OU, Quarry Bulk Waste OU, and Quarry Residuals OU.
- Closure reports documenting final site conditions.
- Site atlas (vicinity, topographic, and base maps).
- *The LTS&M Plan (this document).

- DOE real property records, including legal descriptions for DOE-owned property.
- Baseline and aerial photographs.
- Groundwater monitoring reports.
- *Annual reports.
- *5-Year review reports.
- Follow-up or contingency inspection preliminary assessments and reports.
- Site maintenance or repair reports.
- Corrective action plans and reports.

These documents will be available either electronically or as printed material. In either case, DOE will attempt to provide a means for users to obtain a printed copy of the information.

**Pre-Surveillance and Maintenance Record Collection**—The Regional Records Center is the federal records repository in Kansas City, Missouri, and is the designated archive facility for Weldon Spring records created during the operation and remediation of the site. To facilitate retrieval of records after site operations cease, and because the greatest repository of site knowledge will reside with the site steward, DOE will obtain copies of box and file indices and Records Transmittal and Receipt forms (SF 135) for the site. These indices and SF 135s will be retained with the surveillance and maintenance collection.

In addition, DOE will have custody of site documents residing in the federal records center and will be notified prior to the destruction of any temporary records.

**Regulatory Requirements—**Weldon Spring Site records are maintained in full compliance with DOE requirements:

- 36 CFR Parts 1220–1238, "National Archives and Records Administration"
- Title 44, *United States Code* (U.S.C.), Chapter 29, "Records Management by the Archivist of the United States and by the Administrator of General Services," Chapter 31, "Records Management by Federal Agencies," and Chapter 33, "Disposal of Records."

DOE has established a Records Disposition Schedule that provides the authority for the transfer, or disposal of records created and maintained by DOE. The complete discussion of the DOE Record Disposition System is found at the DOE Office of Chief Information Officer, http://cio.doe.gov/RBManagement/Records/records.html. The Weldon Spring Site records are subject to the DOE Programmatic Records Schedule for unique and site specific records. Utilizing the sub category of Environmental Records, the primary focus of the schedule is retention and disposition of records of those activities that may affect the physical environment. The records covered by this schedule document the results of sampling and analysis, monitoring, permitting and disposal and cleanup activities affecting the physical environment. Environmental records include, but are not limited to, the administrative record, permits, reports, studies, evaluations, characterizations, logbooks of various kinds, as well as more obvious burial or storage records, closure plans, and waste management documentation. Other issues such as, medical, health and safety concerns emanating from these activities, but not specifically required

by environmental regulations are dispositioned using the Epidemiological Records. These records are under a moratorium from ever being destroyed (found under the Records Moratoria), so that these records are available for health researchers and other pertinent activities. The technical, medical, health and safety records for the site will be maintained permanently (technical records are never to be destroyed or permanent and 75 years plus for the epidemiological records which now cannot be destroyed due to the moratoria) at the U.S. National Archives and Records Administration (NARA) facility. All records require written authorization from DOE prior to destruction by NARA.

### 2.12.1 Site Drawings and Photographs

Weldon Spring Site conditions were documented with as-built drawings and maps. Aerial photographs of the Weldon Spring Site were taken regularly. These drawings and photographs will be maintained in the permanent site record at the DOE office in Grand Junction.

### 2.12.2 Site Maps

The maps for the Chemical Plant and Quarry (Figure 2−2 and Figure 2−3) show the locations of the property boundaries, structures, roads inside and near the property boundaries, and monitor wells. Map data are maintained in a geographical information system database.

The site map data will be used to generate maps for site inspections. After each inspection, new inspection maps will be prepared that show the locations of items of interest noted during previous inspections. Each site inspection map will indicate the year of the inspection and inspection purpose.

### 2.12.3 Site Record Drawings and Maps

Site record drawings and maps represent final site conditions and configurations of the cell, structures, monitor wells, and other site features. These drawings and maps are included in the Remedial Action Reports for each OU, and will be managed in the permanent Weldon Spring Site records file at the DOE office in Grand Junction.

### 2.12.4 Site Baseline Photographs

Photographs taken during various phases of Weldon Spring Site remediation and a photographic record of final site conditions are maintained in the Weldon Spring Site permanent site file. These photographs provide a visual record to complement the as-built drawings and maps.

Initial site features will be photographed by DOE. This initial set of photographs will serve as site baseline photographs.

### 2.12.5 Site Inspection Photographs

Photographs also will be taken during subsequent site inspections to document current conditions, especially new or changed conditions, at the site. Comparison of current photographs with the baseline set of photographs will be useful to document steady or changing conditions at the site over time.

### 2.12.6 Site Aerial Photographs

Aerial photographs of the Weldon Spring Site (in black and white or color) have been taken numerous times during operation and reclamation of the site. The photographs provide a record for monitoring changing conditions (e.g., erosion, vegetation, and land use) over time and are preserved in the permanent site file.

## 2.13 Quality Assurance

Quality assurance for environmental monitoring activities at the Weldon Spring site is divided into two separate categories. The first is programmatic or overall project quality assurance, and relates to the incorporation and documentation of the quality of all site activities. This approach is discussed in Section 2.13.1. The second category is specific to the environmental monitoring activities presented in this plan and is discussed in Section 2.13.2.

### 2.13.1 Programmatic Quality Assurance

The Weldon Spring Site is obligated to comply with DOE Order 414.1A (Quality Assurance) and 10 CFR 830.120 (Quality Assurance). These requirements are documented utilizing DOE plans to ensure that work performed at facilities handling, processing, or utilizing radioactive materials is of documented quality. These requirements include: project organization, a quality assurance program, a document control system, the identification and control of items, inspections, the control of measuring and test equipment, handling, storage, and shipping of quality-affecting items, a program for implementing and verifying corrective action, a program for maintaining quality assurance records, and a routine assessment program.

### 2.13.2 Environmental Monitoring Program Quality Assurance

The quality of the environmental monitoring program is maintained and documented through a number of measures described in the following subsections. The measures include: the use of standard operating procedures; the collection, analysis, and evaluation of quality control samples and performance evaluation samples; the use of standardized analytical methods; data management activities and data quality evaluations (data validation); maintaining quality assurance records; and evaluating analytical laboratory data, sample collection activities, and programmatic procedures. Each of these items will be discussed in the following subsections.

### 2.13.3 Standard Operating Procedures

Standard operating procedures have been developed for routine activities associated with environmental monitoring at the Weldon Spring site under DOE documents. These procedures have been developed from EPA and DOE guidance and from standard industry practices. Controlled copies of procedures are maintained in accordance with the document control requirements of DOE Order 414.1A and 10 CFR 830.120.

### 2.13.4 Quality Control Samples

Numerous quality control samples are collected in support of environmental monitoring activities. Quality control samples were developed in accordance with the *Groundwater and*

*Surface Water Sampling and Analysis Plan for GJO Projects* (DOE 2002c). These include: field duplicate samples, blank samples, and equipment blank samples. Samples also are provided to the laboratory for internal laboratory quality control evaluations specific to sample media (matrix spikes, matrix spike duplicate, and matrix duplicate samples). Table 2−11 presents a summary of the various quality control samples that will be collected to support environmental monitoring activities.

*Table 2–11. Field Quality Control Sample Summary*

| QC Sample Type | Frequency | Purpose |
|---|---|---|
| Matrix Spike/Matrix Spike Duplicate or Matrix Duplicate | 1 per 20 | Assess matrix and possible intralaboratory variability |
| Field Duplicate | 1 per 20 | Assess matrix, intralaboratory, and field operations variability |
| Equipment Blank (non-dedicated equipment only) | 1 per 20 | Assess effectiveness of decontamination |
| Trip Blank | 1 pair per cooler containing VOC samples | Assess potential volatile organic compound (VOC) cross-contamination during shipping |

### 2.13.5 Analytical Methods

Standardized analytical methods, procedures, and protocols used to analyze samples collected for the environmental monitoring plan are contained in *Groundwater and Surface Water Sampling and Analysis Plan for GJO Projects* (DOE 2002c). These standardized analytical methods, procedures, and protocols will be used whenever possible, or variations will be approved prior to analysis. Variations to methods, procedures, or protocols are documented in the controlled standard operating procedures received from contracted laboratories or by revisions to the DOE standard operating procedures.

### 2.13.6 Data Management Activities and Data Quality Evaluations

Environmental data management activities performed for the Weldon Spring Site are detailed in the *Groundwater and Surface Water Sampling and Analysis Plan for GJO Projects* (DOE 2002c). The plan directs data management activities and data validation requirements. This plan and the associated data validation requirements have been adopted for the monitoring program at the Weldon Spring site. The primary activities associated with data management and data quality are field documentation, sample management, data validation, data review, and database maintenance. These programs ensure that analytical data generated by laboratories for samples collected at the Weldon Spring site are reviewed and qualified prior to release for general usage.

Data validation is the process of reviewing the sampling documentation and analytical data to ensure that adequate documentation was maintained and that results are qualified in compliance with established reporting requirements. Data generated during sampling activities and by analytical laboratories for the Weldon Spring site monitoring programs are validated.

The validation process consists of reviewing data for transcription errors, reviewing sampling documentation and chain-of-custody documentation, and comparing actual holding times to the method specified holding times. During validation, personnel determine whether the laboratory

records document the established quality control criteria for the analytical procedures were followed, quality control samples were within their respective acceptance limits, and that adequate documentation is available to support the validity of the data.

Also, during the validation process, the data are reviewed and qualified by the data reviewer for comparability with historical results and for statistical and compliance evaluations.

Upon completion of data validation, data are flagged with appropriate final data qualifiers and are then available for general use. All databases containing final validated data are backed up regularly. To maintain the integrity of the computer files, access to edit the database is extensively restricted.

### 2.13.7 Quality Assurance Records

Records generated as a result of environmental monitoring are maintained as quality assurance records. Field sampling forms, analytical data, equipment calibration records, and validation documentation records are all considered quality assurance records and are maintained in accordance with the requirements of DOE procedures.

## 2.14 Health and Safety

Health and safety procedures for long-term surveillance and maintenance activities are consistent with DOE orders, regulations, codes, and standards. Long-term surveillance and maintenance activities at the Weldon Spring Site are conducted in accordance with the *Weldon Spring Site Project Safety Plan* (DOE 2004a). Weldon Spring Site contractors and subcontractors must read the plan and sign a Statement of Understanding for the program files.

Immediate health and safety concerns are listed in the Weldon Spring Site Project Safety Plan. Before performing long-term surveillance and maintenance activities, DOE Contractor staff will conduct a site safety briefing, after which attendees must sign an attendance roster.

# 3.0 Institutional Controls Implementation Plan for the Weldon Spring Site

This section summarizes information related to the evaluation and implementation of institutional controls (ICs) that meet use restrictions described in the Explanation of Significant Differences (ESD) issued in February 2005 (DOE 2005b). The procedures for maintaining and performing periodic inspections for ICs are described also. The ESD clarified use restrictions necessary for the remedial actions specified in the Chemical Plant Operable Unit (CPOU), Chemical Plant area Groundwater OU (GWOU), and the Quarry Residuals Operable Unit (QROU) Records of Decision (RODs) to remain protective over the long-term.

Current site conditions (reflecting post-remedial action conditions) for the Chemical Plant and Quarry areas and the risk-basis for why use restrictions are needed are discussed in Section 3.1. The objectives of, or performance expectations for, the use restrictions are summarized in Section 3.2. The process by which IC mechanisms that meet the objectives discussed in Section 3.2 are identified, evaluated, selected, and implemented is described in Section 3.3. The current expectation regarding the timeframe for completing the implementation of ICs is discussed in Section 3.4. Finally, Section 3.5 presents the procedures for maintaining the ICs and for conducting periodic inspections. Actual agreements or documentation of ICs that are in place to date are reproduced in Appendix E.

## 3.1 Current Site Conditions and Risk-Basis for Use Restrictions

The discussion in this section is presented by the two primary site areas: the Chemical Plant area and the Quarry area; with the information from the two OUs (CPOU and GWOU) for the Chemical Plant area presented first. The discussion for the Southeast Drainage is included with that for the CPOU.

### 3.1.1 Chemical Plant Area

Remedial action for the Chemical Plant soils and structures was addressed in the CPOU; removal of contaminated soils and sediments at the Southeast Drainage was addressed via an Emergency Evaluation/Cost Analysis (EE/CA) as part of the CPOU. Chemical Plant area (including Southeast Drainage) groundwater and springs was addressed in the Chemical Plant area GWOU.

#### *3.1.1.1 Chemical Plant OU*

The contaminated soil and other wastes generated from the CPOU cleanup are now permanently disposed of at an engineered disposal cell constructed at the Chemical Plant. Wastes generated from cleanup of the Quarry area have been disposed of in the disposal cell also. At the time of its closure, the cell contained approximately 1.13 million cubic meters ($m^3$) (1.48 million cubic yards [$yd^3$]) of waste.

The CPOU ROD specified that “perpetual care be taken of the committed land within the disposal cell footprint because waste would retain its toxicity for thousands of years.” It stipulated that the cell cover be inspected and that the groundwater be monitored.

The CPOU ROD also specifies that "following completion of the site cleanup activities, an assessment of the residual risks based on actual site conditions will be performed to determine the need for any future land use restrictions. This assessment would consider the presence of the on-site disposal cell, the buffer zone, the adjacent U.S. Department of the Army (Army) site, and any other relevant factors necessary to ensure that appropriate measures are taken to protect human health and the environment for the long term."

It was decided at the time of the CPOU ROD that the final decision regarding land use for the Chemical Plant outside of the disposal cell and its buffer area should be determined after post-cleanup information was evaluated. Hence, the ROD specified that a post-remediation risk assessment would be performed following cleanup to determine the need for any future land use restrictions. Soil cleanup goals were established in the CPOU ROD that were intended to be as low as reasonably achievable given the design limitations pertaining to safe field excavation techniques and field survey capabilities. Recreational use was considered to be the reasonably anticipated future land use. A standard conservative recreational visitor scenario as defined in the CPOU Baseline Risk Assessment was considered to be representative of recreational use. The exposure assumptions used were consistent with those recommended for a recreational scenario in EPA Risk Assessment Guidance for Superfund (RAGS). Risk calculations based on the soil cleanup goals showed cumulative risk to the recreational visitor was within the acceptable risk range. Recognizing that the actual post cleanup conditions might be different than what was anticipated by the cleanup goals, the ROD specified that a post-remediation risk assessment would be performed following cleanup and that a final decision on the need for any future land use restrictions would be based on the actual residual condition.

The soil excavations were conservatively designed to remove contamination to depth to achieve the established cleanup goals or better. The post-remediation risk assessment used post cleanup confirmation data to evaluate the cumulative risk posed by exposure to soils from all contaminants. The assessment is believed to overestimate risks because it did not take into consideration the backfilling and reworking of the soils following excavation. The assessment confirmed that the potential risks to recreational visitors are within the acceptable risk range.

The post-remediation risk assessment also evaluated the risk to a suburban resident. A standard conservative suburban residential scenario as defined in the CPOU Baseline Risk Assessment was used. Following recommendations in EPA guidance (RAGS, Exposure Factors Handbook), the exposure assumptions (e.g., contact rate, exposure frequency and duration variables) used as input to this estimate were based on statistical data representing the $95^{th}$ or, if not available, the $90^{th}$ percentile value for these variables. This approach provides risk estimates for reasonable maximum exposure to a resident receptor. The calculated risk to the suburban resident was generally greater than $1 \times 10^{-4}$ but less than $1 \times 10^{-3}$ and therefore slightly exceeds the acceptable risk range. However, the risk to the suburban resident from exposure to naturally occurring background concentrations of radionuclides in soils is $5.3 \times 10^{-4}$ or essentially the same risk posed by residual concentrations in the remediated areas. In other words, there is no significant incremental increase in risk from exposure to the remediated areas for a suburban resident. For purposes of this site and this ESD, the standard conservative suburban residential scenario is considered representative of unlimited use and unrestricted exposure (UUUE), the EPA policy threshold for determining whether ICs are appropriate.

These calculated risks are cumulative of all contaminants; however, the risks are primarily due to the radionuclides associated with the uranium ores. The CPOU ROD considered the standards for residual radium-226 found in 40 CFR 192, Subpart B to be relevant and appropriate (RAR) to the cleanup of these radionuclides. The ROD was issued in 1993 prior to the issuance of EPA Directive 9200.4-25, Use of Soil Cleanup Criteria 40 CFR 192 as Remediation Goals for CERCLA Sites. A review of the expectations set forth by EPA in this guidance confirms 1) these standards would still be considered RAR were the decision to be made today, i.e., the contamination and its distribution was consistent with the outlined expectations; and 2) the actual residual concentrations for radium and thorium combined are much less than the concentrations identified in the guidance as meeting the health-based standard.

For the above reasons, DOE concludes that there is no need to restrict land use in the Chemical Plant area on the basis of exposure to soils. This assessment applies to land use only. The groundwater pathway and the appropriate use restrictions for groundwater are addressed in Section 3.1.1.2, "Chemical Plant Area Groundwater OU". This assessment does not apply to the soils and sediments in the Southeast Drainage, which are addressed below.

Although there is no reason to restrict land use in the Chemical Plant area to prevent exposure to soils, it is necessary to restrict land use in the buffer area to protect the long-term effectiveness of the remedy. Missouri Regulation 10 CSR 25-7.264(2)(N)2.D providing for a 300-ft buffer zone between the property line and the actual landfill was identified as relevant and appropriate in the CPOU ROD. This is the basis for the 300-ft buffer zone around the disposal cell. The buffer is intended to provide an area which would only be used for monitoring and maintenance activities. It also provides an area of erosion protection for the cell. Use restrictions are needed to ensure that the buffer zone remains effective for these purposes.

The EE/CA and decision document for the Southeast Drainage specified removal of radioactively contaminated soil and sediment from accessible areas of the drainage, with the removed soil and sediment to be transported to the Chemical Plant for temporary storage and ultimate disposal in the disposal cell. The removal action was completed in 1999.

The Southeast Drainage is narrow and wooded with limited access and one of the objectives of this cleanup was to limit ecological damage to the drainage. It was determined that the soil cleanup goals developed for the CPOU described above were not appropriate for cleanup of this area and risk-based cleanup goals were developed for the drainage that were designed to be protective for recreational use and for a modified residential scenario involving a child living near the drainage and using it periodically for play activities. Post-cleanup soil and sediment sampling was conducted, and a post-cleanup risk assessment was performed to confirm that the drainage is protective for these uses and therefore protective for any reasonably anticipated land use. However, residual soil and sediment contamination remains in some locations within the drainage at levels exceeding those that would support UUUE as represented in this case by a standard conservative suburban residential exposure scenario described above. Therefore, land use restrictions are needed in the drainage to prevent residential use or other uses inconsistent with recreational use. The Southeast Drainage is located on property owned by state entities.

The length of time it may take soils and sediments to attenuate to levels that support UUUE can not be accurately estimated, and was not anticipated as an eventuality in the removal action. Also, there are no effective means to monitor or verify attenuation of the soils and sediments at

this time. Therefore, land use restrictions will need to remain in place for the long term. The width for the restricted area for the Southeast Drainage was estimated to be 200 ft. The width of the restricted area is based on the average width of the drainage used in the modified residential scenario and represents a practical boundary outside which a future resident would not routinely access the drainage.

#### *3.1.1.2 Chemical Plant Area Groundwater OU*

The selected remedy in the GWOU Final ROD is monitored natural attenuation of the contaminants of concern (COCs) with ICs to limit the use of groundwater and spring water as a drinking water source during the period of remediation (or attenuation). This ROD also stipulates that ICs "be implemented to restrict use of contaminated groundwater and spring water to prevent human-induced impacts on groundwater flow."

The reasonably expected future land use at the Chemical Plant area is recreational use, which would not make use of groundwater. Also, low groundwater yields and the availability of a municipal drinking water source reduce the likelihood of groundwater being used for residential purposes. Nevertheless, the potential future risk from residential use of the water was evaluated. This evaluation included an assessment of the risk from ingesting the groundwater at quantities typical for a resident scenario. The assessment indicated unacceptable cancer and noncancer risks for a resident from ingesting the contaminated groundwater. Hence, use restrictions need to be specified that will ensure that groundwater is not used as a residential drinking water source until cleanup standards for groundwater are met. The cleanup standards are set at levels that allow for UUUE. The use restrictions should also apply to the contaminated springs identified on Figure 3−1 as SP-6301, SP-6303, SP-5303, and SP-5304. It is estimated that it would take approximately 100 years for contaminants in groundwater and spring water to naturally attenuate to the cleanup standards.

The buffer area necessary to prevent hydraulic impacts to the area of contamination was defined as extending 1,000 ft from the outer edge of where contaminated groundwater exceeds cleanup standards. The size of the buffer area was conservatively determined by considering the area that would be covered by the hydraulic capture of a well installed in the most transmissive location at the site (the location where the highest water yield could be obtained). The Chemical Plant area affected by the groundwater contamination is on property under the jurisdictional control of DOE and the Army and on property owned by state entities.

### 3.1.2 Quarry Area

The 1998 QROU ROD was intended to address the residual contamination remaining at the Quarry Area following removal of the waste material from the Quarry proper. The bulk waste was removed and transported to the Chemical Plant area for permanent disposal in the onsite disposal cell under the 1990 Quarry Bulk Waste Operable Unit ROD.

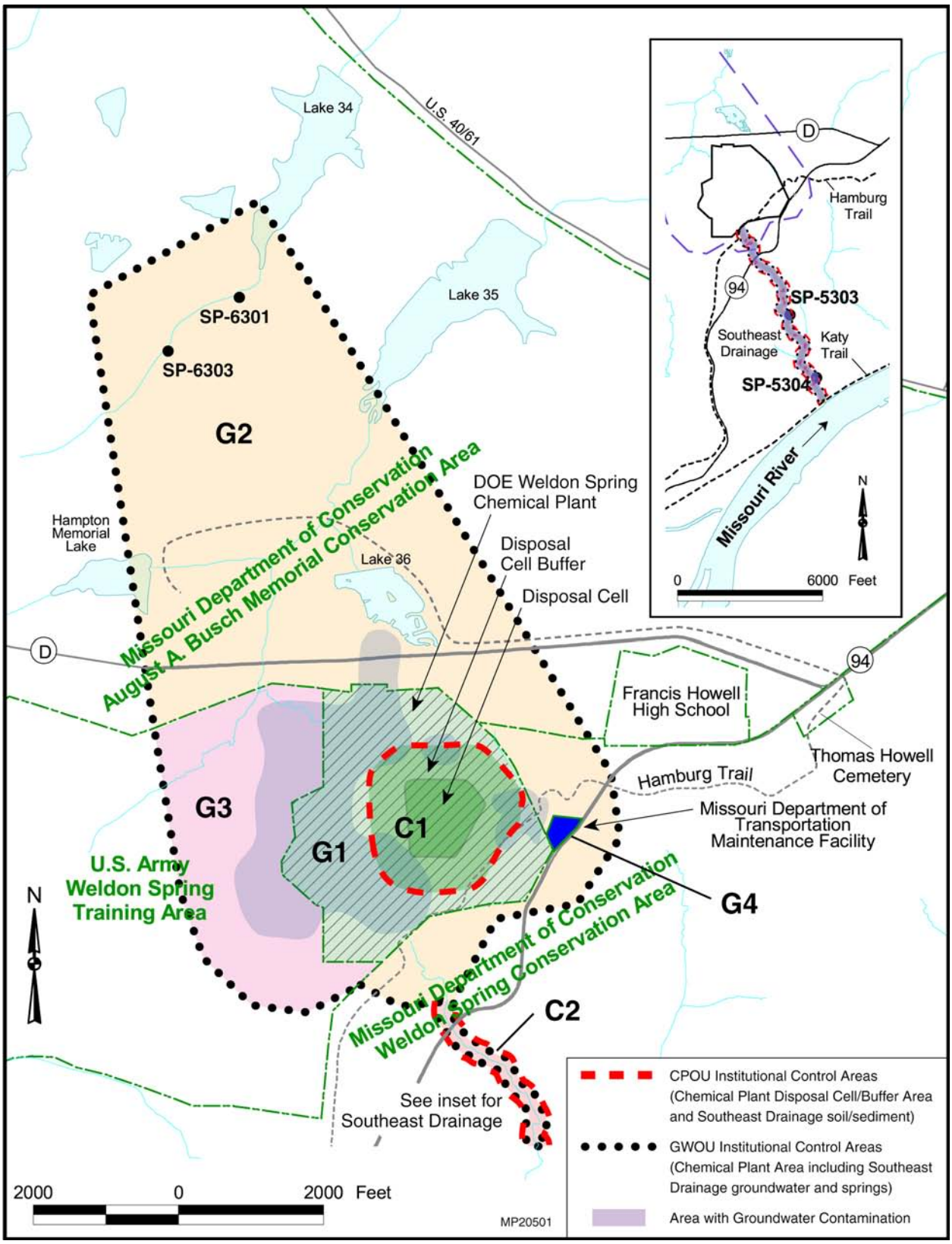


*Figure 3–1. Institutional Control Areas for the Chemical Plant and Groundwater Operable Units*

### *3.1.2.1 Quarry Residuals OU*

The primary residual concern is the uranium contaminated groundwater beneath the Quarry and its immediate surrounding area north of the Femme Osage Slough. The conditions at the quarry area were determined to be protective for its current and reasonably anticipated future land use (recreational) because exposure to contaminated groundwater is not a concern for these uses. The ROD determined that "ICs will be necessary to prevent uses inconsistent with recreational use, or uses that would adversely affect contaminant migration." A long-term groundwater monitoring network was implemented.

Residual soil contamination in the Quarry Area was remediated to the cleanup goals established by the CPOU ROD described above, except for some inaccessible soils that remain in the cracks and fissures of the Quarry walls and floor. As part of the Quarry restoration, the cracks and fissures were grouted and the Quarry was backfilled with clean borrow soil to an elevation at or above where the waste material had been present. The area is now fully vegetated. Under these conditions, DOE could not identify a plausible exposure scenario which would result in an unacceptable risk. The main purpose for backfilling the Quarry was to address physical safety concerns (e.g., to minimize the risk of someone falling into an open pit), stabilize the north and south highwalls, and to minimize infiltration to groundwater through the Quarry cracks and fissures. To sustain these conditions the backfill material must remain in place over the long term with a surface grade that promotes surface runoff. Therefore, DOE will monitor the quarry fill and restrict activities that could result in the removal of the fill (e.g., use as a borrow source).

The contaminated groundwater in the Quarry area is confined to the shallow system beneath the quarry and the marginal alluvium north of the slough (Figure 3−2). The impacted groundwater system was determined not to be a potential source of drinking water because of insufficient yields; however, uranium concentrations exceed the drinking water standard and the system is located adjacent to the Missouri River Alluvial aquifer which is currently used as a drinking water source. A 2-year study was conducted to investigate the potential effectiveness of installing a groundwater removal and treatment system. This study confirmed the validity of model projections reported in the feasibility study, which had indicated that a groundwater removal and treatment system would not be effective in significantly reducing uranium mass or concentrations in the Quarry Area groundwater.

Uranium concentrations in the groundwater in the marginal alluvium north of the slough decrease rapidly in the direction of the slough and uranium concentrations south of the slough are consistent with background. This indicates the geochemical conditions in this zone north of the slough are favorable for reducing the amount of dissolved uranium in groundwater. Geochemical investigations were performed confirming that processes, including sorption to the soil matrix and precipitation, are acting to reduce uranium and limit uranium migration south of the slough. This area is referred to as the reduction zone. Natural processes in the reduction zone should continue to mitigate migration of uranium toward the well field over the long term. This zone is approximately 4.7 acres in size and is shown in Figure 3.2. Drilling, digging, or other construction activities that result in the large-scale removal or exposure of soils in the reduction zone should be restricted so that the natural characteristics, (e.g., oxidation potential) are not changed. The geochemical investigation established that this reduction zone begins at a depth of approximately 5 ft.

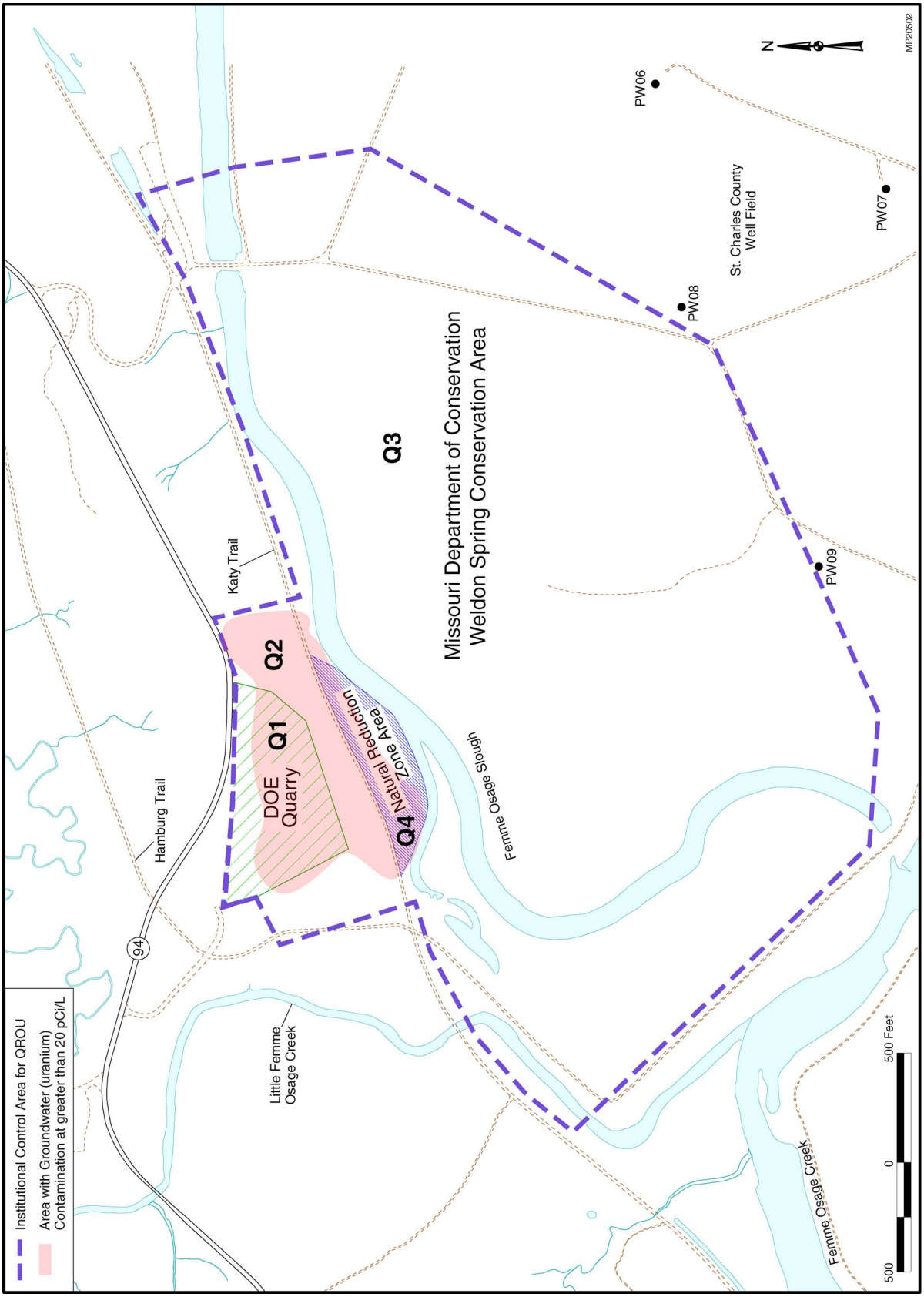


*Figure 3–2. Institutional Control Areas for the Quarry Residuals Operable Unit*

Installation of pumping wells in the proximity of the contaminated area should be restricted to limit the potential for contaminant migration to be artificially induced or increased. The 220-acre IC boundary shown in Figure 3−2 is expected to provide a sufficient hydraulic buffer. The size of the area was determined based on the estimated maximum hydraulic capture zone of a pumping well. With the exception of the 9-acre Quarry, which is under DOE jurisdictional control, the remainder of the restricted area (i.e., 211 acres) is owned by state entities. The time frame for groundwater north of the slough to reach levels that no longer pose a concern for the adjacent alluvial aquifer is expected to be greater than 100 years considering the hydrogeologic characteristics present in this location. It was estimated in the remedial design phase that a uranium concentration of 300 pCi/L or lower in groundwater north of the slough would not cause levels south of the slough to exceed the drinking water standard, on the basis of conservative assumptions postulating the migration of the contaminated groundwater. The evaluation indicated that recharge to the impacted area (quarry area north of the slough) accounts for less than 1 percent of the total flow to the St. Charles County well field (i.e., at 300 pCi/L, it is expected that no more than 3 pCi/L would be contributed to the well field if it is conservatively assumed that all attenuation mechanisms failed, including the attenuation from the reduction zone discussed above).

## 3.2 Objectives of or Performance Expectations for the Use Restrictions

The ESD (DOE 2005b) prepared for the Weldon Spring site presents use restrictions for specific areas. These use restrictions or ICs objectives (as listed in Section 3.2.1, Section 3.2.2, and Table 3−1 below) will be implemented through this LTS&M Plan. The specific IC strategy will be designed to maintain the long-term effectiveness of agreements, contracts, covenants, easements, deed records, maintenance, monitoring, and inspection plans, and any other instrument that may be executed to achieve these ICs objectives, even if DOE transfers ownership or control of the property to another entity.

### 3.2.1 Chemical Plant Area

#### *3.2.1.1 Chemical Plant OU*

**Disposal Cell and Buffer Area:** The use restrictions listed below must be met throughout the disposal cell area, including its surrounding 300-ft buffer zone as identified in Figure 3−1. This area is under federal DOE jurisdictional control. The use restrictions listed below shall be maintained in perpetuity due to the extremely long-lived nature of the radioactive constituents within the disposal cell. Use restrictions will therefore remain in place for as long as contaminant concentrations contained within the disposal cell do not allow for UUUE. The objectives of the controls or restrictions are as follows:

1. Prevent activities on the disposal cell, such as the use of recreational vehicles that could compromise the integrity of the cell cover (e.g., result in the removal or disturbance of the riprap).

2. Prevent activities in the buffer zone such as drilling, boring, or digging, that could disturb the vegetation, disrupt the grading pattern, or cause erosion.

3. Retain access to the buffer area for continued maintenance, monitoring, and routine inspections of the cell and buffer area.

4. Prevent construction of any type of residential dwelling or facility for human occupancy on the disposal cell and buffer area, other than facilities to be occupied for activities associated with performing environmental investigation and/or restoration and expansion of the existing Interpretive Center.

5. Maintain the integrity of any current or future remedies or monitoring systems.

**Southeast Drainage Soil or Sediment:** The use restrictions listed below must be met at the approximately 37-acre area shown in Figure 3−1 covering the 200-ft corridor along the length of the Southeast Drainage. The restricted area is located on property that is owned by state entities. These restrictions will need to be maintained until the remaining hazardous substances are at levels allowing for UUUE, which is anticipated to be a period of decades or longer.

1. Prevent the development and use of the Southeast Drainage property for residential housing, schools, child care facilities and playgrounds.

#### *3.2.1.2 Groundwater OU*

**Chemical Plant Area Groundwater and Springs:** The use restrictions listed below must be met in the entire area of approximately 1,100 acres shown on Figure 3−1 where groundwater use needs to be restricted until concentrations of the COCs meet drinking water or risk-based standards that allow for UUUE. The period of time necessary for contaminants to attenuate to these levels has been estimated at approximately 100 years. The size of the restricted area includes a 1,000-ft buffer area that accounts for the groundwater gradient and flow conditions at the site. The restricted area includes properties under Federal jurisdictional control (DOE and the Army) as well as properties owned by state entities. The objectives of the controls or restrictions are as follows:

1. Prevent the use of the contaminated shallow groundwater and springwater for drinking water purposes. The contaminated shallow groundwater occurs in the weathered and unweathered portions of the upper limestone unit (Burlington-Keokuk). The contaminated groundwater and springwater system occurs within the limits of the hydraulic buffer zone identified on Figure 3−1. The springs are identified on the figure as SP−6301, SP−6303, SP−5303, and SP−5304. This restriction will need to be maintained over a period of decades or longer.

2. Limit the use of all groundwater within the outlined restricted area to investigative monitoring only. The boundary of the restricted area extends beyond the area of contamination and is intended to provide a buffer against potential hydraulic influences on the area of contamination by preventing such things as pumping wells being located in the proximity of the contaminated area. This restriction includes the shallow groundwater system and also extends vertically to all groundwater systems that underlie the contaminated groundwater. This restriction will need to be maintained over a period of decades or longer.

3. Retain access to the area for continued monitoring and maintenance of groundwater wells and springs.

4. Maintain the integrity of any current or future remedies or monitoring systems.

### 3.2.2 Quarry Area

The use restrictions listed below must be met at the specific areas shown in Figure 3−2. The use restrictions must be maintained until the remaining hazardous substances are at levels allowing for UUUE.

1. Prevent the development and use of the Quarry for residential housing, schools, child care facilities and playgrounds. Prevent drilling, boring, digging, or other activities in the quarry proper that disturb the vegetation, disrupt the grade, expose the Quarry walls, or cause erosion of the clean fill that was used to restore the Quarry. This restriction should be maintained for the long-term. The 9-acre Quarry is under DOE jurisdictional control.

2. Prevent the use of the contaminated shallow groundwater for drinking water purposes. The contaminated shallow groundwater underlies the Quarry and extends to the marginal alluvium north of the slough as indicated on Figure 3−2. This restriction will need to be maintained over a period of decades or longer.

3. Limit the use of all groundwater within the outlined restricted area shown on Figure 3.2 to investigative monitoring only. The boundary of the restricted area extends beyond the area of contamination and is intended to provide a buffer against potential hydraulic influences on the area of contamination by preventing such things as pumping wells being located in the proximity of the contaminated area. This restriction includes the shallow groundwater system and also extends vertically to all groundwater systems that underlie the contaminated groundwater. This restriction will need to be maintained over a period of decades or longer, until uranium concentrations in Quarry groundwater north of the slough are at 300 pCi/L or lower. With the exception of the 9-acre Quarry, this restricted area is owned by state entities. This area covers approximately 220 acres.

4. Prevent drilling, boring, digging, construction, earth moving or other activities in the location identified as the Natural Reduction Zone Area that could result in disturbing the soils at this location or exposing subsurface soils (i.e., soils deeper than [about] 5 ft below the surface). The soil in this area at a depth of 5 ft or greater contains geochemical properties that allow reduction processes to naturally occur, resulting in the precipitation of uranium from Quarry groundwater north of the Femme Osage Slough and thereby minimizing uranium migration to the well field. The restrictions must be maintained over a period of decades or longer, until uranium concentrations in Quarry groundwater north of the slough are 300 pCi/L or lower. This area is located on property owned by a state entity and is approximately 4.7 acres in size.

5. Retain access to the area for continued monitoring and maintenance of groundwater wells.

6. Maintain the integrity of any current or future remedies or monitoring systems.

*Table 3–1. Properties Requiring Institutional Controls At The Weldon Spring Site*

| Property | Figure No. and Key[a] | Pertinent OU | Property Owner | Approx. Acreage | Existing ROWs |
|---|---|---|---|---|---|
| Chemical Plant disposal cell and buffer area | 3−1, C1 | CPOU | DOE | 90 | None |
| Southeast Drainage (200-ft corridor along the entire drainage) | 3−1, C2 | CPOU | MDC, MDNR-Parks | 37 | Explorer Pipeline, Union Electric, Missouri American Water Co., MoDOT State Route 94 |
| Chemical Plant groundwater | 3−1, G1 | GWOU | DOE | 219 | St. Charles County Water Department, Union Electric, Missouri American Water Co., Southwestern Bell Telephone, Explorer Pipeline, Public Water District No. 2, MoDOT State Route 94. |
| August A. Busch Memorial Conservation Area and Weldon Spring Conservation Area groundwater and springs (i.e., SP-6301, SP-6303, SP-5303, SP-5304) | 3−1, G2 | GWOU | MDC | 734 | Explorer Pipeline, Union Electric, Southwestern Bell Telephone, Public Water District No. 2, MoDOT State Route 94 and Highway D |
| Weldon Spring Training Area groundwater | 3−1, G3 | GWOU | U.S. Army | 183 | St. Charles County Water Department, Public Water District No. 2; Union Electric, Southwestern Bell Telephone |
| Highway Maintenance Facility groundwater | 3−1, G4 | GWOU | MoDOT | 4.3 | Union Electric, Missouri American Water Co. |
| Quarry soil | 3−2, Q1 | QROU | DOE | 9 | MoDOT State Route 94 |
| Quarry area groundwater north and south of Femme Osage Slough | 3−2, Q2 and Q3 | QROU | DOE, MDC, MDNR-Parks | 220 (includes quarry and pea-pod area) | Explorer Pipeline, St. Charles County Water Department |
| Peapod-shaped soil area south of the Katy Trail and north of Slough | 3−2, Q4 | QROU | MDC | 4.7 | None |

[a]The figure key is intended to facilitate identification of the properties discussed in this section. The first letter designates whether the area is being restricted as part of the CPOU (designated as C), the QROU (designated as Q), or the GWOU (designated as G). Numbers have been assigned to each of the various parcels of property within the boundaries of the restricted area for each of the operable units.

## 3.3 Process for Evaluating and Implementing Institutional Control Mechanisms

DOE is continuing the process of identifying additional appropriate IC mechanisms to implement at various site areas for which use restrictions have been identified. These areas are either under federal or state ownership which constitute IC mechanisms for these properties so long as the owners continue to recognize and abide by the use restrictions. No privately owned property is affected by the use restrictions. Some IC mechanisms have already been implemented (see Section 3.4). Multiple layers of ICs would be implemented, if beneficial, to provide as much durability as possible for meeting the objectives of the use restrictions. DOE is responsible for implementing, maintaining, reporting on, and enforcing the ICs. In the event DOE transfers these procedural responsibilities to another party by contract, property transfer agreement, or through other means, DOE shall retain ultimate responsibility for remedy integrity.

The following steps describe the process by which DOE identifies, evaluates, selects, and implements the appropriate IC mechanism(s) that require establishing realty or interagency instruments with property owners (other types of ICs would not require all of these steps):

1. Obtain Legal Descriptions and survey the affected properties;

2. Conduct a title search for the affected properties;

3. Identify applicable IC mechanisms for Federally-owned and State-owned affected properties by considering the four categories recommended by EPA;

4. Evaluate the mechanisms against EPA recommended criteria (focusing on the implementability and long-term effectiveness criteria) to select the most enforceable and durable mechanisms that are allowable under state of Missouri law and that are acceptable to the DOE, EPA, MDNR and the various state property owners;

5. Summarize the results of the evaluation (performed in steps 3 and 4) to support the selection of mechanisms for implementation;

6. Obtain preliminary title commitment;

7. Conduct an appraisal for the affected properties;

8. Evaluate and, if needed, seek budget and/or congressional authorization to acquire realty interest;

9. For State-owned affected properties, negotiate with the various state entity to reach consensus on the specific IC mechanism(s) that would be acceptable for implementation; this would be done in consultation with the EPA and the MDNR;

10. Obtain title insurance on State-owned affected properties;

11. Prepare final IC realty instruments for State-owned affected properties and associated documentation for implementation including warranty deeds from state property owners;

12. For properties that are under Army jurisdictional control, negotiate an appropriate restrictive agreement, in consultation with EPA and MDNR;

13. For the properties under DOE jurisdictional control (Chemical Plant and Quarry), select an appropriate IC mechanism, in consultation with the EPA and MDNR;

14. Record these instruments, mechanisms and agreements, or summaries of them, with the St. Charles County Recorder; and

15. Provide public notice of IC implementation through the LTS&M Plan revision process. Incorporate maintenance and inspection requirements from the agreements into the long-term surveillance, maintenance, and inspection activities.

### 3.3.1 Obtain Legal Descriptions and Survey for Affected properties

The affected properties identified for use restrictions were surveyed with legal descriptions obtained as presented in Appendix D of this report.

### 3.3.2 Title Search

DOE conducted a title search (Investors Title Search Company 2004) to identify "less than fee simple" owners within the wider area originally comprising the Weldon Spring Ordnance Works to investigate real property interests, easements or rights-of-way (ROWs) in these areas.

### 3.3.3 Identification of Applicable Institutional Control Mechanisms

For this step of the process, DOE identified applicable IC mechanisms for the affected properties consistent with the following four categories recommended by EPA guidance (EPA 2000).

- Proprietary controls—such as easements and covenants are based in real property law and generally create legal property interests;
- Governmental controls—are generally implemented and enforced by state or local governments and can include zoning restrictions, building permits, ordinances, or similar mechanisms that restrict land or resource use;
- Enforcement and permit tools with ICs components—CERCLA Unilateral Administrative Orders and Administrative Orders on Consent can be used to restrict site activities as can RCRA permits and orders; and
- Informational devices—such as state registries, deed notices, and advisories provide information that a site contains residual or capped contamination.

The general applicability, effectiveness, and implementability of various mechanisms were considered in the screening that was conducted to identify mechanisms that merit further evaluation. In the process of screening, consideration was given to whether the mechanisms were

applicable to Federal or state owned properties. The mechanisms that were considered applicable for federal properties include the following:

- Governmental Controls:
  - Federal Ownership
  - Missouri Well Drilling Regulations (10 CSR 23)
- Proprietary Controls:
  - Real estate use license/permit
  - Easement
  - Memorandum of Understanding (MOU)
- Enforcement Tools:
  - Administrative order
  - Federal facility agreement
  - Post-closure federal facility agreement
  - Consent decree
- Informational Devices:
  - Deed notice (Notation on federal ownership record)
  - Interpretive Center (and prairie, native plant garden, ramp, and platform with plaques)
  - Historical markers along hike and bike trail

The mechanisms considered applicable to state-owned properties include the following:

- Governmental Controls:
  - State ownership
  - Groundwater use restriction
  - Missouri Well Drilling Regulations (10 CSR 23)
- Proprietary Controls:
  - Easement
  - Covenant
  - State use restriction
  - Conservation easement
  - Real estate use license/permit
  - MOU
- Enforcement Tools:
  - Administrative Order
  - Consent decree
- Informational Devices:
  - Historical Markers along hike and bike trail

### 3.3.4 Evaluation of IC Mechanisms Using EPA Criteria

IC mechanisms identified are evaluated using a similar approach to that used for evaluating remedial action alternatives in identifying the remedial actions already completed for the site (i.e., using National Contingency Plan recommended criteria). The evaluation for IC mechanisms focuses on the implementability and long-term effectiveness of the mechanisms.

Preliminary results of DOE's evaluation indicate that federal ownership (by DOE) of the Chemical Plant and Quarry provides an effective form of IC whereby the needed use restrictions are imposed through the notation on ownership record filed with the St. Charles County Recorders Office that provides notification about the use restrictions. The operation of the interpretive center, placement of historical markers and the disposal cell platform with plaques provide additional IC layers. Discussions with the various state entities (property owners) are ongoing to establish the additional realty mechanisms that could be implemented on state-owned properties. Similar discussions are being held with the Army.

Access agreements to operate, maintain and replace groundwater wells are currently in place, but could be made more durable by incorporation into longer term realty instruments.

### 3.3.5 Preferred IC Mechanisms Based on Evaluation Results

DOE and EPA are in the process of each completing a brief report to summarize findings of evaluations that each conducted to determine the IC mechanisms that would be applicable and appropriate for implementation at the Weldon Spring site. IC options identified in these reports could then be used as a starting point for discussion with the various state entities that are the property owners and with the Army. The summaries are targeted for completion in April 2005.

### 3.3.6 Obtain Preliminary Title Commitment

A follow-on title search was conducted (Investors Title Search Company March 2005) to provide sufficient ownership information to proceed with negotiations. The information obtained from these title searches are summarized in Table 3−1. Most, if not all, of the "less than fee simple" ownership in the properties identified for use restrictions are expected to be unaffected by the restriction (e.g., utility rights-of-way will not be impaired by the implementation of DOE use restrictions).

### 3.3.7 Appraisals

Appraisals also are being conducted to determine the fair market value of the real property interest to be acquired. The appraisals would reflect the extent to which the properties are devalued as a result of the restrictions to be imposed. This appraisal is not dependent on the type of IC mechanism or instrument to be implemented and can therefore be conducted before specific instruments are identified for implementation. These appraisals are being conducted and are targeted for completion by June 2005.

### 3.3.8 Seek Budget and/or Congressional Authorization

Part of the process for establishing ICs would be to seek budget and congressional authorization to acquire the necessary realty interest. However, for the Weldon Spring site, budget authorization for establishing ICs is part of the authorization for the remedial action under CERCLA. In addition, congressional authorization is not needed for less than "fee simple" acquisitions, which should be the case for the Weldon Spring site.

### 3.3.9 Negotiate With Various State Property Owners to Select the Appropriate IC Mechanisms for Implementation

DOE will continue to meet with the various state property owners in identifying the appropriate IC mechanisms that meet their expectations for implementation at their respective properties. The discussions will take into consideration issues pertaining to enforceability, implementability, long-term effectiveness and durability. These discussions will be conducted in consultation with EPA and the MDNR.

In addition, the various state entities could consider obtaining an appraisal and title insurance from another source independent of that obtained by DOE. This would be appropriate as a means of providing additional information to facilitate the discussions and for decision-making.

### 3.3.10 Title Insurance

At the closure to the negotiations discussed in Section 3.3.9, a "Title Insurance Policy" will be obtained through an independent provider. This title insurance serves the purpose of providing a guarantee that due diligence has been done in identifying the property owner(s) and that all parties that may have ROW or other rights to the property have been identified. This will ensure that agreements are being established with the appropriate parties. Parties with ROW will be required to enter into real estate agreements only if their current ROW activities need to be restricted in order to maintain the protectiveness of the remedies. The state entities would issue warranty deeds to complete this part of the process.

### 3.3.11 Preparation of Real Estate Agreements for Implementation at State-Owned Properties

Real estate agreements would be prepared for each of the state-owned properties by DOE's real property and legal support in consultation with the property owners, EPA, and MDNR. The time needed to complete the preparation of agreements would depend on the review cycles required by the property owners and for EPA and MDNR. Completion of the remaining steps is being targeted for the next 6 to 12 months.

### 3.3.12 ICs for the Army Property

For the portion of the Army Training area (shown as G3 in Figure 3−1) where use restrictions have also been identified as part of DOE's GWOU remedy, an existing MOU is currently in effect that commits the Army to support the remedial actions implemented by DOE, which includes groundwater use restrictions and access to groundwater monitoring wells. It is expected that this MOU can be modified if necessary to specify the use restrictions identified in Section 3.2. Further discussions will be held with the Army to finalize these expectations or identify another mechanism, as appropriate.

The Army also would be pursuing appropriate IC mechanisms as part of the CERCLA groundwater remedy they have implemented for their area. It is possible that some overlap may occur between the Army's and DOE's implementation of use restrictions in the Army area.

### 3.3.13 ICs for DOE Properties

For the Chemical Plant and Quarry properties, DOE enforces the use restrictions identified in Section 3.2 as the Federal agency that has jurisdiction, custody and control. As an additional layer, DOE also has filed a notation on the ownership record with the St. Charles County recorder of deeds. The notation specifies the use restrictions being imposed and a copy of this notation is included in Appendix E. DOE will continue to look for means to add layers of IC mechanisms, as appropriate. Additional IC documentation would be prepared by a DOE real property specialist according to existing DOE practices.

DOE's jurisdiction over the Chemical Plant and Quarry was obtained through federal acquisition procedures and interagency real estate transfer doctrine for the 228 acres now under DOE jurisdiction.

### 3.3.14 Record IC Instruments With the St. Charles County Recorder

All completed real estate instruments or summaries will be recorded with the St. Charles County Recorder.

### 3.3.15 Incorporate Agreements Into Long-Term Surveillance and Maintenance Activities

Consistent with project procedures and requirements, the public will be notified of any completed agreements. These agreements would be reproduced and included in a subsequent issuance of the LTS&M Plan. Maintenance and inspection requirements specific to these agreements would be incorporated into the maintenance and inspection procedures already established for the site as described in the LTS&M Plan (see Section 3.5). DOE expects to update the LTS&M Plan as a means to add copies of any new agreements completed since the last issuance of the report.

## 3.4 Schedule for Implementing Institutional Controls

The current expectation is that the IC mechanisms or agreements needed would be obtained and implemented with completion targeted in the next 6 to 12 months. If by this time, negotiations do not result in the selection of mutually acceptable IC mechanisms for preparation and implementation, alternative approaches including condemnation of the required property interests would have to be considered. However, it is expected that the federal government will not need to pursue condemnation as a means of implementing needed use restrictions unless the subject properties change ownerships or if the planned reuse of the properties is incompatible with maintaining protectiveness of the remedies for the long-term. Therefore, DOE prefers to defer any condemnation until such time as an incompatible use is imminent. Table 3−2 presents a summary of the various affected areas, use restrictions, status of IC implementation, and IC mechanisms being considered. Some ICs have already been implemented and copies of these agreements are included in Appendix E.

## 3.5 Maintenance and Inspection Procedures for Institutional Controls

Maintenance and inspection activities associated with existing ICs are described in Section 2.3.4 and Appendix H. It is expected that the implementation of additional agreements or ICs would not result in additional surveillance and maintenance requirements. However, any new requirements that could result from specific agreements reached in the near future would be incorporated into site surveillance, maintenance, inspection, and reporting procedures.

*Table 3–2. Status of IC Implementation for the Weldon Spring Site (as of February 2005)*

| Area | OU | Use Restrictions | Status of IC Implementation | IC Mechanisms Being Considered |
|---|---|---|---|---|
| Disposal Cell and Buffer Area | CPOU | 1. Prevent activities on the disposal cell, such as the use of recreational vehicles that could compromise the integrity of the cell cover (e.g., result in the removal or disturbance of the riprap). | DOE has jurisdictional control of this property. A notation on the ownership record has been recorded with the St. Charles County recorder of deeds. To date, additional layers have also been established in the operation of the Interpretive Center, placement of historical markers and the ramp and platform leading to the information plaques. | DOE will continue to identify and consider other mechanisms for implementation as a means of layering ICs. |
| | | 2. Prevent activities in the buffer zone such as drilling, boring, or digging that could disturb the vegetation, disrupt the grading pattern, or cause erosion. | Same as for use restriction #1. | Same as for use restriction #1. |
| | | 3. Retain access to the buffer area for continued maintenance, monitoring, and routine inspections of the cell and buffer area. | DOE has jurisdictional control on this property. DOE expects to continue ownership of this property for as long as the use restrictions are required. | No additional mechanism required. |
| | | 4. Prevent construction of any type of residential dwelling or facility for human occupancy on the disposal cell and buffer area, other than facilities to be occupied for activities associated with performing environmental investigation and/or restoration and expansion of the existing Interpretive Center. | Same as for use restriction #1. | Same as for use restriction #1. |

*Table 3–2 (continued). Status of IC Implementation for the Weldon Spring Site (as of February 2005)*

| Area | OU | Use Restrictions | Status of IC Implementation | IC Mechanisms Being Considered |
|---|---|---|---|---|
| Disposal Cell and Buffer Area (con't) | | 5. Maintain the integrity of any current or future remedies or monitoring systems. | Same as for use restriction #1. Maintenance and inspection requirements as identified in this LTS&M Plan are being implemented. | Additional requirements would be incorporated into the maintenance and inspection procedures, as appropriate, to reflect new IC mechanisms implemented. |
| Southeast Drainage | CPOU | 1. Prevent the development and use of the Southeast Drainage property for residential housing, schools, child care facilities and playgrounds. | DOE is in discussion with the MDC to determine the appropriate IC mechanisms for implementation. Existing easement for sewage discharge provides some protection against incompatible development. | Either an easement or a restrictive covenant or a combination of both could be considered for implementation. |
| Chemical Plant Area Groundwater and Springs | GWOU | 1. Prevent the use of the contaminated shallow groundwater and springwater for drinking water purposes. The contaminated shallow groundwater occurs in the weathered and unweathered portions of the upper limestone unit (Burlington-Keokuk). The contaminated groundwater and springwater system occurs within the limits of the hydraulic buffer zone identified on Figure 3−1. The springs are identified on the figure as SP-6301, SP-6303, SP-5303, and SP-5304. This restriction will need to be maintained over a period of decades or longer. | For the Chemical Plant itself, DOE has jurisdictional control of this property. A notation on the ownership record has been recorded with the St. Charles County recorder of deeds.<br><br>For the state-owned areas, DOE is in discussion with the state entities involved to determine the appropriate IC mechanisms for implementation. | DOE will continue to identify and consider other mechanisms for implementation as a means of layering ICs.<br><br>Either an easement or a restrictive covenant or a combination of both could be considered for implementation. |

*Table 3–2 (continued). Status of IC Implementation for the Weldon Spring Site (as of February 2005)*

| Area | OU | Use Restrictions | Status of IC Implementation | IC Mechanisms Being Considered |
|---|---|---|---|---|
| Chemical Plant Area Groundwater and Springs (cont.) | | 2. Limit the use of all groundwater within the outlined restricted area to investigative monitoring only. The boundary of the restricted area extends beyond the area of contamination and is intended to provide a buffer against potential hydraulic influences on the area of contamination by preventing such things as pumping wells being located in the proximity of the contaminated area. This restriction includes the shallow groundwater system and also extends vertically to all groundwater systems that underlie the contaminated groundwater. This restriction will need to be maintained over a period of decades or longer. | Same as for use restriction #1. | Same as for use restriction #1. |
| | | 3. Retain access to the area for continued monitoring and maintenance of groundwater wells and springs. | DOE has real estate licenses and an MOU for accessing and maintaining groundwater wells and springs for sampling at the Chemical Plant area. | Either continue using existing mechanisms or add to any new agreements reached. Either an easement or a restrictive covenant or a combination of both could be considered for implementation. |
| | | 4. Maintain the integrity of any current or future remedies or monitoring systems. | Same as for use restriction #1. Maintenance and inspection requirements as identified in this LTS&M Plan are being implemented. | Additional requirements would be incorporated into the maintenance and inspection procedures, as appropriate, to reflect new IC mechanisms implemented. |

*Table 3–2 (continued). Status of IC Implementation for the Weldon Spring Site (as of February 2005)*

| Area | OU | Use Restrictions | Status of IC Implementation | IC Mechanisms Being Considered |
|---|---|---|---|---|
| Quarry Area | QROU | 1. Prevent the development and use of the Quarry for residential housing, schools, child care facilities and playgrounds. Prevent drilling, boring, digging, or other activities in the Quarry proper that disturb the vegetation, disrupt the grade, expose the Quarry walls, or cause erosion of the clean fill that was used to restore the Quarry. This restriction should be maintained for the long-term. The 9-acre Quarry is under DOE jurisdictional control. | DOE has jurisdictional control of this property. A notation on the ownership record has been recorded with the St. Charles County recorder of deeds. To date, additional layers have also been established in the operation of the interpretive center, placement of historical markers and the ramp and platform leading to the information plaques. | DOE will continue to identify and consider other mechanisms for implementation as a means of layering ICs. |
| | | 2. Prevent the use of the contaminated shallow groundwater for drinking water purposes. The contaminated shallow groundwater underlies the Quarry and extends to the marginal alluvium north of the slough as indicated on Figure 3−2. This restriction will need to be maintained over a period of decades or longer. | For the Quarry itself, DOE has jurisdictional control of this property. A notation on the ownership record has been recorded with the St. Charles County recorder of deeds. To date, additional layers have also been established in the operation of the interpretive center and placement of historical markers.<br><br>For the state-owned areas, DOE is in discussion with the state entities involved to determine the appropriate IC mechanisms for implementation. | DOE will continue to identify and consider other mechanisms for implementation as a means of layering ICs.<br><br>Either an easement or a restrictive covenant or a combination of both could be considered for implementation. |

*Table 3–2 (continued). Status of IC Implementation for the Weldon Spring Site (as of February 2005)*

| Area | OU | Use Restrictions | Status of IC Implementation | IC Mechanisms Being Considered |
|---|---|---|---|---|
| Quarry Area (cont.) | QROU | 3. Limit the use of all groundwater within the outlined restricted area shown on Figure 3−2 to investigative monitoring only. The boundary of the restricted area extends beyond the area of contamination and is intended to provide a buffer against potential hydraulic influences on the area of contamination by preventing such things as pumping wells being located in the proximity of the contaminated area. This restriction includes the shallow groundwater system and also extends vertically to all groundwater systems that underlie the contaminated groundwater. This restriction will need to be maintained over a period of decades or longer, until uranium concentrations in Quarry groundwater north of the slough are at 300 pCi/L or lower. With the exception of the 9-acre Quarry, this restricted area is owned by state entities. | Same as for use restriction #2. | Same as for use restriction #2. |

*Table 3–2 (continued). Status of IC Implementation for the Weldon Spring Site (as of February 2005)*

| Area | OU | Use Restrictions | Status of IC Implementation | IC Mechanisms Being Considered |
|---|---|---|---|---|
| Quarry Area (cont.) | QROU | 4. Prevent drilling, boring, digging, construction, earth moving or other activities in the location identified as the Natural Reduction Zone Area that could result in disturbing the soils at this location or exposing subsurface soils (i.e., soils deeper than [about] 5 ft below the surface). This restriction will need to be maintained over a period of decades or longer. The soil in this area at a depth of 5 ft or greater contains geochemical properties that allow reduction processes to naturally occur, resulting in the precipitation of uranium from Quarry groundwater north of the Femme Osage Slough and thereby minimizing uranium migration to the well field. The restrictions must be maintained over a period of decades or longer, until uranium concentrations in Quarry groundwater north of the slough are at 300 pCi/L or lower. This area is located on property owned by a state entity. | DOE is in discussion with the MDC to determine the appropriate IC mechanisms for implementation. | Either an easement or a restrictive covenant or a combination of both could be considered for implementation. |
| | | 5. Retain access to the area for continued monitoring and maintenance of groundwater wells. | DOE currently has real estate licenses for accessing and maintaining groundwater wells for investigative sampling purposes. | Either continue using existing mechanisms or add to any new agreements reached. Either an easement or a restrictive covenant or a combination of both could be considered for implementation. |
| | | 6. Maintain the integrity of any current or future remedies or monitoring systems. | Same as for use restriction #1. Maintenance and inspection requirements as identified in this LTS&M Plan are being implemented. | Additional requirements would be incorporated into the maintenance and inspection procedures, as appropriate. |

# 4.0 Glossary

**Alluvium:** Sediments generally composed of clay, silt, sand, gravel, or similar unconsolidated material deposited by flowing rivers.

**Aquifer**: Rock or sediment that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

**Background level:** 1. The concentration of a substance in an environmental medium (air, water, or soil) that occurs naturally or is not the result of human activities. 2. In exposure assessment the concentration of a substance in a defined control area, during a fixed period of time before, during, or after a data-gathering operation.

**Confining unit:** A layer of material of low hydraulic conductivity immediately above or below an aquifer that prevents the upward or downward movement of groundwater.

**Contamination:** Introduction into water, air, and soil of microorganisms, chemicals, toxic substances, wastes, or wastewater in a concentration that makes the medium unfit for its next intended use. Also applies to surfaces of objects, buildings, and various household and agricultural use products.

**Exposure pathway**: The course a contaminant takes from its source to the exposed individual. A complete exposure pathway generally requires four elements: (1) a source and mechanism of release, (2) a retention or transport medium, (3) a point of potential human contact with the contaminant (referred to as the exposure point), and (4) an exposure route (e.g., external gamma irradiation, ingestion, inhalation, dermal absorption). If any of these elements is missing, the exposure pathway is considered incomplete.

**Exposure scenario**: A series of assumptions based on factors such as land use and human activities at a site. The major assumptions inherent to a scenario aside from land use, are the frequency and duration of exposure to a contaminant. These exposure assumptions are assigned numerical values along with assumptions regarding exposure pathways and estimate of exposure point concentrations to calculate potential intakes of a contaminant by a receptor. Typical exposure scenarios are residential, commercial/industrial, and recreational.

**Feasibility Study (FS):** 1. Analysis of the practicability of a proposal; e.g., a description and analysis of potential cleanup alternatives for a site such as one on the NPL. The feasibility study usually recommends selection of a cost-effective alternative. It usually starts as soon as the remedial investigation is underway; together, they are commonly referred to as the RI/FS. 2. A small-scale investigation of a problem to ascertain whether a proposed research approach is likely to provide useful data.

**Groundwater:** The supply of water found beneath the Earth's surface, usually in aquifers, which supply wells and springs.

**Headward erosion:** Occurs when the upper end of a drainage is cut back (lengthened in the upstream direction) by water as it flows in at its head.

**Institutional controls**: Controls such as deed restrictions, use restrictions, and permitting requirements that prohibit or limit activities that may result in exposure to contamination. Effective ICs must remain in effect for the duration of the hazard, survive a change in property ownership, and be enforceable. ICs also include those which preserve knowledge and facilitate public education regarding hazards at a site in order to enhance protectiveness into the future.

**Leachate**: Water that collects contaminants as it percolates through wastes, pesticides or fertilizers.

**Leaky confining unit**: A layer or zone of relatively lower permeability material immediately above or below an aquifer that allows some upward or downward movement of groundwater.

**Maximum Credible Earthquake (MCE)**: A measure of the greatest seismic load that can be expected at a given location. The Weldon Spring disposal cell was designed to withstand a maximum credible earthquake.

**Operable Unit (OU)**: Term for each of a number of separate activities undertaken as part of a Superfund site cleanup.

**Probable Maximum Precipitation (PMP)**: The greatest amount of precipitation for a given duration that is theoretically possible from a storm event at a particular geographical area at a certain time of year. PMP is derived by adjusting the results of depth-area-duration analyses of precipitation in major storms that have occurred or could have occurred in the area of interest for maximum moisture charge and rate of moisture flow. The Weldon Spring disposal cell was designed and built to withstand 38.4 inches of rainfall in 6 hours.

**Protectiveness**: Maintaining risks to human health and the environment to within approved limits.

**Radioactivity**: The spontaneous emission of radiation, generally alpha or beta particles, often accompanied by gamma rays, from the nucleus of an unstable atom.

**Radon:** A colorless, naturally occurring, radioactive, inert gas formed by radioactive decay of radium atoms in soil and rocks.

**Radon/infiltration barrier**: A layer of compacted low-permeability clayey soil in the disposal cell cover that slows the movement of radon enough for the radon to decay before it escapes, and prevents precipitation water from entering the disposal cell.

**Raffinate**: A waste product from a refining process.

**Record of Decision (ROD)**: A public document that explains which cleanup alternative(s) will be used at NPL sites under CERCLA.

**Reduction zone:** A subsurface zone with characteristics of a reducing environment, such as gray to black soils, presence of organic materials, and absence of iron oxides. Reducing indicates a chemical condition that will change the solubility of most metals (e.g., uranium is typically precipitated in a reducing environment).

**Remedial Action (RA)**: The actual construction or implementation phase of a Superfund site cleanup that follows remedial design.

**Remedial Design (RD):** A phase of remedial action that follows the remedial investigation/feasibility study and includes development of engineering drawings and specifications for a site cleanup.

**RD/RA Work Plan:** A plan implementing the requirements of a ROD consisting of a combination of the remedial design and remedial action phases.

**Remedial Investigation (RI):** An in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site, establish site cleanup criteria, identify preliminary alternatives for remedial action, and support technical and cost analyses of alternatives. The remedial investigation is usually done with the feasibility study. Together they are usually referred to as the RI/FS.

**Remediation**: Removal of contamination at a site to levels that do not exceed pre-established goals, such as federal or state standards or alternate concentration limits that are protective of human health and the environment.

**Risk:** A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard.

**Risk assessment**: A process for organizing and analyzing information to determine if an environmental chemical might cause harm to exposed persons or the ecosystem. Risk assessments for the Weldon Spring Site conform to the procedures established by EPA. For human health, the EPA risk assessment process analyzes the possibility of cancer and noncancer effects caused by site contamination. EPA considers it acceptable if a person's chances of developing cancer (from site contaminants) are increased by only 1 chance in 1 million to 1 chance in 10,000 in addition to the chances of a person developing cancer from other causes. For noncancer effects, EPA compares the potential intake amount to the toxicity of the site contaminant. This ratio is called the hazard quotient; if one or more chemicals are present, the ratios are added to get a hazard index. EPA considers it not acceptable if the hazard quotient or hazard index is greater than 1.

**Risk factor:** Characteristics (e.g., race, sex, age, obesity) or variables (e.g., smoking, occupational exposure level) associated with increased probability of a toxic effect.

**Route of exposure:** The avenue by which a chemical comes into contact with an organism, (e.g., inhalation, ingestion, dermal contact, injection).

**Select soil waste:** A silty-clayey soil, with at least 50 percent passing the No. 200 sieve and maximum particle size limited to 6 inches. For construction of the Weldon Spring disposal cell, the material for this layer was selectively retrieved from the available contaminated soils present on site. The material was free of debris that could damage the high-density polyethylene (HDPE) liner.

**Stakeholders**: Any organization, government entity, or individual who has a stake in or may be affected by an approach to environmental regulation, pollution prevention, energy conservation, and other activities.

**Surveillance and Maintenance**: All activities necessary to ensure protection of human health and the environment following completion of cleanup, disposal, or stabilization at a site or portion of a site. Long-term surveillance and maintenance includes all engineered and ICs designed to contain or prevent exposure to residual contamination and waste, such as surveillance activities, record-keeping activities, inspections, groundwater monitoring, ongoing pump and treat activities, cap repair, maintenance of entombed buildings or facilities, maintenance of other barriers and contained structures, access control, and posting signs.

**Stratigraphic unit**: A stratum or collection of adjacent strata recognized as a unit in the classification of a rock sequence with respect to any of the many properties and attributes that rocks may possess, for purposes such as description, mapping, and correlation. Rocks may be classified stratigraphically on the basis of features such as color, properties (e.g., mineral content, radioactivity, chemical composition), age, and fossil content.

**Superfund:** The program operated under the legislative authority of CERCLA and the Superfund Amendments and Reauthorization Act of 1986 that funds and carries out EPA solid waste emergency and long-term removal and remedial activities. These activities include establishing the NPL, investigating sites for inclusion on the list, determining their priority, and conducting and/or supervising cleanup and other remedial actions.

**Surface water:** All water naturally open to the atmosphere (e.g., rivers, lakes, reservoirs, ponds, streams, impoundments, seas, and estuaries).

**Transient drainage**: Gravity drainage of water expelled from the pore spaces of soil encapsulated in the disposal cell. Water is introduced into the cell during construction as water added for compaction and dust control, as moisture in waste materials, and from precipitation. The weight of overlying material squeezes water from pore space, which drains out the bottom of the waste material. In the Weldon Spring disposal cell, this water is captured on the bottom liner system and conveyed to the LCRS. “Transient” refers to the fact that the cell cover prevents recharge of water into the cell, and drainage is an artifact of construction that will eventually reach zero flow.

**Vicinity property**: A discrete and off-site property or structure contaminated with hazardous materials that were derived from a processing site.

# 5.0 References

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40 CFR 192. U.S. Environmental Protection Agency, "Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings," *Code of Federal Regulations,* July 1, 2001.

40 CFR 264. U.S. Environmental Protection Agency, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations,* July 1, 2001.

10 CSR 20-7.031. Missouri *Code of State Regulations,* Title 10, "Department of Natural Resources," Division 20, "Clean Water Commission," Chapter 7.031, "Water Quality Standards."

10 CSR 23. Missouri *Code of State Regulations,* Title 10, "Department of Natural Resources," Division 23, "Division of Geology and Land Survey."

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