

Weldon Spring Site Annual Report for Calendar Year 2012

June 2013



U.S. DEPARTMENT OF
ENERGY

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**Weldon Spring Site Annual Report
for Calendar Year 2012**

June 2013

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Appendix G	CD of Report (This appendix is a CD of the entire report and, therefore, is not included in the website posting)

Abbreviations

AEC	U.S. Atomic Energy Commission
ARAR	applicable or relevant and appropriate requirement
BTL	baseline tolerance limits
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CWA	Clear Water Act
DCE	dichloroethene
DNB	dinitrobenzene
DNT	dinitrotoluene
DOE	U.S. Department of Energy
EE/CA	Engineering Evaluation/Cost Analysis
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
ESD	explanation of significant differences
FFA	Federal Facilities Agreement
ft	feet
GPS	global positioning system
GWOU	Groundwater OU
HVAC	heating, venting and air conditioning
IC	institutional control
ISMS	Integrated Safety Management System
ISO	International Organization for Standardization
LCRS	Leachate Collection and Removal System
LM	Office of Legacy Management
LTS&M	Long-Term Surveillance and Maintenance Plan
MCL	maximum contaminant level
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MDNR-Park	Missouri Department of Natural Resources Division of State Parks
mg/L	milligrams per liter
MNA	monitored natural attenuation
MoDOT	Missouri Department of Transportation
MOU	memorandum of understanding

mrem	millirem
MSD	Metropolitan St. Louis Sewer District
NB	nitrobenzene
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
ORP	oxidation reduction potential
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
QROU	Quarry Residuals OU
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPD	relative percent difference
SDWA	Safe Drinking Water Act
SWPPP	Storm Water Pollution Prevention Plan
SWRAU	(EPA superfund) sitewide ready for anticipated use
TCE	trichloroethene
TED	total effective dose
TNB	trinitrobenzene
TNT	trinitrotoluene
µg/L	micrograms per liter
WSSRAP	Weldon Spring Site Remedial Action Project

Executive Summary

The Weldon Spring Site, located in St. Charles, Missouri, is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. The objective of this report is to summarize the activities, provide a compliance status, and report annual inspection and environmental monitoring results from the calendar year 2012 for the site. The report is prepared in accordance with the requirements of the Long-Term Surveillance and Maintenance Plan for the Weldon Spring, Missouri, Site (LTS&M Plan) (December 2008) and the Federal Facility Agreement. This report will combine the annual inspection report and annual environmental report that were issued as separate documents in the past. The annual inspection report (DOE 2013) was issued in January 2013, and has been incorporated into this document to retain consistency with future reports.

Compliance Summary

The Weldon Spring Site is listed on the National Priorities List and is governed by CERCLA, the Weldon Spring Site has been subject to meeting or exceeding applicable or relevant and appropriate requirements of federal, state and local laws. Many of these regulations no longer apply due to reduction in physical activities and waste handling at the site.

Compliance related activities associated with the demolition of the administration building and installation of the new wastewater treatment system were addressed. Universal wastes were recycled in accordance with the Missouri Universal Waste regulations; the building was inspected and notification of demolition was submitted in accordance with Missouri asbestos regulations; and a storm water permit was obtained. An additional compliance issue was an exceedance of the chlorine limit for the National Pollutant Discharge Elimination System sanitary treatment system permit (MO 0129917) that was associated with the former wastewater treatment system and was one of the reasons for replacement of the system.

Inspection Summary

The Weldon Spring Site was inspected October 23 through 25, 2012. The inspection was conducted in accordance with the LTS&M Plan, and associated inspection checklist. Representatives from the U.S. Department of Energy (DOE), the DOE contractor S.M. Stoller Corporation (Stoller), the U.S. Environmental Protection Agency, and the Missouri Department of Natural Resources participated in the inspection. Representatives from the Missouri Department of Transportation, and St. Charles County, Division of Environmental Health and Protection participated in portions of the inspection.

The main areas inspected at the site were the Quarry, the disposal cell, the Leachate Collection and Removal System (LCRS), monitoring wells, assorted general features, and areas where institutional controls have been established.

Institutional control areas were inspected to ensure that restrictions such as excavating soil, groundwater withdrawal, residential use, etc., were not being violated. Each area was inspected and no indication of violations of the restrictions was observed.

The disposal cell was inspected by walking ten transects over the cell and around the cell perimeter. Hand-held global positioning system equipment was used to navigate the 10 transects. Six areas of the cell which had been marked were located and observed for any signs of rock degradation. The areas were found to still be in good condition. The LCRS was also inspected and observed to be in good condition. Forty-eight of the 107 groundwater-monitoring wells were inspected and were in good condition. Other site features including the prairie, site markers, and roads also were inspected.

Environmental Monitoring Summary

The environmental monitoring program at the Weldon Spring Site includes sampling and analysis of water collected from wells at the former Chemical Plant, the Quarry, adjacent properties, and selected springs in the vicinity of the former Chemical Plant. Surface water in the vicinity of the former Chemical Plant and Quarry are also sampled. Separate monitoring programs have been established for remedies for the former Chemical Plant and the Quarry groundwater and the disposal cell.

Groundwater monitoring at the former Chemical Plant focuses on the selected remedy of monitored natural attenuation (MNA) for the Groundwater Operable Unit. Total uranium, nitroaromatic compounds, trichloroethene, and nitrate have been monitored at selected locations throughout the former Chemical Plant area and offsite. Sampling has targeted areas of highest impact in the shallow aquifer and migration pathways associated with paleochannels in the weathered unit of the Burlington-Keokuk Limestone. The monitoring network is designed to provide data either to show that natural attenuation processes are acting as predicted or to trigger the implementation of contingencies when these processes are not acting as expected.

The performance of the MNA remedy is assessed through the sampling of monitoring wells that are within the areas of impact. These wells are monitored to verify that contaminant concentrations are declining or remaining stable and that cleanup standards will be met within a reasonable time frame. Overall, natural attenuation of the contaminants of concern is occurring as expected, and concentrations are stable or decreasing, with the exception of uranium in the unweathered unit of the Burlington-Keokuk Limestone beneath the former Raffinate Pits area. This area of impact is the focus of the ongoing special study.

Detection monitoring is performed to ensure that lateral and vertical migration remains confined to the current area of impact and that expected lateral downgradient migration within the paleochannels is minimal or nonexistent. Detection monitoring is performed by sampling selected wells, springs, and a surface water location. Concentrations in downgradient (laterally and vertically) and fringe locations have been behaving as expected; however, uranium levels in one downgradient well in the former Raffinate Pits area are higher than predicted. This impact is being assessed as part of an ongoing special study. While uranium levels in the former Raffinate Pits area have changed since the implementation of the MNA remedy for uranium, overall the remedy remains protective. Groundwater flow directions are unchanged, and impacted groundwater is contained within the paleochannels in this area and is migrating along the expected pathways.

Groundwater monitoring at the Quarry focuses on the selected remedy of long-term groundwater monitoring for the Quarry Residuals Operable Unit. Total uranium, nitroaromatic compounds,

and geochemical parameters have been monitored in the area of impact and in the Missouri River alluvium. Groundwater is sampled under two programs that focus on the area of impact in the Quarry proper and north of the Femme Osage Slough and the unimpacted Missouri River alluvium south of the Femme Osage Slough. Overall, uranium levels in the area of impact are decreasing or remaining stable. Results from the monitoring wells south of the slough indicate that uranium levels are similar to background for the Missouri River alluvium. The data continue to indicate that a strongly reducing environment is prevalent in the groundwater immediately south of the slough. This type of environment is not favorable for the migration of uranium.

Groundwater, spring, and leachate samples are collected as part of the detection monitoring program for the disposal cell. Under the monitoring program, signature parameter (barium and uranium) data from each location are compared to baseline tolerance limits to track general changes in groundwater quality and determine whether statistically significant evidence of contamination due to cell leakage exists. The data from the remainder of the parameters are reviewed to evaluate the general groundwater quality in the vicinity of the disposal cell and to determine if changes are occurring in the groundwater system. The results indicate that there is no evidence of leakage into the groundwater beneath the disposal cell. The general groundwater quality in the detection monitoring wells and spring is consistent with historical data. Leachate is sampled to verify its composition, and its composition has remained relatively unchanged for the past few years.

Surface water monitoring was conducted in the vicinity of the former Chemical Plant and the Quarry to measure the effects of groundwater and surface water discharge on the quality of downstream surface water. Monitoring results for the surface waters in the vicinity of the former Chemical Plant show relatively low levels of uranium that are consistent with levels from previous years. Uranium levels in the Busch Conservation Lakes 34, 35, and 36 and Dardenne Creek remain low. Uranium levels in the slough continued to be elevated, a condition that began in 2006 when the slough dried out due to drought conditions.

Historical water quality and water level data for existing wells can be found on the DOE Office of Legacy Management website: <http://www.lm.doe.gov/land/sites/mo/weldon/weldon.htm>. Photographs, maps, and physical features can also be viewed on this website.

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1.0 Introduction

1.1 Purpose and Scope

The Weldon Spring Site, located in St. Charles, Missouri, is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. The purpose of this report is to summarize the activities, compliance status, annual inspection and environmental monitoring results from the calendar year 2012 for the site. The report is prepared in accordance with the requirements of the Long-Term Surveillance and Maintenance Plan for the Weldon Spring, Missouri, Site (LTS&M Plan) (DOE 2008) and the Federal Facility Agreement (FFA).

1.2 Site Description

The Weldon Spring Site is located in St. Charles County, Missouri, about 30 miles west of St. Louis (Figure 1). The site comprises two geographically distinct, DOE-owned properties: the Weldon Spring former Chemical Plant and Raffinate Pit sites (Chemical Plant) and the Weldon Spring Quarry (Quarry). The former Chemical Plant is located about 2 miles southwest of the junction of Missouri State Route 94 and U.S. Highway 40/61. The Quarry is about 4 miles southwest of the former Chemical Plant. Both sites are accessible from Missouri State Route 94.

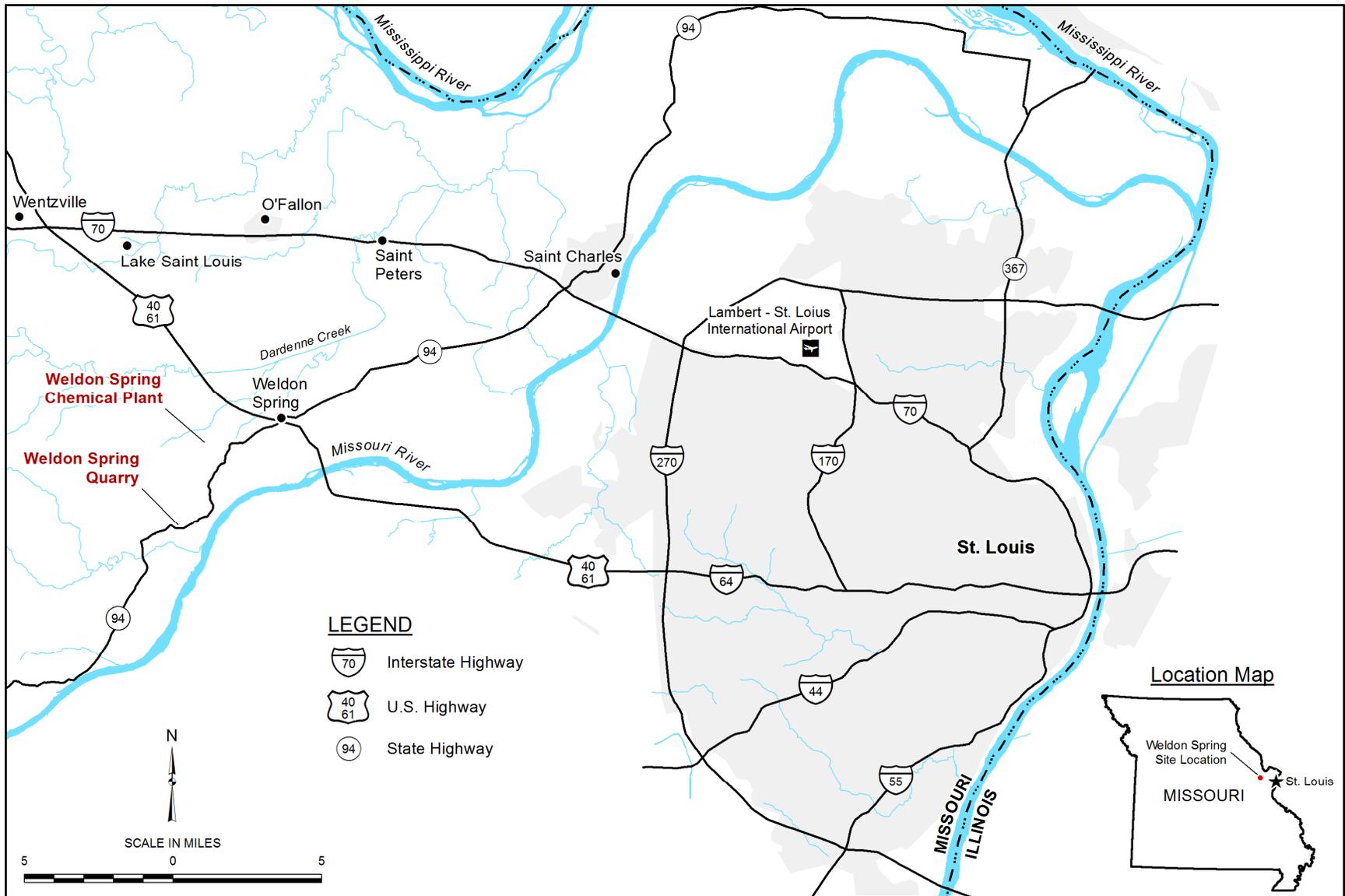
During the early 1940s, the Department of the Army acquired 17,232 acres of private land in St. Charles County for the construction of the Weldon Spring Ordnance Works facility. The former Ordnance Works site has since been divided into several contiguous areas under different ownership, as depicted in Figure 2. Current land use of the former Ordnance Works site includes the former Chemical Plant and Quarry; the U.S. Army Reserve Weldon Spring Training area; the Missouri Department of Conservation (MDC); the Missouri Department of Natural Resources (MDNR) Division of State Parks (MDNR-Parks); Francis Howell High School; a St. Charles County highway maintenance (formerly Missouri Department of Transportation [MoDOT]) facility; the Public Water Supply District #2 water treatment facility; the St. Charles County law enforcement training center; the village of Weldon Spring Heights, and a University of Missouri research park.

The former Chemical Plant and Quarry areas total 228.16 acres. Former The Chemical Plant property is located on 219.50 acres; the Quarry occupies 8.66 acres.

1.3 Site History

1.3.1 Operations History

In 1941, the U.S. government acquired 17,232 acres of rural land in St. Charles County to establish the Weldon Spring Ordnance Works. In the process, the towns of Hamburg, Howell, Toonerville, and 576 citizens of the area were displaced. From 1941 to 1945, the Department of 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, groundwater, and some offsite springs.



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Figure 1. Location Map of the Weldon Spring, Missouri, Site

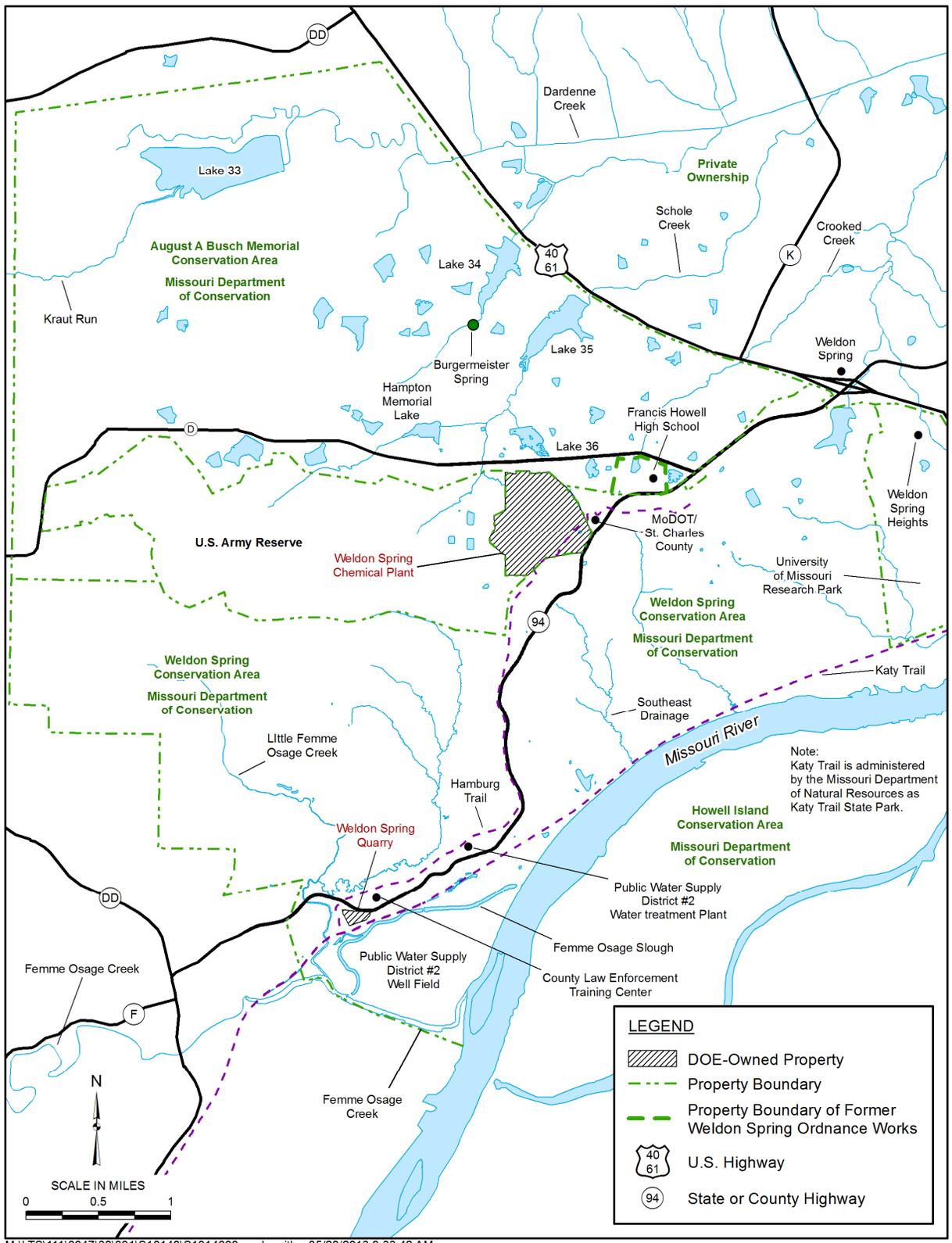


Figure 2. Vicinity Map of the Weldon Spring, Missouri, Site

Following a considerable amount of explosives decontamination of the facility by the Army and the Atlas Powder Company, 205 acres of the former Ordnance Works property were transferred to the U.S. Atomic Energy Commission (AEC) in 1956 for the construction of the Weldon Spring Uranium Feed Materials Plant, now referred to as the Weldon Spring Chemical Plant. An additional 14.88 acres 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 was also processed. Wastes generated during these operations were stored in four raffinate pits located on the Chemical Plant property. Uranium-processing operations resulted in the radiological contamination of the same locations previously contaminated by former Army operations.

The Quarry was mined for limestone aggregate used in the construction of the Ordnance Works. The Army also used the Quarry for burning wastes from explosives manufacturing and disposal of TNT-contaminated rubble during Ordnance Works operations. These activities resulted in the nitroaromatic contamination of the soil and groundwater at the Quarry. In 1960, the Army transferred the Quarry to AEC, which used it from 1963 to 1969 as a disposal area for uranium and thorium residues (both drummed and uncontained) from the former Chemical Plant.

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-production 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 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 the control and decontamination of the Chemical Plant, raffinate pits, and Quarry as a major project.

1.3.2 Remedial Action History

The U.S. Environmental Protection Agency (EPA) placed the Quarry and former Chemical Plant areas on the National Priorities List in 1987 and 1989, respectively. Initial remedial activities at the former Chemical Plant (a series of Interim Response Actions authorized through the use of Engineering Evaluation/Cost Analysis (EE/CA) reports) included:

- The removal of electrical transformers, electrical poles and lines, and overhead piping and asbestos that presented an immediate threat to workers and the environment.
- The construction of an isolation dike to divert runoff around the Ash Pond area to reduce the concentration of contaminants going offsite in surface water.
- A detailed characterization of onsite debris, the separation of radiological and nonradiological debris, and the transport of materials to designated staging areas for interim storage.

- The dismantling of 44 Chemical Plant buildings under four separate Interim Response Actions.
- The treatment of contaminated water at the former Chemical Plant and the Quarry.

The remediation of the Weldon Spring Site was administratively divided into four operable units (OUs): the Chemical Plant OU, the Quarry Bulk Waste OU, the Quarry Residuals OU (QROU), and the Groundwater OU (GWOU). The Southeast Drainage was remediated under a CERCLA removal action and documented through an EE/CA report (DOE 1996a) and the Decision Document for the Southeast Drainage (DOE 1996b). The following sections describe the selected remedies.

1.3.2.1 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 former Chemical Plant (except groundwater) and disposing of contaminated materials in an onsite disposal cell.

The selected remedy included:

- The removal of contaminated soils, sludge, and sediment.
- The treatment of wastes by chemical stabilization/solidification, as appropriate.
- The disposal of wastes removed from the former Chemical Plant and stored Quarry bulk wastes in an engineered onsite disposal facility.

The remedy included the remediation of 17 offsite vicinity properties affected by former Chemical Plant operations. The vicinity properties were remediated in accordance with Chemical Plant Record of Decision (ROD) cleanup criteria.

The *Chemical Plant Operable Unit Remedial Action Report* (DOE 2004a) was finalized in January 2004.

1.3.2.2 Quarry Bulk Waste OU

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

The selected remedy included:

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

1.3.2.3 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 Quarry Residuals Operable Unit Interim Remedial Action Report (DOE 2003b) was finalized in November 2003.

The selected remedy included:

- Long-term monitoring and institutional controls (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 the implementation of a well-field contingency plan.
- Confirming the model assumptions regarding the extraction of contaminated groundwater and establishing controls to protect naturally occurring attenuation processes.

1.3.2.4 Groundwater OU

DOE implemented the *Interim Record of Decision for Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site* (DOE 2000a), which was approved on September 29, 2000, to investigate the practicability of remediating trichloroethene (TCE) contamination in Chemical Plant groundwater using in situ chemical oxidation. It was determined, based on extensive monitoring, that in situ oxidation did not perform adequately under field conditions; therefore, the remediation of TCE was reevaluated with the remaining contaminants of concern.

In the *Record of Decision for the Final Remedial Action for the Groundwater Operable Unit at the Chemical Plant Area of the Weldon Spring Site* (DOE 2004b), DOE established the remedy of monitored natural attenuation (MNA) to address contaminated groundwater and springs. The Interim Remedial Action Report for the Groundwater Operable Unit of the Weldon Spring Site (DOE 2005b) was finalized in March 2005.

The selected remedy included:

- Sampling of groundwater and surface water, including springs, to verify the effectiveness of naturally occurring processes to reduce contaminant concentrations over time.
- ICs to prevent exposure to contaminated groundwater at the former Chemical Plant and to the north toward Burgermeister Spring.

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) was prepared in August 1996 to evaluate the human and ecological health risks within the drainage. The EE/CA recommended that selected sediment in accessible areas of the drainage should be removed with

track-mounted equipment and transported by off-road haul trucks to the Chemical Plant. Soil removal occurred in two phases: 1997 to 1998, and in 1999. More details are included in the *Southeast Drainage Closeout Report Vicinity Properties DA4 and MDC7* (DOE 1999).

1.4 Final Site Conditions

Contamination remains at the Weldon Spring Site at the following locations:

- An onsite disposal cell contains approximately 1.48 million cubic yards of contaminated material.
- Residual groundwater contamination remains in the shallow aquifer beneath the former Chemical Plant, at the Quarry, and at some surrounding areas.
- A few springs near the former Chemical Plant discharge contaminated groundwater.
- Residual soil and sediment contamination remain in the Southeast Drainage.
- Fixed radiological contamination remains within a culvert within the Southeast Drainage under Missouri State Route 94.
- Residual soil contamination remains at inaccessible locations within the Quarry.

1.5 Compliance Summary

The Weldon Spring Site is listed on the National Priorities List and is therefore governed by the CERCLA process. Under CERCLA, the Weldon Spring Site Remedial Action Project (WSSRAP) was subject to meeting or exceeding the applicable or relevant and appropriate requirements (ARARs) of federal, state, and local laws and statutes, such as the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Clean Air Act, the National Historic Preservation Act, the Safe Drinking Water Act (SDWA), the Endangered Species Act, and Missouri State regulations. Because DOE is the lead agency for the site, National Environmental Policy Act (NEPA) values must be incorporated. The requirements of DOE orders must also be met. Section 1.5.1 summarizes compliance with applicable federal and state regulations, Section 1.5.2, summarizes compliance with major DOE orders, and Section 1.5.3 discusses compliance agreements and permits. The physical completion of the project has reduced or, in some cases, eliminated the applicability of certain ARARs.

1.5.1 Federal and State Regulatory Compliance

1.5.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Weldon Spring Site has integrated the procedural and documentation requirements of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), and NEPA. Section 1.3.2 discusses the remedial actions conducted under CERCLA.

The site reached construction completion under CERCLA on August 22, 2005. The site also recently received the EPA Superfund Sitewide Ready for Anticipated Use (SWRAU) designation. The SWRAU measure reports sites documented as ready for reuse when the entire construction complete National Priority List (NPL) site meets the following requirements:

- All cleanup goals in the ROD(s) or other remedy decision document(s) have been achieved for media that may affect current and reasonable anticipated future land uses, of the site, so that there are no unacceptable risks; and
- All institutional or other controls required in the ROD(s) or other remedy decision document(s) have been put in place.

After a review of all relevant site documents, including the RODs; Long-Term Surveillance and Maintenance Plan; five-year reviews; annual inspections and monitoring data; and ICs documentation, EPA determined that DOE has achieved the SWRAU performance measure for all DOE owned land at the site. This includes the former Chemical Plant and Quarry areas and totals approximately 229 acres. The SWRAU measure was recorded as completed in the EPA Comprehensive Environmental Response, Compensation, and Liability Information System database on February 13, 2013.

Because some areas of the site are still contaminated beyond levels that would allow unlimited use and unrestricted exposure (UUUE), CERCLA requires that the remedial actions be reviewed at least every 5 years. These reviews are commonly called 5-year reviews. DOE completed the fourth five-year review report for the site in September 2011.

The *Explanation of Significant Differences, Weldon Spring Site* (ESD) (DOE 2005a) was issued in accordance with CERCLA in February 2005. It clarified the use restrictions for the separate operable units that are necessary for the remedial actions specified in the RODs to remain protective over the long-term. The ESD clarified specific requirements for each site area that needed use restrictions and established how DOE would implement, maintain, and monitor the specific requirements.

DOE developed the LTS&M Plan that addressed the full scope of the site management activities necessary to ensure that the Weldon Spring Site remains protective over the long-term. The LTS&M Plan is revised periodically to ensure its applicability to changing site, regulatory, or procedural conditions. In addition to addressing such activities as long-term groundwater monitoring and disposal cell maintenance, the LTS&M Plan was developed and issued to ensure that the use restrictions identified in the ESD were properly imposed and maintained. The LTS&M Plan included a detailed IC Implementation Plan, which includes a process for evaluating and identifying specific IC mechanisms that best accomplish the objectives set out in the ESD. Consistent with EPA guidance on selecting ICs, various IC mechanisms were evaluated, including government controls, proprietary controls, enforcement tools, and informational devices. Redundant mechanisms were employed to increase the effectiveness of the ICs.

The status of implementing the additional ICs discussed in the ESD and LTS&M Plan is presented below:

- Special Use Area designation under the State Well Drillers' Act: The "Special Use Area" under the Missouri well code was finalized in the Missouri regulations and became effective

August 2007 (10 CSR 23-3.100[8]). This is a special regulation that DOE and the Army pursued with MDNR that requires additional drilling protocols and construction procedures to be implemented by regulations on any well construction conducted within the restriction boundaries. This IC is complete.

- Memorandum of Understanding (MOU) with the Army: The Army and DOE signed the MOU in September and October 2009, respectively. This IC is complete.
- Easements with surrounding affected State agency landowners (MDC, MDNR-Parks, Missouri Department of Transportation [MoDOT]) for implementing the use restrictions required on State properties: DOE established easements to restrict use of the contaminated groundwater in the area of the hydraulic buffer zone, to restrict land use in the Southeast Drainage, and to restrict land use at the Quarry reduction zone. DOE and MDNR-Parks finalized and signed the easement regarding the MDNR-Parks property in September 2009. The easement with MDC was finalized in July 2011 and the easement with MoDOT was finalized in June 2012. The MoDOT property was transferred to St. Charles County and the restrictive easement was conveyed with the land transfer and is still in effect.

1.5.1.2 Resource Conservation and Recovery Act

Hazardous wastes at the Weldon Spring Site have been managed as required by RCRA, a substantive ARAR. Waste management has included the characterization, consolidation, inventory, storage, treatment, disposal, and transportation of hazardous wastes that remained onsite after the closure of the Weldon Spring Uranium Feed Materials Plant and wastes that were generated during remedial activities.

Section 121(e)(1) of CERCLA states that no federal, state, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, therefore, a RCRA treatment, storage, and disposal permit was not required at the site during remedial activities.

The Weldon Spring Site no longer routinely generates any hazardous waste and has deactivated its RCRA generator identification number. During demolition of the administration building (Section 1.11.1), universal wastes were generated in the form of fluorescent light bulbs, light ballasts, batteries and mercury switches. These wastes were appropriately recycled in accordance with the Missouri Universal Waste Regulations (10 CSR 25-16.273).

1.5.1.3 Clean Water Act

The Weldon Spring Site had three National Pollutant Discharge Elimination System (NPDES) permits during 2012. The first permit (MO 0107701), which covers discharges from the leachate collection and removal system (LCRS), is maintained as a contingency to current disposal methods. The second permit (MO 0129917) is for the sanitary sewer system for the site. The third permit (MORA01773) was a storm water permit obtained on August 23, 2012. See Section 1.5.3.1 for additional discussion of these permits and compliance issues related to the permits.

1.5.1.4 Safe Drinking Water Act

Safe Drinking Water Act regulations are not applicable because maximum contaminant levels (MCLs) apply only to drinking water systems, not groundwater. However, under the National

Contingency Plan, MCLs are relevant and appropriate to groundwater that is a potential drinking water source. The principal ARARs for the impacted groundwater at the former Chemical Plant are the MCLs and Missouri water quality standards, which were established in the GWOU ROD (DOE 2004b) and are shown in Table 1.

Long-term groundwater monitoring for the QROU consists of two programs. Groundwater monitoring is necessary to continue to ensure that uranium-contaminated groundwater has a negligible potential to affect the well field owned by Public Water Supply District #2. 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.

Table 1. Federal and State Water Quality Standards for the former 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, *Code of State Regulations* (CSR).

^b Risk-based concentration equivalent to 10⁻⁵ for a residential scenario.

^c Risk-based concentration equivalent to 10⁻⁶ for a residential scenario.

DNB = dinitrobenzene; DNT = dinitrotoluene; NB = nitrobenzene; mg/L = milligrams per liter; µg/L = micrograms per liter; pCi/L = picocuries per liter; TNT = trinitrotoluene; TCE = trichloroethene

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

Under current conditions, groundwater north of the slough poses no imminent human health risk or impact to the potable 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 0.11 µg/L, the Missouri Water Quality standard.

1.5.1.5 Clean Air Act (Missouri Asbestos Regulations)

The administration building was demolished beginning in September 2012. This project is further discussed in Section 1.11.1. Prior to demolition or renovation activities, regulated structures or those areas that will be subject to demolition or renovation activities are required to

be thoroughly inspected to determine if any asbestos containing materials are present. This inspection must be performed by a Missouri-certified asbestos inspector. The inspector must identify all potential asbestos containing materials that may be disturbed by the demolition or renovation activity. Samples of the suspect materials are collected and submitted for laboratory analysis to determine if they contain asbestos.

An environmental assessment was conducted by NPN Environmental Engineers, Inc. (Missouri-certified asbestos inspectors) to identify lead-based paint, asbestos-containing building materials, and other potentially hazardous constituents requiring special handling or removal prior to demolition of the administration building. During the course of the survey, 36 suspect materials were encountered in the administration office, annex and laboratory and 102 bulk samples were analyzed. No asbestos was found in any samples extracted from the administration building or annex.

A demolition notification is required prior to the demolition of any regulated structure. A copy of the asbestos inspection report must accompany the notification. This notification (National Emission Standards for Hazardous Air Pollutants Notification of Demolition) along with a copy of the asbestos inspection report was provided to the MDNR on July 31, 2012.

1.5.1.6 Emergency Planning and Community Right-to-Know Act

The site no longer stores large quantities of chemicals and none above a threshold level; therefore, the site is not required to submit a 2012 Emergency Planning and Community Right-to-Know Act Tier II report.

The Toxic Release Inventory report for 2012 is due on July 1, 2013. Based on the chemical usage in 2012, the Weldon Spring Site is not required to submit a Toxic Release Inventory report.

1.5.2 DOE Order Compliance

1.5.2.1 DOE Order 458.1, Radiation Protection of the Public and the Environment

DOE Order 458.1 which replaced DOE Order 5400 in June 2011, establishes primary standards and requirements for DOE operations to protect members of the public and the environment against undue risk from radiation. DOE operates its facilities and conducts its activities so that radiation exposures to members of the public are maintained within established limits.

The estimated total effective dose to the hypothetical maximally exposed individual was due to consumption of water from Spring SP-5303 in the Southeast Drainage. This dose was calculated to be 0.22 millirem (mrem), which is well below the 100 mrem guideline for all potential exposure pathways. Refer to Section 5.6.2 for additional information regarding the total effective dose calculation.

1.5.2.2 DOE Order 231.1B, Environment, Safety and Health Reporting

DOE Order 231.1B, *Environment, Safety and Health Reporting*, ensures the collection and reporting of information on environment, safety, and health that is required by law or regulation.

This directive also includes requirements for occurrence reporting. Two occurrence reports were submitted for the site in 2012. The first report was submitted on April 24, 2012 for exceedance of the NPDES chlorine limit and the second report was submitted on September 19, 2012 for the Letter of Warning received from the MDNR regarding the NPDES chlorine limit violation. These issues are further discussed in Section 1.5.3.1. Noncompliance and functional issues were some reasons that the old wastewater treatment plan was replaced with a new advanced treatment package plant.

1.5.2.3 DOE Order 436.1, Departmental Sustainability

DOE Order 436.1 requires that contractors integrate numerous environmentally related requirements already placed on them by existing statutes, regulations, and policies through the use of an Environmental Management System (EMS) incorporated into an Integrated Safety Management System (ISMS). EMS requirements must be addressed in the contractor's ISMS, which must be submitted for DOE review and approval under DEAR 970.5223-1, "Integration of Environment, Safety and Health into Work Planning and Execution" (48 CFR 970.5223-1).

DOE Order 436.1 incorporates the sustainability requirements of Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management, Executive Order 13514, Federal Leadership in Environmental, Energy, and Economic Performance. DOE Order 436.1 also requires the implementation of an EMS that reflects the elements and framework found in the International Organization for Standardization (ISO) 14001:2004(E), Environmental Management Systems—Requirements with Guidance for Use, or the equivalent. DOE's Office of Legacy Management (LM) EMS integrates the four core elements of ISO 14001:2004(E): (1) planning, (2) implementation and operation, (3) checking and corrective action, and (4) management review. These elements are commonly referred to as a Plan-Do-Check-Act continuous cycle and apply to all LM and contractor work processes and activities. LM and its contractors are committed to systematically integrating environmental protection, safety, and health into management and work practices at all levels so that the LM mission is accomplished in a manner that continually integrates environmental aspects during planning, implementation, monitoring, project evaluation, and closeout. Guidance for identifying environmental aspects, objectives, and targets that are related to proposed activities is included in the EMS and ensures that LM staff and contractors maintain compliance with applicable regulations and appropriately plan and implement activities.

The EMS provides mechanisms for planning and mitigating the negative impacts that proposed projects or actions could have on the environment by mandating environmental compliance; promoting the use of post-recycled-content materials; recycling to the extent practicable; conserving fuel, energy, and natural resources; minimizing the generation of greenhouse gases and hazardous wastes and the use of toxic chemicals; and enhancing disrupted ecosystems.

A list of items recycled during 2012 is provided in Table 2. Many items and materials were recycled as the result of the demolition of the administrative building.

Table 2. Recycled Items and Quantities

Material Recycled	Quantity
Paper	3,595 pounds
Cardboard	876 pounds
Plastic	123 pounds
Batteries	205 pounds
Glass	152 pounds
Iron/Steel	286,200 pounds
Toner Cartridges	10
Fluorescent Bulbs	1,290 pounds
Ballasts	3,147 pounds
HVAC and other Equipment—Reuse	5,747 pounds
Plumbing and Other Equipment—Reuse	160 pounds
Office Furniture—Reuse	1,000 pounds
Copper/Aluminum Metal Mix	8,356 pounds
Mercury Thermostats	6 pounds

1.5.3 Permit and Agreement Compliance

1.5.3.1 NPDES Permits

The Weldon Spring Site had three NPDES permits during 2012. The first permit (MO 0107701), which covers discharges from the LCRS, is maintained as a contingency to current disposal methods. No water has been discharged under this permit since 2002. The current permit expires in April 2013. A renewal application was submitted to the MDNR in October 2012.

The second permit (MO 0129917) is for the point source discharge of treated sanitary sewage. On April 23, 2012, sample results were received that revealed the daily maximum limit for total residual chlorine had been exceeded. The NPDES permit for the wastewater treatment plant specifies a maximum daily effluent discharge limit of 1.0 mg/L. A routine sample taken on April 11, showed a result of 1.5 mg/L. A letter notifying the state of the exceedance and potential corrective actions was sent on April 26, 2012. A standard Letter of Warning response was received from MNDR on September 4, 2012. The letter stated “If you have already provided this information to the Department, you may disregard this request.” On September 19, the site provided additional clarification documentation to MDNR to officially close out the warning letter.

This sanitary sewer system was over 20 years old, oversized for current needs, costly to maintain, and unable to meet new surface discharge compliance requirements that were due to be implemented in April 2013. It was decided to replace the system. A new wastewater treatment system was installed beginning in October 2012. The system uses a Wisconsin Mound leaching field system. The wastewater is highly pretreated before being introduced into the mound system and consists of a septic tank to remove solids, and a BioMicrobics system to reduce total suspended solids, biochemical oxygen demand, and fecal coliform bacteria. The system became operational on November 15, 2012. An application to terminate the NPDES permit for the previous wastewater treatment plant was submitted to MDNR on January 31, 2013.

Planning for the administration building demolition (discussed in Section 1.11.1) initially included covering the concrete slab with soil. This land disturbance or exposed soil area would amount to greater than one acre, therefore a NPDES storm water permit was required. It was decided to combine the land disturbance associated with the wastewater treatment system installation and the demolition because they would be taking place during the same time period. A Storm Water Pollution Prevention Plan (SWPPP) was prepared and the storm water permit was obtained using the new MDNR e-permitting system on August 23, 2012. The permit number is MORA01773. The permit requires regular inspections and cannot be terminated until approximately 70% vegetation coverage is established in the disturbed areas. During demolition of the building, it was decided not to cover the concrete slab with soil and vegetate, but to leave the concrete slab uncovered. This greatly reduced the area of disturbed soil, and the SWPPP was revised. The areas of soil which were disturbed by the demolition project were seeded and covered with straw. The areas attained revegetation very quickly. The area of disturbed soil in the new wastewater treatment area including the mounds was not fully vegetated at the end of 2012, therefore the permit remained open at the end of 2012. Once the mound area establishes vegetation, the permit can be closed.

1.5.3.2 Federal Facility Agreement

EPA and DOE signed a FFA in 1986 and amended it in 1992. The main purpose of the FFA is to establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the site in accordance with CERCLA. EPA, DOE, and MDNR subsequently signed an updated FFA; EPA provided the final signature on March 31, 2006.

1.5.3.3 Metropolitan St. Louis Sewer District (MSD) Agreement

The Weldon Spring Site has approval from the MSD to discharge treated disposal cell leachate and purge water from groundwater sampling at their Bissell Point Plant. DOE received notification in April 2004 that the leachate must meet the radiological drinking-water standard for all contaminants including uranium of 30 µg/L (20 pCi/L) prior to acceptance. The disposal cell untreated leachate uranium concentration was very close to this limit in 2004; therefore, DOE exercised a pretreatment contingency process and began treating the leachate through a system of cartridge filters and ion exchange media that is selective for uranium. The leachate was sampled after pretreatment and found to be significantly below the 30 µg/L limit. The untreated levels continued to be close to the 30 µg/L limit during 2012, so the leachate continued to be pretreated by the same process with the same results (that is, the levels continued to be significantly lower than the 30 µg/L limit).

1.6 Geology and Hydrogeology

Due to lithologic differences, including geologic features that influence groundwater flow, and the geographical separation of the former Chemical Plant and Quarry areas, separate groundwater monitoring programs have been established for the two sites. This section presents generalized geologic and hydrologic descriptions of the two sites, and Figure 3 provides a generalized stratigraphic description for reference. Hydrogeologic descriptions of lithologies monitored for each program are discussed in Sections 5.2.1.1 and 5.2.2.1. The Weldon Spring Site is situated near the boundary between the Central Lowland and the Ozark Plateau physiographic provinces. This boundary nearly coincides with the southern edge of Pleistocene glaciation that covered the northern half of Missouri over 10,000 years ago (Kleeschulte et al. 1986).

System	Series	Stratigraphic Unit	Typical Thickness (feet) ^a	Physical Characteristics	Hydrostratigraphic Unit
Quaternary	Holocene	Alluvium	0–120	Gravelly, silty loam	Alluvial aquifer
	Pleistocene	Loess and glacial drift ^b	10–60	Silty clay, gravelly clay, silty loam, or loam over residuum from weathered bedrock	
Mississippian	Meramecian	Salem Formation ^c	0–15	Limestone, limey dolomite, finely to coarsely crystalline, massively bedded, and thin-bedded shale	Locally a leaky confining unit
		Warsaw Formation ^c	0–80	Shale and thin- to medium-bedded finely crystalline limestone with interbedded chert	
	Osagean	Burlington-Keokuk Limestone	100–200	Cherty limestone, very fine to very coarsely crystalline, fossiliferous, thickly bedded to massive	Shallow aquifer system
		Fern Glen Limestone	45–70	Cherty limestone, dolomitic in part, very fine to very coarsely crystalline, medium to thickly bedded	
	Kinderhookian	Chouteau Limestone	20–50	Dolomitic argillaceous limestone, finely crystalline, thin to medium bedded	
Devonian	Upper	Sulphur Springs Group Bushberg Sandstone ^d	40–55	Quartz arenite, fine to medium grained, friable	Upper leaky confining unit
		Lower part of Sulphur Springs Group undifferentiated		Calcareous siltstone, sandstone, oolitic limestone, and hard carbonaceous shale	
Ordovician	Cincinnatian	Maquoketa Shale ^e	0–30	Calcareous to dolomitic silty shale and mudstone, thinly laminated to massive	
	Champlainian	Kimmswick Limestone	70–100	Limestone, coarsely crystalline, medium to thickly bedded, fossiliferous and cherty near base	Middle aquifer system
		Decorah Group	30–60	Shale with thin interbeds of very finely crystalline limestone	Lower confining unit
		Plattin Limestone	100–130	Dolomitic limestone, very finely crystalline, fossiliferous, thinly bedded	
		Joachim Dolomite	80–105	Interbedded very finely crystalline, thinly bedded dolomite, limestone, and shale; sandy at base	
		St. Peter Sandstone	120–150	Quartz arenite, fine to medium grained, massive	
	Canadian	Powell Dolomite	50–60	Sandy dolomite, medium to finely crystalline, minor chert and shale	Deep aquifer system
		Cotter Dolomite	200–250	Argillaceous, cherty dolomite, fine to medium crystalline, interbedded with shale	
		Jefferson City Dolomite	160–180	Dolomite, fine to medium crystalline	
		Roubidoux Formation	150–170	Dolomitic sandstone	
Gasconade Dolomite		250	Cherty dolomite and arenaceous dolomite (Gunter Member)		
Cambrian	Upper	Eminence Dolomite	200	Dolomite, medium to coarsely crystalline, medium bedded to massive	
		Potosi Dolomite	100	Dolomite, fine to medium crystalline, thickly bedded to massive; drusy quartz common	

^a Thickness estimates vary depending on data source.

^b Glacial drift unit includes the Ferrelview Formation and is saturated in the northern portion of the Ordnance Works where this unit behaves locally as a leaky confining unit.

^c The Warsaw and Salem Formations are not present in the Weldon Spring area.

^d The Sulphur Springs Group also includes the Bachelor Sandstone and the Glen Park Limestone.

^e The Maquoketa Shale is not present in the Weldon Spring area.

Figure 3. Generalized Stratigraphy and Hydrostratigraphy of the Weldon Spring, Missouri, Site

The uppermost bedrock unit underlying the former Chemical Plant is the Mississippian Burlington-Keokuk Limestone. Overlying the bedrock are unconsolidated units consisting of fill, topsoil, loess, glacial till, and limestone residuum of thicknesses ranging from a few feet to several tens of feet.

Three bedrock aquifers underlie St. Charles County. The shallow aquifer consists of the Mississippian Burlington-Keokuk Limestone and Fern Glen Formation, and the middle aquifer consists of Ordovician Kimmswick Limestone. The deep aquifer includes formations from the top of the Ordovician St. Peter Sandstone to the base of the Cambrian Potosi Dolomite. Alluvial aquifers of Quaternary age are present near the Missouri and Mississippi Rivers.

The Weldon Spring Quarry is located in low limestone hills near the northern bank of the Missouri River. The middle Ordovician bedrock of the Quarry area includes, in descending order, Kimmswick Limestone, Decorah Formation, and Plattin Limestone. These formations are predominantly limestone and dolomite. Massive Quaternary deposits of Missouri River alluvium cover the bedrock to the south and east of the Quarry.

1.7 Surface Water System and Use

The former Chemical Plant and Raffinate Pits areas are located on the Missouri–Mississippi River surface drainage divide. Elevations on the site range from approximately 608 feet (ft) above mean sea level near the northern edge of the site to 665 ft above mean sea level near the southern edge. (The disposal cell is not included in these elevation measurements.) The natural topography of the site is gently undulating in the upland areas, typical of the Central Lowlands physiographic province. South of the site, the topography changes to the narrow ridges and valleys and short, steep streams common to the Ozark Plateau physiographic province (Kleeschulte et al. 1986).

No natural drainage channels traverse the site. Drainage from the southeastern portion of the site generally flows southward to a tributary referred to as the Southeast Drainage (or 5300 Drainage, based on the site's nomenclature) that flows to the Missouri River.

The northern and western portions of the former Chemical Plant site drain to tributaries of Schote Creek and Dardenne Creek, which ultimately drain to the Mississippi River. The manmade lakes in the August A. Busch Memorial Conservation Area, which are used for public fishing and boating, are located within these surface drainages. No water from the lakes or creeks is used for irrigation or for public drinking water supplies.

Before the remediation of the former Chemical Plant and Raffinate Pits areas began, there were six surface water bodies on the site: the four raffinate pits, the Frog Pond, and the Ash Pond. The water in the raffinate pits was treated prior to release, and the pits were remediated and confirmed clean. The Frog Pond and Ash Pond were flow-through ponds that were monitored prior to being remediated and confirmed clean. Throughout the project, retention basins and sedimentation basins were constructed and used to manage potentially contaminated surface water. During 2001, the four sedimentation basins that remained were remediated, and the entire site was brought to final grade and seeded with temporary vegetation. Final seeding was conducted during 2002.

The Weldon Spring Quarry is situated within a bluff of the Missouri River Valley about 1 mile northwest of the Missouri River at approximately River Mile 49. A 0.2 acre pond within the Quarry proper acted as a sump that accumulated direct rainfall within the Quarry. Past dewatering activities in the Quarry suggested that the sump interacted directly with the local groundwater. All water pumped from the Quarry before remediation was treated before it was released. Bulk waste removal, which included the removal of some sediment from the sump area, was completed during 1995. The Quarry was partially backfilled, graded, and seeded during 2002.

The Femme Osage Slough, located approximately 700 ft south of the Quarry, is a 1.5 mile section of the original Femme Osage Creek and Little Femme Osage Creek. The University of Missouri redirected the creek channels between 1960 and 1963 during the construction of a levee system around the university's experimental farms (DOE 1990a). The slough is essentially landlocked and is currently used for recreational fishing. The slough is not used for drinking water or irrigation.

1.8 Ecology

The Weldon Spring Site is surrounded primarily by state conservation areas that include the 6,988-acre Busch Conservation Area to the north, the 7,356-acre Weldon Spring Conservation Area to the east and south, and the 2,548-acre Howell Island Conservation Area, which is an island in the Missouri River (Figure 2).

The wildlife areas are managed for multiple uses, including timber, fish and wildlife habitat, and recreation. Fishing constitutes a relatively large portion of the recreational use. Seventeen percent of the area consists of open fields that are leased to sharecroppers for agricultural production. In these areas, a percentage of the crop is left for wildlife use. The main agricultural products are corn, soybeans, milo, winter wheat, and legumes (DOE 1992b). The Busch and Weldon Spring Conservation Areas are open year-round, and the number of annual visits to both areas totals about 1,200,000.

The Quarry is surrounded by the Weldon Spring Conservation Area, which consists primarily of forest with some old-field habitat. Prior to bulk waste removal, the Quarry floor consisted of old-field habitat containing a variety of grasses, herbs, and scattered wooded areas. When bulk waste removal began, this habitat was disturbed. The rim and upper portions of the Quarry still consist primarily of slope and upland forest, including cottonwood, sycamore, and oak (DOE 1990a).

1.9 Climate

The climate in the Weldon Spring area is continental, with warm to hot summers and moderately cold winters. Air masses that are alternately warm and cold, wet and dry converge and pass through the area, causing frequent changes in the weather. Although winters are generally cold and summers are generally hot, prolonged periods of very cold or very warm to hot weather are unusual. Occasional mild periods with temperatures above freezing occur almost every winter, and cool weather interrupts periods of heat and humidity in the summer (Ruffner and Bair 1987).

The National Weather Service website lists the following statistics about St. Louis for 2012:

- Warmest year on record (average temperature - 61.2 degrees).
- Record for most occurrences of maximum temperatures greater than or equal to 105 degrees (11 days).
- Tied least snowiest fall (September–November) season on record (0 inches).
- Fourth warmest summer (June–August) on record (82.0 degrees).
- Warmest spring (March–May) on record (64.8 degrees).

The precipitation and average temperature results in Table 3 are provided by the National Weather Service. This data is used to show general climate data for the site. The St. Louis office of the National Weather Service is located in Weldon Spring approximately 2.5 miles from the site.

Table 3. Monthly Precipitation and Average Temperature for 2012

Month	Total Precipitation (inches)	Average Temperature (°F)
January	2.34	38.1
February	2.01	41.4
March	3.33	61.1
April	7.3	60.2
May	1.7	73.2
June	1.97	78.2
July	0.72	88.1
August	4.00	79.6
September	3.03	69.4
October	2.5	56.9
November	1.4	46.0
December	2.0	41.7

1.10 Land Use and Demography

The 2012 census (U.S. Census Bureau) estimated the population of St. Charles County to be about 368,666. The three largest communities in St. Charles County are O’Fallon (population: est. 79,329), St. Charles (population: est. 65,794), and St. Peters (population: est. 52,575) (Figure 1). The two communities closest to the site are Weldon Spring and Weldon Spring Heights, about 2 miles to the northeast. The combined population of these two communities is about 5,000. No private residences exist between Weldon Spring Heights and the site.

Francis Howell High School is about 0.6 mile northeast of the site along Missouri State Route 94 (Figure 2). The school employs approximately 150 faculty and staff members, and about 1,780 students attend school there. The school recently constructed a new school building, which was completed in time for the start of the 2011–2012 school year.

The MoDOT Weldon Spring maintenance facility, adjacent to the north side of the former Chemical Plant, closed on November 1, 2011. The property was transferred to St. Charles County in December 2012. The Army Reserve Training Area is located to the west of the former Chemical Plant. A Naval Reserve Center was built on the site in 2008 and is currently

operational. The Army has constructed a new Reserve center outside its fence line and is currently constructing a larger center inside the fence.

The University of Missouri owns about 741 acres of land east and southeast of the high school. The northern third of this land is being developed into a high-technology research park. MDC operates the conservation areas adjacent to the former Chemical Plant and employs about 50 people.

1.11 Non-Routine Activities

1.11.1 Administration Building Demolition

Following cleanup activities, the administration building was leased to Lindenwood University for off-campus classroom space. In 2011, the university vacated the premises and efforts to obtain another tenant were unsuccessful. To avoid long-term maintenance and operational costs and to reduce DOE property inventory, the approximately 32,000 square feet, metal frame building was demolished in 2012.

As previously mentioned, an environmental assessment was conducted by NPN Environmental Engineers, Inc. to identify lead-based paint, asbestos-containing building materials, and other potentially hazardous constituents requiring special handling or removal prior to building demolition. No asbestos was detected in the portions of the building to be demolished. Other materials identified for special handling included Freon in the roof-mounted HVAC systems, mercury in some interior thermostats, and numerous ceiling-mounted fluorescent light bulbs and ballasts.

Following removal of the above materials, shut-off and capping of water and sewer connections and deactivation of electrical supply, the building demolition process began in mid-September 2012. The work was accomplished primarily using a track-mounted excavator with grapple attachment and a skid steer (Bobcat). The demolition proceeded from the roof downward and from the north end to the south end in controlled work segments where the building materials were separated into steel, mixed metals, and wiring for recycling and landfill debris (wood, roofing, drywall, floor tiles, etc.). These materials were segregated daily and separate containers or trucks were loaded with the various building debris on a weekly basis and transported offsite for final disposition.

The administration building was replaced with office trailers for the current staff.

1.11.2 Sanitary Wastewater Treatment Plant Replacement

As discussed in Section 1.5.3.1, the original wastewater treatment system was over 20 years old, oversized for current needs, costly to maintain, and currently unable to meet new surface discharge compliance requirements that were due to go in effect April 2013. It was decided to replace the system. Installation of a new wastewater treatment system began in October 2012. The system uses a Wisconsin Mound system to provide no discharge final disposal. The wastewater is pretreated before going to the mound system using a septic tank to remove solids, and a BioMicrobics system to reduce total suspended solids, biochemical oxygen demand and fecal coliform bacteria. Discharge is to an onsite subsurface discharge (Wisconsin Mound)

system, therefore there is no offsite discharge and no requirement for an NPDES permit. An application to terminate the permit for the previous sanitary wastewater treatment plant was submitted to MDNR on January 31, 2013.

2.0 Inspection Report

2.1 Introduction

The Weldon Spring Site was inspected October 23 through 25, 2012. The inspection was conducted in accordance with the LTS&M Plan (DOE 2008), and associated inspection checklist. Representatives from DOE, Stoller, EPA, and MDNR participated in the inspection. Representatives from MoDOT, and St. Charles County, Division of Environmental Health and Protection participated in portions of the inspection. As previously mentioned, the Weldon Spring Site is a CERCLA site.

The main areas inspected at the site were the Quarry, the disposal cell, the LCRS, monitoring wells, assorted general features, and areas where ICs have been established.

IC areas were inspected to ensure that restrictions such as excavating soil, groundwater withdrawal, residential use, etc., were not being violated. Each area was inspected and no indication of violations of the restrictions was observed.

The disposal cell was inspected by walking ten transects over the cell and around the cell perimeter. Hand-held global positioning system (GPS) equipment was used to navigate the ten transects. Six areas of the cell which had been marked were located and observed for any signs of rock degradation. The LCRS was also inspected and observed to be in good condition. Forty-eight of the 107 groundwater-monitoring wells were inspected and were in good condition. Other site features including the prairie, site markers, and roads also were inspected.

The purpose of the annual inspection was to confirm the integrity of the visible features (such as disposal cell, LCRS, and monitoring wells) at the site, document the site condition subsequent to remediation and restoration, identify changes in conditions that may affect site integrity, determine if ICs are adequately implemented, and determine the need, if any, for maintenance or additional inspections and monitoring.

At the time of the inspection nine Stoller personnel were employed full-time at the site. Stoller is the LM contractor for DOE. Some of these employees also support other LM sites around the nation. Also employed at the site are part-time contractor and subcontractor employees.

This report presents the results of the DOE annual inspection of the Weldon Spring Site. The following personnel from Stoller were the lead inspectors during the inspection:

- Terri Uhlmeier, Weldon Spring Site
- Randy Thompson, Weldon Spring Site

The following support personnel from Stoller participated in the inspection:

- Tom Welton, Weldon Spring Site
- Tim Zirbes, Weldon Spring Site
- Becky Cato, Weldon Spring Site

The following personnel observed the inspection and provided oversight:

- Ken Starr—DOE
- Hoai Tran—EPA, Region VII
- Patrick Anderson—MDNR
- Dan Carey—MDNR
- Kevin Wideman—MoDOT
- Stowe Johnson—MoDOT
- Brittany Poletti—St. Charles County
- Ryan Tilley—St. Charles County
- Jeff Becker—St. Charles County
- Michelle Watkins—St. Charles County
- Tom Nelson—Citizen

The inspection was conducted in accordance with the LTS&M Plan, dated December 2008.

2.2 Inspection Results

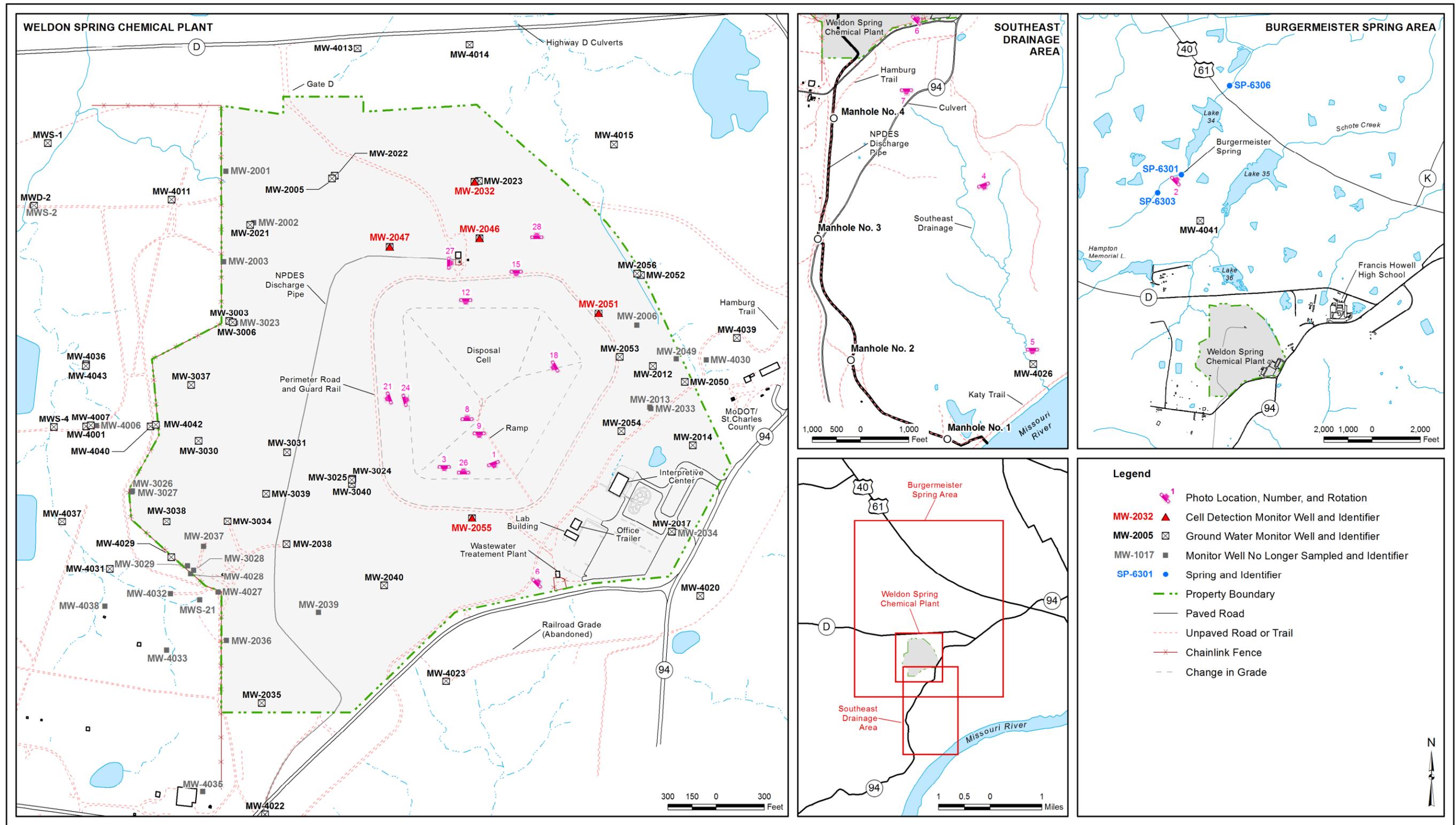
Prior to the inspection, the site inspection agenda (Appendix A) was reviewed with the inspection participants. A safety briefing was also held prior to the inspection and the corrective action report from the 2011 annual inspection was reviewed (Appendix B). The following is a summary of the inspection results. The inspection base maps, which include the locations of the photographs, are included as Figures 4 and 5. The checklist (from Appendix H of the LTS&M Plan) is included in this report as Appendix C.

2.2.1 Institutional Controls

Section 2.3.4 of the LTS&M Plan states “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.”

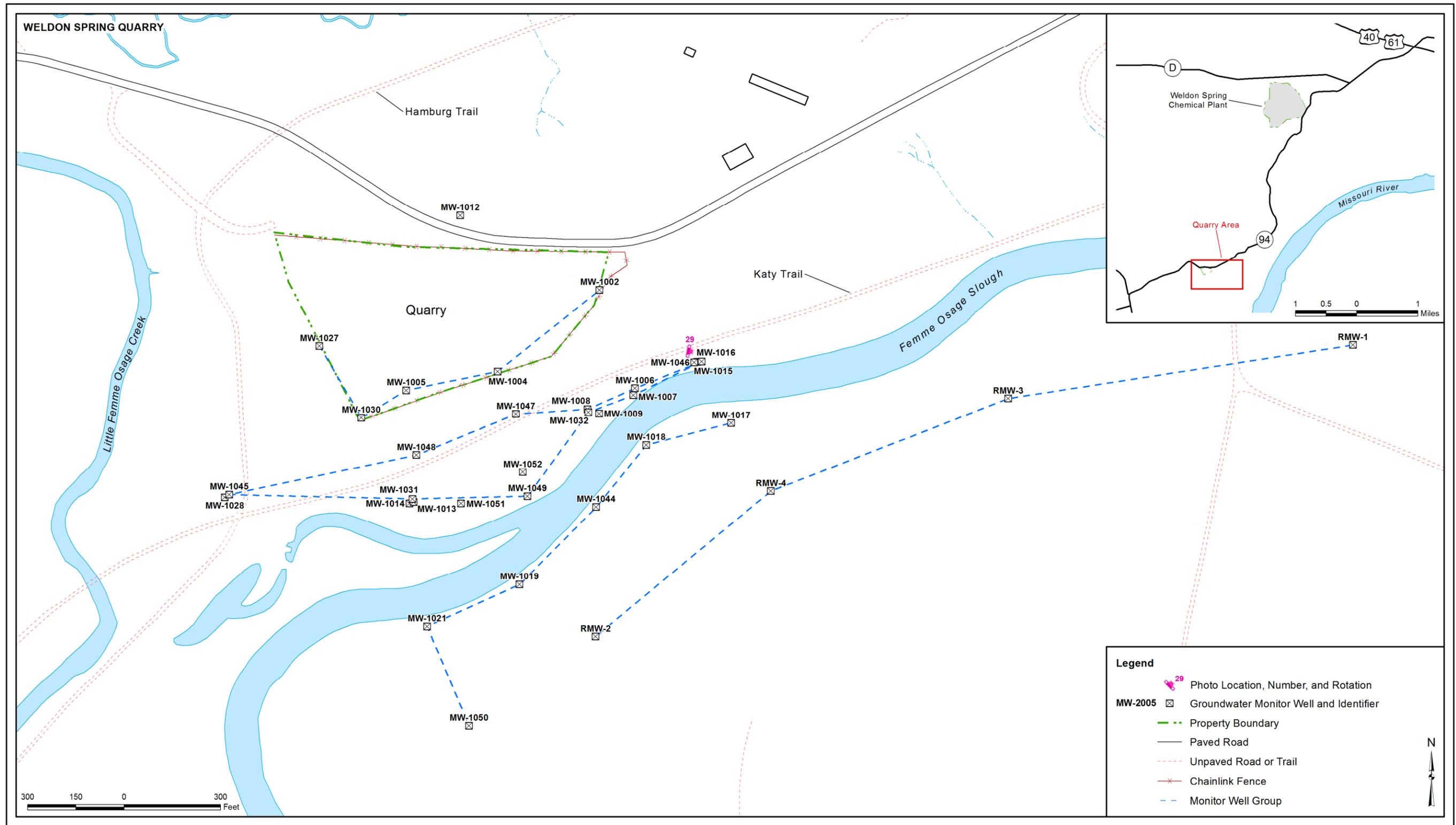
Easements have been negotiated and finalized with surrounding State agency landowners for implementing use restrictions required on the state properties. The state agencies included the Missouri Department of Conservation (MDC), MDNR-Parks, and MoDOT. The easements are for the purpose of restricting potential use of the contaminated groundwater in the hydraulic buffer zone, and also to restrict land use in the Southeast Drainage area and at the Quarry site. Figures 6 and 7 provide the IC location maps from the LTS&M Plan.

The IC areas are listed in the following section as they are referenced in the inspection checklist.



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Figure 4. 2012 Inspection Map for the Chemical Plant Area of the Weldon Spring, Missouri, Site



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Figure 5. 2012 Inspection Map for the Quarry Area of the Weldon Spring, Missouri, Site

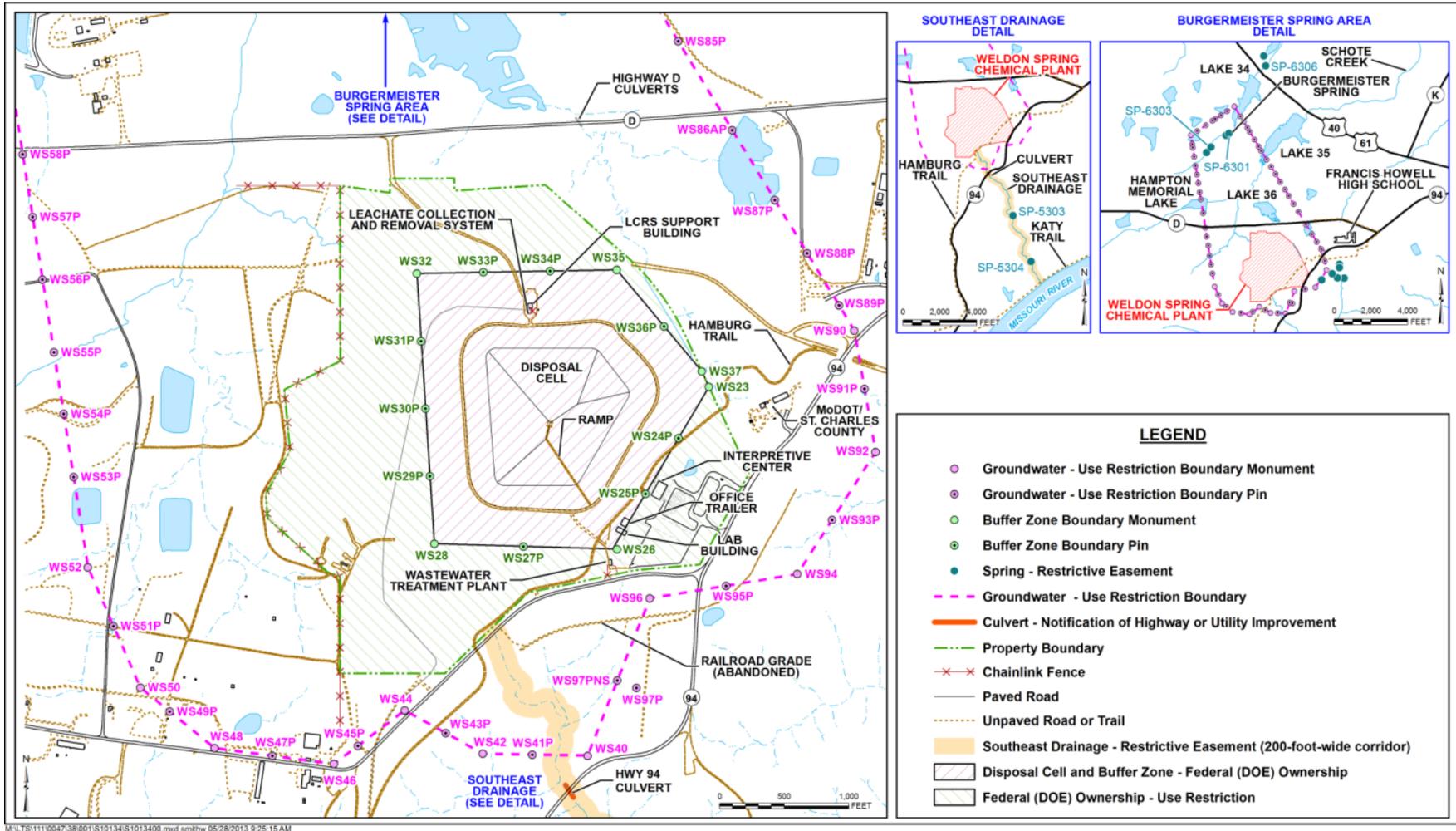


Figure 6. Institutional Controls Location Map for the Chemical Plant Area of the Weldon Spring, Missouri, Site

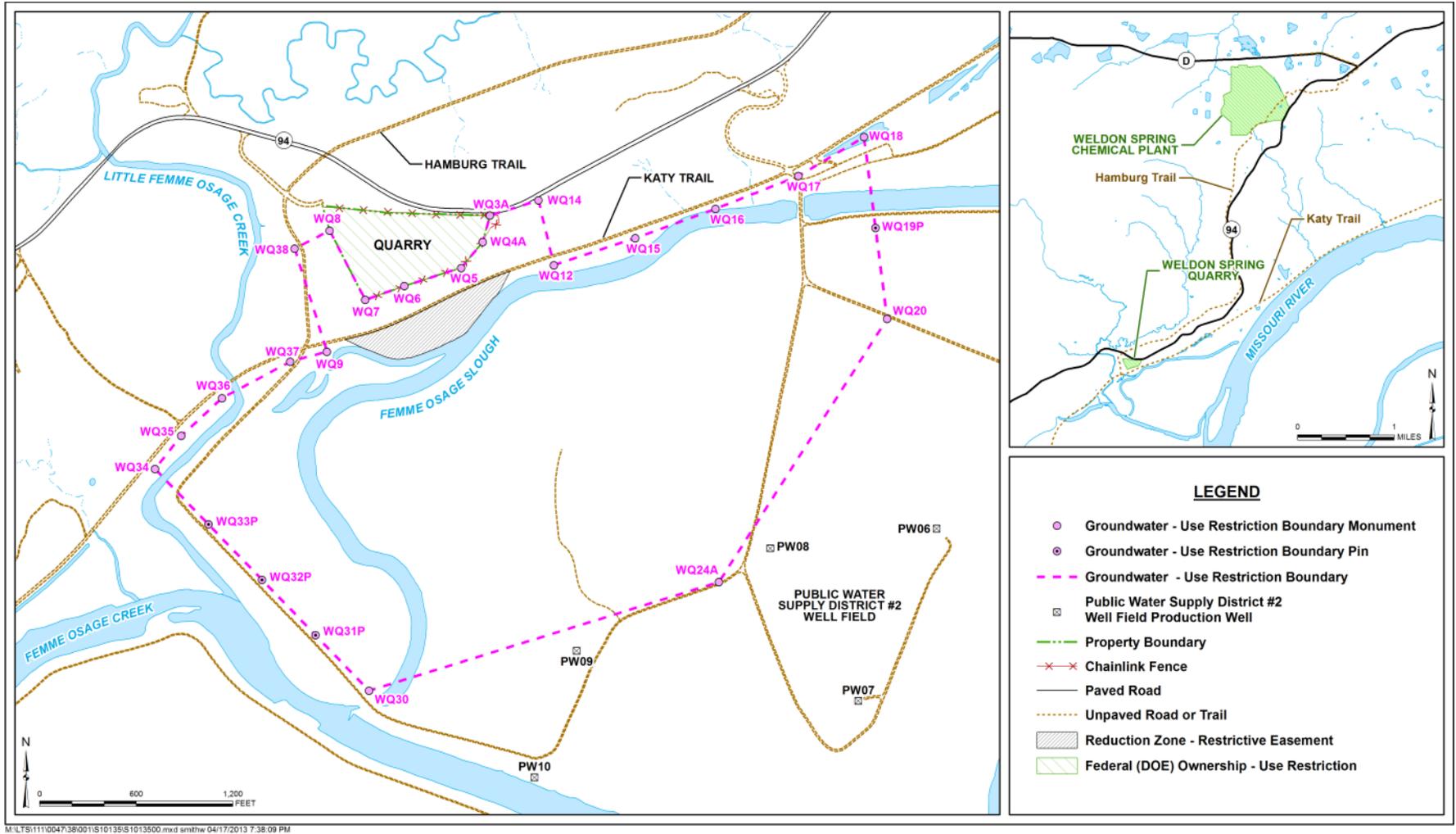


Figure 7. Institutional Controls Map for the Quarry Area of the Weldon Spring, Missouri, Site

2.2.1.1 Land and Shallow Groundwater Use Within the Site Proper Boundary (Outside Disposal Cell Buffer Zone)

Inspection Criteria: Inspect for indications of excavations into soil or bedrock and groundwater withdrawal or use in restricted areas. If any party has been granted use of portions of the former Chemical Plant area, inspect to ensure that land use is in compliance with the terms of the restrictions within the notation.

Inspection Results: This area was inspected and no indications of excavations into soil or bedrock, groundwater withdrawal, or use were observed. At the time of the inspection the demolition of the administration building was close to being completed and a new wastewater treatment package plant was being installed (Photo 1). The new wastewater treatment package plant replaces the outdated and problematic old system. The wastewater treatment package plant does involve some excavations into this area to install new tanks and the mound system, but this is considered maintenance which is an exemption to the notation. The site staff is now located in office trailers located just west of the original administration building.

2.2.1.2 Land and Shallow Groundwater Use at DOE Site Proper Disposal Cell and Buffer Zone

Inspection Criteria: Inspect for indications of excavations into soils and bedrock, and for residential use of the shallow groundwater within the buffer zone. Inspect to ensure that the land use continues to be in compliance with the terms of the restrictions within the notation.

Inspection Results: This area was inspected and no indications of excavations into soils or bedrock, and no residential uses of the shallow groundwater within the buffer zone were observed. Current land use remains consistent with the ICs.

2.2.1.3 Groundwater Use in Areas Surrounding the Former Chemical Plant

Inspection Criteria: Groundwater use is restricted in this area as shown on Figure 6. Inspect affected areas for evidence of groundwater or spring water use (Burgermeister Spring and Spring 6303). Inspect to ensure that land use continues to be in compliance with the terms of the license, easement, or permit and the restrictions contained therein.

Inspection Results: The surrounding area where groundwater use is restricted was inspected. This included property owned by MDC and the Army. No evidence of groundwater use was observed and current land use remains consistent with ICs on both properties. Burgermeister Spring 6301 (Photo 2) and Spring 6303 on MDC property were inspected and there were no indications of spring water use. Spring 6303 was not flowing. All the monitoring wells inspected were appropriately secured. The maintenance on the monitoring wells was also sufficient. It was noted that the Army has started clearing land for a new large reserve center (Photo 3).

2.2.1.4 Land and Shallow Groundwater Use on the DOE Quarry Property

Inspection Criteria: Inspect for indications of excavations into soil or bedrock and groundwater withdrawal or use in restricted areas. If any party had been granted use of portions of the Quarry area, inspect to ensure that land use is in compliance with the terms of the restrictions within the notation.

Inspection Results: The Quarry Property was inspected and no indications of excavation into soil or bedrock, and no groundwater withdrawal or use were observed. Also, no party has been granted use of portions of the Quarry area. Original Quarry backfill continues to provide positive drainage from the Quarry to the Little Femme Osage Creek and vegetative cover remains well established. Current land use remains consistent with ICs.

2.2.1.5 Groundwater (Quarry)

Inspection Criteria: The Quarry groundwater restriction area boundary is shown in Figure 7. Inspect affected areas for evidence of groundwater withdrawal or use in the area of impact. Inspect to ensure that land use continues to be in compliance with the terms of the license and the restrictions contained therein.

Inspection Results: The groundwater restricted area was inspected and no evidence of groundwater withdrawal or use in the area was observed.

2.2.1.6 Land Use in Quarry Area Reduction Zone

Inspection Criteria: A naturally occurring reduction zone exists in soil south of the Katy Trail and north of the Femme Osage Slough. This area is restricted for excavations and is shown on Figure 7. Inspect for indications of excavations into soils and bedrock in the uranium reduction zone. Inspect to ensure that land use continues to be in compliance with the terms of the easement and the restrictions contained therein.

Inspection Results: The Quarry reduction zone area was inspected and no indications of excavation into soils or bedrock were observed. As required by the LTS&M Plan, information signage and contact numbers were posted on monitoring wells at the Quarry Area reduction zone. The labels indicate no digging is allowed in this area and include contact numbers for DOE and MDC. Land use remains consistent with planned ICs.

2.2.1.7 Southeast Drainage

Inspection Criteria: Check for indications of residential use or construction in the Southeast Drainage (200-ft-wide-corridor), or other activity that would indicate non-recreational use of the area. Check Springs 5303 and 5304 for residential, commercial, or agricultural use of spring water.

Inspection Results: The inspectors walked down the entire Southeast Drainage (Photo 4) and no indications of residential use, construction, or any other activity that would indicate non-recreational use of the area were observed. The springs also were inspected and no indications of residential, commercial, or agricultural use of the springs were observed. Both of the springs

were observed to be flowing. Current land use remains consistent with planned ICs. It was recommended during the 2011 inspection that monitoring well MW-4026 be repainted and it was noted during this inspection that the well had been repainted (Photo 5). It was observed during the 2011 inspection that erosion is occurring under the culvert which crossed under the Hamburg Trail (Photo 6). John Vogel of MDC had noted this issue during the 2011 inspection as they are responsible for maintenance of the Hamburg Trail under a formal agreement between DOE and MDC. The erosion was again observed during the 2012 inspection and an e-mail was sent on November 2, 2012, to John Vogel informing him of the observation.

2.2.1.8 State Route 94 Culvert

Inspection Criteria: Check for signs of disturbance of the affected region where the culvert passes beneath State Route 94 and in the utility rights-of-way in the affected area.

Inspection Results: The State Route 94 culvert was inspected. It was noted during the inspection that the culvert inlet was filled with tree debris (Photo 7). The MoDOT representative, Kevin Wideman, stated that he would inform the local MoDOT representatives.

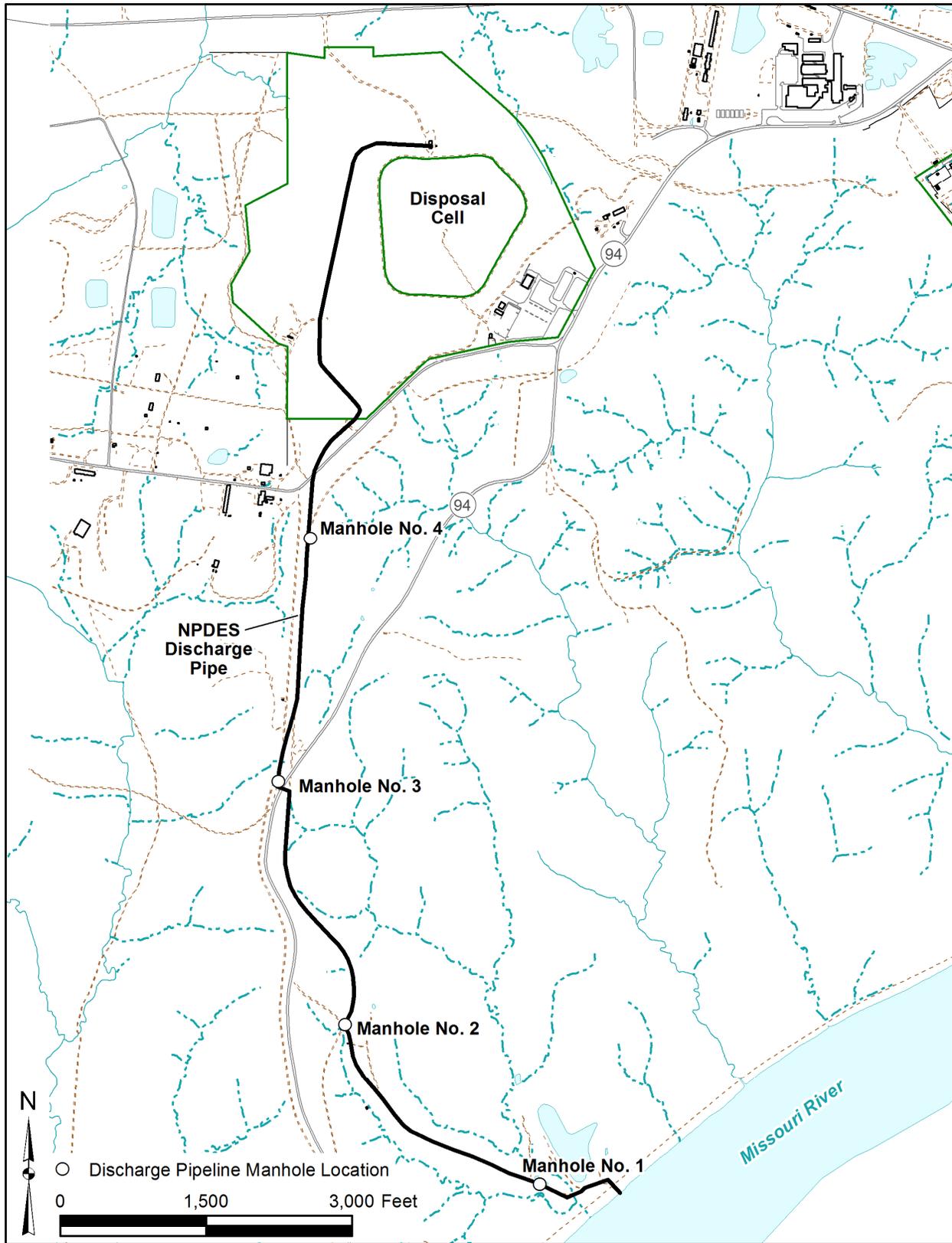
2.2.1.9 NPDES Discharge Pipeline from LCRS to Missouri River

Inspection Criteria: Inspect the entire length of the NPDES discharge pipeline and outfall for any disturbance or maintenance needs.

Inspection Results: The area of the pipeline was inspected. A map of the pipeline, indicating the manhole locations, is shown in Figure 8. It was noted that there were no onsite disturbances of the pipeline and there were no apparent disturbances in the area of the pipeline or manholes in the offsite areas. It was observed that there is some minor debris in the opening of the discharge pipe at the Missouri River. This pipeline serves as a contingency for discharge of disposal cell leachate. The pipeline has not been used for that purpose to date.

2.2.2 Disposal Cell

The disposal cell was inspected in accordance with the LTS&M Plan and the annual inspection checklist (Photos 8 and 9). The cell was divided into ten transects (Figure 9). The inspectors separated into two groups and walked five transects each. The inspectors looked for depressions, shifts of cell plane vertices, and other indications of settlement. Other items for inspection were vegetation, wet areas, apron drains, guardrails, and the stairs. The six rock test plot areas were also inspected. The inspectors took photographs of these delineated sections and compared them to photographs from the previous inspection of the same areas and observed no rock degradation. The test plot areas are shown from the original inspection in 2003, 2011, and this year for comparison purposes. Refer to Photos 10 through 26. It was noted during the 2010 inspection that some rocks had been removed by vandals from the Test Plot #5 during the 2010 inspection. A new test plot (Test Plot #6) had been marked during 2011 in response to a request from MDNR during the 2010 inspection. This new plot is located on the southern face of the disposal cell (Figure 9). It was noted during the 2011 inspection that the painted lines around the test plots had faded a great deal and it was recommended that the lines be repainted. The lines had all been repainted during 2012.



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Figure 8. NPDES Discharge Pipeline Between the LCRS Support Building at the Missouri River, Weldon Spring, Missouri, Site

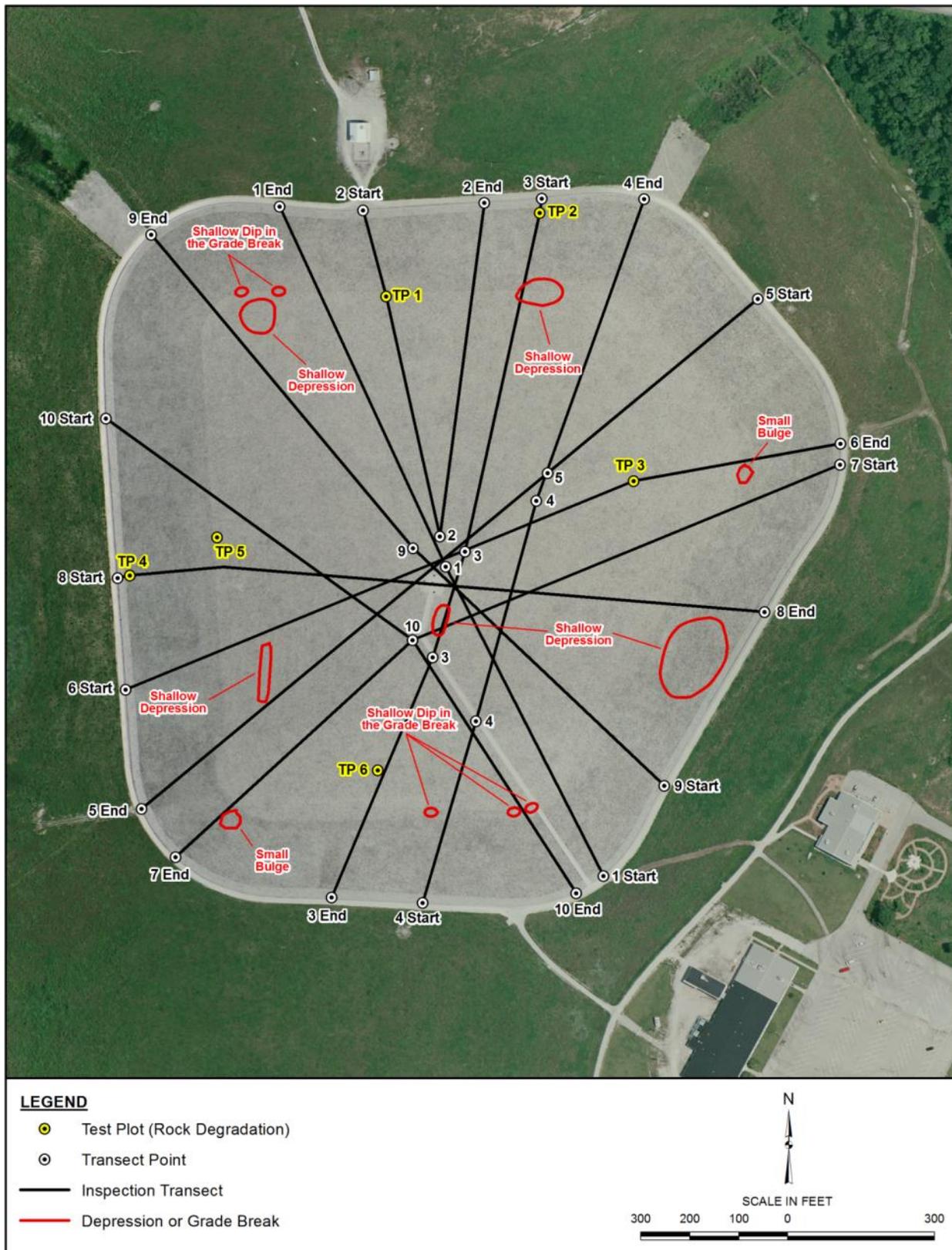


Figure 9. Disposal Cell Inspection Transects and Rock Test Plot Locations at the Weldon Spring, Missouri, Site

In accordance with the inspection criteria included in the checklist, the inspectors also evaluated the cell cover for wet areas or water drainage and observed that none were present. The toe and apron drains were inspected and found to be functioning as designed. The guardrail and stairs were in good condition. No vegetation was found on the disposal cell during the inspection. It has been observed the past four years that much of the rock is darker than in previous years and is assumed to be due to weathering. The darkened rock is not an issue that could compromise the disposal cell, just an observation of a changed condition.

2.2.3 Leachate Collection and Removal System (LCRS)

Operations of the LCRS were discussed with the inspection participants, the LCRS data and the SOARS system was presented, and the system was inspected (Photo 27). The fences and doors were locked and were in good condition. The system was functioning as designed. The leachate production rates, uranium levels, and flow rates are provided in Appendix D.

DOE continues to exercise its pretreatment contingency process equipment by pre-treating the leachate through a system of cartridge filters and ion exchange media that is selective for uranium. The leachate is sampled and continues to be well below the limit for uranium. The leachate will continue to be managed in this manner until the untreated leachate is consistently below the 20 pCi/L level for uranium.

2.2.4 Erosion

2.2.4.1 Chemical Plant Area

The erosion areas were observed during the inspection. Erosion channels within the entire prairie have been mapped with GPS annually since 2007 (Figure 10). The resulting information will be used to track the nature and extent of erosion and to determine possible action if deemed necessary.

2.2.4.2 Quarry Area

No erosion areas were noted during the inspection of the Quarry area. Subsidence of soil beneath groundwater monitoring well concrete pads due to drought conditions was noted and a contractor will be selected to remediate any damage to surface casing seals.

2.2.5 General Site Conditions

General site conditions as listed in the checklist were inspected and are discussed below.

2.2.5.1 Roads

The roads consist of asphalt roads leading into the property and a gravel road that extends around the disposal cell and to Gate D. The roads were in good condition.

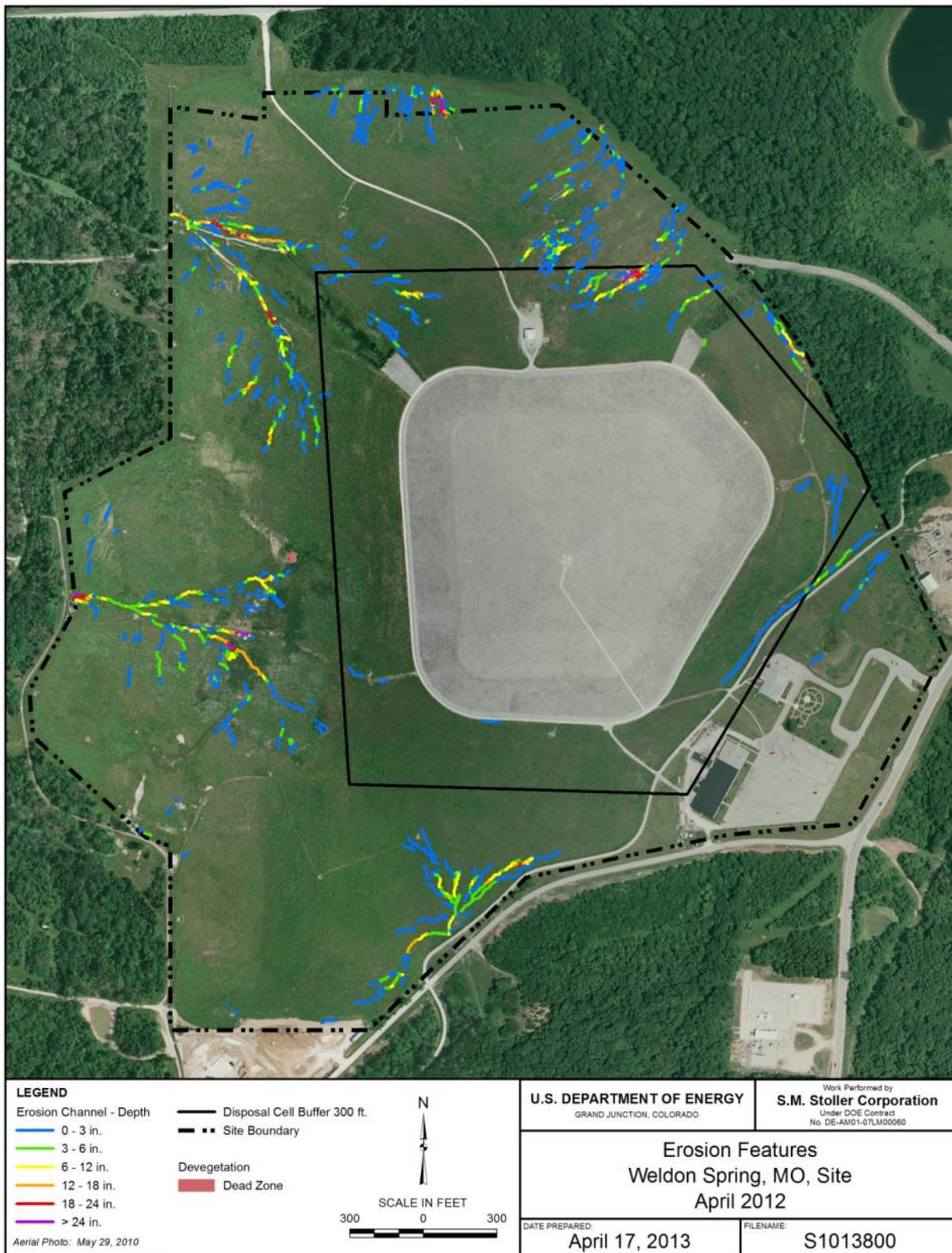


Figure 10. Erosion Features within the Prairie

2.2.5.2 Vandalism

Although the site is publicly accessible, signs are clearly posted at the disposal cell that the viewing platform is open during daylight hours only. Public use of the site continues to increase. Because of on-going issues associated with this use (e.g., littering at various locations throughout the site including at the top of the disposal cell, increasing evidence of nighttime access), a private security firm was hired to provide seasonal patrol coverage of the site during the evening hours. These patrols, along with the upgraded safety-oriented security system have dramatically curtailed the degree of undesirable activities at the site. Signs were also posted at the disposal cell entrance and the top of the disposal cell that state that video surveillance is being conducted. This was a result of a recommendation made during the 2010 inspection.

The disposal cell monument plaques were observed to have been vandalized during 2010. The corners of the plaques have been bent down by the use of excessive force. It was noted during the 2011 and 2012 inspections, that the plaques are continuing to be vandalized. The plaques are still functional and nothing further will be done at this time.

On September 19, 2012, it was discovered that wells MW-3031 and MW-3037 had been vandalized. Upon inspection, it was determined that the aluminum top caps had been broken off of both wells. Attempts to measure the static water level in MW-3031 revealed that a large rock had been forced down MW-3031 and was lodged in the casing approximately 4.5 ft from the top of the casing. It appears the rock cannot be removed from the well casing. It is not known if any additional rocks or other materials are present below this rock. It is planned to abandon this well. No additional damage was observed on MW-3037. Well caps that are more vandal-proof have since been installed on all of the groundwater monitoring wells.

2.2.5.3 Personal Injury Risks

No personal injury risks were observed.

2.2.5.4 Site Markers (Four Information Plaques on Top of Cell, Historical Markers, and Other Information Markers)

The four information plaques on top of the cell were generally in good condition (see Section 2.2.5.2). There was vandalism noted to the plaques in that the corners had been bent down from the use of excessive force as noted above. The historical markers were inspected and were in good condition.

The LTS&M Plan also states that signs are required to be 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) for information. During the 2012 inspection, it was noted that these signs were posted on the LCRS fence and were in good condition.

2.2.6 Monitoring Wells

Monitoring wells in the Disposal Cell Monitoring Well Network, former Chemical Plant Monitoring Well Network, and Quarry Monitoring Well Network were inspected. The inspection checklist required all the disposal cell wells to be inspected, and greater than 10 percent of the former Chemical Plant and Quarry wells to be inspected. The checklist required the wells to be inspected to ensure they are properly secured and locked, in good condition, and to check if they need maintenance and have the proper ID number on the well. The maintenance on the wells looked good, with many wells having been freshly painted. Prior to the inspection during regular sampling and inspection of the wells it was noted that several of the wells and/or well casings had settled and caused damage to the wells or the concrete pads (Photo 29). It is assumed that the extreme drought over the summer caused the settling. The following wells from the former Chemical Plant were affected: MW-2033, 2034, 4001. The wells affected at the Quarry were MW-1013, 1015, 1016, 1018, and 1046. It is planned to hire a subcontractor to repair the affected wells.

2.2.6.1 Disposal Cell Monitoring Well Network

Each of the wells in the disposal cell network were inspected and found to be in good condition. The wells are listed below:

MW-2032, 2046, 2047, 2051, 2055.

2.2.6.2 Chemical Plant Area Monitoring Well Network

The inspection checklist requires at least 10 percent of the wells be inspected from the former Chemical Plant monitoring well network. The monitoring well network consists of 68 wells owned by DOE and 4 wells owned by the Army. This number does not include the five disposal cell wells, although some of those wells are monitored for the groundwater remedy. Twenty-four wells were inspected (35 percent). Only 43 DOE-owned wells are monitored for the groundwater remedy of monitored natural attenuation. The remaining wells are monitored quarterly for static water levels only. The wells that were inspected are listed below:

MW-2006, 2017, 2023, 2034, 2053, 3024, 3025, 3027, 3028, 3029, 3031, 3040, 4001, 4006, 4007, 4026, 4027, 4028, 4029, 4036, 4040, 4041, 4042, 4043.

2.2.6.3 Quarry Monitoring Well Network

The inspection checklist requires greater than 10 percent of the wells in the Quarry monitoring well network be inspected. The monitoring well network consists of 34 wells. Nineteen wells were inspected (55 percent). The wells that were inspected are listed below:

MW-1002, 1004, 1005, 1006, 1007, 1008, 1009, 1013, 1014, 1015, 1016, 1027, 1030, 1031, 1032, 1046, 1048, 1049, 1052.

2.2.7 Onsite Document and Record Verification

The following onsite documents and records were verified:

- Surveillance and Maintenance Plan: (Long-Term Surveillance and Maintenance Plan for the Weldon Spring, Missouri, Site, December 2008).
- Maintenance log (Plan of the Day/Week forms).
- NPDES Storm water permit (MORA01773) and associated SWPPP and inspection checklists. The storm water permit was obtained for the land disturbance from the demolition of the administration building and wastewater treatment plant installation.
- NPDES permit(s): #MO-0107701, 0129917.
- Metropolitan St. Louis Sewer District (MSD) agreement and records.
- Groundwater monitoring records.
- Leachate records.
- Interpretive Center sign-in logs.
- Telecons and interview records.

2.3 Contacts

Several stakeholders were notified prior to the inspection in accordance with the checklist. The purpose of this notification is to keep contact with the stakeholders and determine if there are any issues or concerns. These included:

- St. Charles County Sheriff
- Cottleville Fire District
- Francis Howell High School
- Simplex-Grinnel
- St. Charles County

The IC contacts also were notified in regard to the inspection and to maintain annual contact with the representatives relevant to IC issues. This annual contact is used to verify cognizance of the ICs and to reiterate the requirements and/or restrictions with each representative. The representatives contacted are listed below.

- John Vogel—Missouri Department of Conservation
- Joel Porath—Missouri Department of Conservation
- Alan Leary—Missouri Department of Conservation
- Mary Bryan—Missouri Department of Natural Resources – Parks
- Quinn Kellner—Missouri Department of Natural Resources – Parks
- Marsha Keeran/John Downing—U.S. Army
- Tom Blair—Missouri Department of Transportation

- Tom Evers—Missouri Department of Transportation
- Kevin Wideman—Missouri Department of Transportation

The St. Charles Planning and Zoning Department also was contacted and they verified that no planning and zoning activities were currently taking place within one-quarter mile of the Chemical Plant and Quarry Property. The Notation of Land Ownership and easements with the state property owners were verified to be filed and present at the St. Charles Recorder of Deeds office by checking the county website at www.sccmo.org.

The Stoller site manager and Environmental Data manager (at this time one person, Randy Thompson, fills both positions) was interviewed as required by the inspection checklist. He was interviewed regarding the status of the project and to discuss any issues as well as the status of the monitoring data. No issues were identified during this interview.

All conversations and interviews were recorded on an Interview Record form adapted from the EPA Comprehensive Five-Year Review Guidance. The forms for each of these contacts and interviews are attached as Appendix E.

2.4 Recommendations

1. Recommendation: Repair wells which have been observed to be damaged by ground subsidence. These include MW-1013, 1015, 1016, 1018, 1046, 2033, 2034, and 4001.

Target Date: September 20130

2. Recommendation: Continue to monitor and evaluate erosion on the Chemical Plant Site.

Target Date: Ongoing.

2.5 Photographs



Photo 1. View from the disposal cell of new wastewater treatment plant installation



Photo 2. Burgermeister Spring



Photo 3. View from the disposal cell of the clearing on the Army Property



Photo 4. Southeast drainage



Photo 5. Monitoring well MW-4026



Photo 6. Erosion under Hamburg Trail culvert



Photo 7. Culvert inlet under Highway 94



Photo 8. Disposal cell looking north



Photo 9. Disposal cell looking south



Photo 10. 2003-Cell cover test plot TP1; north edge of north facet



Photo 11. 2011-Cell cover test plot TP1; north edge of north facet



Photo 12. 2012-Cell cover test plot TP1; north edge of north facet



Photo 13. 2003-TP2; foot of north side slope of disposal cell



Photo 14. 2011-Cell cover test plot TP2; bottom of north side slope



Photo 15. 2012-Cell cover test plot TP2; bottom of north side slope



Photo 16. 2003-Cell cover test plot TP3; northeast ridgeline



Photo 17. 2011-Cell cover test plot TP3; northeast ridgeline



Photo 18. 2012-Cell cover test plot TP3; northeast ridgeline



Photo 19. 2003-Cell cover test plot TP4; located on upper west side



Photo 20. 2011-Cell cover test plot TP4; located on upper west side



Photo 21. 2012-Cell cover test plot TP4; located on upper west side



Photo 22. 2003-Cell cover test plot TP5; located on lower west side



Photo 23. 2011-Cell cover test plot TP5; located on lower west side



Photo 24. 2012-Cell cover test plot TP5; located on lower west side



Photo 25. 2011-Cell cover test plot TP6; located on upper south side



Photo 26. 2012-Cell cover test plot TP6; located on upper south side



Photo 27. Sump outside LCRS Building



Photo 28. Erosion north of the disposal cell



Photo 29. Monitoring well MW-1016; one of wells damaged from the drought due to ground subsidence

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3.0 Prairie and Garden Maintenance

Several prairie maintenance activities were performed throughout the previous 12 months.

Due to unfavorable weather in the spring of 2012 there was no controlled burn performed during this period. In June and July, spot-spraying individual small trees and *Sericea lespedeza* and *Robinia pseudoacacia* plants with herbicide was performed as part of on-going efforts to reduce numbers and control encroachment of invasive weed and tree species throughout the prairie area. An increase in the numbers of trees was observed during this season's eradication efforts.

Garden maintenance of the areas surrounding the interpretive center continued in 2012. This consisted of manual weeding and frequent irrigation in 2012 and was performed throughout the growing season. Mulching of the beds was performed to reduce the weeds and control moisture. Dried seed heads from forbs were harvested and utilized for hand overseeding on the prairie area of the site in December 2012. Locations in the prairie with erosion and less plant establishment were targeted for overseeding. Several individuals and organizations continued to perform garden maintenance activities throughout this period.

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4.0 Interpretive Center Update

The Weldon Spring Site Interpretive Center is part of DOE's LTS&M activities at the Weldon Spring Site. The purpose of this facility is to inform the public of the site's history, remedial action activities, and final conditions. The Interpretive Center provides information about the LTS&M program for the site, provides access to surveillance and maintenance information, and supports community-involvement activities.

Current exhibits in the Interpretive Center present:

- The history of the towns that once occupied the 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, as well as their manufacturing wastes.
- The events and community efforts to clean up the site, and the people who made it happen.
- A summary of LM's mission.
- An overview of LTS&M activities at the site.
- Information pertaining to the site's natural environment, such as soil and groundwater conditions and the prairie.
- Information about LM's renewable energy initiatives.

These exhibits may be changed as appropriate due to changing conditions or emerging issues at and near the site. An exhibit upgrade was completed in 2010; it included updating information in several exhibits, adding interactive and multimedia components, creating several new exhibits that address site-related topics, and improving the flow of foot traffic through the Interpretive Center.

The Interpretive Center's hours of operation 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 4:00 p.m. (10:00 a.m. to 2:00 p.m. November 1 through March 31).
- Sunday: 12:00 p.m. to 4:00 p.m.

The Interpretive Center is closed on federal holidays.

Attendance is tracked through the following types of public activities:

- Individuals that walk into the Interpretive Center from the street during normal hours of operation.
- Scheduled groups that participate in Interpretive Center educational programs.
- Community-based organizations that use the Paul T. Mydler and Howell-Hamburg meeting room to conduct business meetings.
- Scheduled groups who are unable to visit the site but are recipients of Interpretive Center outreach presentations.

A significant number of individuals also use site amenities (e.g., Hamburg Trail, disposal cell perimeter road for prairie viewing, disposal cell viewing platform, native plant garden); however, because this use does not involve entering the Interpretive Center and is often outside of normal hours of operation, it is not consistently tracked. It is estimated that between 5,000 and 15,000 individuals per year make use of site amenities in this way.

Attendance at the Interpretive Center in 2012 was 23,218 (Table 4). The kindergarten through grade 12 educational community continues to have significant interest in Interpretive Center programs. Field trips are usually scheduled at least several months in advance, and available calendar dates fill up quickly. At times, this requires reservations to be made for the following school year. For a few school districts that have limited funding for field trips, outreach activities are scheduled, and Interpretive Center personnel give educational presentations at the school. Outreach activities usually involve several classes or the entire grade level of students.

Table 4. Interpretive Center Attendance

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2002								301	224	190	40	31	786
2003	6	44	44	85	174	191	161	233	251	350	125	122	1,786
2004	52	61	166	182	104	324	192	353	379	850	556	354	3,573
2005	123	605	1,056	2,048	1,888	1,408	1,370	1,091	1,511	1,663	1,739	903	15,405
2006	542	1,136	1,595	1,874	1,685	1,226	1,465	1,431	1,176	2,215	1,735	692	16,772
2007	1,157	1,022	2,786	2,479	2,192	1,960	1,703	1,129	1,843	2,811	1,569	882	21,524
2008	1,132	1,445	2,261	3,086	2,489	1,734	1,556	1,395	2,412	2,624	1,705	1,142	22,981
2009	1,418	1,987	3,183	2,181	2,036	1,928	1,299	1,492	2,591	2,857	1,522	1,106	23,600
2010	1,440	1,441	2,485	2,378	2,968	2,002	1,904	1,117	2,615	2,696	2,396	1,534	24,956
2011	1,631	1,958	2,593	3,036	2,938	2,182	1,441	1,165	2,455	2,848	2,087	2,111	26,445
2012	1,986	1,687	2,556	2,663	2,025	2,107	1,085	1,787	2,150	2,041	1,771	1,360	23,218
													181,051

Interpretive Center marketing efforts continue to be a critical component of making the public aware of Interpretive Center programs. Starting in 2010, several new educational programs were developed based on teacher requests and Missouri curriculum requirements.

5.0 Environmental Monitoring Summary

5.1 Introduction

This section includes environmental monitoring information regarding groundwater, surface water, air, leachate, and radiation dose analysis.

5.2 Groundwater Monitoring

The groundwater monitoring program at the Weldon Spring Site includes sampling and analysis of water collected from wells at the former Chemical Plant, the Quarry, adjacent properties, and selected springs in the vicinity of the former Chemical Plant. The groundwater monitoring program is formally defined in the LTS&M Plan (DOE 2008).

5.2.1 Chemical Plant Groundwater

EPA signed the GWOU ROD (DOE 2004b) on February 20, 2004. The final GWOU ROD specified a remedy of 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 GWOU ROD establishes remedial goals and performance standards for MNA.

In July 2004, DOE initiated monitoring for 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 2004c). This network has since been modified as presented in the *Interim Remedial Action Report for the Groundwater Operable Unit of the Weldon Spring Site* (DOE 2005b).

5.2.1.1 Hydrogeologic Description

The former Chemical Plant Site is in a physiographic transitional area between the Dissected Till Plains of the Central Lowlands province to the north and the Salem Plateau of the Ozark Plateaus province to the south. Subsurface flow and transport in the former Chemical Plant area occurs primarily in the carbonate bedrock. The unconsolidated surficial materials are clay-rich, mostly glacially derived units, which are generally unsaturated beneath the site. These materials become saturated to the north and influence groundwater flow. The thickness of the unconsolidated materials ranges from 20 to 50 ft (DOE 1992a).

A groundwater divide is located along the southern boundary of the site. Groundwater north of the divide flows north toward Dardenne Creek and ultimately to the Mississippi River, and groundwater south of the divide flows south to the Missouri River. Localized flow is controlled largely by bedrock topography. Groundwater movement is by generally diffuse flow with localized zones of discrete fracture-controlled flow.

The aquifer of concern beneath the former Chemical Plant is the shallow bedrock aquifer comprised of Mississippian Burlington-Keokuk Limestone (the uppermost bedrock unit) and the underlying Fern Glen Formation. The Burlington-Keokuk Limestone is described as having two different lithologic zones, a shallow weathered zone and an underlying unweathered zone. The

weathered portion of this formation is highly fractured and exhibits solution voids and enlarged fractures. These features may also be present on a limited scale in the unweathered zone, particularly in the vicinity of buried preglacial stream channels (paleochannels). Localized aquifer properties are controlled by fracture spacing, solution voids, and preglacial weathering, including structural troughs along the bedrock–overburden interface. The unweathered portion of the Burlington-Keokuk Limestone is thinly to massively bedded. Fracture densities are significantly less in the unweathered zone than in the weathered zone.

All monitoring wells at the former Chemical Plant are completed in the Burlington-Keokuk Limestone. Most of the wells are completed in the weathered zone of the bedrock where groundwater has the greatest potential to be contaminated. Some wells screened in the unweathered zone of the Burlington-Keokuk Limestone are used to assess the vertical migration of contaminants. Monitoring wells within the boundaries of the former Chemical Plant are located near historical contaminant sources and preferential flow pathways (paleochannels) to assess the movement of contaminated groundwater in the shallow aquifer. Additional wells are located outside the former Chemical Plant boundary to detect and evaluate the potential offsite migration of contaminants (Figure 11).

Preferential flow zones (Figure 12) have been inferred from bedrock topography, groundwater surface maps, hydraulic conductivity data, and subsurface tracer results (DOE 2005). Subsurface data indicate the presence of linear bedrock lows that are likely paleochannels (also referred to as pre-glacial drainages) in the top of the weathered Burlington-Keokuk Limestone near the northern and western boundaries of the former Chemical Plant site. The contact between the weathered and unweathered units reflects lows in these areas. The groundwater surfaces within the weathered and unweathered units indicate flow paths that are coincident with the bedrock lows. Hydraulic conductivities in the bedrock are typically higher within these bedrock lows and support quicker movement of groundwater.

Numerous springs, a common feature in carbonate terrains, are present in the vicinity of the site. Four springs that are monitored routinely (Figure 13) have been historically influenced by former Chemical Plant discharge water, or by groundwater, that contained one or more of the contaminants of concern.

The presence of elevated total uranium and nitrate levels at Burgermeister Spring (SP-6301), which is 1.2 miles north of the site, indicates that discrete subsurface flow paths are present in the vicinity of the site. Groundwater tracer tests performed in 1995 (DOE 1997) confirmed that a discrete and rapid subsurface hydraulic connection exists between the northern portion of the former Chemical Plant and Burgermeister Spring. These flow paths are associated with the preglacial stream channels present beneath the site.

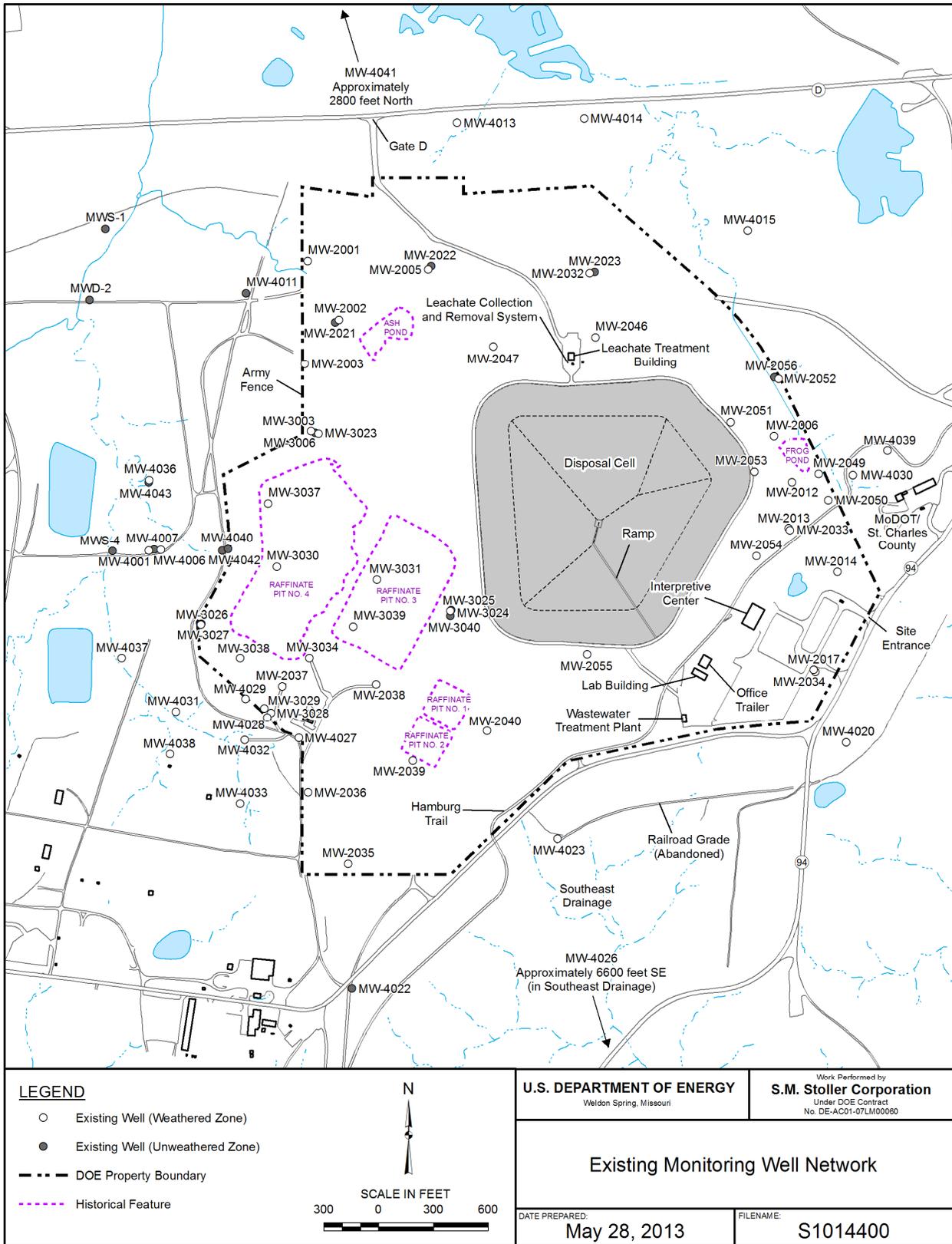
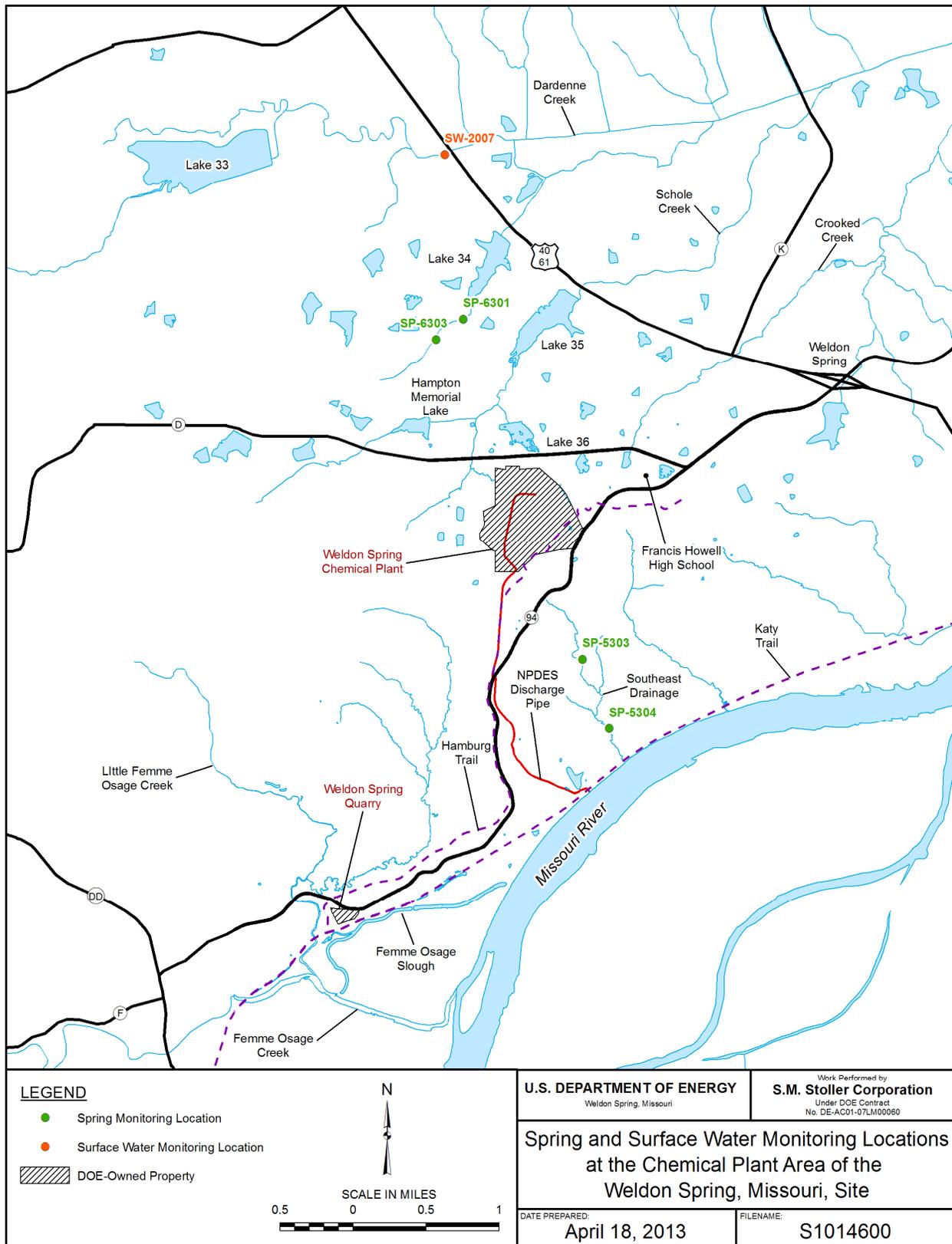


Figure 11. Existing Monitoring Well Network



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Figure 13. Spring and Surface Water Monitoring Locations at the Chemical Plant Area of the Weldon Spring, Missouri, Site

5.2.1.2 Contaminants of Interest

Contaminated groundwater remains beneath the former Chemical Plant. Contaminants include uranium, nitrate, TCE, and nitroaromatic compounds. Contamination in groundwater is generally confined to the shallow, weathered portion of the Burlington-Keokuk Limestone. Some contamination occurs in the deeper, unweathered portion of the bedrock, primarily beneath the former raffinate pits. The groundwater at the former Chemical Plant has been contaminated by past operations that resulted in multiple source areas. Remediation activities have eliminated the sources for the groundwater contamination beneath the site. The distribution of contaminants in the shallow aquifer at the site is controlled by several processes, such as transformation, adsorption, desorption, dilution, or dispersion; the primary attenuation mechanisms are dilution and dispersion.

The raffinate pits were the primary historical source of uranium contamination in groundwater. Uranium entered the shallow aquifer via infiltration through the thin overburden beneath the pits. The extent of uranium in groundwater was limited, because uranium is partially sorbed to the clays in the overburden materials. At locations where uranium contaminated water migrated beneath the overburden, it entered the limestone conduit system and subsequently discharged to springs north of the site. The oxidizing conditions of the shallow aquifer are not favorable for the precipitation of uranium from solution. Uranium contaminated sediments were also discharged offsite during past operations. These sediments accumulated in subsurface cracks and fissures in the losing stream segments and act as residual sources to groundwater and springs.

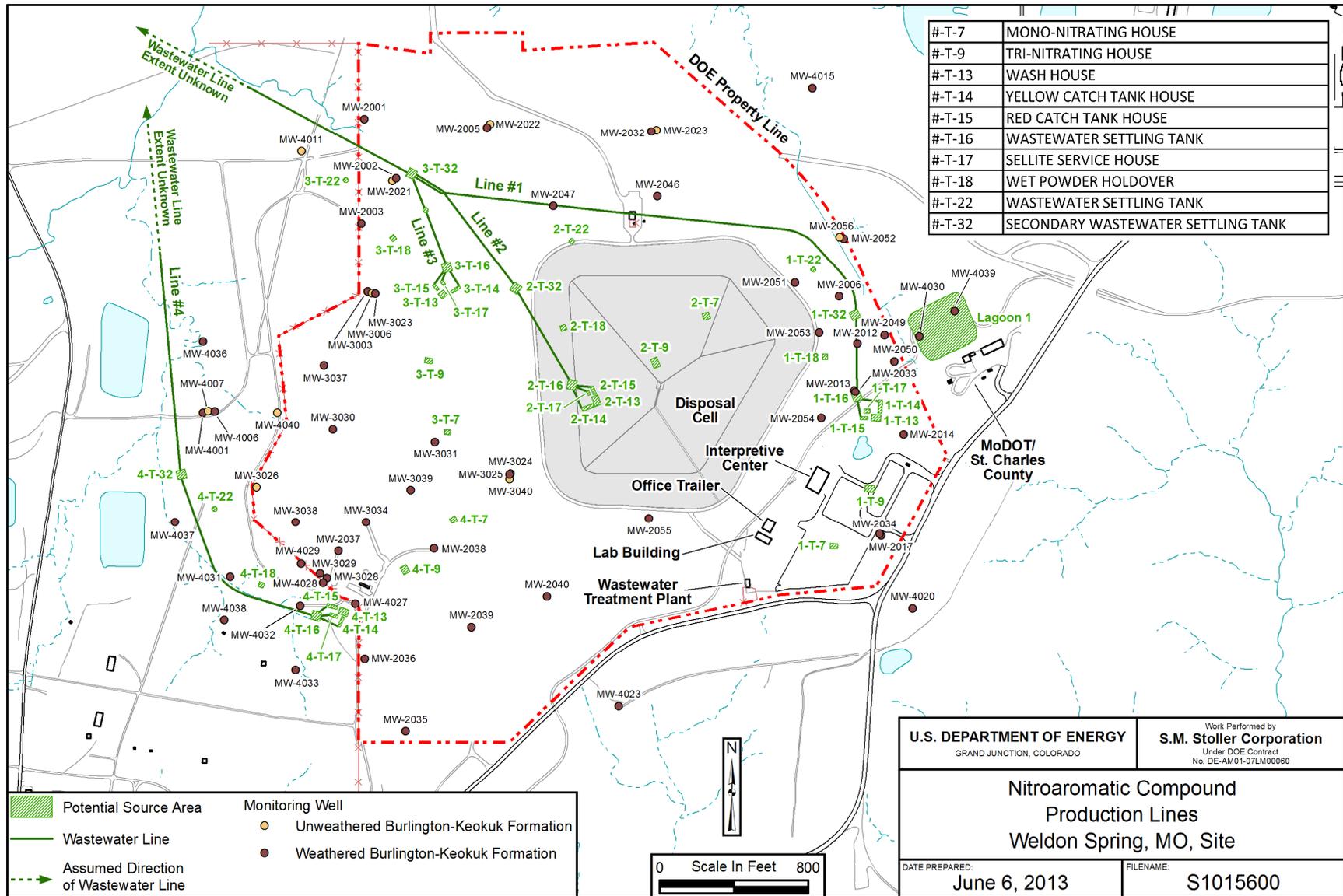
Nitrate is present in the groundwater near the former raffinate pits and the Ash Pond area, which are the historical sources of this contaminant. Nitrate is mobile in the shallow groundwater system, as it is not readily sorbed to subsurface materials. Conditions for natural denitrification have not been identified in the shallow aquifer, so nitrate persists in groundwater, enters the limestone conduit system, and subsequently discharges to springs north of the site.

Groundwater contaminated with TCE is localized in the weathered portion of the bedrock aquifer in the vicinity of the former location of Raffinate Pit 4. The source of TCE contamination was drums that were disposed of in Raffinate Pit 4. The oxidizing conditions in the shallow bedrock aquifer do not promote the biodegradation of organic compounds.

Nitroaromatic compounds (1,3-dinitrobenzene [DNB]; 2,4,6-TNT; 2,4-DNT; 2,6-DNT; and nitrobenzene) in the groundwater system coincide with former production line locations. The presence of nitroaromatic compounds in groundwater is a result of leakage from former TNT process lines, discharges from water lines, and leaching from contaminated soils and waste lagoons (Figure 14). The mobility of nitroaromatic compounds in the bedrock aquifer is high due to little sorption to the bedrock materials. Microorganisms indigenous to the soils and the shallow aquifer have the ability to transform and degrade TNT and DNT.

5.2.1.3 Chemical Plant (GWOU) Monitoring Program

Monitoring at the former Chemical Plant was changed in July 2004 to focus on MNA, the selected remedy. Under the new monitoring program, total uranium, nitroaromatic compounds, TCE, and nitrate (as N) are monitored at selected locations throughout the former Chemical Plant area.



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Figure 14. Nitroaromatic Compound Production Lines

The sampling locations target areas of highest impact in the shallow aquifer and migration pathways associated with paleochannels in the Burlington-Keokuk Limestone. Deeper wells are sampled to assess potential vertical movement.

The monitoring network consists of 50 wells, 4 springs, and 1 surface water location. The locations are depicted on Figure 11 and Figure 13. Each well was selected to fulfill objectives specified in the GWOU ROD (DOE 2004b) for the MNA monitoring network (Table 5). The objectives are as follows:

- Objective 1 is to monitor the unimpacted water quality at upgradient locations to maintain a baseline of naturally occurring constituents from which to evaluate changes in downgradient locations. This objective will be met by using wells upgradient of the contaminant plumes.
- Objective 2 is to verify that 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 concentrations 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 (which tends to temporarily mobilize some of the remaining contamination), 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 flow paths associated with bedrock lows (paleochannels) in the upper Burlington-Keokuk 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 are either not impacted or minimally impacted. Contaminant impacts in these locations are expected to remain minimal or nonexistent.
- 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 in and influenced by the unweathered zone. No significant impacts should be observed at these locations.
- 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 former 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.
- Objective 6 is to monitor for hydrologic conditions at the site over time 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.

Table 5. Monitoring Program for GWOU MNA Remedy

Location	Objective	Unit	Sampling Frequency	TCE	Nitrate (as N)	Uranium	1,3-TNB	2,4,6-TNT	2,4-DNT	2,6-DNT	NB
MW-2017	1	Weathered	A				✓	✓	✓	✓	✓
MW-2035	1	Weathered	A	✓	✓	✓			✓		
MW-4022	1	Unweathered	A		✓	✓					
MW-4023	1	Weathered	A		✓	✓					
MW-2012	2	Weathered	S				✓	✓	✓	✓	✓
MW-2014	2	Weathered	S						✓	✓	
MW-2038	2	Weathered	S		✓				✓		
MW-2040	2	Weathered	S		✓						
MW-2046	2	Weathered	S					✓			
MW-2050	2	Weathered	S						✓	✓	
MW-2052	2	Weathered	S						✓	✓	
MW-2053	2	Weathered	S					✓	✓	✓	
MW-2054	2	Weathered	S						✓	✓	
MW-3003	2	Unweathered	S		✓	✓(B)					
MW-3024	2	Unweathered	Q			✓(B)					
MW-3030	2	Weathered	S	✓		✓			✓		
MW-3034	2	Weathered	S	✓	✓				✓		
MW-3039	2	Weathered	S						✓		
MW-3040	2	Unweathered	Q		✓	✓(B)					
MW-4013	2	Weathered	S		✓						
MW-4029	2	Weathered	S	✓	✓						
MW-4031	2	Weathered	S		✓						
MW-4036	2	Weathered	S		✓						
MW-4040	2	Unweathered	Q		✓	✓(Q)					
MW-2032	3	Weathered	A				✓	✓	✓	✓	✓
MW-2051	3	Weathered	A				✓	✓	✓	✓	✓
MW-3031	3	Weathered	A	✓		✓(S)					
MW-3037	3	Weathered	A	✓		✓(S)			✓		
MW-4013	3	Weathered	A						✓	✓	✓
MW-4014	3	Weathered	A		✓		✓	✓	✓	✓	✓
MW-4015	3	Weathered	A						✓	✓	✓
MW-4026	3	Alluvium/SED	A			✓(S)					
MW-4036	3	Weathered	A	✓		✓(Q)					
MW-4039	3	Weathered	A				✓	✓	✓	✓	✓

Table 5 (continued). Monitoring Program for GWOU MNA Remedy

Location	Objective	Unit	Sampling Frequency	TCE	Nitrate (as N)	Uranium	1,3-TNB	2,4,6-TNT	2,4-DNT	2,6-DNT	NB
MW-4040	3	Unweathered	A	✓					✓		
MW-4041	3	Weathered	A	✓	✓	✓ (B)	✓	✓	✓	✓	✓
MWS-1	3	Weathered	A	✓	✓	✓ (B)			✓		
MWS-4	3	Weathered	A	✓	✓	✓ (S)					
MW-2021	4	Unweathered	A		✓						
MW-2022	4	Unweathered	A	✓			✓	✓			
MW-2023	4	Unweathered	A				✓	✓	✓	✓	✓
MW-2056	4	Unweathered	A				✓	✓	✓	✓	✓
MW-3006	4	Unweathered	A	✓	✓	✓ (B)			✓		
MW-4007	4	Unweathered	A	✓	✓	(B)					
MW-4042	4	Unweathered	S		✓	✓ (B)					
MWD-2	4	Unweathered	A		✓	✓ (B)					
SP-5303	5	Spring/SED	Q			✓					
SP-5304	5	Spring/SED	Q			✓					
SP-6301	5	Spring	Q	✓	✓	✓ (B)	✓	✓	✓	✓	✓
SP-6303	5	Spring	Q	✓	✓	✓	✓	✓	✓	✓	✓
SW-2007	5	Stream	A			✓					

Objective 1 = Upgradient locations

Objective 2 = Area of groundwater impact

Objective 3 = Downgradient and lateral locations

Objective 4 = Locations beneath the area of groundwater impact

Objective 5 = Springs or surface water locations

A = annual; B = Bi-monthly; DNT = dinitrotoluene; Q = quarterly; NB = nitrobenzene; S = semiannual; SED = Southeast Drainage; TNB = trinitrobenzene; TNT = trinitrotoluene

Frequencies in parentheses support unweathered unit evaluation

The monitoring network is designed to provide data either to show that natural attenuation processes are acting as predicted or to trigger the implementation of contingencies when these processes are not acting as predicted (e.g., 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 or remaining stable, as expected.
- Detection monitoring locations (Objectives 3, 4, and 5) indicate when a trigger has been exceeded, indicating unacceptable expansion of the area of impact.
- Hydrogeologic monitoring locations (Objectives 1, 2, 3, 4, and 6) indicate any changes in groundwater flow that might affect the protectiveness of the MNA remedy at the site over time.

Trigger levels were set for each contaminant at the performance and detection monitoring locations in the event that unexpected increases occur. There are two trigger levels for each contaminant (Table 6). The first trigger level is set at what would be considered a statistically significant increase of a contaminant at a location and is defined as the mean plus three standard deviations for the previous eight data points. The second trigger level was established as a fixed concentration that indicates unacceptable increases within the area of impact (Objective 2), outside the area of impact (Objectives 3 and 4), or at discharge points (Objective 5).

Table 6. Trigger Levels for Performance and Detection Monitoring for the GWOU

Analyte	Cleanup Standard	Objective 2	Objective 3 (near)	Objective 3 (far)	Objective 4	Objective 5
Nitrate as N (mg/L)	10	1,350	30	10	20	20
Uranium (pCi/L)	20	100	50	20	40	150
TCE (µg/L)	5	1,000	15	5	10	5
2,4-DNT (µg/L)—FP	0.11	2,300	1.1	0.11	0.22	0.22
2,4-DNT (µg/L)—RP		5	0.55			
2,6-DNT (µg/L)	1.3	2,000	13	1.3	2.6	1.3
2,4,6-TNT (µg/L)	2.8	500	11.2	2.8	5.6	2.8
1,3-DNB (µg/L)	1.0	20	4	1	2	1
NB (µg/L)	17	50	34	17	17	17

DNB = dinitrobenzene; DNT = dinitrotoluene; FP = Frog Pond; mg/L = milligrams per liter; µg/L = micrograms per liter; NB = nitrobenzene; pCi/L = picocuries per liter; RP = Raffinate Pits; TNT = trinitrotoluene

Groundwater data from the upgradient locations are compared with the previously collected data from each respective location. If a statistically significant increase (mean plus 3 standard deviations for the previous eight data points) is measured, then the value is evaluated for its validity. For those locations that are “nondetect,” a statistically significant increase is considered to be the respective cleanup standard measured for two consecutive sampling periods. Contingency actions are defined in Appendix M of the LTS&M Plan.

Testing for temporal trends was performed using uranium, nitrate, TCE, and nitroaromatic compound data, as required in the *Remedial Design/Remedial Action Work Plan for the Final Remedial Action for the Groundwater Operable Unit at the Weldon Spring Site* (DOE 2004c) using data from the previous 5 years (2008 through 2012). Results for the trending analysis are reported for the Objective 2 wells and the Objective 5 springs because these locations monitor the area of groundwater impact and the discharge points. The trend analysis is conducted using the Visual Sampling Plan (VSP) Method (VSP 2013; Gilbert 1987; Hirsch, Slack, and Smith 1982).

The Mann-Kendall test is used for temporal trend identification because it can easily facilitate missing data and does not require the data to conform to a particular distribution (such as a normal or lognormal distribution). The nonparametric method is valid for scenarios where there are a high number of nondetect data points. Data reported as trace concentrations or less than the detection limit can be used by assigning them a common value that is smaller than the smallest measured value in the data set (i.e., one-half the specified detection limit). This approach is valid because only the relative magnitudes of the data, rather than their measured values, are used in the method. A possible consequence of this approach is that the test can produce biased results if a large fraction of data within a given time series are nondetects and if detection limits change between sampling events. One-half the specified detection limit (on the date of analysis) was used in place of all concentrations reported at or below the detection limit. Estimated time frames of when a location may reach the MCL are provided only for those locations where statistically significant downward trends were identified. A trend is considered statistically significant if there is a 5 percent or less chance of incorrectly concluding that a trend exists.

5.2.1.4 Baseline Monitoring Results for the GWOU

Baseline conditions are monitored in four upgradient wells to determine if possible changes in downgradient areas of impact are the result of changes in upgradient conditions (horizontal gradient and flow direction maps are provided in Sections 5.2.1.8 and 5.2.2.1). The objective of this monitoring is to determine if baseline conditions have remained unchanged. Each of these wells was sampled once during 2012. The concentration for each parameter is presented in Table 7. The concentrations measured in 2012 are similar to those from previous years and indicate no change in upgradient groundwater quality.

Table 7. Baseline Monitoring for the GWOU MNA Remedy Objective 1 Wells

Location	MW-2017	MW-2035	MW-4022	MW-4023
Zone	Weathered	Weathered	Unweathered	Weathered
Parameters				
Uranium (pCi/L)	NR	0.42	2.5	2.2
Nitrate (as N) (mg/L)	NR	0.67	0.3	0.69
TCE (µg/L)	NR	ND (<0.16)	NR	NR
1,3-DNB (µg/L)	ND (<0.013)	ND (<0.014)	NR	NR
2,4,6-TNT (µg/L)	ND (<0.021)	ND (<0.021)	NR	NR
2,4-DNT (µg/L)	ND (<0.018)	ND (<0.018)	NR	NR
2,6-DNT (µg/L)	ND (<0.021)	ND (<0.021)	NR	NR
Nitrobenzene (µg/L)	ND (<0.032)	ND (<0.032)	NR	NR

DNB = dinitrobenzene; DNT = dinitrotoluene; mg/L = milligram per liter; µg/L = microgram per liter; ND = analyte not detected above reporting limit indicated in parentheses; NR = analyte not required; pCi/L = picocurie(s) per liter; TNT = trinitrotoluene

5.2.1.5 Performance Monitoring Results for the GWOU

The performance of the MNA remedy is assessed through the sampling of the Objective 2 monitoring wells. Objective 2 wells are within the areas of impact and monitor both the weathered and unweathered units of the Burlington-Keokuk Limestone. Objective 2 of the MNA strategy is to verify that contaminant concentrations are declining or remaining stable as expected and that cleanup standards will be met in a reasonable time frame.

Contaminant concentrations are monitored using 20 wells (Figure 11) within the areas of highest impact of each contaminant plume at the site. These wells were sampled at least semiannually during 2012. The data are discussed in the following sections.

Well MW-3003 is presently monitored under the MNA program as part of the network to monitor uranium in the weathered unit. At the time of developing the MNA monitoring program, this well was categorized as a weathered well as the filter pack crossed both units. With the change to a micro-purge sampling method, water samples are obtained solely from the unweathered unit. It has been decided that water samples collected from this well represent the water quality in the unweathered unit and the well has been re-categorized as an unweathered unit well.

Uranium

The area of uranium impact is in the former Raffinate Pits area in the western portion of the site. Uranium levels exceed the MCL of 20 pCi/L in both the weathered and unweathered units of the Burlington-Keokuk Limestone. A summary of the uranium data for 2012 is presented in Table 8. Sampling frequencies were increased to bimonthly starting in April 2010 in support of a special study (see Section 5.2.1.7).

Table 8. Uranium Data from GWOU Objective 2 Wells

Location	Uranium (pCi/L)					
	B1	B2	B3	B4	B5	B6
Weathered Unit						
MW-3030	26.0	30.4	28.9	26.0	28.8	31.9
Unweathered Unit						
MW-3003	NS	NS	2.6	NS	3.1	3.0
MW-3024	108	125	127	108	114	223
MW-3040	102	118	107	102	112	140
MW-4040	318	320	330	278	319	328

pCi/L = picocuries per liter; B1, B2, B3, B4, B5, B6 = bimonthly sampling periods
NS = Not sampled

Uranium impact in the weathered unit is monitored in well MW-3030 (Figure 15), which is installed within the footprint of the former Raffinate Pits. The Objective 2 well screened in the weathered unit shows decreasing uranium levels.

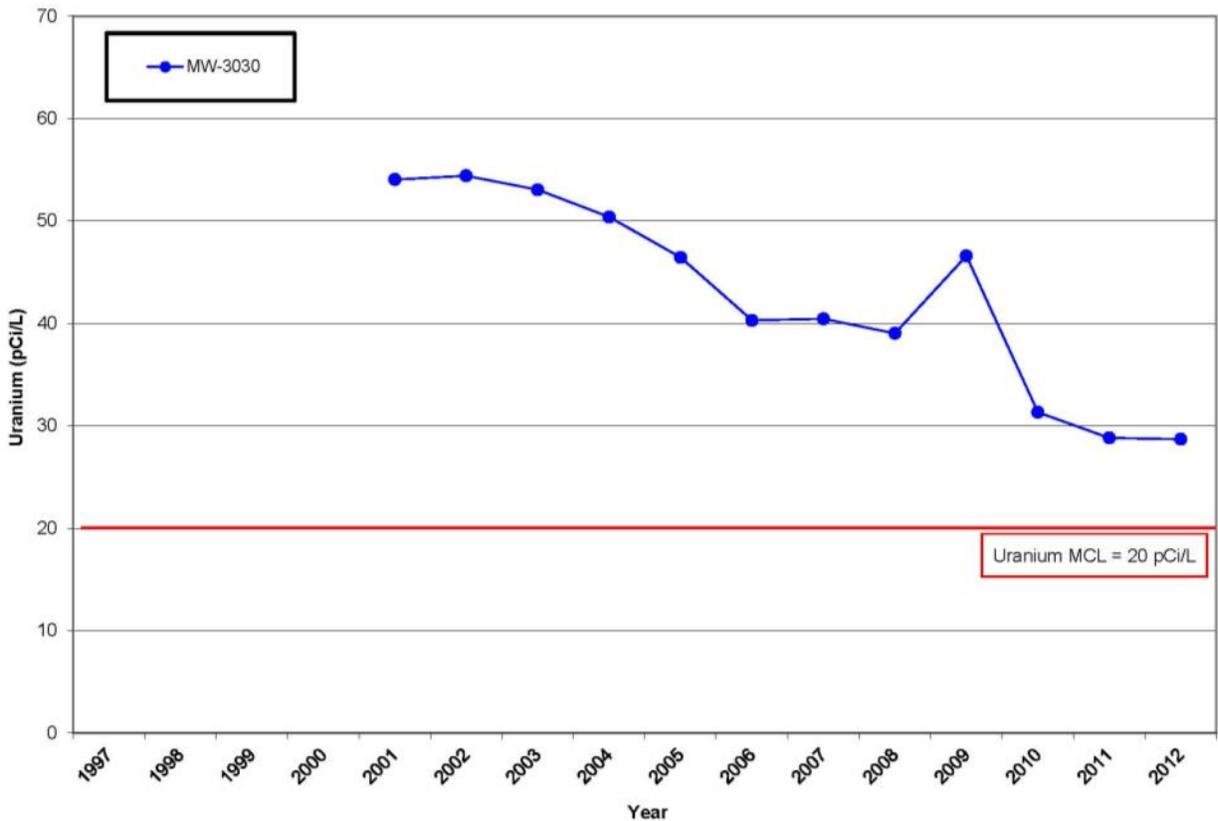


Figure 15. Average Uranium Levels in Objective 2 Wells Screened in the Weathered Unit

Results for trend analysis of uranium data from the weathered unit wells (Table 9) indicate that uranium levels for the past 5 years have shown an overall decline, as indicated by negative slopes. A statistically significant downward trend was determined from the data from MW-3030. If the current decrease in uranium levels continues in MW-3030, the MCL of 20 pCi/L could be reached in the next few years, based on an estimate derived from an exponential curve model.

Table 9. Trending Analysis for Uranium in Objective 2 MNA Weathered Unit Wells (2008–2012)

Location	No. of Samples	Trend	Slope (pCi/L/yr)	Confidence Intervals	
				Lower	Upper
MW-3030	22	Down	-2.4	-3.2	-1.4

pCi/L/yr = picocurie(s) per liter per year

Uranium impact is greatest in the wells that are screened in the unweathered unit within the footprint and immediately downgradient of the former Raffinate Pits. Removal of the raffinate pits was completed in 2000. Wells MW-3040 and MW-4040 were installed in 2004 to provide uranium data for the unweathered unit in this area. Uranium levels in wells MW-3024, MW-3040, and MW-4040 have consistently been greater than the MCL of 20 pCi/L (Figure 16). Overall, the uranium levels in these two wells have increased since installation. Trigger values for uranium impact in the unweathered unit are being evaluated through the continuation of a special study that was started in 2008 (see Section 5.2.1.7). Uranium levels in MW-3003, which is located on the northwestern corner of former raffinate pit 4 has been less than the MCL since 2000.

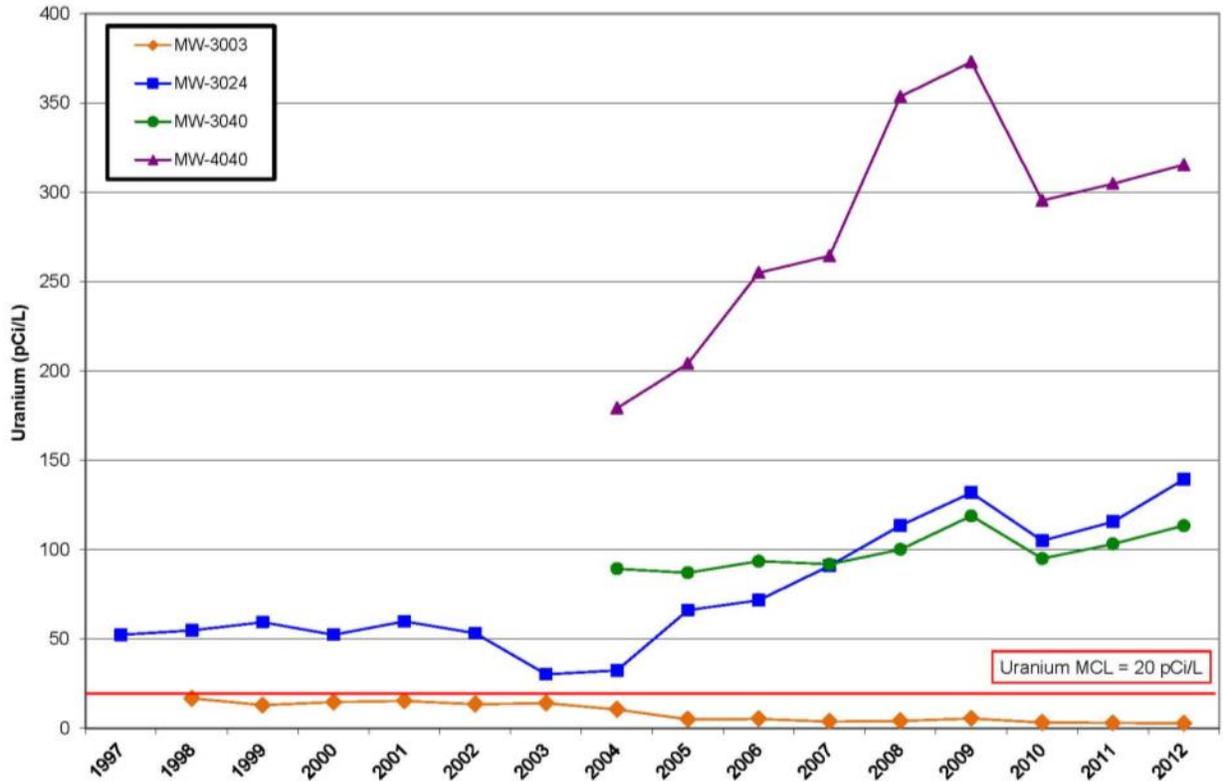


Figure 16. Average Uranium Levels in Objective 2 Wells Screened in the Unweathered Unit

Results from the trend analyses for uranium in the unweathered unit (Table 10) indicate increasing uranium levels in the two Objective 2 wells screened in the unweathered unit, as indicated by positive slopes. A statistically significant upward trend was calculated for well MW-3040, using data from the past 5 years. Analysis of the uranium data from MW-3024 and MW-4040 indicates no trend, either upward or downward.

Table 10. Trending Analysis for Uranium in Objective 2 MNA Unweathered Unit Wells (2008–2012)

Location	No. of Samples	Trend	Slope (pCi/L/yr)	Confidence Intervals	
				Lower	Upper
MW-3003	16	Down	-0.37	-0.51	-0.12
MW-3024	26	None	2.5	0	7.0
MW-3040	27	Up	2.5	0.28	5.2
MW-4040	27	None	-4.6	-14.4	6.7

pCi/L/yr = picocurie(s) per liter per year

Overall, uranium impact is contained within the upper portion of the shallow aquifer (weathered and upper unweathered units of the Burlington-Keokuk Limestone). Uranium levels in the weathered unit are decreasing as a result of source removal and natural attenuation (dilution and dispersion). The MCL for uranium could be attained in this portion of the shallow aquifer by 2015 if decreases continue at the current rate. Uranium levels within the less-permeable

unweathered unit are increasing due to desorption of uranium from residual materials as a result of reduced recharge at greater depths in the aquifer, where flushing is more limited. Any recharge that does enter the system is more likely to move horizontally through the weathered unit than vertically into the unweathered unit due to greater hydraulic conductivity in the horizontal direction and the decreased downward vertical gradient that resulted from removal of water in the Raffinate Pits.

Nitrate (as N)

The highest concentrations of nitrate have been measured in the former Raffinate Pits area. Elevated nitrate concentrations are also present in the former Ash Pond area. Both are historical sources of this contaminant. The higher mobility of nitrate, as compared to other contaminants at the site, has resulted in a larger distribution in the shallow aquifer. Nitrate levels exceed the MCL of 10 milligrams per liter (mg/L) (for nitrate as N) in both the weathered and unweathered units of the Burlington-Keokuk Limestone. A summary of the nitrate data for 2012 is presented in Table 11.

Table 11. Nitrate Data from GWOU Objective 2 Wells

Location	Nitrate (as N) Concentration (mg/L)	
	S1	S2
Weathered Unit		
MW-2038	430	490
MW-2040	72.0	91.0
MW-3034	190	177
MW-4013	70.0	82.0
MW-4029	420	461
MW-4031	150	170
MW-4036	43.4	47.0
Unweathered Unit	S1	S2
MW-3003	400	497
MW-3040	95.2	82.0
MW-4040	122	103

mg/L = milligrams per liter; S1, S2 = semiannual sampling periods.

Nitrate concentrations are generally higher in the weathered unit of the Burlington-Keokuk Limestone and are measured in wells that are in the former Raffinate Pits area (MW-2038, and MW-4029) (Figure 17). Recent data show little change in nitrate concentrations in all of the wells for the past 4 or 5 years. The overall general decline in concentrations is the result of source removal in the former Raffinate Pits and Ash Pond areas.

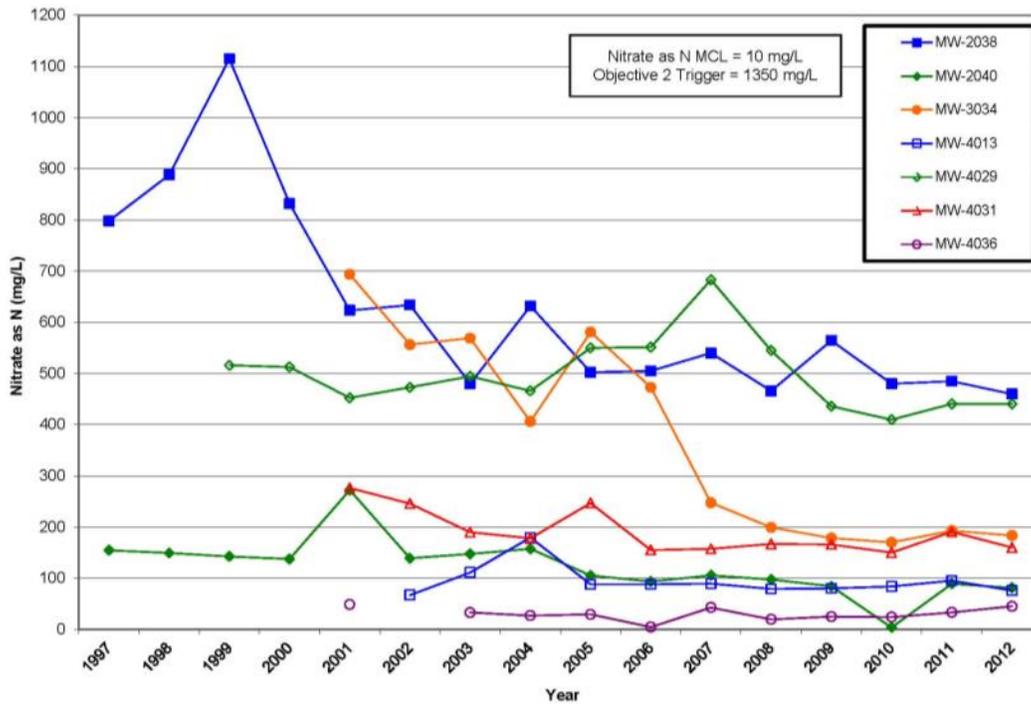


Figure 17. Average Nitrate Concentrations in Objective 2 Wells Screened in the Weathered Unit

Results of trend analysis of nitrate data from the weathered unit indicate decreasing levels over the past 5 years in MW-2040, MW-3034, and MW-4029, as indicated by negative slopes (Table 12). A statistically significant upward trend was calculated for MW-4036, which is located downgradient of the former Raffinate Pit area. No trends, either upward or downward, were calculated for the remainder of the Objective 2 wells.

Table 12. Trending Analysis for Nitrate (as N) in Objective 2 MNA Weathered Unit Wells (2008–2012)

Location	No. of Samples	Trend	Slope (mg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-2038	10	None	0	-27.9	19.0
MW-2040	10	None	-2.0	-11.7	11.2
MW-3034	11	None	-3.3	-13.3	4.7
MW-4013	9	None	0.58	-5.4	7.9
MW-4029	10	None	-5.6	-38.1	10.7
MW-4031	10	None	0.97	-17.6	17.1
MW-4036	17	Up	6.4	-2.8	10.1

mg/L/yr = milligram(s) per liter per year

Nitrate concentrations in the unweathered unit exceed the MCL only in the former Raffinate Pits area. Nitrate concentrations in MW-3003, located on the northwestern corner of the former Raffinate Pit 4 began to increase in 2004, but have stabilized for the past few years. In MW-3040 concentrations have decreased since monitoring was started in 2004 (Figure 18). Nitrate concentrations in MW-4040 increased in 2008; however, the concentrations have declined since that time. Wells MW-3003 and MW-4040 are downgradient of the former Raffinate Pit area, and

increases observed are likely the eventual migration of groundwater with higher nitrate concentrations that were measured beneath the former raffinate pits. Presently the concentrations of nitrate are similar in both wells.

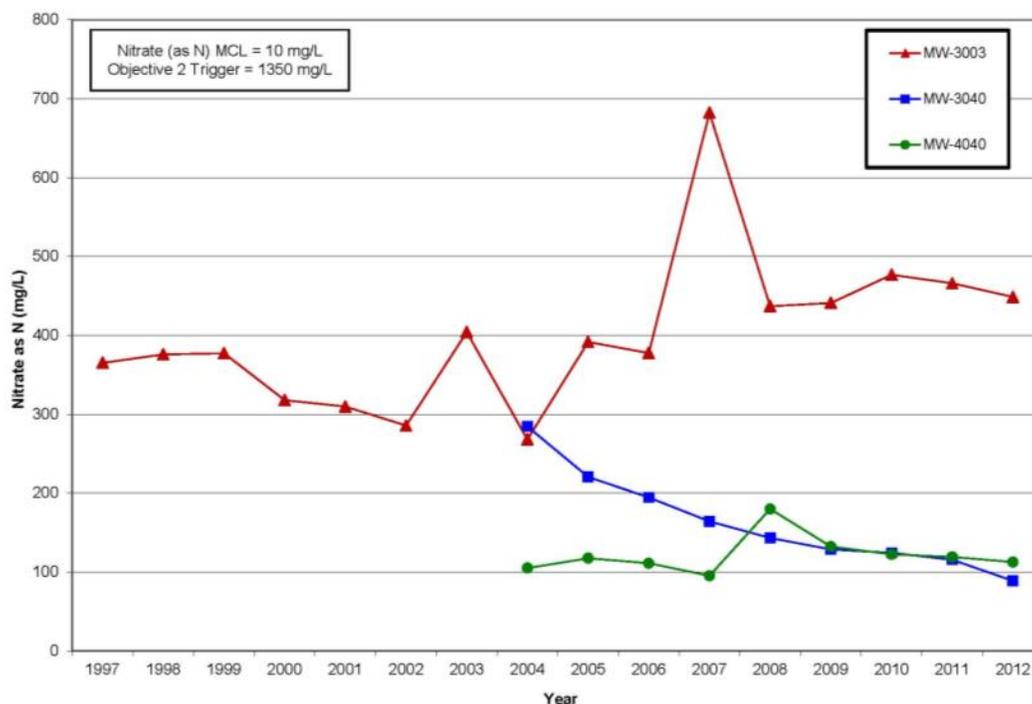


Figure 18. Average Nitrate Concentrations in Objective 2 Wells Screened in the Unweathered Unit

Results of trend analysis show decreasing concentrations in wells MW-3040 and MW-4040 over the past 5 years, as indicated by negative slopes (Table 13). Statistically significant downward trends were calculated for both of these wells. If the current decreases in nitrate concentrations continue in MW-3040, the MCL of 10 mg/L (for nitrate as N) could be reached in 20–25 years in MW-3040 and in about 20 years in well MW-4040, based on estimates derived from an exponential curve model.

Table 13. Trending Analysis for Nitrate (as N) in Objective 2 MNA Unweathered Unit Wells (2008–2012)

Location	No. of Samples	Trend	Slope (mg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-3003	13	None	0.68	-30.6	34.0
MW-3040	19	Down	-12.3	-16.0	-7.7
MW-4040	19	Down	-14.4	-25.7	-6.3

mg/L/yr = milligram(s) per liter per year

Overall, nitrate impact is contained within the upper portion of the shallow aquifer (weathered and upper unweathered units of the Burlington-Keokuk Limestone). Nitrate concentrations in the weathered and unweathered units are decreasing except along the leading edge of the area of impact in the weathered unit (MW-4036). Some locations were expected to show temporary upward trends due to nitrate being mobilized by recent source control remediation; however,

concentrations are not expected to exceed historical maximums seen within the areas of highest impact. Trigger values were developed to account for these expected increases. The higher mobility of nitrate, as compared to other contaminants at the site, has resulted in more rapid flushing of this contaminant from the aquifer system.

Trichloroethene

TCE contamination in the shallow groundwater is located in the vicinity of former Raffinate Pit 4, where drums containing TCE residues are suspected to have been discarded. TCE impact is detected in only the weathered unit of the Burlington-Keokuk Limestone. A summary of the TCE data for 2012 is presented in Table 14.

Table 14. TCE Data from GWOU Objective 2 Wells

Location	TCE Concentration (µg/L)	
	S1	S2
MW-3030	207	190
MW-3034	140	127
MW-4029	270	297

µg/L = micrograms per liter; S1, S2 = semiannual sampling periods

TCE impact is highest in MW-4029, along a preferential flow pathway in the area. The TCE concentrations in MW-3030 and MW-3034 have varied over time (Figure 19); however, the changes observed from 2001 through 2005 are a result from field studies (in situ chemical oxidation and pump and treat) performed in 2001 and 2002 and subsequent rebound. Data from recent years indicate an overall decrease in TCE concentrations in these three wells since MNA monitoring started in 2004. Concentrations of TCE in all of the Objective 2 wells continue to exceed the MCL.

Low levels of the TCE degradation product *cis*-1,2-dichloroethene (DCE) are measured in the three Objective 2 wells and the concentrations are significantly less than the MCL of 70 µg/L. Estimated detections of *trans*-1,2-DCE less than 1 µg/L are reported in the three Objective 2 wells. No detectable concentrations of vinyl chloride were reported in any of the Objective 2 wells. Oxidizing conditions are present in groundwater at the chemical plant; therefore, reductive dechlorination of TCE is limited. Dilution and dispersion are the primary attenuation mechanisms for TCE in groundwater.

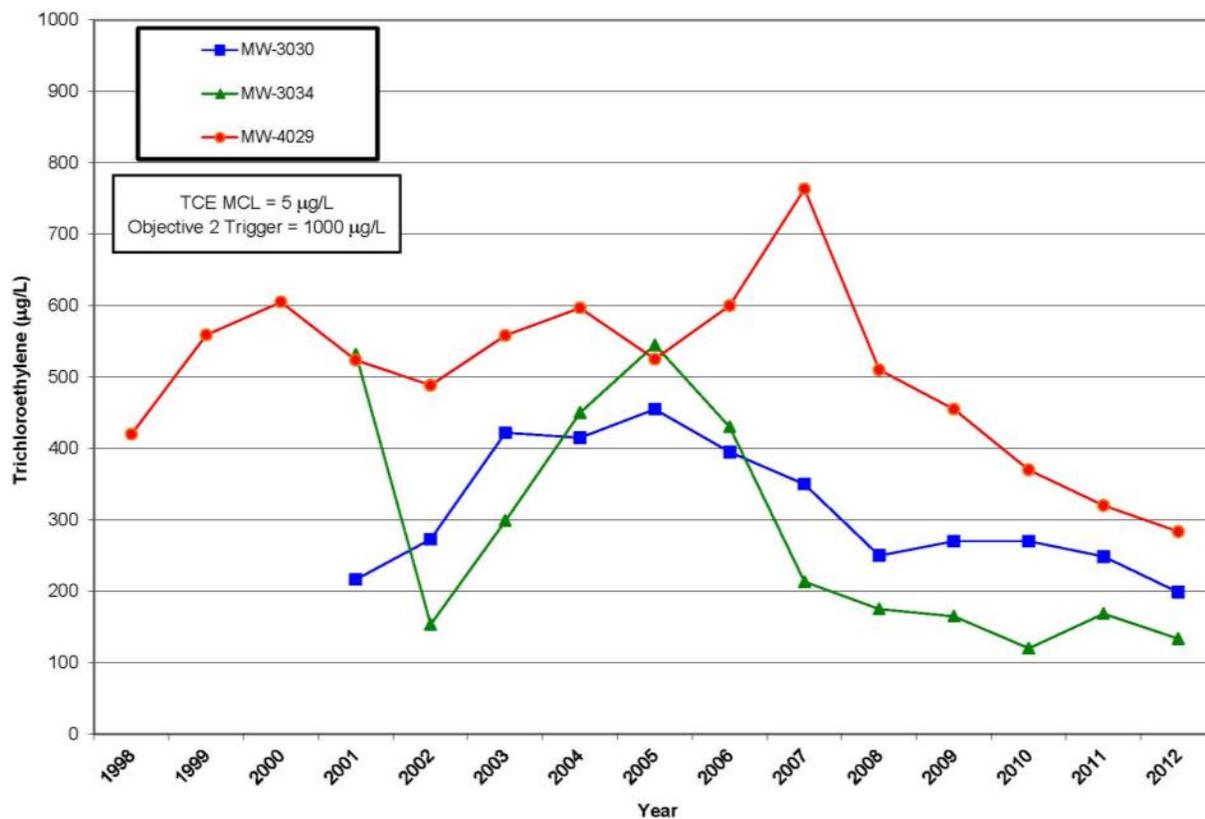


Figure 19. Annual Average TCE Concentrations in Objective 2 Wells

Results of the trend analysis for the Objective 2 TCE wells indicate that concentrations in groundwater are decreasing, as indicated by negative slopes (Table 15). Downward trends for MW-3034 and MW-4029 were calculated from the data collected over the last 5 years. If the current decreases in TCE concentrations continue in this area, the MCL of 5 µg/L could be reached within 20 years, based on estimates derived from an exponential curve model.

Table 15. Trending Analysis for TCE in Objective 2 MNA Wells (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-3030	10	Down	-13.0	-36.0	-2.2
MW-3034	10	Down	-13.6	-20.1	-3.3
MW-4029	10	Down	-56.1	-102	-13.1

µg/L/yr = micrograms per liter per year

Overall, TCE impact is confined to a discrete area near the former Raffinate Pits site and is limited to the weathered unit of the Burlington-Keokuk Limestone. TCE concentrations in the weathered unit are decreasing in the area of impact.

Nitroaromatic Compounds—Former Frog Pond Area

The area of greater nitroaromatic compound groundwater impact at the site is in the former Frog Pond area and is limited to the weathered unit of the Burlington-Keokuk Limestone. Groundwater in this area has historically shown impact above the cleanup standards for 1,3-DNT; 2,4,6-TNT; 2,4-DNT; 2,6-DNT; and nitrobenzene (NB). Recent data have indicated that several Objective 2 wells have concentrations less than cleanup standards for some compounds.

The distribution of nitroaromatic compounds suggests that the primary source area is production line #1 (Figure 14), most notably the wash house (T-13) and the wastewater settling tank (T-16). Some contribution to the nitroaromatic contamination originates from Army Lagoon 1. The preferential flow path in the vicinity of former Frog Pond has been identified from the bedrock topography, and the contaminant distribution is controlled somewhat by the topography. Nitroaromatic compound impact in the former Frog Pond area is isolated to the weathered unit of the Burlington-Keokuk Limestone.

In recent years, nitroaromatic compound concentrations, primarily the DNT isomers, have varied in the former Frog Pond area. Starting in 1997, increases in concentrations were reported, and concentrations increased dramatically during and after two activities, (1) the completion of soil excavation in this area and (2) remedial activities performed by the U.S. Army Corps of Engineers in nearby Army Lagoon 1. Also during this time frame, groundwater elevations steadily decreased, likely in response to the removal of the Frog Pond and redirection of surface water runoff, both of which reduced the amount of infiltration into the groundwater system. Nitroaromatic compound concentrations in several wells in this area dramatically decreased in 2004. The suspected cause was the infiltration of surface water runoff into the groundwater system through a subsidence feature that formed near MW-2012. Continued influence of surface water infiltration has been observed in the fluctuation of groundwater elevations in this area. In recent years, groundwater elevations have generally increased in wells along the preferential pathway, and the increase is likely attributable to surface water contribution in a natural drainage channel that is beginning to establish in this area.

Concentrations of 1,3-DNB in MW-2012 were reported as estimated values (Table 16). Starting in 2006, the average concentration decreased below the cleanup standard of 1.0 µg/L (Figure 20). Decreases in 1,3-DNB are expected, as this nitroaromatic compound is a photodegradation breakdown product of 2,4-DNT. Increases in concentration of this compound began during the period that 2,4-DNT impacted soils were being excavated in this area. Exposure of impacted soil likely resulted in some photodegradation and subsequent infiltration into the aquifer system.

Table 16. 1,3-DNB Data from GWOU Objective 2 Wells

Location	1,3-DNB Concentration (µg/L)	
	S1	S2
MW-2012	0.022 (J)	0.17 (J)

µg/L = microgram per liter; J = estimated value less than the reporting limit
S1, S2 = semiannual sampling periods



Figure 20. Annual Average 1,3-DNB Concentrations in MW-2012

Results of the trend analyses for 1,3-DNB (Table 17) indicated decreasing concentrations, as indicated by the negative slope in the Objective 2 well in the former Frog Pond area. Analysis of the data for MW-2012 indicates no trend either upward or downward; however, concentrations for the past 7 years have been less than the cleanup standard and can be regarded as stable due to the small slope and confidence intervals.

Table 17. Trending Analysis for 1,3-DNB in Objective 2 MNA Wells (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-2012	10	None	-0.006	-0.010	0.032

µg/L/yr = microgram per liter per year

The highest 2,4,6-TNT concentrations are monitored in MW-2012 and MW-2053, which are close to where TNT production buildings once stood (Table 18). Concentrations of TNT have generally decreased in the former Frog Pond area (Figure 21), with the largest decrease in MW-2012. Well MW-2046 monitors a discrete area of TNT impact that is located in the north-central portion of the site. Concentrations of 2,4,6-TNT were variable in MW-2012 and MW-2053 and may be the result of fluctuating groundwater levels. The annual average TNT concentrations in all of the Objective 2 wells have been less than the cleanup standard of 2.8 µg/L since 2009.

Table 18. 2,4,6-TNT Data from GWOU Objective 2 Wells

Location	2,4,6-TNT Concentration (µg/L)	
	S1	S2
MW-2012	0.62	2.1
MW-2046	0.62	0.49
MW-2053	1.4	1.8

µg/L = microgram(s) per liter
 S1, S2 = semiannual sampling periods

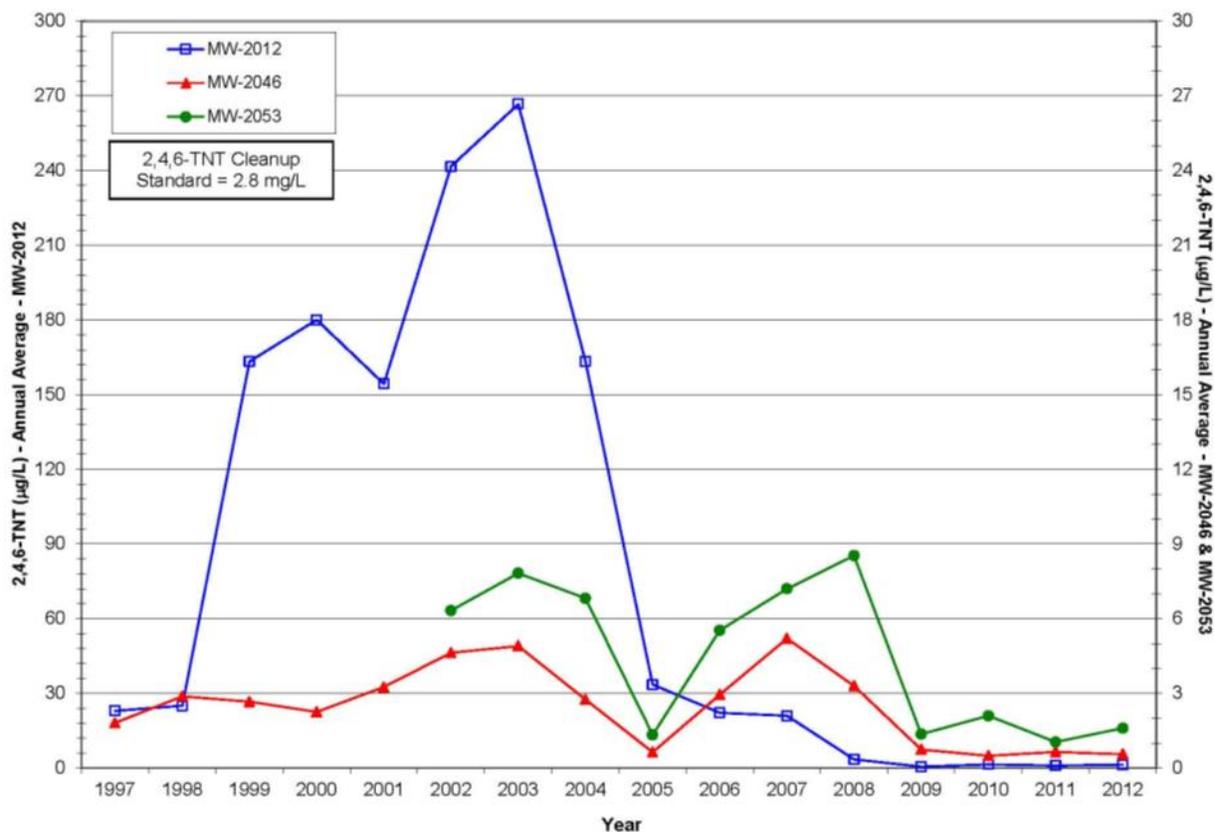


Figure 21. Annual Average 2,4,6-TNT Concentrations in Objective 2 Wells

Trend analysis of 2,4,6-TNT data collected from 2008 through 2012 indicates decreasing concentrations in two of the Objective 2 wells, as indicated by negative slopes (Table 19). A statistically significant downward trend was calculated for MW-2046. Analysis of the data from MW-2012 and MW-2053 indicated no trend, either upward or downward.

Table 19. Trending Analysis for 2,4,6-TNT in Objective 2 MNA Wells (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-2012	10	None	-0.06	-0.94	0.52
MW-2046	10	Down	-0.14	-0.90	-0.01
MW-2053	10	None	0.09	-2.3	0.63

µg/L/yr = microgram(s) per liter per year

The nitroaromatic compounds 2,4-DNT and 2,6-DNT are the most persistent in groundwater at the site. Data continue to indicate that concentrations of DNT are variable in most of the Objective 2 wells (Table 20 and Table 21). The concentrations of these compounds can vary significantly between sampling events. This variability in 2,4-DNT and 2,6-DNT may be attributed to the introduction of surface water into the groundwater system during wet periods. Concentrations of these compounds are typically higher during periods of low groundwater elevations and decrease as groundwater elevations rise. The introduction of surface water infiltration temporarily dilutes the concentrations in groundwater.

Table 20. 2,4-DNT Data from GWOU Objective 2 Wells in the Former Frog Pond Area

Location	2,4-DNT Concentration (µg/L)	
	S1	S2
MW-2012	0.39	77.0
MW-2014	0.12	0.12
MW-2050	13.0	12.0
MW-2052	0.063 (J)	0.082 (J)
MW-2053	ND (<0.18)	ND (<0.092)
MW-2054	0.082 (J)	0.078 (J)

µg/L = microgram(s) per liter

S1, S2 = semiannual sampling periods

ND = analyte not detected above reporting limit indicated in parenthesis

J = estimated value less than the reporting limit

Table 21. 2,6-DNT Data from GWOU Objective 2 Wells

Location	2,6-DNT Concentration (µg/L)	
	S1	S2
MW-2012	3.8	100
MW-2014	0.33	0.41
MW-2050	25.0	32.0
MW-2052	0.14	0.27
MW-2053	33.0	7.9
MW-2054	0.22	0.19

µg/L = microgram(s) per liter

S1, S2 = semiannual sampling periods

The changes in 2,4-DNT and 2,6-DNT concentrations in the former Frog Pond area are generally similar in each well. The highest concentrations of 2,4-DNT and 2,6-DNT are reported in MW-2012, MW-2050, and MW-2053 (Figure 22, Figure 23, and Figure 24), which are downgradient of the TNT-production buildings and Army Lagoon 1. Data from these wells exceed the cleanup standards for 2,4-DNT or 2,6-DNT. Data from MW-2012 decreased significantly in 2008 and have increased slightly since that time. Concentrations in well MW-2050 have decreased since 2008. The concentrations reported for MW-2053 in 2010 were new highs and decreased significantly in 2011 and 2012. The concentrations reported for these locations are significantly less than the Objective 2 triggers. Concentrations of 2,4-DNT in MW-2014, MW-2052, MW-2053, and MW-2054 were less than the cleanup standard of 0.11 µg/L, and concentrations of 2,6-DNT in MW-2014, MW-2052, and MW-2054 were less than the cleanup standard of 1.3 µg/L in 2012 (Figure 25).

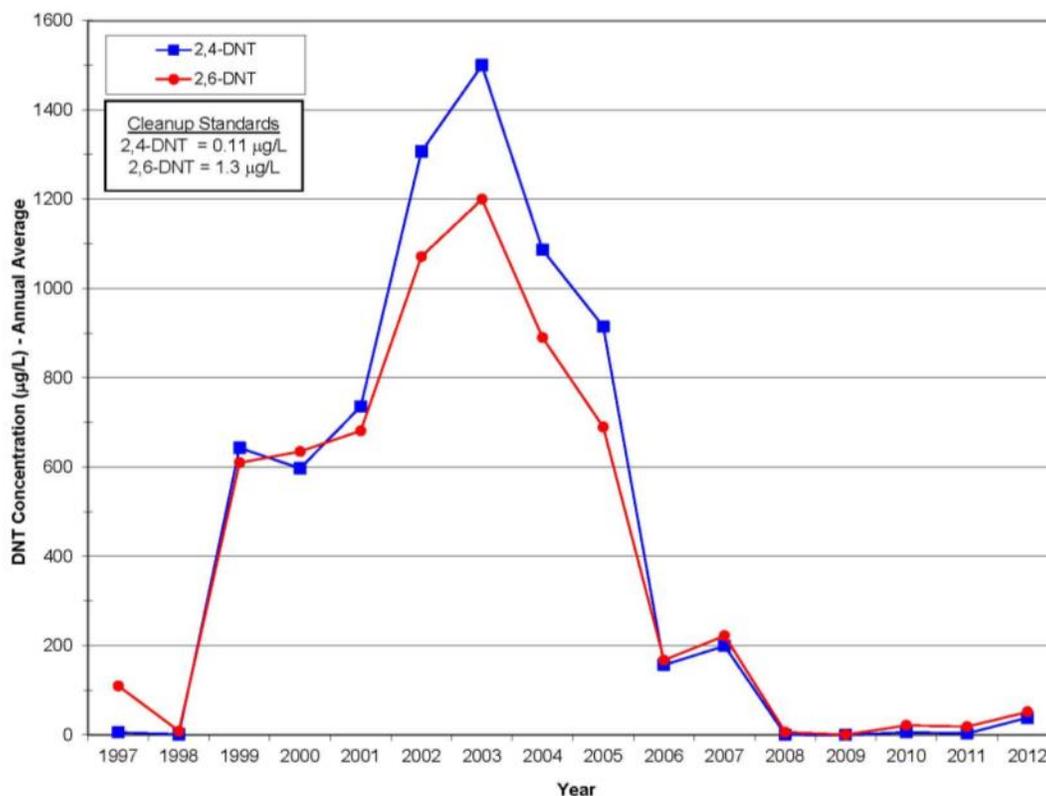


Figure 22. Annual Average 2,4-DNT and 2,6-DNT Concentrations in MW-2012

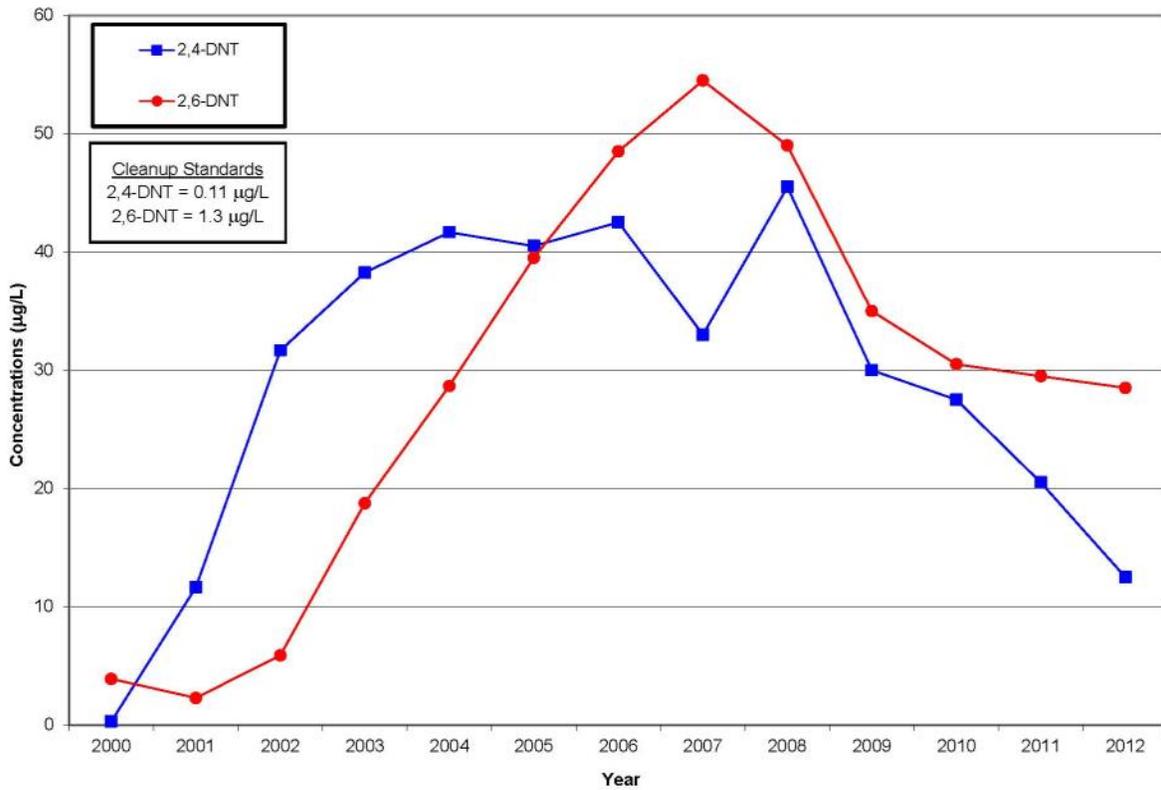


Figure 23. Annual Average 2,4-DNT and 2,6-DNT Concentrations in MW-2050

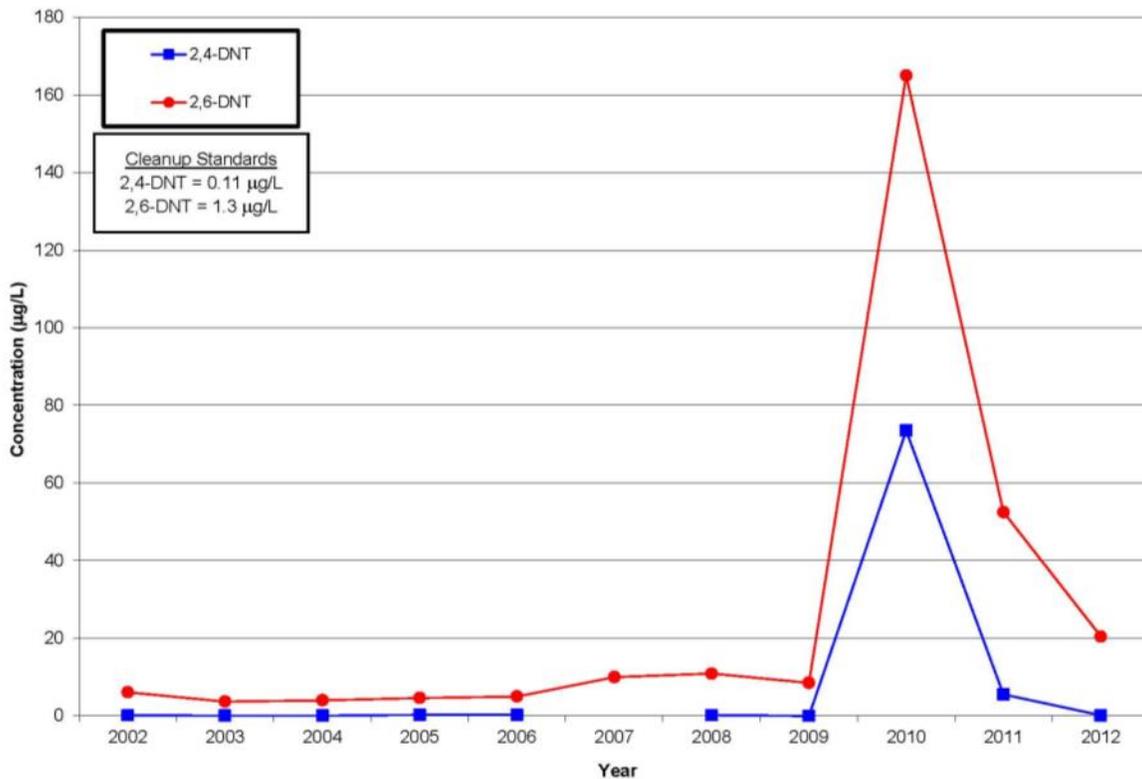


Figure 24. Annual Average 2,4-DNT and 2,6-DNT Concentrations in MW-2053

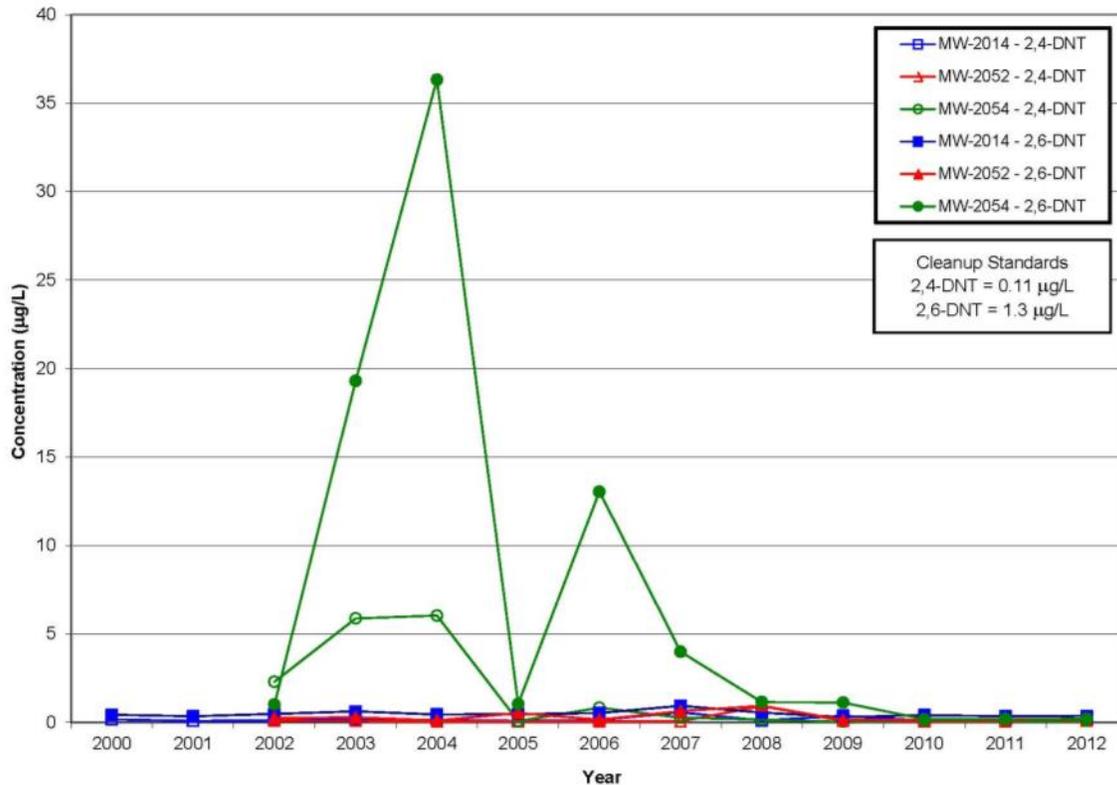


Figure 25. Annual Average 2,4-DNT and 2,6-DNT Concentrations in MW-2014, MW-2052, and MW-2054

Trend analysis of 2,4-DNT data from 2008 through 2012 indicate decreasing concentrations in all of the Objective 2 wells except MW-2012 and MW-2053, as indicated by negative slopes (Table 22). A statistically significant downward trend was calculated for MW-2050. If current decreases continue, the cleanup standard of 0.11 µg/L for 2,4-DNT could be attained in the next 5 years, based on an estimate derived from an exponential curve model. A review of the trend data suggests that concentrations of 2,4-DNT are relatively stable in wells MW-2014, MW-2052, and MW-2054, where slopes and confidence intervals are small.

Trend analysis of 2,6-DNT data, using the data from 2008 through 2012, indicates decreasing concentrations in all of the wells except MW-2052 and MW-2053, as indicated by negative slopes (Table 23). A statistically significant downward trend was calculated for wells MW-2050. If current decreases continue, the cleanup standard of 1.3 µg/L for 2,6-DNT could be attained in the next 5 years, based on an estimate derived from an exponential curve model. A review of the trend data suggests that concentrations of 2,6-DNT are relatively stable in wells MW-2014, MW-2052, and MW-2054, where slopes and confidence intervals are small.

Table 22. Trending Analysis for 2,4-DNT in Objective 2 MNA Wells in the Former Frog Pond Area (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-2012	10	None	0.31	-0.11	13.2
MW-2014	10	None	-0.01	-0.09	0.02
MW-2050	10	Down	-7.0	-11.4	-3.8
MW-2052	10	None	-0.01	-0.04	0.01
MW-2053	10	None	0.01	-0.39	5.0
MW-2054	10	None	-0.01	-0.04	0.02

µg/L/yr = microgram(s) per liter per year

Table 23. Trending Analysis for 2,6-DNT in Objective 2 MNA Wells (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-2012	10	None	-7.9	-0.72	22.9
MW-2014	10	None	-0.03	-0.12	0.05
MW-2050	10	Down	-4.4	-8.8	-1.1
MW-2052	10	None	0.02	-0.07	0.05
MW-2053	10	None	2.0	-12.3	35.2
MW-2054	10	None	-0.01	-0.60	0.03

µg/L/yr = microgram(s) per liter per year

Well MW-2012 is the only location where NB is monitored. NB has not been detected at this location since 2002, when a one-time detection of 69 µg/L was reported. The cleanup standard for NB is 17 µg/L.

Overall, nitroaromatic compound impact in the former Frog Pond area is confined to the weathered unit of the Burlington-Keokuk Limestone. The concentrations of 2,4-DNT and 2,6-DNT continue to be variable; however, samples from only a few locations exceed the cleanup standards, and no statistically significant upward trends have been identified in the data from the past 5 years. Concentrations of 1,3-DNB, 2,4,6-TNT, and NB are less than the cleanup standards in the Objective 2 wells. The cleanup standard for 2,4-DNT and 2,6-DNT in MW-2050 could be attained in the next 5 years, if decreases continue at the current rate.

Nitroaromatic Compounds—Former Raffinate Pits Area

The other area of nitroaromatic compound impact at the former Chemical Plant site is in the former Raffinate Pits area where portions of TNT-production lines #3 and #4 (Figure 14) were located. Groundwater in this area is impacted by 2,4-DNT in concentrations that exceed the cleanup standard of 0.11 µg/L. Nitroaromatic compound impact is isolated to the weathered unit of the Burlington-Keokuk Limestone. A summary of the 2,4-DNT data from the former Raffinate Pits area for 2012 is presented in Table 24.

Table 24. 2,4-DNT Data from GWOU Objective 2 Wells in the Former Raffinate Pits Area

Location	2,4-DNT Concentration (µg /L)	
	S1	S2
MW-2038	0.13	0.16
MW-3030	0.58	0.55
MW-3034	0.057 (J)	0.054 (J)
MW-3039	0.14	0.18

µg/L = microgram per liter

S1, S2 = semiannual sampling periods

J = estimated value less than the reporting limit

The highest concentrations of 2,4-DNT continued to be monitored in MW-3030 (Figure 26). Concentrations in wells MW-2038, MW-3034, and MW-3039 have been variable, showing substantial decrease in 2008 and then an increase during 2009. Concentrations in these wells have generally declined since that time. The annual average concentrations of 2,4-DNT in MW-3034 have been less than or equal to the cleanup standard of 0.11 µg/L since 2008.

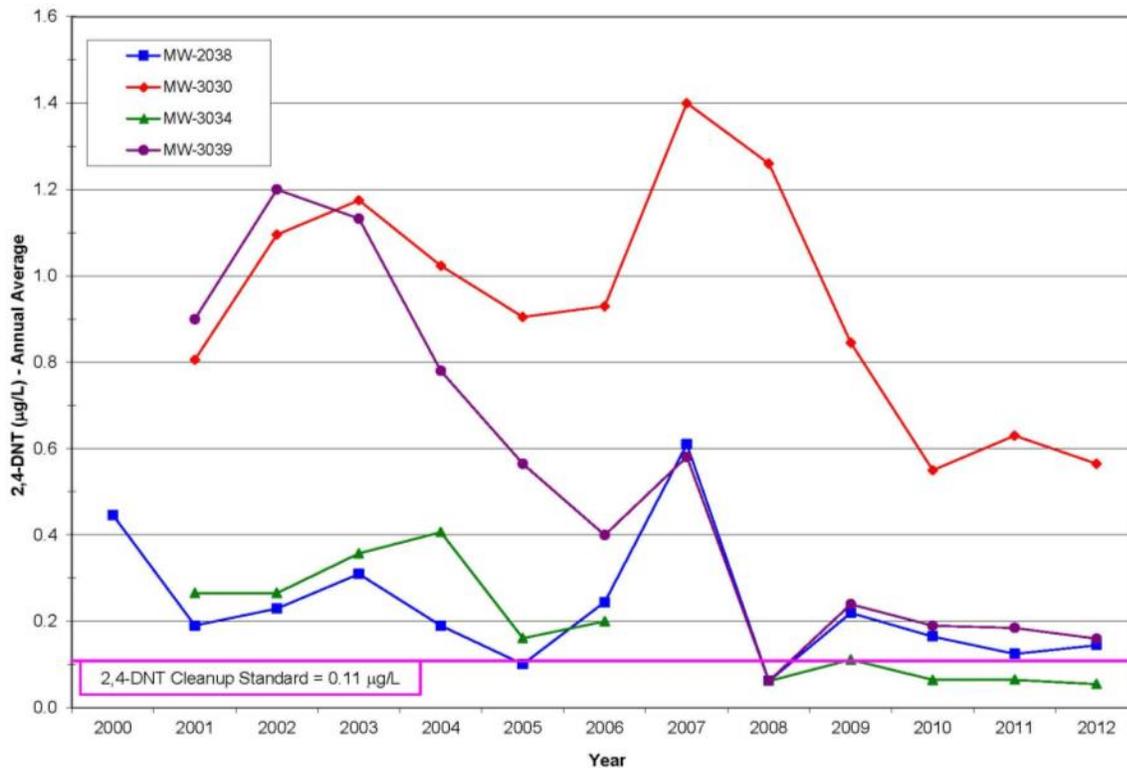


Figure 26. Annual Average 2,4-DNT Concentrations in Objective 2 Wells in the Former Raffinate Pits Area

Trend analysis of data from 2008 through 2012 indicates that 2,4-DNT concentrations in the former Raffinate Pits area are decreasing, as indicated by negative slopes (Table 25). A statistically significant downward trend was calculated for well MW-3030. A review of the trend data suggests that concentrations of 2,4-DNT are relatively stable in the remainder of the

Objective 2 wells, where slopes and confidence intervals are small. If the current overall decrease in 2,4-DNT concentrations continue in MW-3030, the cleanup standard of 0.11 µg/L could be reached in the next 5 years, based on an estimate derived from an exponential curve model.

Table 25. Trending Analysis for 2,4-DNT in Objective 2 MNA Wells in the Former Raffinate Pits Area (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-2038	10	None	0	-0.03	0.02
MW-3030	10	Down	-0.18	-0.66	-0.04
MW-3034	9	None	-0.001	-0.02	0.05
MW-3039	10	None	0	-0.03	0.04

µg/L/yr = microgram per liter per year

Overall, nitroaromatic compound impact in the former Raffinate Pits area is confined to the weathered unit of the Burlington-Keokuk Limestone. The concentrations of 2,4-DNT are decreasing. The cleanup standard for 2,4-DNT could be attained in MW-3030 in the next 5 years if decreases continue at the current rate.

5.2.1.6 Detection Monitoring Results for the GWOU

Detection monitoring consists of sampling to fulfill Objectives 3, 4, and 5 of the MNA strategy. Wells along the fringes and downgradient (both laterally and vertically) of the areas of impact are monitored to ensure that lateral and vertical migration remains within the current area of impact and that expected lateral downgradient migration within the paleochannels is minimal or nonexistent. Springs and a surface water location on Dardenne Creek are also monitored as part of this program, as these are the closest groundwater discharge points for the shallow aquifer in the vicinity of the former Chemical Plant. These locations are monitored to ensure that concentrations remain protective of human health and the environment and that water quality continues to improve in the springs.

Contaminant concentrations are monitored using 21 wells, 4 springs, and 1 surface water location situated along the fringes or downgradient of the areas of highest impact of the different contaminant plumes at the site. The monitoring well locations were sampled at least once in 2012, and the springs were sampled quarterly. Several wells and Burgermeister Spring were sampled bimonthly as part of a special study (see Section 5.2.1.7).

Uranium

Data from the detection monitoring network indicate that uranium is migrating along the preferential flow pathways (paleochannels), as expected. Uranium levels exceeding the MCL of 20 pCi/L were reported in MW-4036 during the second bimonthly sampling period. The uranium levels in the remainder of the wells screened in either the weathered or unweathered unit are low and have been stable over time. A summary of the uranium values for samples collected in 2012 is presented in Table 26.

Table 26. Uranium Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Unit/Location	Uranium (pCi/L)					
Weathered Unit							
MW-3031	Fringe		2.2			NS	
MW-3037	Fringe		2.4			3.09	
MW-4026	Southeast Drainage (alluvium)		ND (<0.045)			ND (<0.045)	
MW-4036	Downgradient	26	55.4	6.1	3.5	3.4	4.0
MW-4041	Downgradient	NS	1.7	1.3	1.3	1.61	1.6
MWS-1	Downgradient		0.81			0.90	
MWS-4	Downgradient		0.37			0.43	
Unweathered Unit							
MW-3006	Fringe	NS	0.55	0.52	0.49	0.56	0.72
MW-4042	Downgradient	NS	0.26	0.24	0.23	0.27	0.28
MWD-2	Downgradient	NS	0.21	0.20	0.18	0.20	0.212
Springs and Surface Water							
SP-5303	Southeast Drainage	48.6		37.0		45.9	104.0
SP-5304	Southeast Drainage	52.4		52.3		51.7	81.9
SP-6301	Burgermeister Spring	21.0	25.6	35.0	41.0	53.7	42.8
SP-6303	Burgermeister Spring Branch	Dry					
SW-2007	Dardenne Creek	0.56					

J = estimated value less than the reporting limit; pCi/L = picocurie(s) per liter

Values in **bold** exceed the MCL of 20 pCi/L

NS = Not Sampled

ND = analyte not detected above reporting limit indicated in parenthesis

Uranium levels in Burgermeister Spring have been variable but within historical ranges and well below the trigger level of 150 pCi/L (Figure 27). Uranium levels increased in 2005 and although variable they have shown a general decline since that time. Periodic increases in uranium levels in Burgermeister Spring may be related to the infrequent increases that occur in groundwater in the former Raffinate Pits area (DOE 2012). No visible flow was observed in SP-6303 during 2012. Uranium levels in Dardenne Creek have been low since monitoring resumed at locations SW-2007 in 2001.

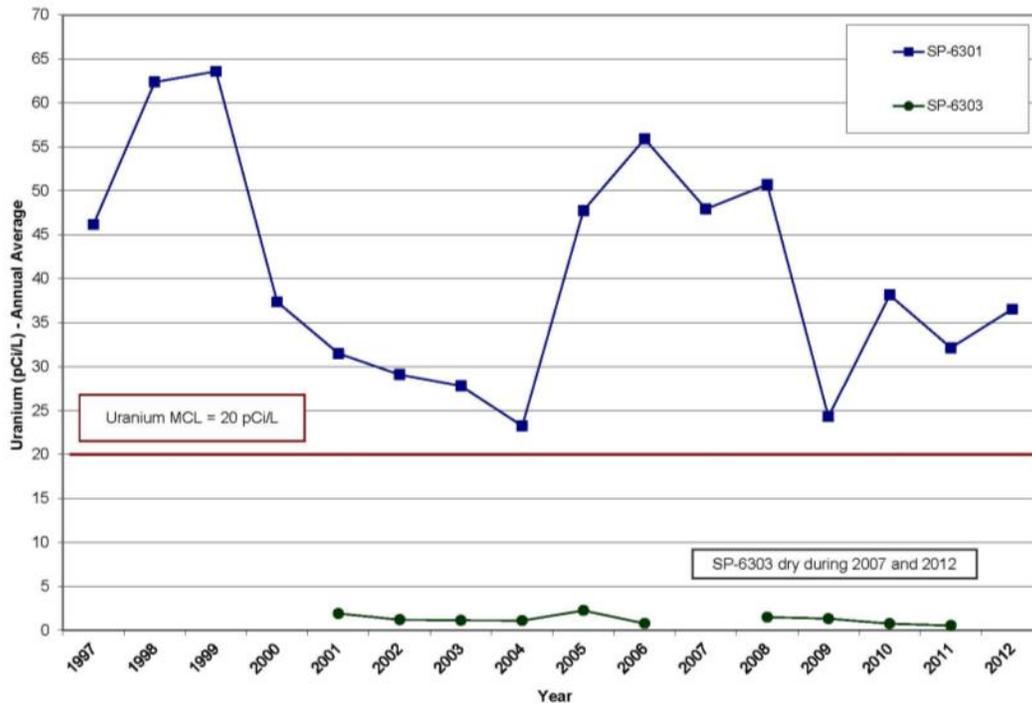


Figure 27. Annual Average Uranium Levels in SP-6301 and Spring and SP-6303

Results of the trend analysis for Burgermeister Spring (SP-6301) indicate that uranium levels are stable, as indicated by small slopes and confidence intervals (Table 27). Analysis of the data collected from 2008 through 2012 indicated no trends, either upward or downward, for these two springs. The data set for SP-6303 is small since no samples were collected in 2012 due to dry conditions.

Table 27. Trending Analysis for Uranium in SP-6301 and SP-6303 (2008–2012)

Location	No. of Samples	Trend	Slope (pCi/L/yr)	Confidence Intervals	
				Lower	Upper
SP-6301	29	None	1.6	-4.9	6.8
SP-6303	13	None	-0.06	-0.32	0.11

pCi/L/yr = picocurie(s) per liter per year

Uranium impact in the Southeast Drainage is the result of historical discharges to this drainage during plant operation that resulted in the transport of contaminated soil and sediment. The source of uranium in the two springs is residually contaminated sediments within the bedrock fracture system. The uranium levels in the two Southeast Drainage springs monitored under this program have been less variable in the past few years (Figure 28), and the behavior of uranium is similar in both springs. Uranium levels in both springs exceed the MCL but are less than the trigger level of 150 pCi/L. Uranium levels in MW-4026, a monitoring well downgradient of the two springs, were within the range of background levels.

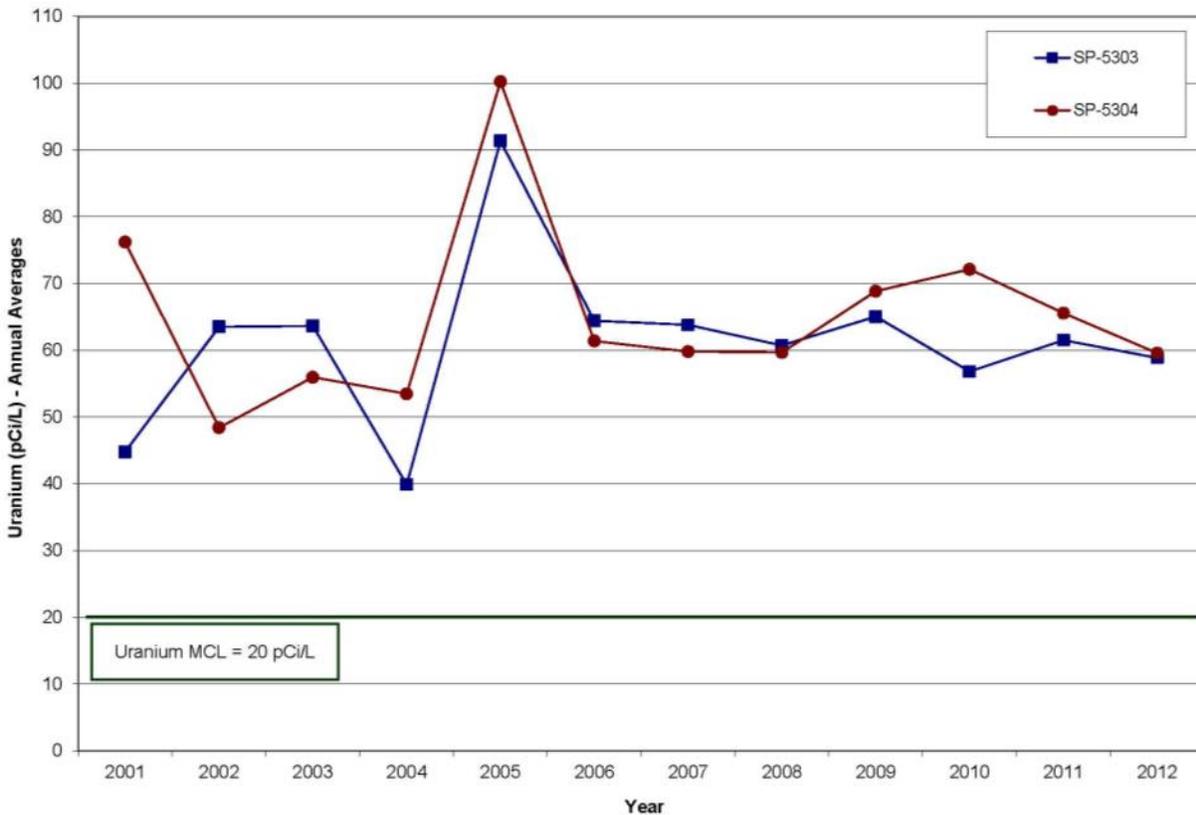


Figure 28. Annual Average Uranium Levels in Southeast Drainage Springs (2001–2012)

Results of the trend analysis for SP-5303 and SP-5304 indicate that uranium levels are stable, as indicated by small and confidence intervals slopes (Table 28). Analysis of the data collected from 2008 through 2012 indicated no trends for these two springs.

Table 28. Trending Analysis for Uranium in SP-5303 and SP-5304 (2008–2012)

Location	No. of Samples	Trend	Slope (pCi/L/yr)	Confidence Intervals	
				Lower	Upper
SP-5303	20	None	-1.3	-7.1	6.7
SP-5304	20	None	0.03	-4.0	5.2

pCi/L/yr = picocuries per liter per year

While uranium levels in the Raffinate Pits area have changed since implementation of the MNA remedy for uranium, overall, the remedy remains protective as indicated by data from the Objective 3, 4, and 5 monitoring locations. Groundwater flow directions are unchanged in the Raffinate Pits area. Impacted groundwater is contained within the paleochannel in this area and is migrating along the expected pathways. Discharge from the impacted portion of the unweathered unit into the weathered unit is monitored at MW-4036. Uranium levels in Objective 3–far wells remain low, and levels in Burgermeister Spring, while variable, are declining.

Nitrate (as N)

The nitrate concentrations in the detection monitoring wells indicate that the movement of impacted groundwater is behaving as expected. The concentrations of nitrate in well MWS-1 exceeded the MCL for nitrate (as N). Data from MWS-1 were consistent with historical data and are less than the trigger level of 30 mg/L. The nitrate concentrations in the remainder of the wells screened in either the weathered or unweathered unit were low and have been stable. Nitrate data reported in the springs were consistent with historical data. A summary of the data is presented in Table 29.

Table 29. Nitrate (as N) Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Unit/Location	Nitrate (as N) (mg/L)			
Weathered Unit					
MW-4014	Fringe	6.2			
MW-4041	Downgradient	0.18			
MWS-1	Downgradient	19.0			
MWS-4	Downgradient	1.7			
Unweathered Unit					
MW-2021	Vertical Extent	ND (<0.019)			
MW-2022	Vertical Extent	ND (<0.019)			
MW-3006	Fringe	0.27			
MW-4007	Downgradient	0.62			
MW-4042	Downgradient	0.113	ND (<0.085)		
MWD-2	Downgradient	0.55			
Springs and Surface Water					
SP-6301	Burgermeister Spring	1.5	3.5	5.4	1.6
SP-6303	Burgermeister Spring Branch	Dry			

Values in **bold** exceed the MCL of 10 mg/L.

mg/L = milligram(s) per liter; ND = not detected above the reporting limit

Note 1: Data were rejected through verification/validation process.

The nitrate concentrations in Burgermeister Spring ranged between 1.5 mg/L and 5.4 mg/L, which are less than the MCL of 10 mg/L. The annual average nitrate concentrations in Burgermeister Spring have been less than the MCL since 2002 (Figure 29). Nitrate concentrations in SP-6303 have been less than the MCL since monitoring resumed in 2001.

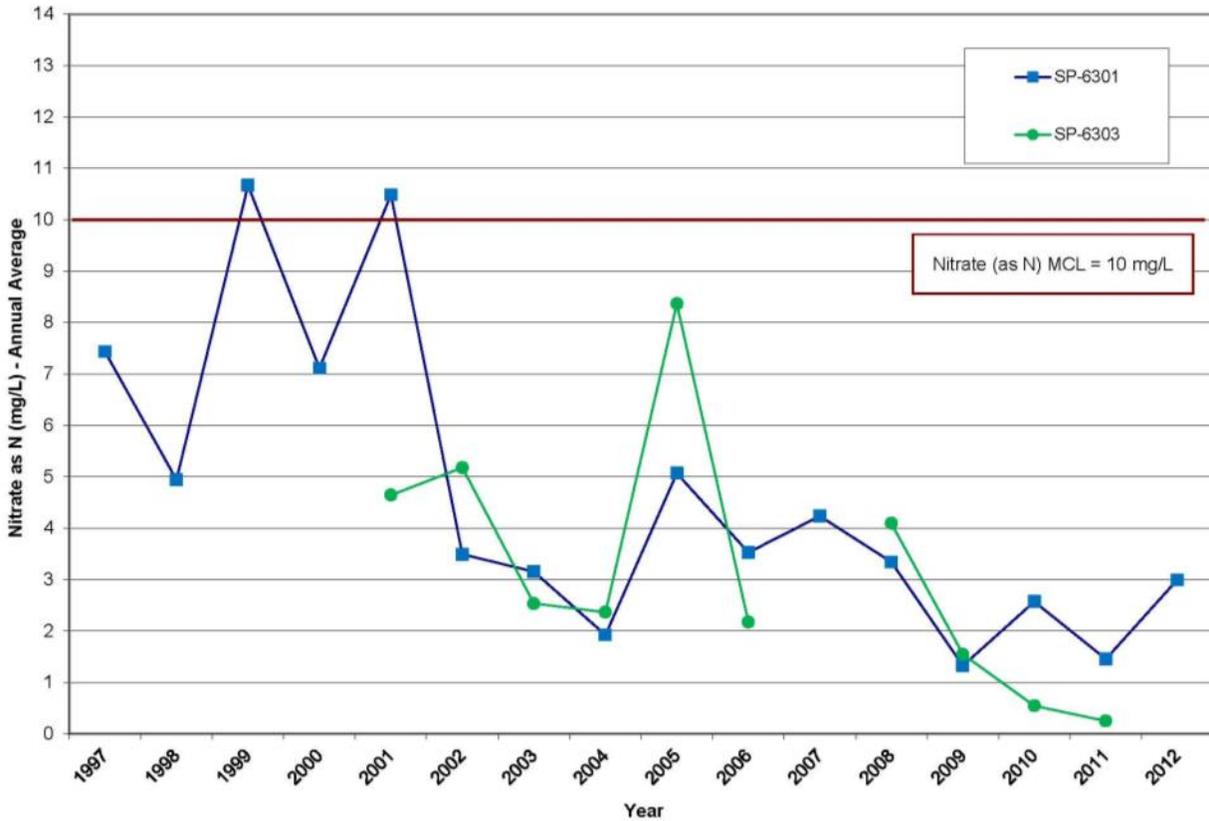


Figure 29. Annual Average Nitrate Concentrations in SP-6301 and SP-6303

Results of the trend analysis for Burgermeister Spring (SP-6301) and SP-6303 indicate that nitrate concentrations are decreasing, as indicated by negative slopes (Table 30). Analysis of the data collected from 2008 through 2012 indicated no statistically significant trends for these two springs. Nitrate concentrations are considered relatively stable in these two springs, where slopes and confidence intervals are small.

Table 30. Trending Analysis for Nitrate (as N) in SP-6301 and SP-6303 (2008–2012)

Location	No. of Samples	Trend	Slope (mg/L/yr)	Confidence Intervals	
				Lower	Upper
SP-6301	23	None	-0.10	-0.53	0.55
SP-6303	11	None	-1.1	-2.8	0.12

mg/L/yr = milligrams per liter per year

Trichloroethene

Detections of TCE were not reported in the detection monitoring wells or SP-6301. The data from the past 5 years indicate that the area of TCE impact has not expanded, either laterally or vertically. No detectable concentrations of the breakdown products *cis*-1,2-DCE, *trans*-1,2-DCE, or vinyl chloride were reported in any of the detection monitoring locations. A summary of the TCE data is presented in Table 31.

Table 31. TCE Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Unit/Location	TCE (µg/L)			
Weathered Unit					
MW-3031	Fringe	ND (<0.16)			
MW-3037	Fringe	ND (<0.16)			
MW-4036	Downgradient	ND (<0.3)			
MW-4041	Downgradient	ND (<0.3)			
MWS-1	Downgradient	ND (<0.16)			
MWS-4	Downgradient	ND (<0.16)			
Unweathered Unit					
MW-3006	Fringe	ND (<0.3)			
MW-4007	Downgradient	ND (<0.3)			
MW-4040	Vertical Extent	ND (<0.3)			
Springs and Surface Water					
SP-6301	Burgermeister Spring	ND (<0.16)	ND (<0.3)	ND (<0.16)	ND (<0.3)
SP-6303	Burgermeister Spring Branch	Dry			

µg/L = microgram per liter;

ND = not detected above the reporting limit

Nitroaromatic Compounds

Detection monitoring results for 1,3-DNB indicated that the impacted groundwater in the overlying weathered unit has not moved downward from the area of known impact within the weathered unit (Table 32). Fringe location MW-2051 had an estimated concentration of 1,3-DNB less than detection limit and is consistent with historical data. An estimated detection of 1,3-DNB was reported in SP-6301.

Table 32. 1,3-DNB Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Location	1,3-DNB (µg/L)			
Weathered Unit					
MW-2032	Fringe	ND (<0.013)	ND (0.013)		
MW-2051	Fringe	0.045 (J)	0.038 (J)		
MW-4014	Downgradient	ND (<0.014)			
MW-4039	Fringe	ND (<0.014)	ND (0.013)		
MW-4041	Downgradient—Far	ND (<0.014)			
Unweathered Unit					
MW-2022	Vertical Extent	ND (<0.013)			
MW-2023	Vertical Extent	ND (<0.013)			
MW-2056	Vertical Extent	ND (<0.014)			
Springs					
SP-6301	Burgermeister Spring	ND (<0.014)	ND (<0.014)	0.015 (J)	ND (<0.014)
SP-6303	Burgermeister Spring Branch	Dry			

J = estimated value less than reporting limit; µg/L = microgram per liter;

ND = nondetect above method detection limit indicated in parentheses

The concentrations of 2,4,6-TNT reported in the detection monitoring wells in the weathered unit indicate that affected groundwater has not migrated beyond the area of known impact (Table 33). Fringe location MW-2051 had estimated concentrations of 2,4,6-TNT less than the detection limit; this concentration is consistent with historical data. No detectable concentrations of 2,4,6-TNT were reported in the wells in the unweathered unit or in Burgermeister Spring.

Table 33. 2,4,6-TNT Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Location	2,4,6-TNT (µg/L)			
Weathered Unit					
MW-2032	Fringe	ND (<0.021)		ND (<0.021)	
MW-2051	Fringe	0.066 (J)		0.075 (J)	
MW-4014	Downgradient	ND (<0.021)			
MW-4039	Fringe	ND (<0.021)		ND (<0.021)	
MW-4041	Downgradient—Far	ND (<0.021)			
Unweathered Unit					
MW-2022	Vertical Extent	ND (<0.021)			
MW-2023	Vertical Extent	ND (<0.021)			
MW-2056	Vertical Extent	ND (<0.021)			
Springs					
SP-6301	Burgermeister Spring	ND (<0.021)	ND (<0.021)	ND (<0.022)	ND (<0.022)
SP-6303	Burgermeister Spring Branch	Dry			

J = estimated value less than reporting limit; µg/L = microgram per liter;
 ND = nondetect above method detection limit indicated in parentheses

Detection monitoring results for 2,4-DNT impact in the former Frog Pond area indicate that limited migration continued in the weathered unit (Table 34), and the concentrations reported in MW-4015 did not exceed the trigger level set for the Objective 3 wells. The concentrations did exceed the cleanup standard of 0.11 µg/L, but are consistent with historical data. The data from the unweathered unit wells indicate that the impacted groundwater in the overlying weathered unit has not moved downward. Estimated concentrations were reported in Burgermeister Spring and are consistent with historical data.

Detection monitoring results for 2,4-DNT impact in the former Raffinate Pits area show that minimal migration from this area has continued (Table 34). The source of the estimated concentration of 2,4-DNT reported in MW-4036 may be the former Chemical Plant site, the Army property, or both. This estimated concentration did not exceed the trigger level set for the Objective 3 wells. The data from the unweathered unit wells verified that the impacted groundwater in the overlying weathered unit has not migrated downward.

Table 34. 2,4-DNT Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Location	2,4-DNT (µg/L)			
Weathered Unit					
MW-2032	Fringe—FP	0.018 (J)		ND (<0.018)	
MW-2051	Fringe—FP	0.071 (J)		0.056 (J)	
MW-3037	Fringe—RP	ND (<0.018)			
MW-4013	Downgradient—FP	0.045 (J)			
MW-4014	Downgradient—FP	ND (<0.018)			
MW-4015	Downgradient—FP	0.12			
MW-4036	Downgradient—RP	0.13			
MW-4039	Fringe—FP	ND (<0.018)		ND (<0.018)	
MW-4041	Downgradient—Far	ND (<0.018)			
MWS-1	Downgradient—RP	ND (<0.018)			
Unweathered Unit					
MW-2023	Vertical Extent—FP	ND (<0.018)			
MW-2056	Vertical Extent—FP	ND (<0.018)			
MW-3006	Vertical Extent—RP	ND (<0.018)			
MW-4040	Vertical Extent—RP	ND (<0.018)			
Springs					
SP-6301	Burgermeister Spring	ND (<0.018)	0.026 (J)	0.028 (J)	ND (<0.019)
SP-6303	Burgermeister Spring Branch	Dry			

FP = Frog Pond area; J = estimated value less than reporting limit; µg/L = microgram per liter;
 ND = nondetect above method detection limit indicated in parentheses; RP = Raffinate Pits area

Continued downgradient migration of 2,6-DNT impacted groundwater from the former Frog Pond area is monitored by the Objective 3 wells (Table 35). Concentrations in these downgradient wells have decreased slightly during the review period. Concentrations are consistent with historical data. No detectable concentrations of 2,6-DNT were reported in the wells in the unweathered unit. The concentrations reported in Burgermeister Spring are low and consistent with historical data. None of the concentrations reported exceeded the trigger levels set for the Objective 3 or 4 wells or the Objective 5 springs.

The nitroaromatic compound NB has not been detected in any of the Objective 3, 4, or 5 monitoring locations since the MNA program began in 2004.

Table 35. 2,6-DNT Data for GWOU Objective 3, 4, and 5 Locations

Sample ID	Location	2,6-DNT (µg/L)			
Weathered Unit					
MW-2032	Fringe	0.026 (J)		0.024 (J)	
MW-2051	Fringe	0.029 (J)		0.026 (J)	
MW-4013	Downgradient	0.29			
MW-4014	Downgradient	0.10			
MW-4015	Downgradient	0.79			
MW-4039	Fringe	ND (<0.021)		ND (<0.021)	
MW-4041	Downgradient—Far	ND (<0.021),0.021			
Unweathered Unit					
MW-2023	Vertical Extent	ND (<0.021)			
MW-2056	Vertical Extent	ND (<0.021)			
Springs					
SP-6301	Burgermeister Spring	0.024 (J)	0.059 (J)	0.13	0.028 (J)
SP-6303	Burgermeister Spring Branch	Dry			

J = estimated value less than reporting limit; µg/L = microgram per liter;
 ND = nondetect above method detection limit indicated in parentheses

5.2.1.7 GWOU Special Study—Elevated Uranium in the Unweathered Unit

An issue identified in the Fourth Five-Year Review (DOE 2011b) was that a specific monitoring program has not been established for uranium in the unweathered unit of the Burlington-Keokuk Limestone unit at the site. The uranium impact in this deeper unit was identified after design and implementation of the MNA remedy for the site. The five-year review recommended (1) that the MNA program should be evaluated and possibly modified with regard to uranium impact in the unweathered unit and (2) the MNA modification might involve the development of new trigger values and additional monitoring locations.

Ten wells and two springs (Figure 30) have been selected to monitor the uranium impact in the unweathered unit in the former Raffinate Pits area. Five of these wells (MW-3024, MW-3040, MW-4040, MW-4042, and MWD-2) are presently included in the MNA monitoring network and used to evaluate uranium impact in the unweathered bedrock unit. Five additional wells (MW-3006, MW-4007, MW-4041, MW-4043, MWS-2) and two springs (SP-6201 and SP-6301) will be added to evaluate the groundwater quality for evaluation of adequately fulfilling Objective 3 and Objective 5 monitoring objectives. All of the wells are existing wells and several locations are presently part of the MNA network used for collection of other contaminant of concern data. Sampling in support of this evaluation was started during the second bimonthly period.

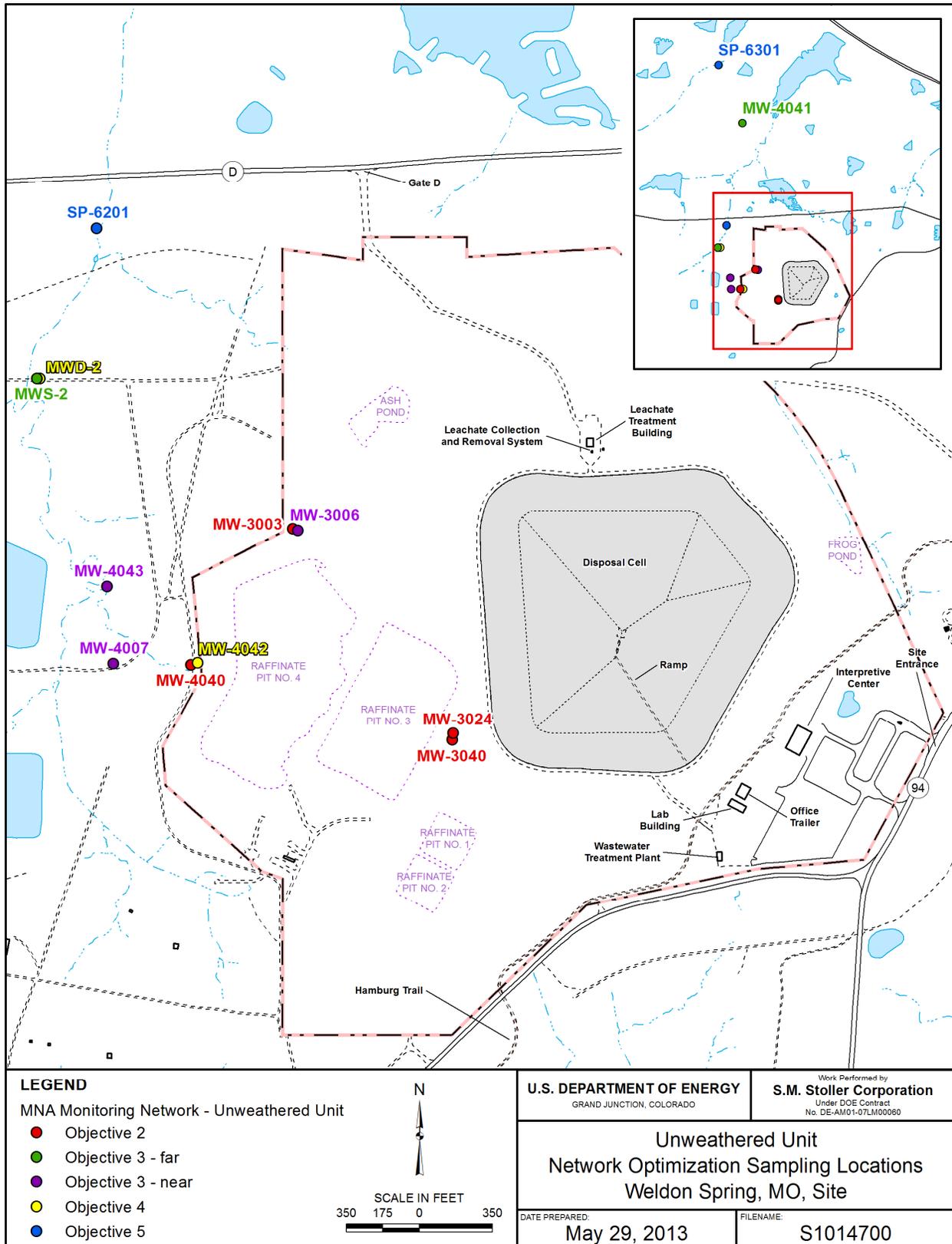


Figure 30. Unweathered Unit Network Optimization Sampling Locations

These wells and springs will be sampled quarterly until eight data points have been obtained for each location. These data are anticipated to be collected within a 2 year time period from the start of monitoring. Samples will be analyzed for total uranium and field parameters (pH, oxidation-reduction potential [ORP], dissolved oxygen, specific conductivity, and turbidity).

After 2 years of monitoring, a data set consisting of 8 data points will be obtained. These data will be used to determine if the selected monitoring locations fulfill the proposed monitoring objectives outlines in Table 36. Also, these data will be used to establish appropriate triggers. Triggers will be selected consistent with those established 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).

Data from the wells and springs from 2012 included in the special study are summarized in Table 36.

Table 36. Uranium Data from MNA Network Optimization Monitoring

Uranium Concentration (pCi/L)						
Location	B1	B2	B3	B4	B5	B6
MW-3003	NS	NS	2.6	NS	3.1	3.0
MW-3006	NS	0.55	0.52	0.49	0.56	0.72
MW-3024	103	125	127	108	114	223
MW-3040	102	118	107	102	112	140
MW-4007	NS	2.6	2.6	2.2	2.4	2.4
MW-4041	NS	1.7	1.5	1.3	1.6	1.6
MW-4042	NS	0.26	0.24	0.23	0.27	0.28
MW-4043	88.0	88.0	79.9	67.7	79.9	88.7
MWS-2	NS	1.4	1.7	1.4	1.6	1.8
MWD-2	NS	0.21	0.20	0.18	0.20	0.22
SP-6201	6.8	8.8	3.3	Dry	11.1	22.7
SP-6301	21.0	25.6	35.0	41.0	53.7	42.8

pCi/L = picocuries per liter

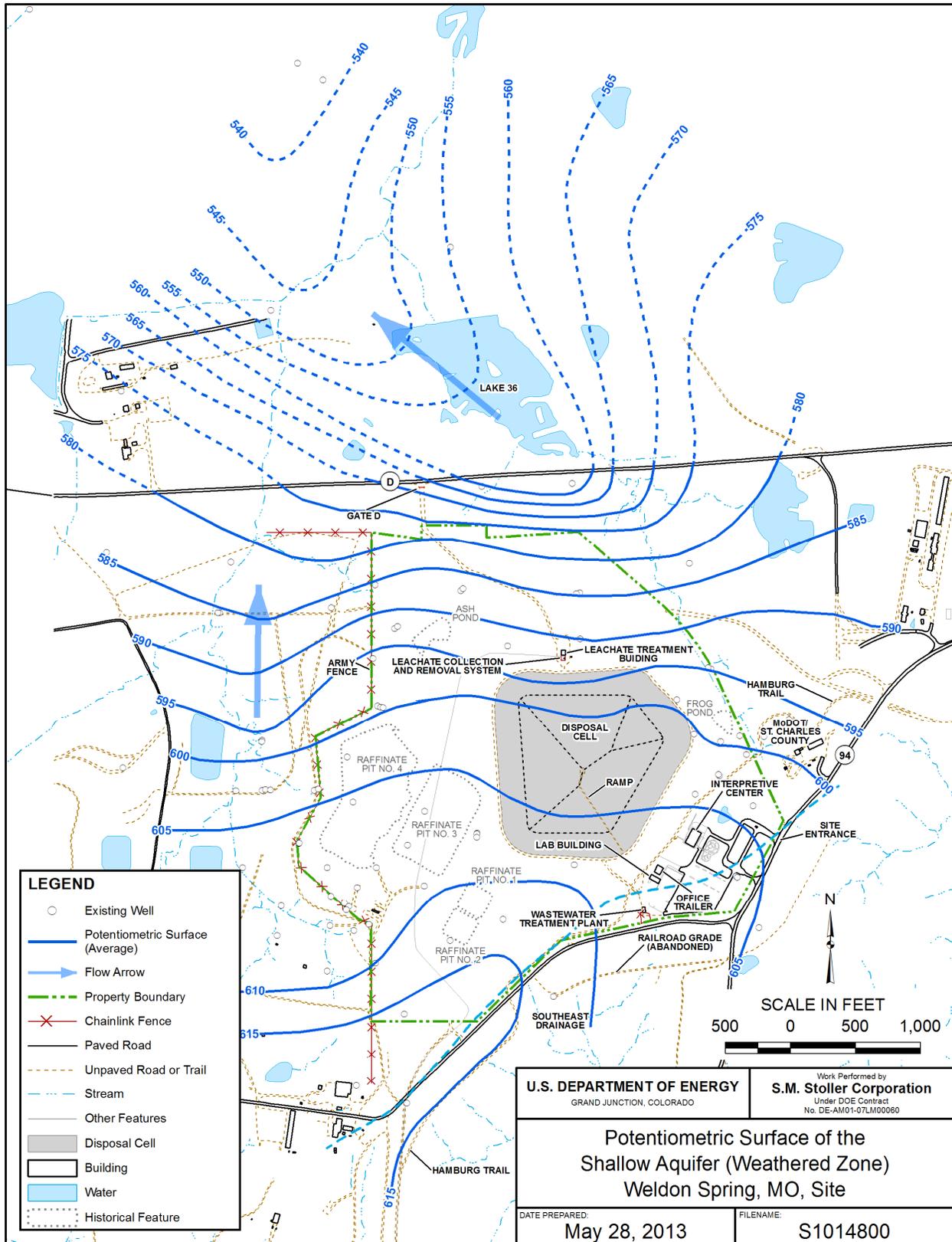
B1, B2, B3, B4, B5, B6 = Bimonthly sampling periods

NS = Not Sampled

5.2.1.8 Chemical Plant Hydrogeologic Data Analysis

Hydrogeologic conditions at the site are being monitored using all the wells included in the MNA network (Objectives 1, 2, 3, and 4 wells) and additional wells (Objective 6 wells) that were selected to provide adequate coverage to identify changes in groundwater flow that might affect the protectiveness of the selected remedy. The static groundwater levels of the monitoring network are measured to establish that groundwater flow is not changing significantly and resulting in shifts in contaminant migration.

The average groundwater elevations measured in 2012 were used to construct a potentiometric surface map of the shallow aquifer, using the available wells at the Chemical Plant (Figure 31). The configuration of the potentiometric surface has remained relatively unchanged. However, groundwater elevations have decreased in several portions of the site. Even though changes have occurred in the groundwater elevations, the groundwater flow direction continues to be generally to the north. A groundwater divide is present along the southern boundary of the Chemical Plant site. Troughs in the groundwater surface occur where paleochannels are located.



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Figure 31. 2012 Potentiometric Surface of the Shallow Aquifer (Weathered Zone)

The groundwater flow direction within the unweathered zone is similar to that in the weathered zone, as indicated by the potentiometric map (Figure 32). Groundwater flow at the chemical plant is to the north or northwest. This figure was constructed using the data from all available unweathered zone wells and lacks the detail of the potentiometric map for the weathered unit due to fewer wells screened in the unweathered unit. A groundwater high is present near well MW-3026 in the southwest corner of the site, where raffinate pit #4 was located. Two trough features are present and are coincident with those observed in the water table for the shallow aquifer.

Groundwater elevations have shown a general decrease in the weathered unit of the Burlington-Keokuk Limestone (Figure 33). Groundwater elevations in the weathered unit in the Frog Pond area show influence of surface water infiltration. Groundwater elevations in the unweathered unit have decreased in the Raffinate Pits area (Figure 34). The decreases in both units are likely due to the removal of large surface water impoundments, such as the Raffinate Pits, during site remediation.

5.2.2 Quarry Groundwater

EPA signed the QROU ROD (DOE 1998) on September 30, 1998. The QROU ROD specified long-term groundwater monitoring and ICs to limit groundwater use during the monitoring period. Groundwater north of the Femme Osage Slough will be monitored until a target level of 300 pCi/L for uranium is attained. In addition, groundwater south of the slough will be monitored to ensure protection of human health and the environment.

In 2000, DOE initiated a long-term monitoring program as outlined in the *Remedial Design/Remedial Action Work Plan for the Quarry Residuals Operable Unit* (DOE 2000b). This network was modified to add wells upgradient of the Quarry (MW-1012), downgradient of the area of impact (MW-1028), and within the area of highest uranium impact (MW-1051 and MW-1052).

5.2.2.1 Hydrogeologic Description

The geology of the Quarry area is separated into three units: upland overburden, Missouri River alluvium, and bedrock. The unconsolidated upland material overlying the bedrock consists of up to 30 ft of silty clay soil and loess deposits and is not saturated (DOE 1989). Three Ordovician formations constitute the bedrock: the Kimmswick Limestone, the limestone and shale of the Decorah Group, and the Plattin Limestone. The alluvium associated with the Missouri River consists of clays, silts, sands, and gravels above the bedrock. The alluvium thickness increases with distance from the edge of the river floodplain toward the river, where the maximum thickness is approximately 100 ft.

Alluvium at the Quarry is truncated by an erosional contact with the Ordovician bedrock bluff consisting of Kimmswick, Decorah, and Plattin Formations. These formations also form the rim wall of the Quarry. The bedrock unit underlying alluvial materials north of Femme Osage Slough is the Decorah Group. Primary sediments between the bluff and the slough are intermixed and interlayered clays, silts, and sands. Organic material is intermixed throughout the sediments.

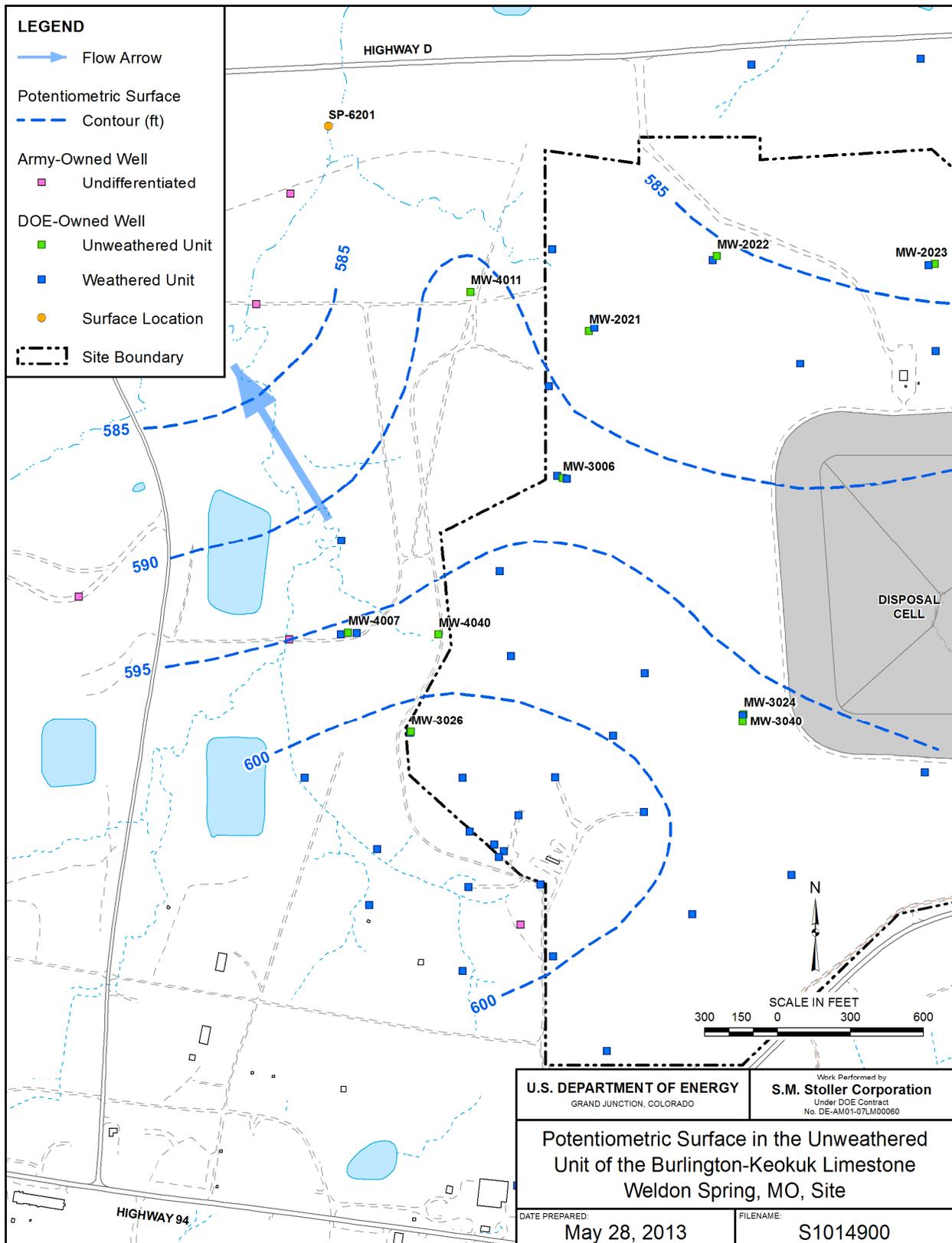


Figure 32. Potentiometric Surface in the Unweathered Zone of the Burlington-Keokuk Limestone

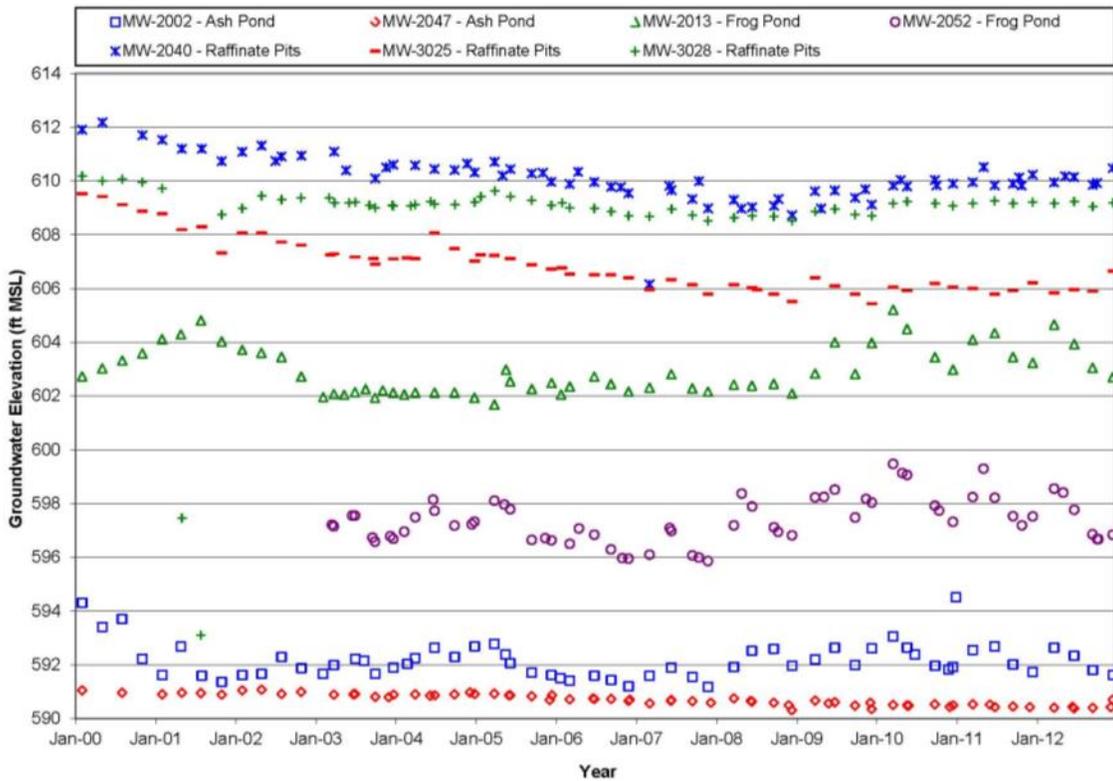


Figure 33. Groundwater Elevations in the Weathered Unit

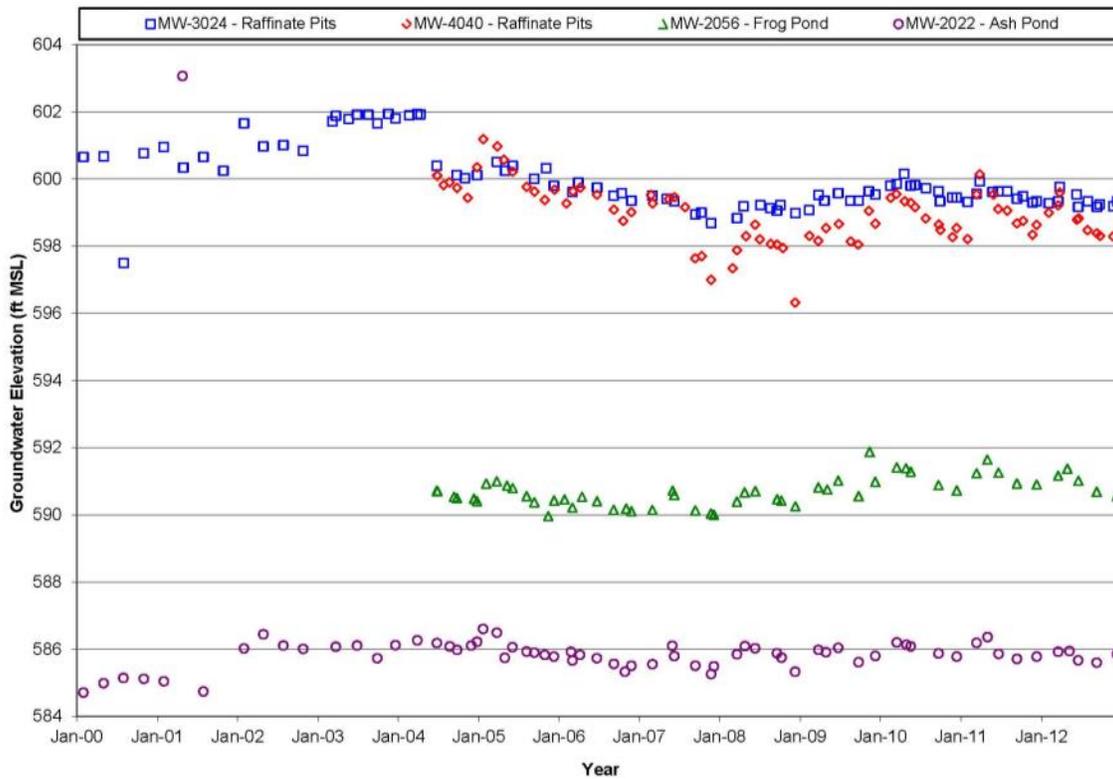


Figure 34. Groundwater Elevations in the Unweathered Unit

The area between the bedrock bluff and the Femme Osage Slough contains a naturally occurring oxidation/reduction front, which acts as a barrier to the migration of dissolved uranium in groundwater by inducing its precipitation. This reduction zone is the primary mechanism controlling the distribution south of the Quarry.

The uppermost groundwater flow systems at the Quarry are composed of alluvial and bedrock aquifers. Water levels in the alluvial aquifer are primarily controlled by surface water levels in the Missouri River and infiltration of precipitation and overland runoff that recharges the bedrock aquifer.

Eight monitoring wells in the Darst Bottom area were used to study the water quality of the Missouri River alluvium upgradient of the Quarry and provide a reference for background values of uranium. Several other bedrock wells were installed north of the quarry to provide background values for uranium in the bedrock units. A summary of the uranium background values is provided in Table 37 (DOE 1998).

Table 37. Background Uranium Levels for Units at the Quarry

Unit	Uranium (pCi/L)	
	Background Value (UCL ₉₅)	Background Range
Alluvium ^a	2.77	0.1–16
Kimmswick/Decorah ^b	3.41	0.5–8.5
Plattin ^c	3.78 ^d	1.2–5.1

^a Based on data from Darst Bottom wells (U.S. Geological Survey and DOE)

^b Based on data from MW-1034 and MW-1043 (DOE)

^c Based on data from MW-1042 (DOE)

^d This background value is lower than previously published as a result of recent data evaluation.

pCi/L = picocurie(s) per liter; UCL₉₅ = 95th percentile upper confident limit on the mean concentration

5.2.2.2 Contaminants of Interest

Uranium and nitroaromatic compounds that leached from wastes in the Quarry proper contaminated the groundwater beneath and downgradient of the Quarry. Contaminant levels have decreased since the removal of the wastes from the Quarry. The remaining sources of groundwater contamination are residual material in the fractures and uranium that has precipitated or sorbed onto the alluvial materials north of the Femme Osage Slough.

Uranium entered the shallow aquifer via migration through bedrock fractures in the Kimmswick Limestone and Decorah Formation that constitute the Quarry. The extent of uranium in groundwater was limited to the area north of the slough through precipitation by a naturally occurring chemical reduction process and adsorption onto aquifer materials.

Nitroaromatic compounds in the groundwater system, primarily 2,4-DNT, coincide with the disposal placement of these wastes in the Quarry proper. Nitroaromatic compounds entered the shallow aquifer via migration through bedrock fractures of the Quarry. The mobility of nitroaromatic compounds in the bedrock aquifer is high because these compounds have little sorptive affinity for the bedrock materials. Some microorganism activity may be able to transform and degrade TNT and DNT in the alluvial materials north of the slough.

5.2.2.3 *Quarry Monitoring Program*

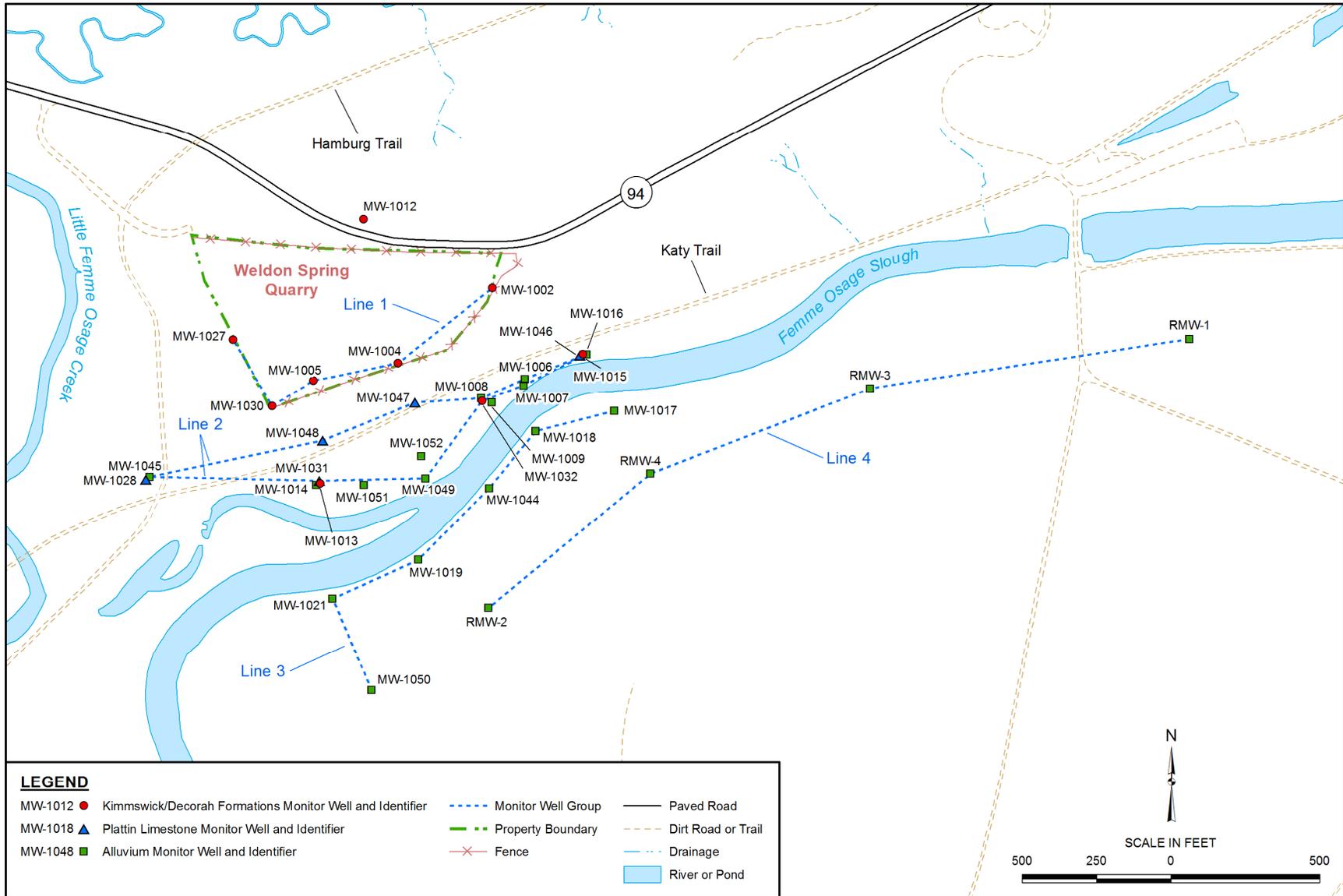
Long-term monitoring at the Quarry is designed to (1) monitor uranium concentrations south of the slough to ensure that they remain protective of human health and the environment, and (2) monitor uranium and 2,4-DNT levels within the area of groundwater impact north of the slough until they attain target levels that have been identified as having a negligible impact on the groundwater south of the slough (DOE 2000a).

To implement these two monitoring objectives, the wells were categorized into monitoring lines (Figure 35). Each line provides specific information relevant to long-term goals at the Quarry:

- The first line of wells (Line 1) monitors the area of impact within the bedrock rim of the Quarry proper. These wells (MW-1002, MW-1004, MW-1005, MW-1027, and MW-1030) are sampled to establish trends in contaminant concentrations within areas of higher impact.
- The second line of wells monitors the area of impact within alluvial materials and shallow bedrock north of Femme Osage Slough (MW-1006, MW-1007, MW-1008, MW-1009, MW-1013, MW-1014, MW-1015, MW-1016, MW-1028, MW-1031, MW-1032, MW-1045, MW-1046, MW-1047, MW-1048, MW-1049, MW-1051, and MW-1052). These wells are also sampled to establish trends in contaminant concentrations within the areas of higher impact and to monitor the oxidizing and reducing environments that are present within this area.
- The third line of wells monitors the alluvium directly south of the slough. These wells (MW-1017, MW-1018, MW-1019, MW-1021, MW-1044, and MW-1050) have shown no impact from Quarry contaminants and are monitored as the first line of warning for potential migration of uranium south of the slough.
- The fourth line of wells monitors the same portion of the alluvial aquifer that supplies the Public Water Supply District #2 (formerly St. Charles County) well field. These wells (RMW-1, RMW-2, RMW-3, and RMW-4) are sampled to monitor the groundwater quality of the productive portions of the alluvial aquifer and to detect potential occurrences of uranium outside the range of natural variation.

Monitoring well MW-1012 has been retained as a background location for the Quarry proper. This well is screened in the Kimmswick Limestone and Decorah Group and is included with the Line 1 wells.

The sampling frequency for each location was selected to provide adequate reaction time on the basis of travel times from the residual sources and areas of impact to potential receptors. Monitoring wells on the Quarry rim were sampled semiannually starting in 2009 due to declining uranium levels. Monitoring wells between the quarry and the Femme Osage Slough, the area of highest impact, are sampled quarterly. Locations south of the slough are sampled semiannually or annually. In 2012, all locations in the Quarry area were sampled for uranium, sulfate, and dissolved iron. A selected group of wells north of the slough was sampled for nitroaromatic compounds.



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Figure 35. Groundwater Monitoring Well Locations at the Quarry Area of the Weldon Spring, Missouri, Site

Testing for temporal trends using the Mann-Kendall test was performed for total uranium and 2,4-DNT data collected between 2008 and 2012. Results for the trending analysis are reported for wells in Lines 1 and 2 of the Quarry monitoring network, as these wells monitor the area of groundwater impact. Trending is used as a general indicator of changes in the groundwater quality in this area.

5.2.2.4 Monitoring Results for Groundwater in the Area of Impact at the Quarry

Contaminant concentrations are monitored using 24 wells screened in either the bedrock or alluvial materials in the area of uranium and 2,4-DNT impact, which is north of the Femme Osage Slough. The data are discussed in the following sections.

Uranium

Uranium is monitored in both the bedrock and the adjoining alluvial materials north of the Femme Osage Slough. These wells are monitored to determine when the area of groundwater impact north of the slough will have a negligible impact on the groundwater south of the slough.

Uranium levels in the Line 1 wells have shown a general decrease (Figure 36). In 2012, two locations had uranium levels that exceeded the target level of 300 pCi/L (Table 38). The annual average levels of uranium in MW-1002, MW-1027, and MW-1030 have been less than the target level of 300 pCi/L established for groundwater north of the Femme Osage Slough since 2006. Uranium levels in MW-1002 and MW-1030 have consistently been less than the MCL of 20 pCi/L since 2001.

Table 38. 2012 Total Uranium in QROU Line 1 Wells

Location	Line	Geologic Unit	Uranium (pCi/L)	
			S1	S2
MW-1002	1	Kimmswick-Decorah	3	2.5
MW-1004	1	Kimmswick-Decorah	542	481
MW-1005	1	Kimmswick-Decorah	948	440
MW-1012	1 ^a	Kimmswick-Decorah	2.5	2.11
MW-1027	1	Kimmswick-Decorah	102	74.5
MW-1030	1	Kimmswick-Decorah	3.1	2.32

^a Upgradient location

Concentrations in **bold** exceed the target level of 300 picocuries per liter

pCi/L = picocuries per liter

S1, S2 = semiannual sampling periods

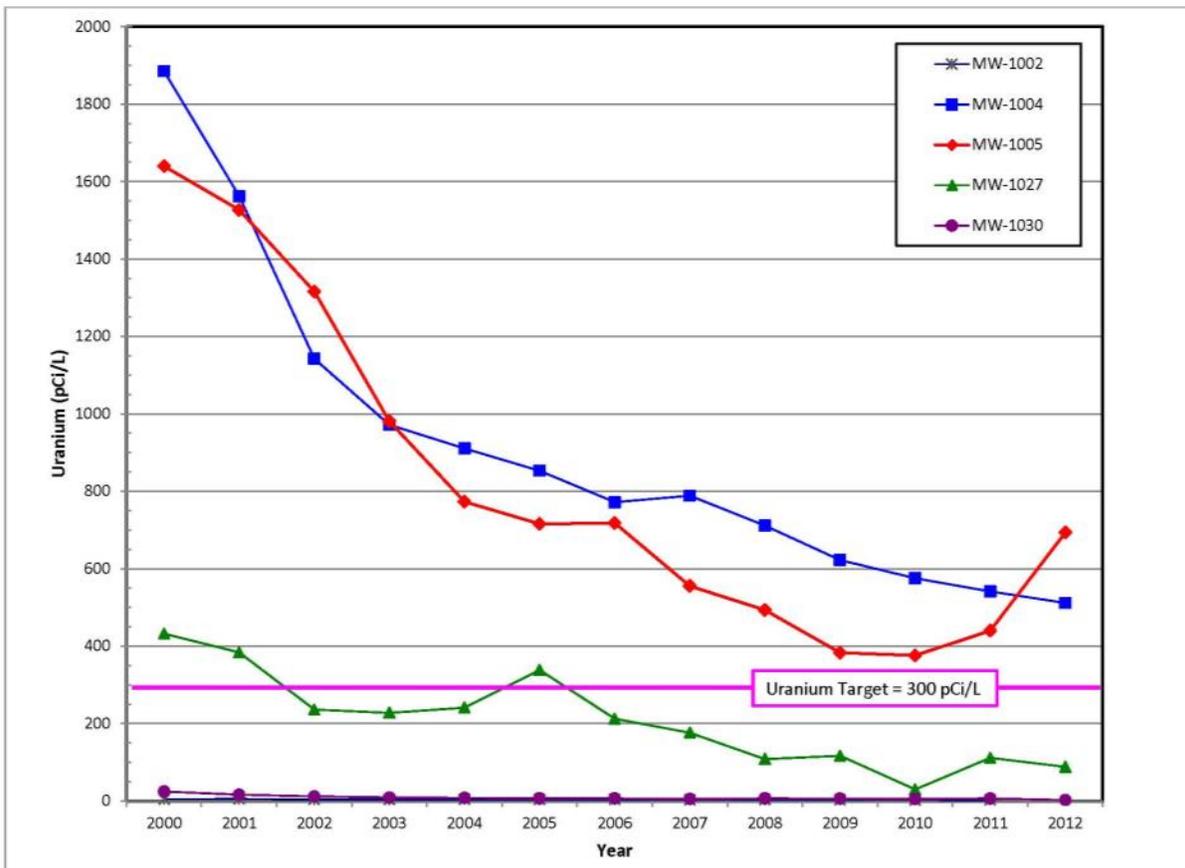


Figure 36. Average Uranium in Line 1 Monitoring Wells

The results of trend analysis for the Line 1 wells (Table 39) indicate that uranium levels in recent years have been decreasing in most of these wells, as indicated by negative slopes. Statistically significant downward trends have been calculated for MW-1002 and MW-1004. If the current overall decline in uranium levels continues in these wells, the target level of 300 pCi/L could be reached in the next 5 to 10 years, based on an estimate for MW-1004 derived from an exponential curve model. Uranium levels in MW-1002 and MW-1030 are stable based on the small slope and confidence intervals.

Table 39. Trending Analysis for Uranium in Line 1 Groundwater Monitoring Wells (2008–2012)

Location	No. of Samples	Trend	Slope (pCi/L/yr)	Confidence Intervals	
				Lower	Upper
MW-1002	12	Down	-0.15	-0.31	-0.02
MW-1004	12	Down	-55.1	-95.2	-18.6
MW-1005	12	None	-4.1	-65.8	32.8
MW-1027	12	None	-8.3	-40.4	21.4
MW-1030	12	None	-0.87	-1.43	0.15

pCi/L/yr = picocurie(s) per liter per year

Several bedrock wells located between the Quarry rim and Femme Osage Slough (Line 2) continue to have elevated uranium levels (Table 40). However, only one Line 2 bedrock well had

uranium levels that exceeded the target level of 300 pCi/L. Uranium levels in the Line 2 bedrock wells have generally decreased since 2000 (Figure 37). The highest levels of uranium are measured in MW-1032, which is screened beneath the area of highest uranium impact in the overlying alluvium. The average levels of uranium in MW-1015, MW-1028, MW-1031, MW-1046, MW-1047, and MW-1048 have been less than the target level of 300 pCi/L since 2009.

Table 40. 2012 Total Uranium in QROU Line 2 Bedrock Wells

Location	Line	Geologic Unit	Uranium (pCi/L)			
			Q1	Q2	Q3	Q4
MW-1013	2	Kimmswick-Decorah	273	298	298	187
MW-1015	2	Kimmswick-Decorah	114	94.8	104	122
MW-1028	2	Plattin	2.6	1.8	1.8	2.5
MW-1031	2	Plattin	10.8	9.5	9.9	10.4
MW-1032	2	Kimmswick-Decorah	528	521	386	406
MW-1046	2	Plattin	1.1	0.95	0.95	0.995
MW-1047	2	Plattin	0.78	0.68	0.68	0.68
MW-1048	2	Plattin	154	149	205	216

Concentrations in **bold** exceed the target level of 300 picocuries per liter.

pCi/L = picocuries per liter

Q1, Q2, Q3, Q4 = Quarterly sampling periods

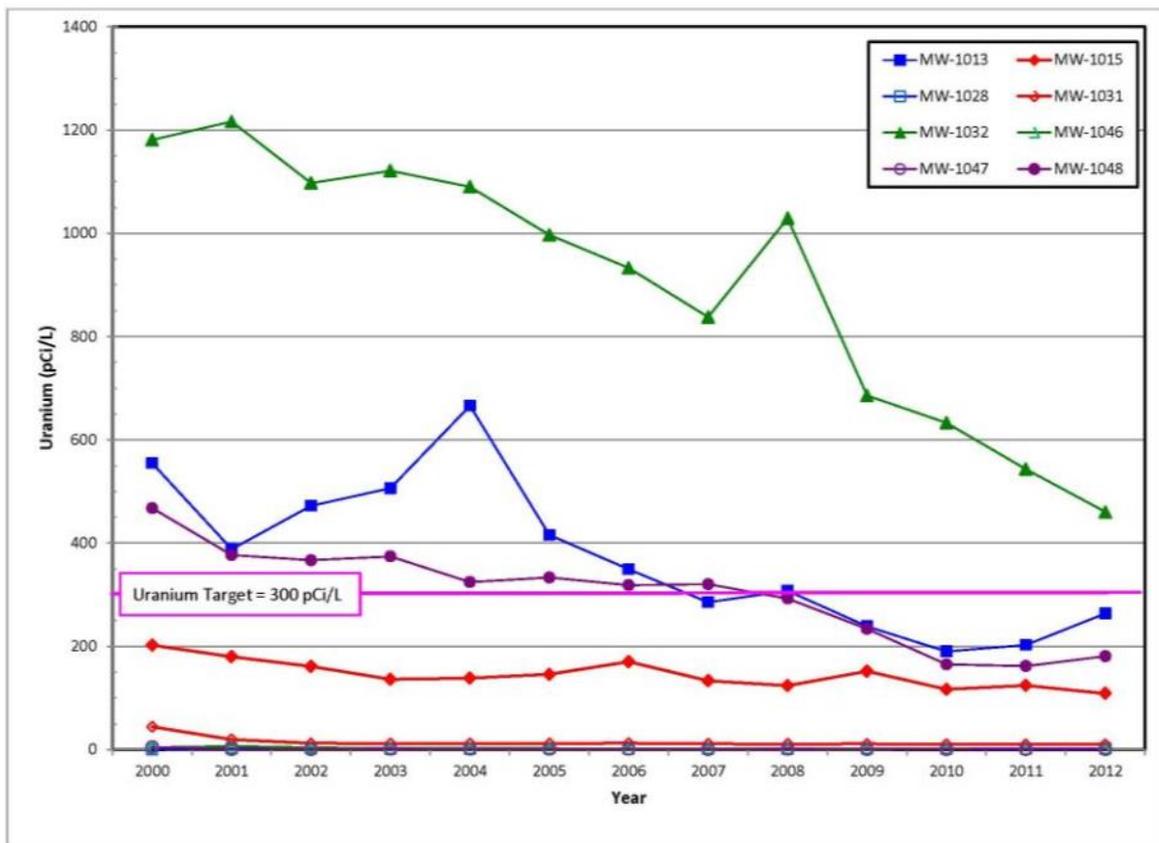


Figure 37. Average Uranium in Line 2 Bedrock Wells

Results continue to indicate that the highest levels of uranium in groundwater occur in the alluvial materials between the Quarry rim and Femme Osage Slough (Table 41). In 2012, five of these locations had uranium levels that exceeded the target level of 300 pCi/L. These wells are in the center of the area of uranium impact. The average levels of uranium in MW-1009, MW-1045, and MW-1049 have remained low during the review period and represent the limits of uranium impact in the groundwater. Uranium levels in the Line 2 alluvial wells rebounded after a significant decrease was observed in this area in 2006 (Figure 38). Since that time, levels have varied at most locations; however, levels have been similar to those measured in 2005.

Table 41. 2012 Total Uranium in QROU Line 2 Alluvial Wells

Location	Line	Geologic Unit	Uranium (pCi/L)			
			Q1	Q2	Q3	Q4
MW-1006	2	Alluvium	949	880	880	1016
MW-1007	2	Alluvium	10.8	12	2.8	1.4
MW-1008	2	Alluvium	779	1083	2200	Dry
MW-1009	2	Alluvium	0.651	1.7	0.934	0.127
MW-1014	2	Alluvium	1110	1151	1219	651
MW-1016	2	Alluvium	138	88	103	106
MW-1045	2	Alluvium	2.1	1.8	3.9	7.4
MW-1049	2	Alluvium	0.049(J)	ND(<0.034)	0.056(J)	0.034(J)
MW-1051	2	Alluvium	819	745	819	548
MW-1052	2	Alluvium	1110	948	1049	832

Concentrations in **bold** exceed the target level of 300 pCi/L.

J = estimated value less than the reporting limit; pCi/L = picocurie(s) per liter

ND = Not detected above the reporting limit

Q1, Q2, Q3, Q4 = Quarterly sampling periods

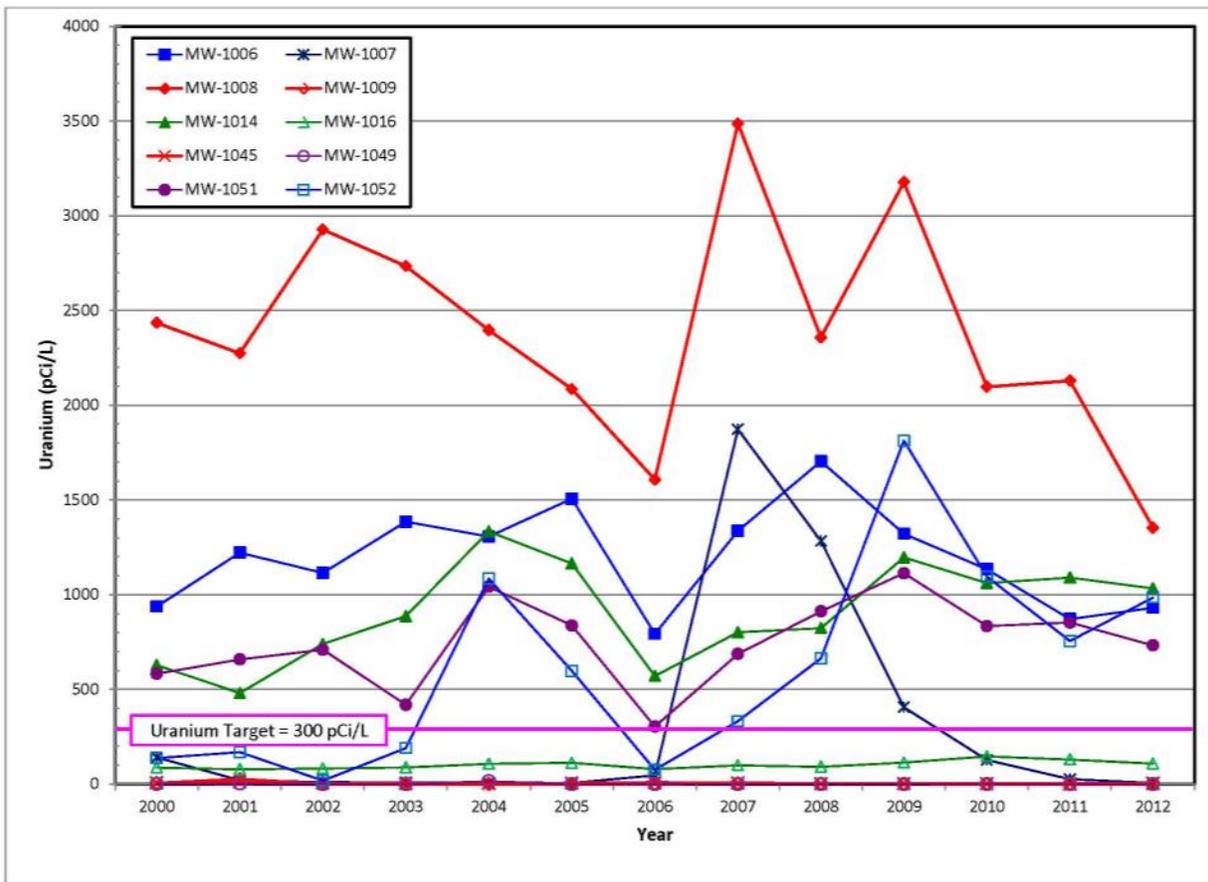


Figure 38. Average Uranium (pCi/L) in Line 2 Alluvial Wells

Trending results for the Line 2 wells (Table 42), which are screened in the saturated alluvium or bedrock between the Quarry Rim and the Femme Osage Slough, show decreases in uranium levels in this area, as indicated by negative slopes in eleven of the 18 wells sampled. The data collected in 2008 through 2012 were evaluated for statistically significant trends. No upward trends were identified in the Line 2 wells. Downward trends were identified in five of the eight bedrock wells in Line 2 and in five of the 10 alluvial wells. Well MW-1032 is the only bedrock well with uranium levels above the target level of 300 pCi/L, and if the current decreases continue, the target level could be reached in the next 5 years in the bedrock groundwater, based on an estimate derived from an exponential curve model. Alluvial wells MW-1006, MW-1008, MW-1051, and MW-1052 have uranium levels greater than the target level of 300 pCi/L. Estimates derived from the exponential curve model indicate that uranium in these wells could reach the target level in the next 5 years if current decreases continue in well MW-1051.

Table 42. Trending Analysis for Uranium in Line 2 Groundwater Monitoring Wells (2008–2012)

Location	Unit	No. of Samples	Trend	Slope (pCi/L/yr)	Confidence Intervals	
					Lower	Upper
MW-1006	Alluvium	20	Down	-155	-212	-108
MW-1007	Alluvium	20	Down	-166	-303	-102
MW-1008	Alluvium	19	Down	-291	-654	-63.6
MW-1009	Alluvium	20	Down	-0.38	-0.65	-0.10
MW-1013	Bedrock	20	None	-14.0	-40.6	11.9
MW-1014	Alluvium	20	None	9.7	-46	88
MW-1015	Bedrock	20	None	-7.2	-10.0	-1.6
MW-1016	Alluvium	20	None	4.4	-6.3	14.9
MW-1028	Bedrock	19	None	0	-0.15	0.16
MW-1031	Bedrock	20	None	-0.24	-0.75	0.20
MW-1032	Bedrock	20	Down	-90.1	-113	-66.1
MW-1045	Alluvium	20	Down	-0.09	-0.34	0.38
MW-1046	Bedrock	20	Down	-0.21	-0.26	-0.18
MW-1047	Bedrock	20	Down	-0.08	-0.14	-0.04
MW-1048	Bedrock	20	Down	-31.5	-49.5	-12.3
MW-1049	Alluvium	20	Down	-0.03	-0.05	-0.01
MW-1051	Alluvium	20	Down	93.3	-159	-27.4
MW-1052	Alluvium	20	None	-23.9	-271	137

pCi/L = picocurie(s) per liter

Increasing uranium levels are reported in alluvial wells MW-1014 and MW-1016, as indicated by positive slopes. A statistically significant upward trend was calculated for MW-1016. No statistically significant trend, either upward or downward, was calculated for MW-1014. Uranium levels in MW-1016 are below the target level of 300 pCi/L. Levels in well MW-1014 exceed the target level of 300 pCi/L; however, an upward trend was not indicated at this location.

The attainment objective for the long-term monitoring of uranium in groundwater north of the slough is for the 90th percentile of the data within a monitoring year to reach a target level of 300 pCi/L (DOE 2000b). The average uranium levels in eight wells north of the slough exceeded the target level in 2012. The 90th percentile associated with the data from the Line 1 and 2 wells was 1,019 pCi/L. Viewed separately (Figure 39), the 90th percentile for Lines 1 and 2 indicate that the metric is controlled by changes in the Line 2 wells, primarily the uranium levels measured in the Line 2 alluvial wells.

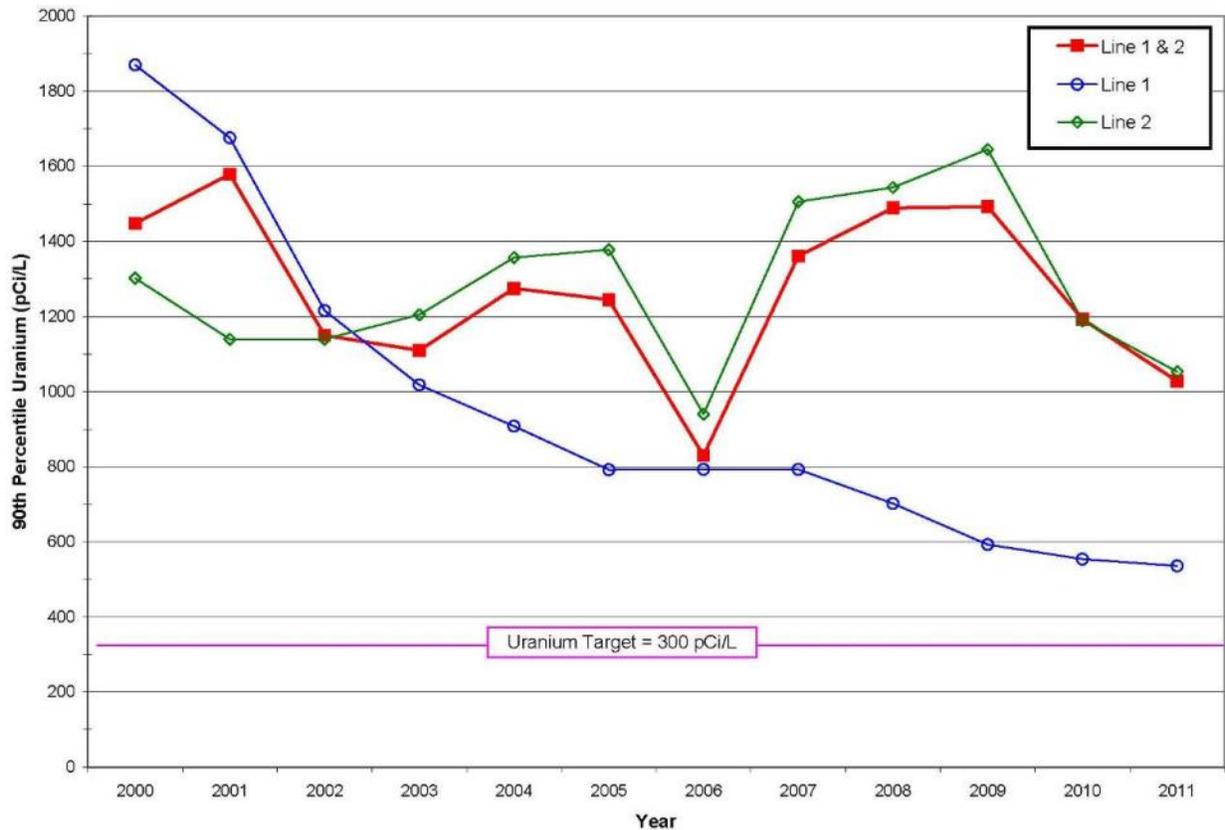


Figure 39. 90th Percentile of Uranium in Line 1 and 2 Wells

Overall, the decreasing uranium levels in the quarry rim and area north of the Femme Osage Slough are the result of bulk waste removal and restoration activities in the quarry proper. Remedial activities in the Quarry reduced and possibly prevented infiltration of precipitation and storm water into the residually contaminated fracture system in the Quarry proper. Uranium does not bind as readily to the bedrock as it does to the alluvial materials; therefore, decreases should occur more readily in the bedrock as groundwater flushes through the system. The distribution of uranium in groundwater is still predominantly controlled by the precipitation of uranium along the oxidizing/reducing front north of the Femme Osage Slough. Although uranium levels have increased in some of the alluvial wells north of the slough, levels are far below historical highs. Monitoring in wells screened in the reducing portion of the area north of the slough indicates that uranium levels continue to remain low.

Nitroaromatic Compounds

In 2012, samples from eight monitoring wells were analyzed for the nitroaromatic compound 2,4-DNT (Table 43). These monitoring wells have historically been impacted by nitroaromatic compounds along the Quarry rim or between the Quarry and Femme Osage Slough. Concentration of 2,4-DNT in MW-1027 were above the Missouri Water Quality Standard of 0.11 µg/L. Also, MW-1006 had a concentration that exceed the cleanup standard during the second sampling event, but is consistent with historical data. MW-1027 is the only well in which 2,4-DNT levels have exceeded the target level of 0.11 µg/L since 2009.

Table 43. 2,4-DNT Concentrations for the QROU Monitoring Locations

Location	Line	Geologic Unit	Concentration (µg/L)			
			S1		S2	
MW-1002	1	Kimmswick-Decorah	ND (<0.019)		ND (<0.018)	
MW-1004	1	Kimmswick-Decorah	0.051(J)		ND (<0.018)	
MW-1005	1	Kimmswick-Decorah	ND (<0.018)		ND (<0.018)	
MW-1006	2	Alluvium	ND (<0.018)	0.063(J)	0.20(J)	0.12(J)
MW-1027	1	Kimmswick-Decorah	1.4		2.9	
MW-1032	2	Kimmswick-Decorah	ND (<0.019)	ND (<0.018)	ND (<0.018)	ND (<0.018)
MW-1045	2	Alluvium	ND (<0.019)	ND (<0.019)	ND (<0.018)	ND (<0.018)
MW-1049	2	Alluvium	ND (<0.019)	ND (<0.019)	ND (<0.018)	ND (<0.018)

Concentrations in **bold** exceed the Missouri Water Quality Standard of 0.11 µg/L for 2,4-DNT. µg/L = microgram per liter; ND = analyte not detected above method detection limit indicated in parentheses. J = estimated value less than the reporting limit; S1, S2 = Semiannual sampling periods.

The concentrations of 2,4-DNT in MW-1006 and MW-1027 have fluctuated since bulk waste removal was completed in the Quarry (Figure 40). Increased concentrations were observed in wells MW-1006 and MW-1027 starting in 2004, and the concentrations fluctuated significantly after that time. Concentrations less than the detection limit have historically been reported in MW-1045 and MW-1049, which are the farthest downgradient wells in the vicinity of wells MW-1006 and MW-1027.

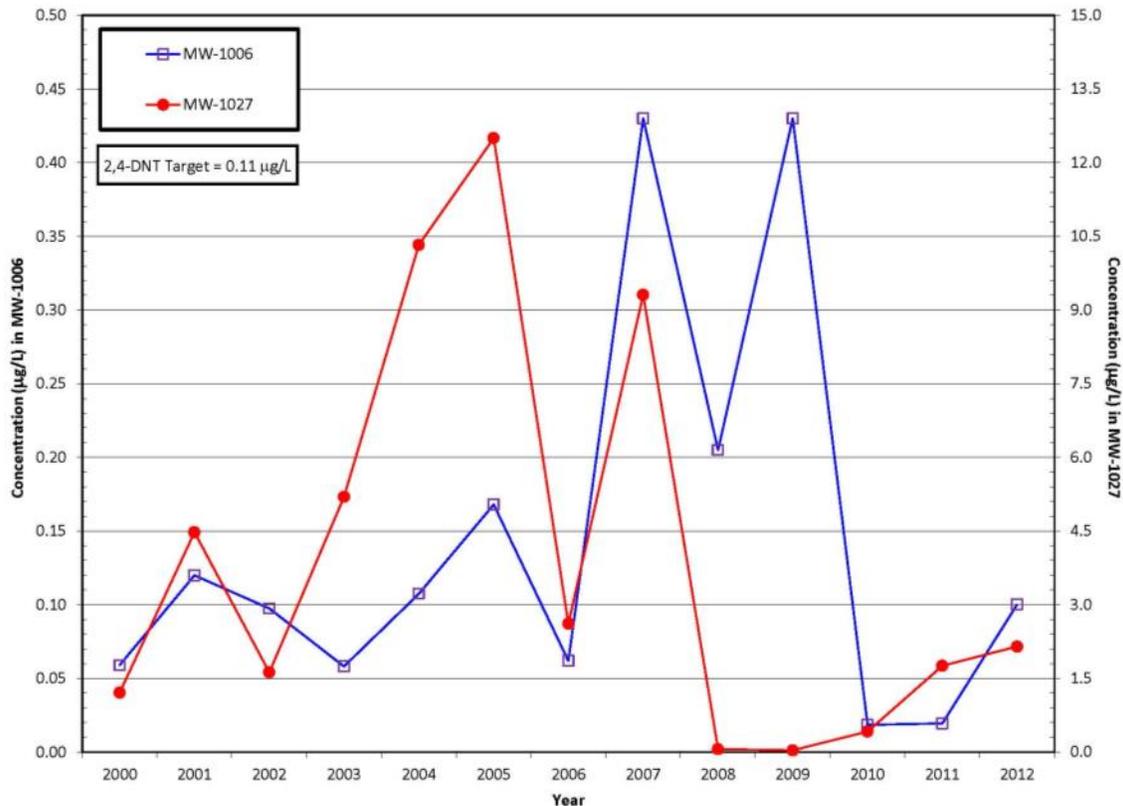


Figure 40. Average 2,4-DNT Concentrations in MW-1006 and MW-1027

Trend analyses for 2,4-DNT were performed for wells MW-1006 and MW-1027 (Table 44), as these are the only locations that had detectable concentrations in the last 5 years. The concentrations of 2,4-DNT are decreasing at MW-1006, as indicated by negative slopes. In MW-1027, the concentrations are increasing as indicated by a positive slope. No statistically significant trends, either upward or downward, were calculated for the two wells.

Table 44. Trending Analysis for 2,4-DNT in Selected Quarry Groundwater Monitoring Wells (2008–2012)

Location	No. of Samples	Trend	Slope (µg/L/yr)	Confidence Intervals	
				Lower	Upper
MW-1006	20	None	-0.33	-0.08	0
MW-1027	12	None	0.32	-0.01	0.72

µg/L/yr = microgram(s) per liter per year

The attainment objective for the long-term monitoring of 2,4-DNT in groundwater north of the slough is that the 90th percentile of the data within a monitoring year is below the target level of 0.11 µg/L (DOE 2000b). The eight monitoring wells that were selected for continued long-term monitoring were used to calculate this metric. The 90th percentile associated with the data from the eight wells was 0.176 µg/L, based on data collected in 2012. This value is higher than those measured in previous years (Figure 41) but is consistent with historical data.

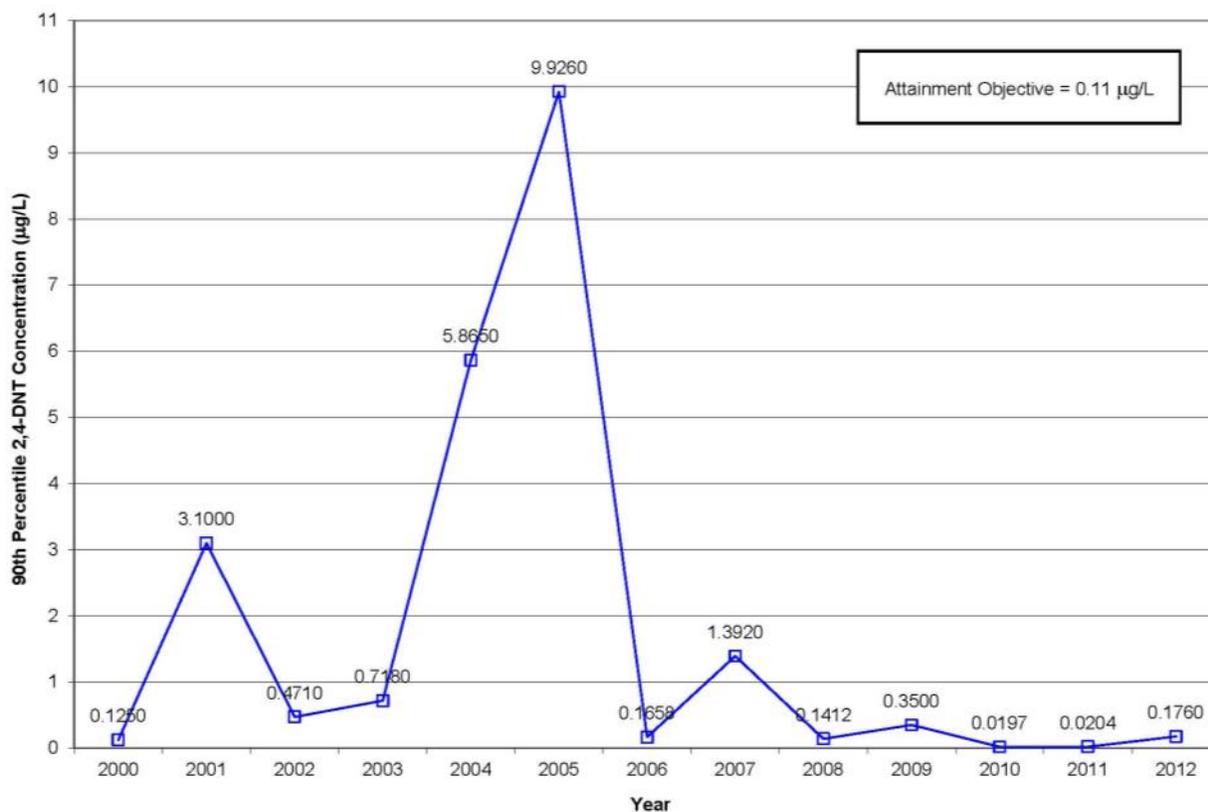


Figure 41. 90th Percentile of 2,4-DNT in Line 1 and 2 Wells

Overall, 2,4-DNT impact in groundwater is located within two discrete areas. Concentrations, although variable, have generally decreased since the removal of the bulk wastes in the quarry. Present concentrations in groundwater pose little potential impact to the groundwater in the Missouri River alluvium.

Geochemical Parameters

The geochemistry of the shallow aquifer is monitored to verify the presence of the reduction zone and to confirm that the reduction zone is capable of the ongoing attenuation of uranium in groundwater. Groundwater is analyzed for sulfate, dissolved iron, ferrous iron, and oxidation potential. Sulfate is monitored as an indicator of redox conditions in the groundwater in the vicinity of the Quarry. Higher sulfate concentrations are generally observed in an oxidizing environment. Iron (total dissolved and ferrous) is also monitored as an indicator of redox conditions in the groundwater. Iron concentrations generally increase in a reducing environment. These results generally correlate with observed uranium concentrations upgradient and downgradient of the reduction zone, as uranium is typically more mobile in an oxidizing environment and precipitates in a reducing environment. A summary of the geochemical parameters for each monitoring location is presented in Table 45.

Table 45. Geochemical Parameter Data at the Weldon Spring Quarry in 2012

Location	Line	Geologic Unit	Average Values			
			Sulfate (mg/L)	Dissolved Iron (µg/L)	Ferrous Iron (µg/L)	ORP ^a (mV)
MW-1002	1	Kimmswick-Decorah	90.5	20.0	20.0	99.7
MW-1004	1	Kimmswick-Decorah	95.0	280	230	47.6
MW-1005	1	Kimmswick-Decorah	125	1400	520	36.4
MW-1012	1	Kimmswick-Decorah	37.8	30.0	20.0	85.8
MW-1027	1	Kimmswick-Decorah	63.0	20.0	20.0	121
MW-1030	1	Kimmswick-Decorah	51.3	10,350	4,470	-111
MW-1006	2	Alluvium	71.8	1,310	880	9.7
MW-1007	2	Alluvium	15.7	48,050	18,080	-128.1
MW-1008	2	Alluvium	59.1	90.0	30.0	81.2
MW-1009	2	Alluvium	9.4	36,730	14,540	-132.
MW-1013	2	Kimmswick-Decorah	65.4	3,820	2,720	-53.2
MW-1014	2	Alluvium	99.0	280	220	30.0
MW-1015	2	Kimmswick-Decorah	65.7	80.0	40	50.8
MW-1016	2	Alluvium	79.3	30.0	40	101
MW-1028	2	Plattin	36.0	30.0	50	101
MW-1031	2	Alluvium	29.1	0.30	10	102
MW-1032	2	Kimmswick-Decorah	99.0	110	70	450
MW-1045	2	Alluvium	27.2	20.0	10	78.3
MW-1046	2	Plattin	57.8	30.0	10	134
MW-1047	2	Plattin	72.4	30.0	20	74.1
MW-1048	2	Plattin	50.6	1,140	830	-113
MW-1049	2	Alluvium	4.9	45,750	29,700	-155
MW-1051	2	Alluvium	89.0	420	10	66.2
MW-1052	2	Alluvium	35.4	10,580	2,050	-57.4

^a Convert oxidation-reduction potential to Eh by adding 200 mV to the ORP value.

J = estimated value less than the reporting limit; mg/L = milligrams per liter; mV = millivolts;

µg/L = micrograms per liter; ND = analyte not detected above method detection limit included in parentheses;

ORP = oxidation-reduction potential

A review of the 2012 geochemical data indicates that although the area of highest impact has an oxidizing environment, reducing conditions are prevalent along the northern edge of the slough, as shown by data for wells MW-1007, MW-1009, and MW-1049. This is consistent with the uranium data where low levels are detected, especially in MW-1049, where very low sulfate and high dissolved iron concentrations are also observed. The location of this reduction area has been consistent, and the attenuation of uranium in this area continues.

5.2.2.5 *Monitoring Results for the Missouri River Alluvium*

Groundwater quality in the Missouri River alluvium is monitored using 10 wells screened in the alluvial materials. These wells are sampled for uranium and geochemical parameters to ensure that water quality remains protective of human health.

Uranium

The six monitoring wells immediately south of the slough (Line 3) and the four RMW-series wells (Line 4) were sampled for uranium during 2012 (Table 46) to verify that levels remain within the range of its natural variation in Missouri River alluvium. The results indicate that uranium levels were less than the statistical background value in the alluvium (Table 37). None of the locations south of the slough have uranium levels that exceed the drinking water standard of 20 pCi/L.

Table 46. 2012 Total Uranium Levels in the Missouri River Alluvial Aquifer

Location	Line	Uranium (pCi/L)			
MW-1017	3	0.11		0.11	
MW-1018	3	ND (<0.045)	0.041 (J)	ND (<0.045)	ND (<0.045)
MW-1019	3	ND (<0.045)		ND (<0.045)	
MW-1021	3	ND (<0.045)		ND (<0.045)	
MW-1044	3	ND (<0.045)	ND (<0.081)	ND (<0.045)	ND (<0.045)
MW-1050	3	ND (<0.045)		ND (<0.045)	
RMW-1	4	1.3			
RMW-2	4	2.6			
RMW-3	4	0.76			
RMW-4	4	0.36			

J = estimate value less than the reporting limit; ND = analyte not detected above method detection limit indicated in parentheses; pCi/L = picocurie(s) per liter

Geochemical Parameters

The monitoring wells south of the slough were sampled for sulfate, dissolved and ferrous iron, and ORP to assess redox conditions in the Missouri River alluvium downgradient of the area of uranium impact (Table 47). The data continue to indicate that a strongly reducing environment is prevalent in the groundwater immediately south of the slough, as shown by high dissolved iron concentrations, low sulfate concentrations, and low ORP values. This environment is not favorable for the migration of uranium if it were to pass beyond the reduction zone north of the slough. Data from the review period were consistent for all locations except MW-1044.

Table 47. 2012 Geochemical Parameter Data in the Missouri River Alluvial Aquifer

Location	Average Values			
	Sulfate (mg/L)	Dissolved Iron (µg/L)	Ferrous Iron (µg/L)	ORP ^a (mV)
MW-1017	1.2	20,500	7,150	--155
MW-1018	5.8	37,650	25,050	--160
MW-1019	0.68	13,950	6,700	--135
MW-1021	0.53	17,750	5,240	--142
MW-1044	83.6	34,100	14,800	--182
MW-1050	1.4	17,200	7,350	--149
RMW-1	21.3	3,800	2,690	--39.1
RMW-2	16.0	7,170	2,130	--125
RMW-3	31.6	17,900	14,700	--125
RMW-4	7.0	20,600	3,100	--151

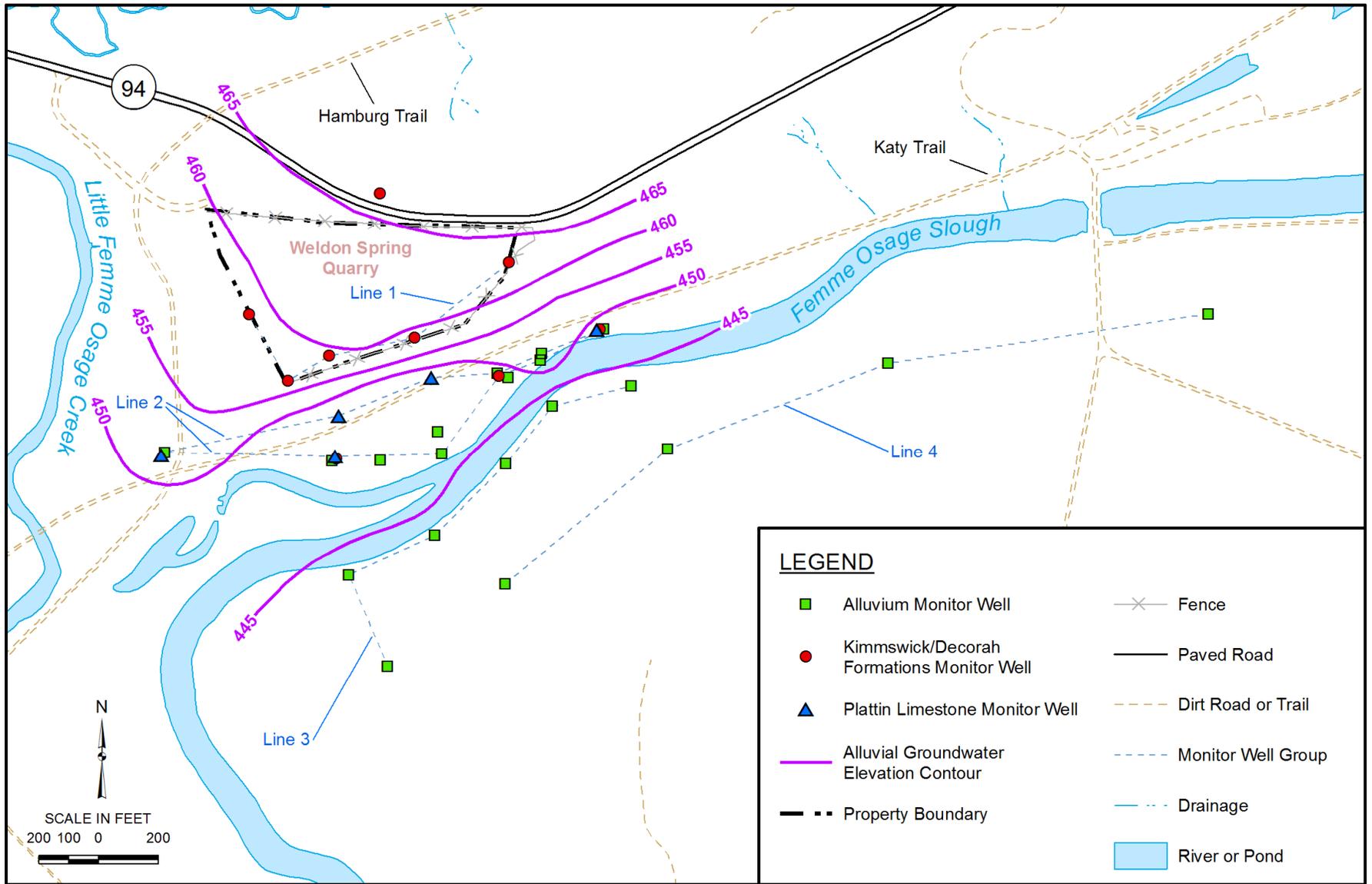
^a Convert oxidation-reduction potential to Eh by adding 200 millivolts to the oxidation-reduction value. mg/L = milligram(s) per liter; mV = millivolts; µg/L = micrograms per liter; ORP = oxidation-reduction potential J = estimated values less than the reporting limit

Increased sulfate concentrations were reported in MW-1044 beginning in 2008 and have continued through 2012. A slight increase in sulfate was also measured in nearby MW-1018. These increases may be caused by infiltration of water from the slough that has exhibited high sulfate concentrations. High iron concentrations and low ORP values continued to support the interpretation that a reducing environment is prevalent in this area. Uranium levels remain low at the locations along the southern edge of the Femme Osage Slough.

5.2.2.6 Quarry Hydrogeologic Data Analysis

Groundwater flow at the Quarry is monitored using all the wells in the long-term monitoring network. The static groundwater levels of the monitoring network are measured at least quarterly to establish that groundwater flow has not changed significantly and resulted in shifts in potential contaminant migration. The average groundwater elevations measured in 2012 were used to construct a groundwater surface map of the shallow bedrock and alluvium at the Quarry (Figure 42). Groundwater flow is parallel to the bedrock bluff of the Quarry as it moves south beneath the Femme Osage Slough. The configuration of the shallow groundwater surface has remained relatively unchanged from previous years.

Groundwater elevations in the quarry area fluctuate significantly (Figure 43), primarily in response to the level of the Missouri River. The bedrock wells along the quarry rim (Line 1) are less influenced by river levels than the wells screened in the Missouri River alluvium (Lines 2, 3, and 4). Water levels declined during 2012 in response to lower than typical river stages caused by drought conditions.



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Figure 42. Groundwater Surface at the Weldon Spring Quarry

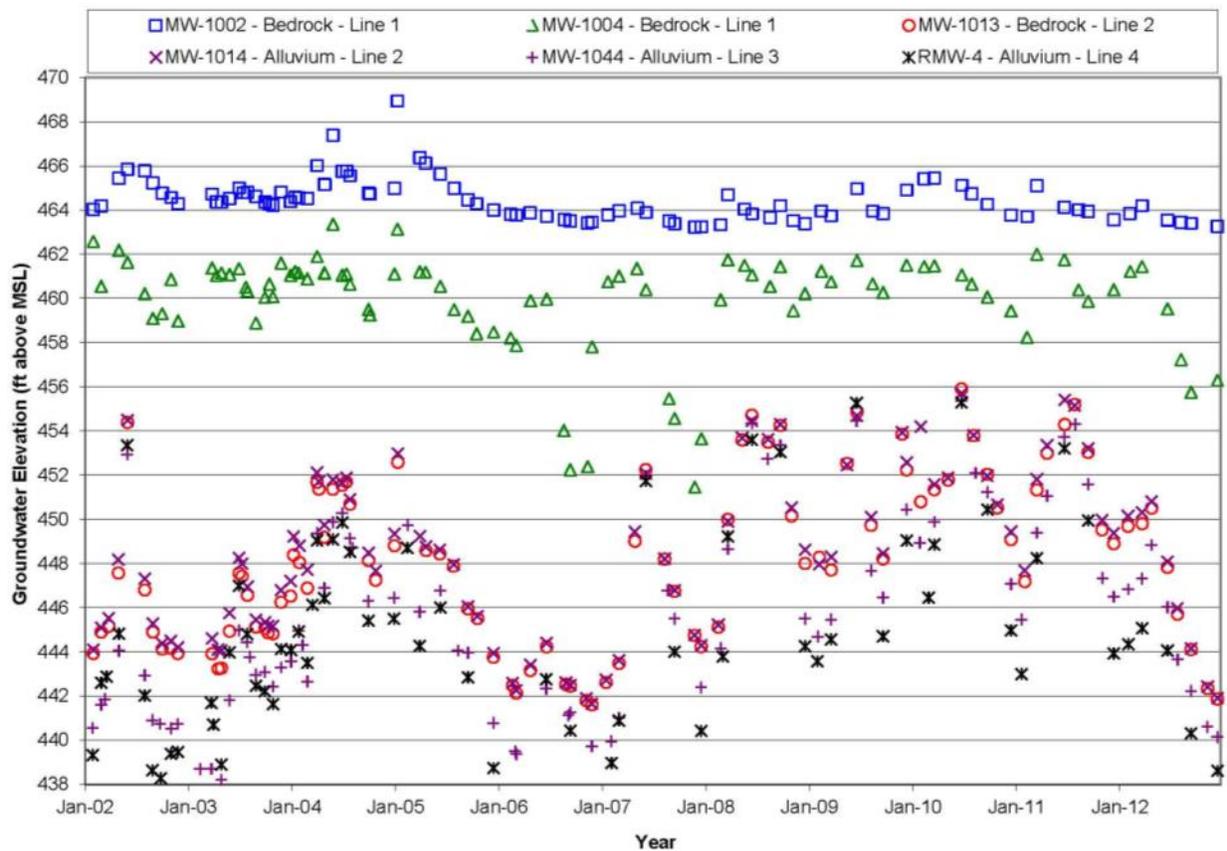


Figure 43. Groundwater Elevations in the Quarry Area

5.2.3 Disposal Cell Groundwater

Five groundwater monitoring wells, one spring, and disposal cell leachate were sampled during 2012 as part of the detection monitoring program for the permanent disposal cell. This monitoring is performed to meet the substantive requirements of 40 CFR 264 Subpart F; 10 CSR 25-7.264(2)(F), and 10 CSR 80-3.010(8). These federal and state hazardous- or solid-waste regulations were identified as ARARs for the selected remedy in the *Record of Decision for the Remedial Action at the Chemical Plant Area of the Weldon Spring Site* (DOE 1993). These wells, the spring, and the leachate were monitored in accordance with Appendix K of the LTS&M Plan (DOE 2008).

5.2.3.1 Disposal Cell Monitoring Program

The disposal cell groundwater detection monitoring network consists of one upgradient well (MW-2055), four downgradient wells (MW-2032, MW-2046, MW-2047, and MW-2051), one downgradient spring (SP-6301), and the disposal cell leachate (Figure 11). Semiannual detection monitoring began in mid-1998, after cell construction and waste placement activities had begun.

The monitoring program for the disposal cell consisted of semiannual sampling of the monitoring wells, spring, and leachate. Groundwater and surface water samples were analyzed for the list of analytes in Table 48. Leachate was analyzed for the list of analytes in Table 49. Sampling was performed as specified in Appendix K of the LTS&M Plan (DOE 2008).

Table 48. Disposal Cell Detection Monitoring—Groundwater and Surface Water Analyte List

Radiological	Metals	Nitroaromatic Compounds	Other	General Indicator Parameters
Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232	Arsenic Barium Chromium Lead Manganese Nickel Selenium Thallium Uranium	1,3,5-TNB 1,3-DNB 2,4,6-TNT 2,4-DNT 2,6-DNT NB	PCBs PAHs	pH Temperature Specific Conductance

PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls; DNB = dinitrobenzene; DNT = dinitrotoluene; NB = nitrobenzene; TNT = trinitrotoluene; TNB = Trinitrobenzene

Table 49. Disposal Cell Detection Monitoring—Leachate Analyte List

Radiological	Inorganic Ions	Metals	Nitroaromatic Compounds	Other	General Indicator Parameters
Radium-226 Radium-228 Thorium-228 Thorium-230 Thorium-232	Chloride Fluoride Nitrate (as N) Sulfate	Arsenic Barium Chromium Cobalt Iron Lead Manganese Nickel Selenium Thallium Uranium	1,3,5-TNB 1,3-DNB 2,4,6-TNT 2,4-DNT 2,6-DNT NB	PCBs PAHs	pH Temperature Specific Conductance COD TDS TOC Turbidity

COD = chemical oxygen demand; PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls; TDS = total dissolved solids; TOC = total organic carbon; DNB = dinitrobenzene; DNT = dinitrotoluene; NB = nitrobenzene; TNT = trinitrotoluene; TNB = Trinitrobenzene

Under the monitoring program, signature parameter (barium and uranium) data from each monitoring event are compared to the baseline tolerance limits (BTLs) to trace general changes in groundwater quality and determine whether statistically significant evidence of contamination due to cell leakage exists. Tolerance limits for signature parameters have been calculated using the data set from 1997 through 2002 (baseline monitoring period), using 95 percent confidence limits.

The data from the remainder of the parameters are reviewed to evaluate the general groundwater quality in the vicinity of the disposal cell and to determine if there are changes in the groundwater system. Data are compared to the three most recent years of data to determine if statistically significant changes in concentrations are present. A measured concentration is considered statistically significant if it is greater than the arithmetic mean plus three times the standard deviation for a given location.

Wells with data showing statistically significant increases or decreases are re-sampled to confirm the exceedance. If the results of the re-sampling confirm the exceedance, historical leachate analytical data and volumes are evaluated to assess the integrity of the disposal cell. If the leachate data do not indicate that the exceedance could be the result of leakage from the cell, the analytical data are assessed, and sitewide monitoring data are reviewed. If the exceeding

parameter is a contaminant of concern for the GWOU, this information is evaluated under the monitoring program for that operable unit.

5.2.3.2 Disposal Cell Monitoring Results

The 2012 monitoring results for the signature parameters are presented in Table 50 along with applicable BTLs. The results were less than the applicable BTLs, which indicates that there is no statistical evidence of leakage of leachate into the groundwater beneath the disposal cell. Data indicating general groundwater quality in the detection monitoring wells and springs during this period were consistent with historical data. The exception was estimated detections of polychlorinated biphenyls (PCBs) (Aroclor-1242, Aroclor-1248, and Aroclor-1254) and PAHs (Benzo(k)fluoranthene) in 4 of the cell wells. These estimated detects were sporadic and not considered to represent actual groundwater quality; however the results could not be rejected.

Table 50. 2012 Signature Parameter Results and Associated BTLs at Disposal Cell Monitoring Locations

Parameter	Location	BTL	Results	
			June 2012	December 2012
Barium (µg/L)	MW-2032	337	194	190
	MW-2046	277	200	148
	MW-2047	471	350	365
	MW-2051	285	262	268
	MW-2055	98	17.9	19.2
	SP-6301	180	123	114
Uranium (pCi/L)	MW-2032	6.4	2.0	2.0
	MW-2046	1.8	1.2	1.1
	MW-2047	2.7	1.2	1.2
	MW-2051	4.5	1.2	1.1
	MW-2055	7.5	1.8	1.7
	SP-6301	159	35.0	42.8

µg/L = micrograms per liter; pCi/L = picocuries per liter

The disposal cell leachate 2012 monitoring results are presented in Table 51. The LCRS is sampled semiannually, and the data are used for comparison with corresponding concentrations in wells if elevated levels of constituents are identified in the groundwater. In general, the composition of the leachate has remained stable over the past 5 years, with the exception of iron, manganese, and uranium. Concentrations of these three constituents have shown a general decline. Estimated detections of polycyclic aromatic hydrocarbons (PAHs) (fluoranthene and pyrene) were reported for the first semiannual sampling event.

Table 51. 2012 Disposal Cell Leachate Monitoring Data

Parameter	Concentrations	
	June 2012	December 2012
Chloride (mg/L)	50.7	46.9
Fluoride (mg/L)	0.20 (J)	ND (<1.65)
Nitrate-N (mg/L)	2.8	1.1
Sulfate (mg/L)	70.0	70.5
Arsenic (µg/L)	3.8	3.5
Barium (µg/L)	490	651
Chromium (µg/L)	ND (<2.0)	ND (<2.0)
Cobalt (µg/L)	2.9	3.7
Iron (µg/L)	1,220	3,060
Lead (µg/L)	ND (<0.5)	ND (<0.5)
Manganese (µg/L)	500	590
Nickel (µg/L)	9.4	10.2
Selenium (µg/L)	7.8	7.9
Thallium (µg/L)	ND (<0.45)	ND (<0.450)
COD (mg/L)	29.6	26.6
TDS (mg/L)	739	684
TOC (mg/L)	Not Analyzed	13.1
1,3,5-TNB (µg/L)	ND (<0.017)	ND (<0.017)
1,3-DNB (µg/L)	ND (<0.014)	ND (<0.014)
2,4,6-TNT (µg/L)	ND (<0.022)	ND (<0.021)
2,4-DNT (µg/L)	ND (<0.019)	ND (<0.019)
2,6-DNT (µg/L)	ND (<0.022)	ND (<0.021)
NB (µg/L)	ND (<0.033)	ND (<0.032)
Radium-226 (pCi/L)	0.86	0.37
Radium-228 (pCi/L)	1.51	0.940
Thorium-228 (pCi/L)	ND (<0.678)	ND (<0.271)
Thorium-230 (pCi/L)	ND (<0.392)	ND (<0.286)
Thorium-232 (pCi/L)	ND (<0.0725)	ND (<0.129)
Uranium (pCi/L)	21.6	21.4
PAHs (µg/L)	(<0.18250) Note 1	ND
PCBs(µg/L)	ND (<0.0333)	ND (<0.100)
DO (mg/L)	2.2	3.44
ORP (mV)	19.3	20.5
pH (s.u.)	6.9	6.8
SC (µmhos/cm)	1228	1209
Temperature (°C)	17.1	13.4
Turbidity (NTU)	11.6	12.5

COD = chemical oxygen demand; DNB = dinitrobenzene; DO = dissolved oxygen; µmhos/cm = micromhos per centimeter; J = estimated value less than the reporting limit; ND = analyte not detected above method detection limit indicated in parentheses; NTU = nephelometric turbidity units; ORP = oxidation-reduction potential; PAHs = polycyclic aromatic hydrocarbons; PCBs = polychlorinated biphenyls; R = data point rejected during validation process; SC = specific conductance; s.u. = standard units; TDS = total dissolved solids; TOC = total organic carbon
 Note 1—Estimated detections of PAHs (fluoranthene and pyrene)

5.2.3.3 Groundwater Flow

Groundwater flow rate and direction are evaluated annually as specified in Appendix K of the LTS&M Plan (DOE 2008). The groundwater flow direction was determined by constructing a potentiometric surface map of the shallow aquifer, using the available wells at the Chemical Plant (Figure 31). The configuration of the potentiometric surface has remained relatively unchanged since the construction of the disposal cell. The groundwater flow direction is generally to the north. A groundwater divide is present along the southern boundary of the site.

The average groundwater flow rate (average linear velocity) is calculated using the following equation:

$$v = \left(\frac{K}{n}\right) \left(\frac{dh}{dl}\right)$$

Where: v = velocity
 K = average hydraulic conductivity
 n = effective porosity
 dh/dl = hydraulic gradient

The average hydraulic conductivity (K), using data from the cell monitoring wells, is 7×10^{-3} centimeters per second. An effective porosity (n) of 0.10 was selected to estimate the maximum groundwater flow rate in this area. The hydraulic gradient (dh/dl) in the disposal cell area is 0.011 ft/ft and is based on data from MW-2032 and MW-2055, located 2,100 ft apart. This approach is consistent with the calculations presented in Appendix K of the LTS&M Plan (DOE 2008). The average flow rate for 2012 was 2.2 ft per day, which is the same as the average flow rate calculated since 2005.

5.3 Surface Water

5.3.1 Chemical Plant Surface Water

The surface water locations at Schote Creek, Dardenne Creek, and Busch Lakes 34, 35, and 36 (Figure 44) were sampled once during 2012 for total uranium. This monitoring was conducted to measure the effects of groundwater and surface water discharges from the site on the quality of downstream surface water.

The results for the Chemical Plant surface water sampling are presented in Table 52 along with the previous 5-year high for each location, for comparison. The uranium levels at Busch Lake 34 continue to be higher compared to the remainder of the locations; however, uranium levels at the Busch Lake outlets have shown an overall decline since remediation at the Chemical Plant site. The Schote Creek and Dardenne Creek locations are downstream of the lakes and have always shown relatively low levels because the Chemical Plant portion of the watershed is much smaller than the total watershed area. These results are consistent with data from previous years.

Table 52. Total Uranium at Weldon Spring Chemical Plant Area Surface Water Locations

Location	Uranium (pCi/L)	Previous 5-Year High ^a
SW-2004 (Busch Lake 34)	5.7	8.1 (2007)
SW-2005 (Busch Lake 36)	2.3	3.4 (2007)
SW-2012 (Busch Lake 35)	1.4	2.4 (2007)
SW-2016 (Dardenne Creek)	1.2	1.4 (2009)
SW-2024 (Schote Creek)	1.1	2.4 (2009)

^a 2007–2011
pCi/L = picocuries per liter

5.3.2 Quarry Surface Water

Four locations within Femme Osage Slough (Figure 44) were sampled quarterly in 2012 to assess the water quality in the slough and the potential impact from groundwater north of the slough (Table 53). These sampling sites are in the upper section of the slough, which is adjacent to the area of groundwater impact. Occasionally, groundwater north of the slough will discharge into the slough when the water table is high.

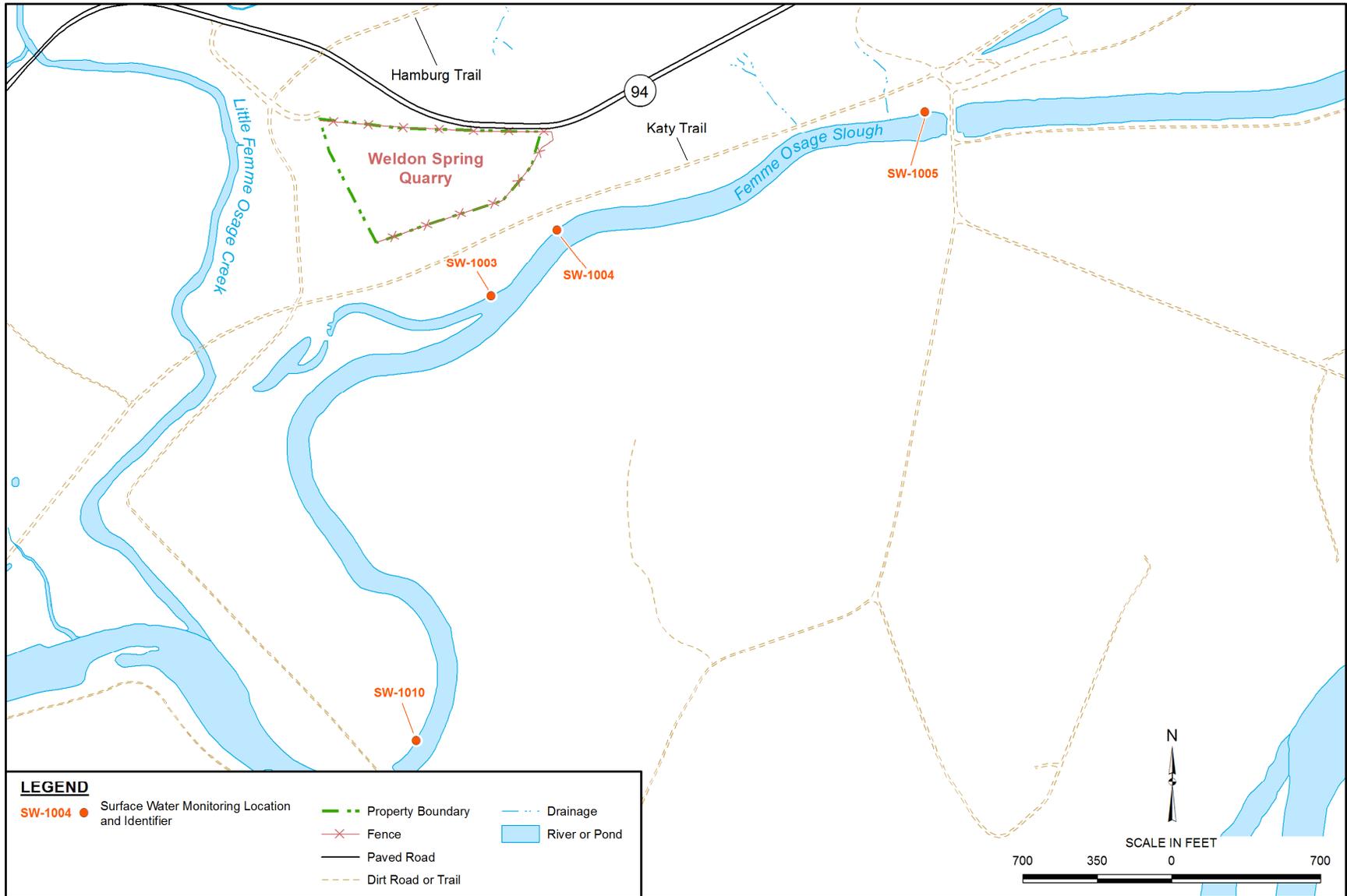
Table 53. 2012 Total Uranium in the Femme Osage Slough near the Quarry

Location	Uranium (pCi/L)			
	Q1	Q2	Q3	Q4
SW-1003	33.6	30.6	16.8	Dry
SW-1004	38.3	37	18.7	44.9
SW-1005	26.8	33	18.2	Dry
SW-1010	32.4	37	11.4	Dry

pCi/L = picocuries per liter; Q1, Q2, Q3, Q4 = quarterly sampling periods

Elevated uranium levels were identified for the four surface water monitoring locations along the Femme Osage Slough in May 2008, and a special study was initiated to evaluate the changes in condition and to identify mechanisms causing the increase in uranium levels. Prior to the May 2008 sampling event, the slough had been completely dewatered for several months, and sampling was performed a short period after water had begun to pond within the slough.

From the special study, it was concluded that after periods when the slough was dry or very low and portions of the slough bottom became exposed, elevated uranium values were reported in the samples collected soon after the slough refilled and inundated. Sorption of uranium onto the sediments is not permanent and can be reversed. Desorption from organics likely occurs when the areas are re-saturated with surface water runoff and river water after the sediments have dried out. The reversal of precipitated uranium may occur to a minor extent. The period that uranium is released from sediments is not long, and levels measured in the surface water return to typical values when the water covers the bottom of the slough.



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Figure 44. Surface Water Monitoring Locations at the Quarry Area of the Weldon Spring, Missouri, Site

Uranium levels in the Femme Osage Slough (Figure 45) have been elevated since this water body has been partially or completely dewatered starting in late 2006. Elevated uranium levels are reported during periods when the slough levels are low, as reflected in the second quarter values. Average uranium values have decreased since 2009. Quarterly sampling of the slough will continue in 2013.

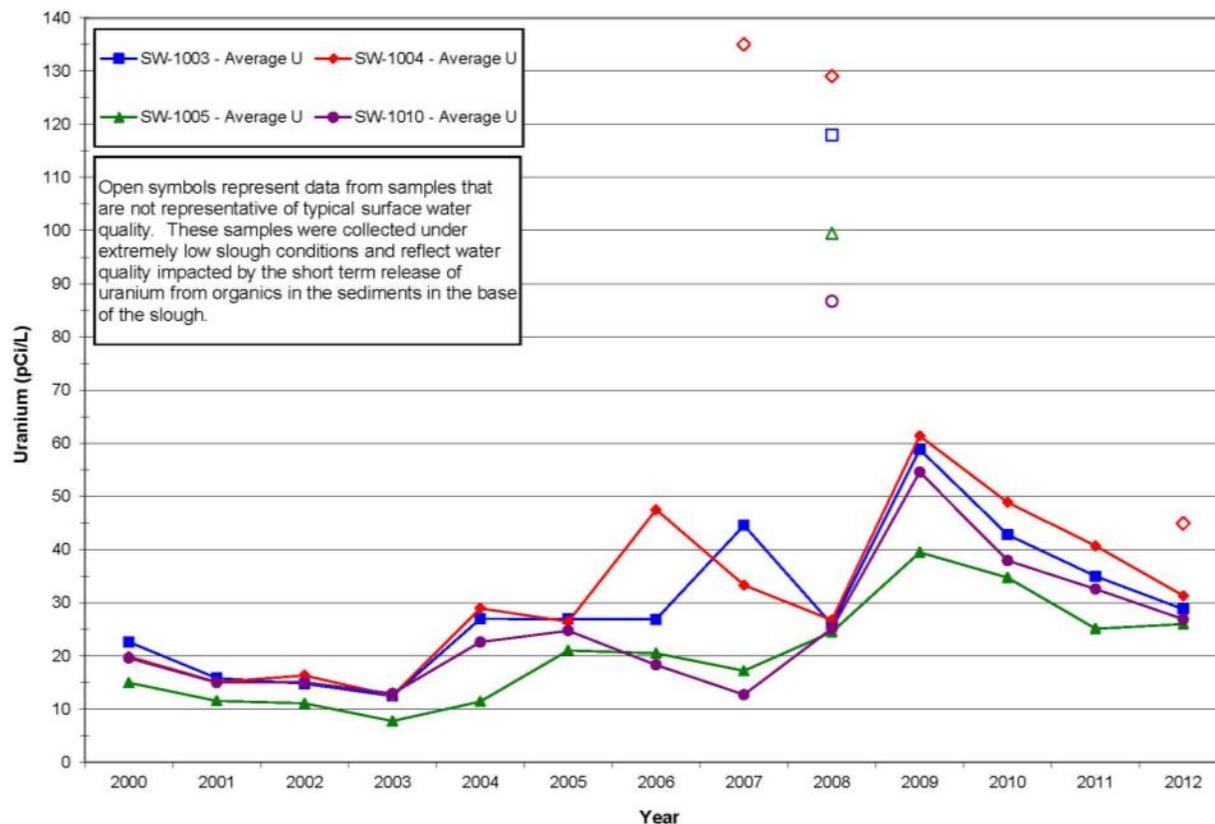


Figure 45. Uranium Levels in the Femme Osage Slough

5.4 Leachate Collection and Removal System Data

The LCRS collects leachate from the disposal cell. The leachate continued to be sampled in accordance with the Disposal Cell Groundwater Monitoring Plan in Appendix K of the LTS&M Plan (DOE 2008). The leachate analytical data for 2012 were discussed previously in Section 5.2.3.2 and are shown in Table 51.

During 2012, the leachate was pumped from the sump on a quarterly basis (January, April, July, and October) and pretreated. Normally, every other quarter the pretreated leachate is transported to MSD for final treatment in their Bissell Point wastewater treatment facility. During 2012 leachate was transported during one extra quarter to adjust the hauling schedule to periods of milder weather. A sample of treated leachate is collected and analyzed in accordance with MSD requirements for each hauling event. MSD requirements for the leachate are discussed in Section 1.5.3.3.

Uranium concentrations in untreated leachate during 2012 averaged approximately 20.7 pCi/L. The uranium concentrations data has increased slightly since 2010, when uranium levels were near 16 pCi/L. A high uranium concentration of 21.56 pCi/L was observed in June 2012. The uranium concentrations in the untreated leachate for the past 8 years are shown in Figure 46.

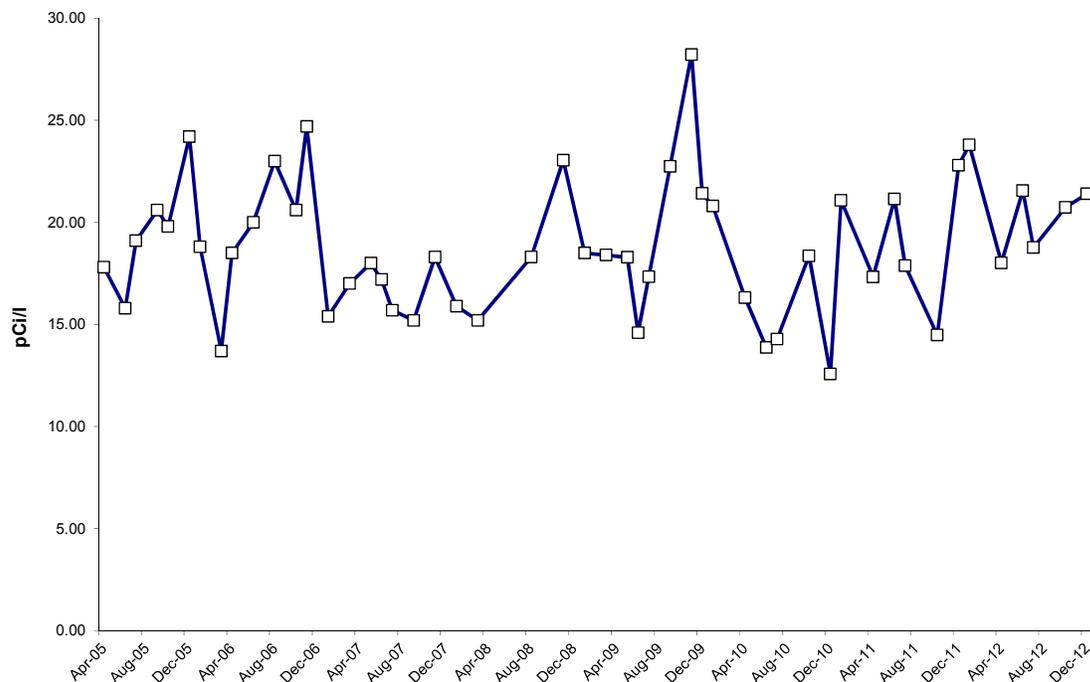


Figure 46. Actual Uranium Concentrations in the Primary Leachate

On a monthly basis, the leachate flow rates from the disposal cell are calculated and a report generated. Every two weeks the LCRS facility is inspected and the secondary containment is pumped and the volume recorded. The leachate levels are recorded on a data logger and downloaded remotely at least once per day. The regulations in 40 CFR 264.303(c) only require monthly recording and, if the levels are stable, quarterly flow recording thereafter. Secondary leachate (east and west secondary and burrito) flow rates are reported in units of gallons per day and compared to the action leakage rate of 100 gallons per acre per day established for the secondary (or lower) leachate collection system.

During 2011 and 2012, discharge from the primary leachate collection system generated approximately 83 gallons per day and 79 gallons per day, respectively. The daily averages for the primary leachate flow rates are shown in Figure 47. The combined leachate flow rate from the secondary leachate collection system averaged approximately 10.2 gallons per day during 2011 and 10.7 gallons per day in 2012. On a per-acre basis, the average leakage rate for the secondary leachate collection system in 2011 and 2012 was approximately 0.42 and 0.47 gallon per acre per day, respectively. This rate continues to be significantly less than 1 percent of the action leakage rate of 100 gallons per acre per day.

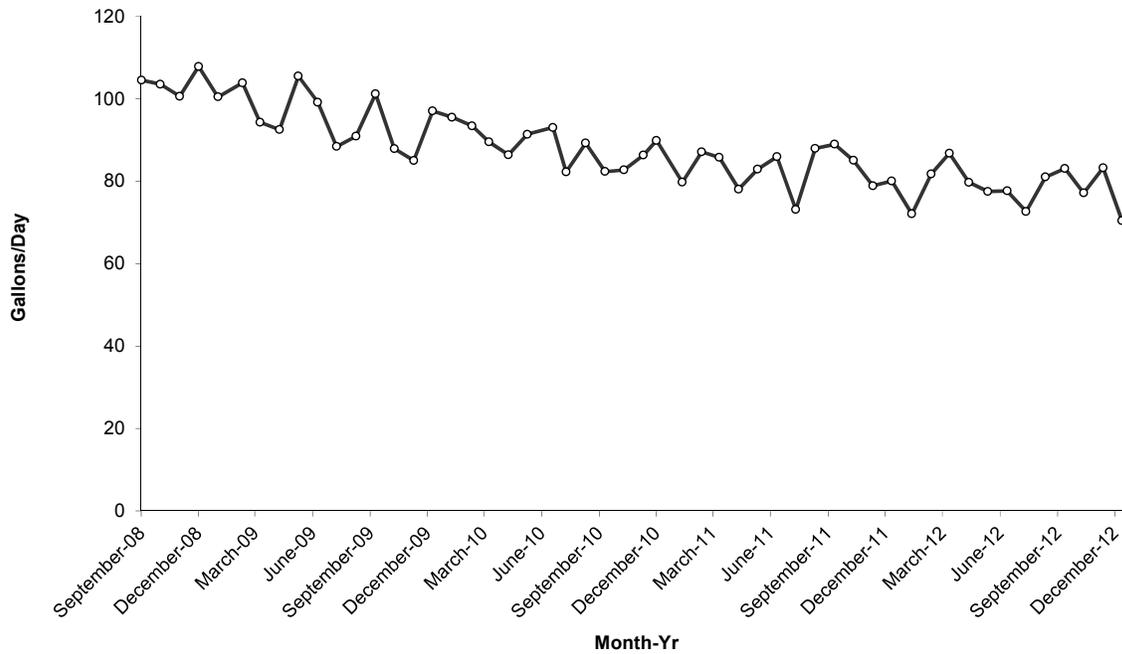


Figure 47. Daily Averages of the Primary Leachate Flow

5.5 Air

During active site remediation, the Weldon Spring Site operated an extensive environmental airborne monitoring and surveillance program in accordance with DOE orders, EPA and National Emission Standards for Hazardous Air Pollutants regulations, and the WSSRAP Environmental Monitoring Plan (DOE 2003a). Throughout the remediation of contaminated soils and materials, the potential for airborne releases and atmospheric migration of radioactive contaminants was closely monitored by measuring gamma exposure rates and concentrations of radon, airborne radioactive particulates, airborne asbestos, and fine particulate matter at various site perimeter and offsite locations. The potential for the airborne release of radionuclides was eliminated with the final emplacement of contaminated materials in the permanent disposal cell. No air monitoring has been required nor conducted since 2001 (DOE 2001).

5.6 Radiation Dose Analysis

This section evaluates the potential effects of remaining surface water and groundwater discharges of radiological contaminants from the Weldon Spring Site in 2012. The total effective dose (TED) has been calculated for 2012 based on the applicable exposure pathway. Doses resulting from airborne emissions are no longer calculated, since the potential for the airborne release of radiological contaminants has been eliminated, and, therefore, the regulations of 40 CFR 61 Subpart H, “National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities,” are no longer relevant. Similarly, doses resulting from external gamma radiation are no longer calculated since the radon sources have been

remediated and are contained within the permanent disposal cell. The cell cover effectively mitigates radon releases to levels comparable to those at background locations.

For this report, the potential exposure in terms of dose to an individual who consumes spring water contaminated with uranium is calculated. Because this calculation uses data from the spring with the highest uranium concentration (SP-5303 in the Southeast Drainage, where the 2012 uranium concentration was 104 pCi/L), the calculated dose represents the dose for the reasonable maximally exposed individual. The estimated TED to this maximally exposed individual is about 0.22 mrem. This result is compared to DOE limits established in DOE Order 458.1 to demonstrate compliance with regulatory requirements.

5.6.1 Pathway Analysis and Exposure Scenario

In developing specific elements of the Weldon Spring Site environmental monitoring program, potential exposure pathways and health effects of the radioactive and chemical materials present onsite are evaluated to determine if potential pathways of exposure exist. Under current site conditions, the only potential pathway to consider is that of a recreational visitor to the Weldon Spring Conservation Area possibly coming into contact with spring water specifically at SP-5303 in the Southeast Drainage. A dose calculation for a population within 49.6 miles of the site is not estimated, since the airborne release of radioactive contaminants is not a factor.

Consumption of contaminated groundwater at both the Chemical Plant/former Raffinate Pits and the Quarry areas is not currently a pathway of concern, as no drinking water wells are located near the contaminated groundwater in the Chemical Plant and former Raffinate Pits area, and there is no access to the impacted groundwater at the Quarry area. Concentrations of uranium in the production wells near the Weldon Spring Quarry are comparable to background concentrations.

The inhalation of airborne particulates, inhalation of radon gas, and external gamma irradiation are also no longer pathways of concern, since the contaminated soils and other materials have been remediated and placed in the onsite cell. Hence, these pathways were not included in the dose estimates for 2012.

The radiological public dose guideline in DOE Order 458.1 is applicable for comparing potential doses at the Weldon Spring Site. This guideline provides for an annual limit of 100 mrem TED, accounting for all exposure pathways (excluding background).

5.6.2 Total Effective Dose Estimates

The TED estimate for the exposure scenario was calculated using 2012 environmental monitoring data. The annual dose is well below the standards set by DOE for public exposure.

This section discusses the estimated TED to a hypothetical individual assumed to frequent the Southeast Drainage of the Weldon Spring Conservation Area. No private residences are adjacent to the Southeast Drainage, which is situated on land currently managed by MDC. Therefore, the calculation of dose equivalent is based on a recreational user of the Conservation Area who drank from SP-5303 20 times per year during 2012.

Exposure scenario assumptions particular to this dose calculation include the following:

- The maximally exposed individual drank 1 cup (0.2 liter [L]) of water from the spring 20 times per year (equivalent to 1.05 gallons [4.0 L] of water for the year).
- The maximum uranium concentration in water samples taken from spring locations during 2012 was at SP-5303 in the Southeast Drainage (104 pCi/L). This concentration was assumed to be present in all of the water ingested by the maximally exposed individual.

On the basis of the natural uranium activity ratios of 49.1 percent for U-234, 2.3 percent for U-235, and 48.6 percent for U-238, the dose conversion factors (DCFs) for ingestion for U-238 and U-234 were used for calculating the dose. These DCFs are 2.69×10^{-4} mrem/pCi and 2.83×10^{-4} mrem/pCi for U-238 and U-234, respectively (Eckerman et al. 1988).

The TED is calculated as shown below:

TED (ingestion of contaminated water for uranium) = Concentration (pCi/L) \times Volume of Water Ingested (L) \times DCF (U-238 + U-234) (mrem/pCi).

TED (total uranium) = 104 pCi/L \times 4 L \times (2.69×10^{-4} mrem/pCi + 2.83×10^{-4} mrem/pCi) = 0.22 mrem.

This value represents less than 0.22 percent of the DOE standard of 100 mrem TED above background. In comparison, the annual average exposure to natural background radiation in the United States results in a TED of approximately 300 mrem (BEIR 1990).

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6.0 Environmental Quality

6.1 Highlights of the Quality Assurance Program

Quality assurance for 2012 sampling activities followed the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351).

- Average relative percent differences were calculated for duplicate samples of groundwater, surface water, and springs.
- Trip and equipment blanks were assessed and summarized.
- The data validation program accepted 99.9 percent of the all data in 2012 (including field data).
- Appendix F provides the 2012 Data Review and Validation Reports that were generated during 2012.

6.2 Program Overview

The environmental quality assurance program includes management of the plans and procedures governing environmental monitoring activities at the Weldon Spring site and at the subcontracted offsite laboratories. This section discusses the environmental monitoring standards at the Weldon Spring site and the goals for these programs, plans, and procedures.

The environmental quality assurance program provides the Weldon Spring site with reliable, accurate, and precise monitoring data. The program furnishes guidance and directives to detect and prevent quality problems from the time a sample is collected until the associated data are evaluated and utilized. Key elements in achieving the goals of this program are compliance with the quality assurance requirements; the use of quality control samples; complete documentation of field activities and laboratory analyses; and validation and reviews of data documentation for precision, accuracy, and completeness.

The *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* summarizes the data quality requirements for collecting and analyzing environmental data. The LTS&M Plan (DOE 2008) lists the sampling locations and provides site-specific detail for quality control samples. These plans describe administrative procedures for environmental data management, data validation, database administration, and data archiving.

Analytical data are received from subcontracted analytical laboratories. These data are reviewed, validated, and qualified according to the Stoller *Environmental Procedures Catalog* (LMS/PRO/S04325).

Applicable standards for environmental quality assurance include (1) use of the approved analytical and field measurement methods; (2) collection and evaluation of quality control samples; (3) accurate, precise, and completeness evaluations; and (4) preservation and security of all applicable documents and records pertinent to the environmental monitoring program.

6.3 Quality Control Samples

Quality control samples for environmental monitoring are collected in accordance with the required sampling plan, which specifies how frequently quality control samples should be collected. Table 54 describes the quality control samples collected at the Weldon Spring Site.

Table 54. Quality Control Sample Description

Type of Quality Control Sample	Description
Equipment Rinsate Blank	Monitors the effectiveness of decontamination procedures used on nondedicated sampling equipment. Equipment blanks include rinsate and filter blanks.
Trip Blank	Monitors volatile organic compounds that may be introduced during transportation or handling at the laboratory. Trip blanks are collected with distilled water in the Weldon Spring Site laboratory.
Field Duplicate	Monitors field conditions that may affect the reproducibility of samples collected from a given location. Field duplicates are collected in the field at the same location.
Matrix Spike ^a	Assesses the matrix and accuracy of laboratory measurements for a given matrix type. The results of this analysis and the routine sample are used to compute the percent recovery for each parameter.
Matrix Duplicate ^a	Assesses the matrix and precision of laboratory measurements for inorganic parameters in a given matrix type. The results of the matrix duplicate and the routine sample are used to compute the relative percent difference for each parameter.
Matrix Spike Duplicate ^a	Assesses the matrix and precision of laboratory measurements for organic compounds. The matrix spike duplicate is spiked in the same manner as the matrix spike sample. The results of the matrix spike and matrix spike duplicate are used to determine the relative percent difference for organic parameters.

^a A laboratory sample is split from the parent sample.

6.3.1 Duplicate Results Evaluation

Field duplicate analyses were evaluated in 2012. The matrix duplicate analyses were performed at subcontracted laboratories from aliquots of original samples collected at the Weldon Spring Site. Matrix duplicates were used to assess the precision of analyses and also to aid in evaluating the homogeneity of samples or analytical interference of sample matrixes. Matrix duplicates were assessed during the data validation process for each sample group.

Generally, field duplicate samples were analyzed for the same parameters as the original samples and were collected at the rate of approximately one for every 10 samples. In 2012, 33 field duplicates were collected from 393 field locations sampled (8.4 percent). Typically, duplicate samples were analyzed for the common parameters (e.g., uranium, inorganic anions, metals).

When field duplicate samples were available, the average relative percent difference (RPD) was calculated. This difference represents an estimate of precision. The equation used was:

$$RPD = \frac{|S - D|}{\left(\frac{S + D}{2}\right)} \times 100$$

Where: S = analytical result of the original sample, and
 D = analytical result of the duplicate sample.

Table 55 summarizes the calculated average RPD for field duplicate samples for groundwater, springs, and surface water matrixes. Parameters that were not commonly analyzed for or that were not contaminants of concern were not evaluated. The RPD was calculated only for samples whose analytical results exceeded five times the detection limit and did not have any quality control problems (e.g., blank contamination).

Table 55. Summary of Calculated RPDs

Parameter	Number of Samples	Average RPD
Uranium	12	3.8
Iron	11	3.4
Cobalt	1	3.9
Barium	3	2.9
Nitrate (as N)	8	5.2
Sulfate	10	2.8
Volatile organic compounds	3	10.2
Nitroaromatic compounds	5	4.3
Manganese	2	1.8
Nickel	3	1.4
Total Dissolved Solids	1	2.7
Total Organic Carbon	1	0.0
Chloride	1	6.2
Copper	1	6.7

RPD = Relative Percent Difference

The results in Table 55 demonstrate that average RPDs calculated were within the 20 percent criterion. Also, several individual parameters exceeded the 20 percent criterion and were assessed and discussed in the individual Data Review and Validation Reports (Appendix F).

6.3.2 Blank Sample Results

Various types of blanks are collected to assess the conditions or contaminants that may be introduced during sample collection and transportation. These conditions and contaminants are monitored by collecting blank samples to ensure that environmental samples are not being contaminated. The following types of blank samples were evaluated:

- The environmental conditions under which the samples (i.e., for analysis of volatile organic compounds) were shipped (trip blanks).
- The ambient conditions in the field that may affect a sample during collection (trip blanks).
- The effectiveness of the decontamination procedure for sampling equipment used to collect samples (equipment rinsate blanks).

6.3.2.1 Trip Blank Evaluation

Trip blanks are collected to assess the impact of sample collection and shipment on groundwater and surface water samples analyzed for volatile organic compounds. Trip blanks are sent to the laboratory with each shipment of volatile organic samples.

In 2012, five trip blanks were analyzed for volatile organic compounds. No reported compounds were detected in the trip blanks, and therefore, no volatile organic contamination was associated with the handling of these samples and their shipment to the laboratory.

6.3.2.2 *Equipment Rinsate Blank Evaluation*

Equipment rinsate blanks are samples that are collected by rinsing decontaminated equipment with distilled or deionized water. The collected rinse water is then analyzed for selected constituents. This procedure is used to determine the effectiveness of the decontamination process. At the Weldon Spring site, most of the groundwater samples are collected from dedicated equipment (e.g., pumps, dedicated bailers), and spring water is collected by placing the sample directly into a sample container. Therefore, no equipment blanks are required for groundwater or spring locations.

Surface water may be collected by directly collecting samples into an appropriate container, using a dip cup or using a stainless-steel bucket. When the dip cup or stainless-steel bucket is used, an equipment rinsate blank is collected to assess the cleanliness of the equipment. All surface water locations that were collected in 2012 were directly placed into the sample container. No equipment rinsate blank samples were collected in 2012.

6.4 Data Validation Program Summary

The data validation program at the Weldon Spring site follows the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. This program involves reviewing and qualifying 100 percent of the data collected during a calendar year. Attached in Appendix F are the completed Data Review and Validation Reports that are prepared for each sample lot or set of samples submitted to a laboratory for analysis. These reports provide detailed results on laboratory and field quality control, associated data qualifier summary and specific information on methodologies used for analyzing associated samples. The reports provide information on potential data outliers, evaluation of sampling protocol and assessment of field instrumentation calibration and measurement.

Table 56 identifies the number of quarterly and total data points that were validated in 2012 and indicates the percentage of those selected that were complete. Data points in this table include all sample types (including field parameters).

Table 56. Validation Summary for Calendar Year 2012

Calendar Quarter	No. of Data Points Validated	No. of Validated Data Points Rejected	Completeness ^a
Quarter 1	578	0	100
Quarter 2	1,469	2	99.9
Quarter 3	544	0	100
Quarter 4	1165	0	100
2012 Total	3656	2	99.9

^a Completeness is a measure of acceptable data. The value is determined by the following equation:

$$\text{Completeness} = \frac{(\# \text{ validated} - \# \text{ rejected})}{\# \text{ validated}}$$

Reflects all validatable data for the calendar year.

Table 57 identifies validation qualifiers assigned to the selected data points as a result of data validation. The Weldon Spring Site validation technical review was performed in accordance with the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. For calendar year 2012, 100 percent of data validation was completed. Data points in this table include samples of groundwater, leachate, surface water, and spring water.

Table 57. Validation Qualifier Summary for Calendar Year 2012

Number of Data Points									
	Field	Anions	Metals	Misc.	Nitro-aromatics	Radio-Chemical	Semi-volatiles	Volatiles	Total
Accepted	904	131	694	828	540	115	368	174	3,754
Rejected	1	1	0	0	0	0	0	0	2
Not Validatable	0	0	0	0	0	0	0	0	0
Total	905	132	694	828	540	115	368	174	3,756
Percentages									
Accepted	99.9%	99.2%	100%	99.5%	100%	100%	100%	100%	99.9%
Rejected	0.1%	0.8%	0%	0%	0%	0%	0%	0%	0.1%
Not Validatable	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Appendix F provides 2012 Data Review and Validation Reports for Weldon Spring Site which detail the data qualifiers applied to individual data points.

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Appendix A

2012 Inspection Report Agenda

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WELDON SPRING ANNUAL INSPECTION
AGENDA

Tuesday, October 23, 2012

8:30 – 9:00 am

Inspectors/observers will divide into 2 separate groups. Review agenda, inspection teams, and safe work issues. Review inspection report and findings/corrective actions on last year's inspection. Team 1 (Team Leader – Terri Uhlmeyer) will cover the Chemical Plant Area. Team 2 (Team Leader – Randy Thompson) will cover the Southeast Drainage and the Quarry Area.

9:00 – 11:30 am

Team 1: Inspect land & shallow groundwater use on Army property and DOE property:

- Monitoring wells along Army property roads
- Drive all Army roads in IC area and note any land disturbance
- Disposal Cell buffer zone
- Monitoring wells on DOE Chemical Plant property

Team 2: Inspect land & shallow groundwater use on Missouri Department of Conservation property, Weldon Spring Conservation Area:

- Southeast Drainage from Army Road to Hwy 94
- Hwy 94 culvert
- Southeast Drainage from Hwy 94 to Missouri River, incl Springs 5303 & 5304

11:30 am – 12:30 pm

Lunch

12:30 – 4:00 pm

Team 1: Inspect land & shallow groundwater use on Missouri Department of Conservation property, August A. Busch Conservation Area:

- Burgermeister Spring
- Spring 6303
- Monitoring wells along MDC roads

Team 2: Inspect land & shallow groundwater use on Missouri Department of Conservation property, Weldon Spring Conservation Area and DOE property:

- DOE Quarry Property (Quarry rim wells)
- DOE Quarry Property (Quarry proper)
- Reduction zone area
- Public Water District #2 well field area

4:00 – 4:30 pm

- Discuss data collected to date regarding uranium in the unweathered bedrock unit
- Discuss future public meetings

Wednesday, October 24, 2012

8:30 – 9:00 am

Review previous day's findings and current day's inspection objectives. Inspectors/observers divide into 2 separate groups to cover 5 transects each on the disposal cell. The Team Leaders will be Terri Uhlmeier and Randy Thompson

9:00 – 11:30 am

Disposal Cell Inspection – Potential settlement, rock degradation, vegetation
Team 1: Walk 5 Transects
Team 2: Walk 5 Transects

11:30 am – 12:30 pm

Lunch

12:30 pm – 1:00 pm

Teams 1 & 2: reconvene in Room 3A for trip to LCRS.

1:00– 3:00 pm

Inspection of LCRS (No confined space entry planned).
Walk disposal cell buffer zone inspecting for erosion issues.

3:00 – 4:00 pm

Document and paperwork review

4:00 – 4:30 pm

Debriefing for DOE and Stoller management of preliminary inspection findings

Thursday, October 25, 2012

8:30-11:30

This time period will be used to conduct any items that do not fit within the 2 previous days, such as additional paperwork review, erosion inspections, walk-down of the LCRS pipeline, and inspection of the historical markers.

Appendix B

2012 Inspection Report Corrective Action Report

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Corrective Actions from 2011 Weldon Spring LTS&M Annual Inspection

1. Recommendation: Wells that required some type of maintenance:

- Need new contact label: MW-4027
- Need painted: MW-4026

Action: Applied the required maintenance to these wells

Completed Date: 5/12 and 10/12

2. Recommendation: Repaint Rock Degradation Test Plots

Action: Repainted Rock Degradation Test Plots

Completed Date: 10/12

3. Recommendation: Repair erosion area on northeast of the apron drain located on the northeast side of the disposal cell.

Action: It was determined to just continue to monitor this area.

4. Recommendation: Continue to monitor and evaluate erosion control on the Chemical Plant Site.

Action: Continue to monitor and evaluate erosion control on the Chemical Plant Site.

Completed Date: Ongoing

5. Recommendation: Remove the reference to inspection of the survey monuments from the LTS&M Plan and future inspections. With use of GPS, the survey monuments are not critical to the project and there is no need to inspect them.

Action: The monuments will no longer be inspected during the annual inspection and the reference will be deleted from the LTS&M Plan.

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Appendix C

2012 Inspection Report Inspection Checklist

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Annual Site Inspection Checklist

Purpose of the Checklist

This checklist has been developed from the EPA guidance document *Comprehensive Five Year Review Guidance* dated June 2001 (OSWER No. 9355.7-03B-P) and from Section 2.3 of the *Long-Term Surveillance and Maintenance Plan for the Weldon Spring, Missouri, Site*. The checklist was modified to site-specific conditions as recommended by the guidance document. The checklist will be completed annually during the Weldon Spring Site annual surveillance and maintenance inspection. The checklist will also be used to assist in compiling information for the five-year review.

I. SITE INFORMATION	
Site name: DOE Weldon Spring Site	Date(s) of inspection: Oct 23-25, 2012
Location: St. Charles, MO	EPA ID: MO6210022830
Agencies accompanying DOE for portions of the annual inspection: <ul style="list-style-type: none"> <input checked="" type="checkbox"/> EPA, Region 7 <input checked="" type="checkbox"/> MDNR <input checked="" type="checkbox"/> Other (list): MoDOT, St. Charles County 	Weather: <ul style="list-style-type: none"> Tues Oct 23: Rain in the a.m. 60° Wed Oct 24: cloudy 70°
Remedy Includes: <ul style="list-style-type: none"> Disposal Cell Institutional controls Monitored Natural Attenuation Long Term Monitoring Other 	
Inspectors: Terri Uhlmeier (Stoller) Randy Thompson (Stoller) Participants: Ken Starr (DOE) <ul style="list-style-type: none"> Hoai Tran (EPA) Patrick Anderson (MDNR) Dan Carey (MDNR) Kevin Wideman (MoDOT) Stuie Johnson (MoDOT) Brittany Politti (St. Charles County) Ryan Tilley (St. Charles County) Jeff Becker (St. Charles County) Michelle Watkins (St. Charles County) Tom Nelson (Citizen) Becky Cato (Stoller) Tom Welton (Stoller) Tim Zirbes (Stoller) 	

5. Stakeholders: Contact to notify of annual inspection and to determine if there are any concerns or issues.

Agency: Francis Howell High School Contact Name: Mr. Randy Carter, Assistant Principal

Contact Name Current yes no

Phone Number Current yes no same (new phone no. if applicable)

Contact same same 10/10/12 636-851-4700
 Name (if different than above) Title Date Phone no.

Problems; suggestions; Report attached email ed Philip Carter @ fhdschools.org

Agency: St. Charles County Contact Name: Ryan Tilley, Environmental Public Health Manager

Contact Name Current yes no

Phone Number Current yes no same (new phone no. if applicable)

Contact same same 9/28/12 636-949-7406
 Name (if different than above) Title Date Phone no.

Problems; suggestions; Report attached

6. Other interviews Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1.	Documents	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> Surveillance and Maintenance Plan	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input type="checkbox"/> Maintenance logs (Plan of Week)	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks			
2.	Health and Safety Procedures	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks <u>Procedures are online</u>			
3.	Permits and Service Agreements	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> NPDES Permits	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> MSD agreement and records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	<input checked="" type="checkbox"/> Other permits <u>NPDES stormwater</u>	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks			
4.	Groundwater Monitoring Records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks			
5.	Leachate Records	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks			
6.	Interpretative Center Sign-In Logs	<input checked="" type="checkbox"/> Readily available	<input checked="" type="checkbox"/> Up to date	<input type="checkbox"/> N/A
	Remarks			

II. INTERVIEWS (Check all that apply)				
1. Local Site Manager	<u>Randy Thompson</u> Name	<u>Site Manager</u> Title	<u>10/19/12</u> Date	
Interviewed <input checked="" type="checkbox"/> at site <input checked="" type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. <u>636-300-2440</u>				
Problems, suggestions; <input checked="" type="checkbox"/> Report attached _____				
2. Environmental Data Manager	<u>Randy Thompson</u> Name	<u>Data Manager</u> Title	<u>10/19/12</u> Date	
Interviewed <input type="checkbox"/> at site <input checked="" type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. <u>636-300-2440</u>				
Check to ensure that environmental data is reviewed and trended.				
Problems, suggestions; <input type="checkbox"/> Report attached _____				
3. Other Staff (as applicable)	<u>N/A</u> Name			
Interviewed <input type="checkbox"/> at site <input type="checkbox"/> at office <input type="checkbox"/> by phone Phone no. _____				
Problems, suggestions; <input type="checkbox"/> Report attached _____				
4. Local response agencies: Contact to notify of annual inspection and to determine if there are any concerns or issues.				
Agency:	<u>St. Charles County Sheriff</u>			
Contact	<u>James Hudson</u> Name	<u>Captain</u> Title	<u>9/20/12</u> Date	<u>636-949-7325</u> Phone no.
Problems; suggestions; <input checked="" type="checkbox"/> Report attached _____				
Agency:	<u>Cottleville Fire Department</u>			
Contact	<u>Mark Boewle</u> Name	<u>Asst Fire Chief</u> Title	<u>9/20/12</u> Date	<u>636-447-6655</u> Phone no. <u>18703</u>
Problems; suggestions; <input checked="" type="checkbox"/> Report attached _____				
Agency:	<u>SimplexGrinnel (LCRS and Interpretive Center Alarm Company)</u>			
Contact	<u>Katie</u> Name		<u>10/19/12</u> Date	<u>888-746-7539</u> Phone no.
Problems; suggestions; <input checked="" type="checkbox"/> Report attached _____				
Agency:	<u>N/A</u>			
Contact				
Problems; suggestions; <input type="checkbox"/> Report attached _____				

IV. O&M COSTS

1. **O&M Cost Records** (This information may be reviewed and completed prior to the inspection)

Original O&M cost estimate \$ 1,252,146

Total annual cost for prior federal fiscal year:

From Oct. 1, 2011 To Sept. 30, 2012 \$ 2,535,428
Date Date Total cost

2. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: Decision to demolish the administration building which also required relocation of staff into trailers and also the installation of a new waste water treatment system.

V. INSTITUTIONAL CONTROLS

Institutional Control (IC) Inspections

1. **Land and Shallow Groundwater Use within the Chemical Plant Site and Quarry Property**

Inspect for indications of excavations into soil or bedrock and groundwater withdrawal or use in restricted areas. If any party has been granted use of portions of the Chemical Plant or Quarry area, inspect to ensure that land use is in compliance with the terms of the restrictions within the notation.

Note any observations: No indications of excavations or groundwater withdrawal or use. The administration building demolition was close to being completed. A new waste water treatment system was being installed.

2. **Groundwater Use in Areas Surrounding the Chemical Plant**

Groundwater use is restricted in areas. Inspect affected areas for evidence of groundwater or spring water use (Burgermeister Spring and Spring 6303). Inspect to ensure that land use continues to be in compliance with the terms of the license, easement, or permit and the restrictions contained therein.

Note any observations: Inspected wells at the Army and the one well at Bush. Inspected springs. No evidence of groundwater or spring water use. No restrictions were being violated.

3. **Groundwater (Quarry)**

Groundwater use is restricted in areas. Inspect affected areas for evidence of groundwater withdrawal or use in the area of impact. Inspect to ensure that land use continues to be in compliance with the terms of the license and the restrictions contained therein.

Note any observations: No evidence of groundwater use. No land use changes. Inspected wells.

4. **Land Use in Quarry Area Reduction Zone**
 A naturally occurring reduction zone exists in soil south of the Katy Trail and north of the Femme Osage Slough. Inspect for indications of excavations into soils and bedrock in the uranium reduction zone. Inspect to ensure that land use continues to be in compliance with the terms of the easement and the restrictions contained therein.
 Note any observations: No evidence of excavations into soil or bedrocks. "No Dig" labels were present on well & ballards in reduction zone
-
5. **Southeast Drainage**
 Check for indications of residential use or construction in the Southeast Drainage (200-foot-wide corridor), or other activity that would indicate nonrecreational use of the area. Check Springs 5303 and 5304 for residential, commercial, or agricultural use of spring water.
 Note any observations: No indications of residential use or construction in the SE Drainage or corridor. No use of springs was noted.
-
6. **State Route 94 Culvert**
 Check for signs of disturbance of the affected region where the culvert passes beneath State Route 94 and in the utility rights-of-way in the affected area. Observe culvert that has been cut.
 Note any observations: The inlet pipe was covered with debris. Kevin Wiseman stated he would inform the local MoDOT.
-
7. **Pipeline from LCRS to Missouri River**
 Inspect the entire length of the pipeline and outfall for any disturbances or maintenance needs.
 Note any observations: No disturbances in areas of the pipeline or manholes.

Institutional Control Annual Contact Log

In accordance with the LTS&M Plan, the following will be contacted to verify cognizance of institutional controls and real estate agreements. Fill in all that apply.

1. **Agency:** Missouri Department of Conservation **Contact Name:** Joel Porath, Wildlife Regional Supv.
Address: August A. Busch Memorial Conservation Area, 2360 Highway D, St. Charles, MO 63304
Institutional Control and Real Estate Licenses to Verify: Chemical Plant Groundwater Use Restriction, Quarry Area Groundwater Use Restriction, Quarry Reduction Zone Land Use Restriction, Southeast Drainage Residential Use Restriction, North Gate Access, Well Sampling Access Agreement, Effluent Discharge Pipeline, Hamburg Trail Use Agreement.

Contact Name Current Yes No 636-300-1453 x 4108
 Phone Number Current Yes No 636-441-4554 (new phone no. if applicable)
 Contact Sam 10/9/12 636-300-1953 x4108

	Name (if different than above)	Title	Date	Phone no.
	Problems; suggestions; <input checked="" type="checkbox"/> Report attached			
2.	Agency: Missouri Department of Conservation Contact Name: John Vogel, Area Manager Address: August A. Busch Memorial Conservation Area, 2360 Highway D, St. Charles, MO 63304 Institutional Control and Real Estate Licenses to Verify: See No. 1 Contact Name Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no Phone Number Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <u>same</u> (new phone no. if applicable) Contact <u>same</u> <u>same</u> <u>9/27/12</u> <u>636-300-1953 X 4131</u> Name (if different than above) Title Date Phone no. Problems; suggestions; <input checked="" type="checkbox"/> Report attached			
3.	Agency: Missouri Department of Conservation Contact Name: Alan Leary, Policy Coordinator Address: P.O. Box 180, Jefferson City, MO 65102 Institutional Control and Real Estate Licenses to Verify: See No. 1 Contact Name Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no Phone Number Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <u>same</u> (new phone no. if applicable) Contact <u>new contact -</u> <u></u> <u>10/16/12</u> <u>573-522-4115 x3346</u> Name (if different than above) Title Date Phone no. Problems; suggestions; <input checked="" type="checkbox"/> Report attached			
4.	Agency: Missouri Department of Natural Resources Contact Name: Mary Bryan, Real Estate Manager Address: P.O. Box 176, Jefferson City, MO 65102 Institutional Controls and Real Estate Licenses to Verify: Quarry Area Groundwater Use Restriction, Southeast Drainage Residential Use Restriction, Well Sampling Access Agreement, Effluent Discharge Pipeline Contact Name Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no Phone Number Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <u>same</u> (new phone no. if applicable) Contact <u>same</u> <u></u> <u>10/11/12</u> <u>573-751-7987</u> Name (if different than above) Title Date Phone no. Problems; suggestions; <input checked="" type="checkbox"/> Report attached			
5.	Agency: Missouri Department of Natural Resources Contact Name: Quinn Kellner, Natural Resource Manager, Jones-Confluence Point State Park Address: P.O. Box 67, West Alton, MO 63386 Institutional Controls and Real Estate Licenses to Verify: Quarry Area Groundwater Use Restriction, Southeast Drainage Residential Use Restriction, Well Sampling Access Agreement, Effluent Discharge Pipeline Contact Name Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no Phone Number Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no <u>same</u> (new phone no. if applicable) Contact <u>same</u> <u></u> <u>10/9/12</u> <u>636-899-1135</u> Name (if different than above) Title Date Phone no. Problems; suggestions; <input checked="" type="checkbox"/> Report attached			

6. **Agency:** Missouri Department of Transportation **Contact Name:** Tom Blair, Asst. District Engineer
Address: 1590 Woodlake Dr., Chesterfield, MO 63017
Institutional Controls to and Real Estate Licenses to Verify: Chemical Plant Groundwater Use Restriction, and question MoDOT regarding Missouri State Highway 94 Culvert and Highway D culverts about plans for repairs/replacements.
 Contact Name Current yes no
 Phone Number Current yes no Same (new phone no. if applicable)

Contact Same Name (if different than above) Title _____ Date 10/10/12 Phone no. 314-340-4203
 Problems; suggestions; Report attached emailed Tom Blair
Thomas.Blair@modot.mo.gov

7. **Agency:** Missouri Department of Transportation **Contact Name:** Kevin Wideman, Sr. Environmental Specialist
Address: P.O. Box 270, Jefferson City, MO 65102
Institutional Controls to and Real Estate Licenses to Verify: Chemical Plant Groundwater Use Restriction, and question MoDOT regarding Missouri State Highway 94 Culvert and Highway D culverts about plans for repairs/replacements.
 Contact Name Current yes no
 Phone Number Current yes no Same (new phone no. if applicable)

Contact Same Name (if different than above) Title same Date 10/9/12 Phone no. 573-526-4171
 Problems; suggestions; Report attached _____

8. **Agency:** Missouri Department of Transportation **Contact Name:** Tom Evers, St. Charles County Area Engineer
Address: 6780 Old Hwy. N. St. Charles, MO 63304
Institutional Controls to and Real Estate Licenses to Verify: Chemical Plant Groundwater Use Restriction, and question MoDOT regarding Missouri State Highway 94 Culvert and Highway D culverts about plans for repairs/replacements.
 Contact Name Current yes no
 Phone Number Current yes no same (new phone no. if applicable)

Contact Same Name (if different than above) Title _____ Date 10/10/12 Phone no. 636-240-5277
 Problems; suggestions; Report attached emailed Tom Evers: thomas.evers@modot.mo.gov

9. **Agency:** U.S. Dept. of Army **Contact Name:** Marsha Keeran, Facility Manager
Address: Weldon Spring Training Area, 7301 Hwy 94 S. St. Charles, MO 63304
Institutional Controls to and Real Estate Licenses to Verify: Chemical Plant Groundwater Use Restriction, Effluent Discharge Pipeline, Well Sampling Access Agreement
 Contact Name Current yes no
 Phone Number Current yes no _____ (new phone no. if applicable)

	Contact <u>John</u>	Contact <u>Sam</u>	Date <u>10/12/12</u>	Phone no. <u>636-329-1243x2505</u>
	Name (if different than above)	Title	Date	Phone no.
	Problems; suggestions; <input checked="" type="checkbox"/> Report attached			
10.	Agency: St. Charles County Recorder of Deeds Address: 201 N 2 nd , St. Charles, MO 63301 Institutional Controls to and Real Estate Licenses to Verify: Recorded real estate restrictions at the Recorder of Deeds Office or on the Internet at www.sccmo.org			
	Contact <u>N/A</u>			
	Name	Title	Date	Phone no.
	Problems; suggestions; <input type="checkbox"/> Report attached <u>Verified on the above website that the notation of land ownership and the easements with MDC, MDNR- Parks and MoDOT are recorded and present on the website.</u>			
11.	Agency: St. Charles County Planning and Zoning Department Contact Name: Wayne Anthony Address: 201 N 2 nd , St. Charles, MO 63301 Institutional Controls to and Real Estate Licenses to Verify: Awareness of Restrictions Contact Name Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no Phone Number Current <input checked="" type="checkbox"/> yes <input type="checkbox"/> no (new phone no. if applicable)			
	Contact <u>Same</u>	Contact <u>Same</u>	Date <u>10/15/12</u>	Phone no. <u>636-949-7900x7221</u>
	Name	Title	Date	Phone no.
	Problems; Report attached; suggestions;			
General				
1.	Land Use Changes On Site <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks <u>Administration Building was demolished and new office trailers installed. New wastewater treatment system is being installed</u>			
2.	Land Use Changes Off Site that could affect site <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Remarks			
VI. GENERAL SITE CONDITIONS				
1.	Roads <input checked="" type="checkbox"/> Location shown on site map Roads adequate <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Remarks			

2.	Vandalism	<input type="checkbox"/> Location shown on site map	Vandalism noted	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Remarks <u>Minor rock movement</u> <u>Vandalism to MW-3031 and MW-3037 was discovered</u> <u>on 9/19/12. Details are included in the report.</u>					
3.	Personal Injury Risks	Housekeeping maintained	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Remarks _____					
4.	Site Markers (Four Information Plaques on Top of Cell, Historical Markers, and Other Information Markers)				
	<input checked="" type="checkbox"/> Location shown on site map	Legible and Secure	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
		In Good Condition	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Remarks _____					
5.	Guard Rail Around Cell	<input checked="" type="checkbox"/> Location shown on site map	Secure	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Remarks _____					
6.	Stairs to Top of Cell	<input checked="" type="checkbox"/> Location shown on site map	Stairs in good condition	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
			Handrail stable and in good condition	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Remarks _____					
7.	Other Site Conditions:				
Remarks <u>N/A</u>					

VII. EROSION

1.	Chemical Plant Areas	<input checked="" type="checkbox"/> Location shown on site map	Erosion evident	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
	Depth				
	Remarks	The erosion has been mapped 2007-2012. The erosion figure is included in the report.			
2.	Quarry Area	<input type="checkbox"/> Location shown on site map	Erosion evident	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
	Depth				
	Remarks				

VIII. CHEMICAL PLANT DISPOSAL CELL

1. **Settlement /Bulges** Location shown on site map New settlement noted Yes No

A. Annually: Walk along the grade break at the top of the side slopes, around the cell perimeter, and along 10 transects across the cell surface. Inspect for local depressions, regional departures from planar surfaces, and shifts in intersections (vertices) of cell surface planes. Inspect for vertical shear of the cover layers indicated by sudden, abrupt steps that exceed an approximately 6-inch change of surface level over no more than 10 feet distance.

B. During 5-Year Review Inspections (Beginning 2005 and at 5-year Intervals): Conduct an aerial mapping survey with a vertical resolution not less precise than 0.5 feet. Produce and record maps and survey data for the cell surface represented by 1.0 foot contour intervals. Evaluate the data for indications of settlement. Consider the position and spacing of contour lines as indications of elevation change and possible settlement.

Remarks The inspectors walked the 10 transects. A few
minor depression areas were noted.

2. **Rock Cover** Signs of degradation Yes No Signs of intrusion Yes No

A. Annually: During settlement monitoring inspection also visually inspect for departures from original rock conditions or from the previous inspection. Note observable discoloration on areas larger than 2,500 square feet, presence of finer materials at surface and apparent rock gradation changes. Document rock conditions annually with photographs.

B. During 5-Year Review Inspections (Beginning 2005 and at 5-year Intervals): Inspect cell cover for gradation changes by walking 10 transects across the cell. Concentrations of degraded, split, or weathered pieces of limestone will be mapped, photodocumented and visually assessed as a percentage of rock exposed within each mapped area. If degraded rock is evenly distributed, inspectors will estimate the overall percentage of degraded rock. If the amount of degraded rock appears to be increasing, based on a review of previous annual rock quality assessments, additional monitoring or gradation testing will be performed. If rock does not appear degraded, photodocumentation of several GPS located areas will establish rock conditions for future reference.

Remarks The 6 rock degradation test plots were compared
to previous years photos. The rocks had not changed or
degraded. The rock plots had been repainted.

3. **Vegetative Growth** Weeds or Plants on Cell Yes No

Remarks _____

4.	Wet Areas/ Water Damage	Wet areas <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Location shown on site map	Areal extent _____
		Ponding <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Location shown on site map	Areal extent _____
		Seeps <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Location shown on site map	Areal extent _____
		Remarks _____		
5.	Toe/Apron Drains	Proper drainage <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Silting <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
		Erosion <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Remarks _____	
6.	Slope Instability	<input type="checkbox"/> Location shown on site map	Evidence of slope instability <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
		Remarks _____		
7.	Leachate Collection and Removal System	<input checked="" type="checkbox"/> Fence/Gates/Locks in good condition	<input checked="" type="checkbox"/> Good condition	<input checked="" type="checkbox"/> No Trespassing sign posted
		<input checked="" type="checkbox"/> Functioning	<input checked="" type="checkbox"/> Routinely sampled	<input checked="" type="checkbox"/> Correct Phone Numbers Posted
		Data Issues <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Flow Rate Issues <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
		Remarks _____		
8.	Condition of 300 Ft. Buffer Zone	Erosion <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Remarks <u>The erosion is being monitored</u>	
9.	Condition of Prairie	Erosion <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Remarks <u>The condition of the prairie is good.</u>	
IX. GROUNDWATER MONITORING				
1.	Disposal Cell Monitoring Well Network	<input checked="" type="checkbox"/> Properly secured/locked	<input checked="" type="checkbox"/> Good condition	<input checked="" type="checkbox"/> Evidence of surface water infiltration at casing
		<input type="checkbox"/> Needs maintenance	<input checked="" type="checkbox"/> Proper ID on each well	
		Remarks <u>Inspected all 5 wells MW-2032, 2046, 2047, 2051, 2055</u>		

<p>2. Chemical Plant Groundwater Monitoring Well Network <input checked="" type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Evidence of surface water infiltration at casing <input type="checkbox"/> Needs maintenance*</p> <p>List wells checked by number (> 10% of wells) MW-2006, 2017, 2023, 2034, 2053, 3024, 3025, 3027, 3028, 3029, 3031, 3040, 4001, 4006, 4007, 4026, 4027, 4028, 4029, 4036, 4040, 4041, 4042, 4045.</p> <p>Remarks* It has been noted that 3 wells at the Chemical Plant require maintenance due to settling (MW-2033, 2034, 4001)</p>
<p>3. Quarry Monitoring Well Network <input checked="" type="checkbox"/> Properly secured/locked <input checked="" type="checkbox"/> Functioning <input checked="" type="checkbox"/> Good condition <input type="checkbox"/> Evidence of surface water infiltration at casing <input type="checkbox"/> Needs maintenance*</p> <p>List wells checked by number (> 10% of wells) MW-1002, 1004, 1005, 1006, 1007, 1008, 1009, 1013, 1014, 1015, 1016, 1027, 1030, 1031, 1032, 1046, 1048, 1049, 1052</p> <p>Remarks* It has been noted that 5 wells at the Quarry require maintenance due to settling (MW-1013, 1015, 1016, 1018 and 1046)</p>
<p>X. OVERALL OBSERVATIONS</p>
<p>Implementation of the Remedies</p> <p>Describe issues and observations relating to whether the remedies are effective and functioning as designed.</p> <p style="text-align: center;">None</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
<p>Adequacy of O&M</p> <p>Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedies.</p> <p style="text-align: center;">None</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of one or more of the remedies may be compromised in the future.

none

Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedies.

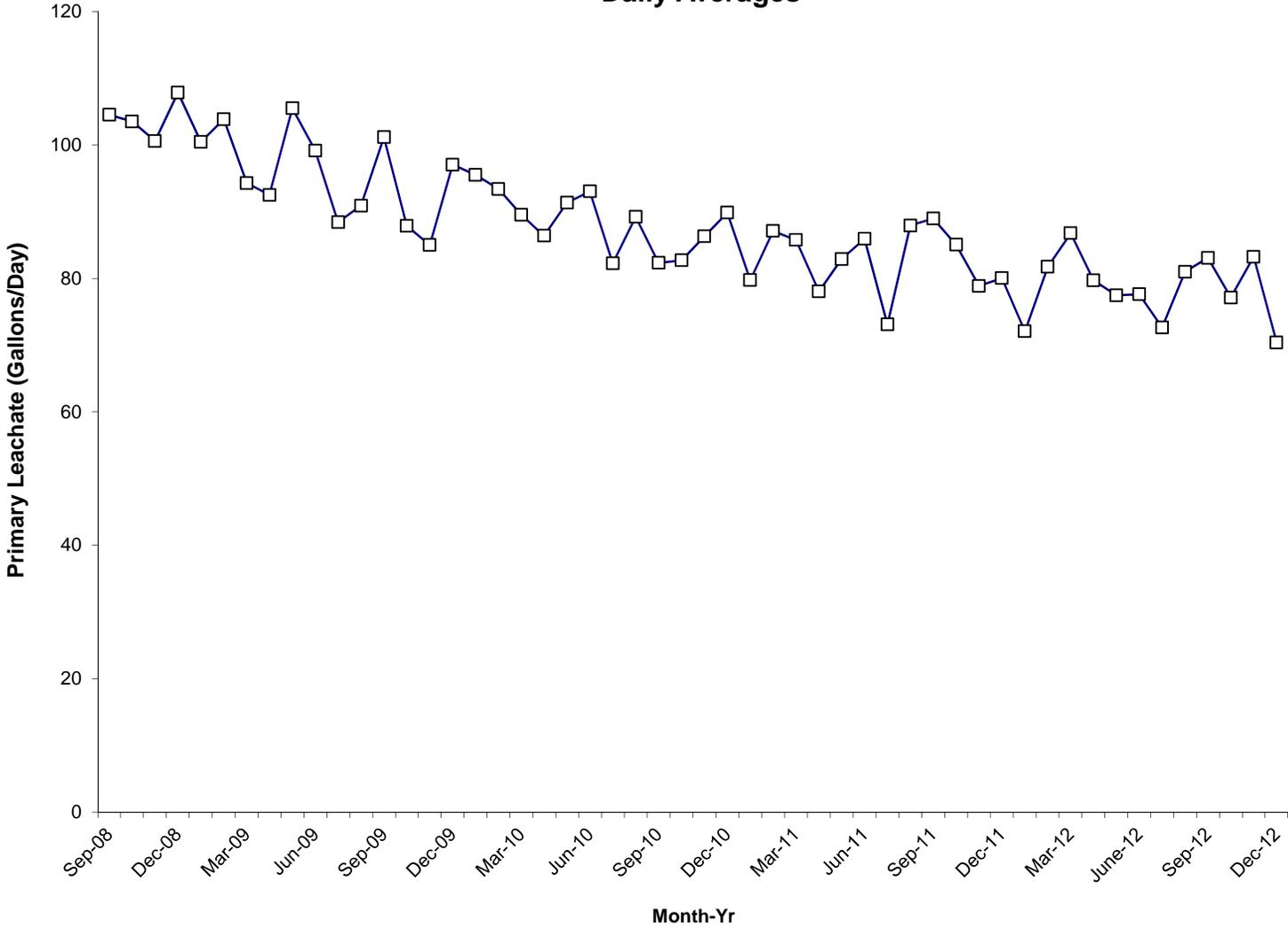
none

Appendix D

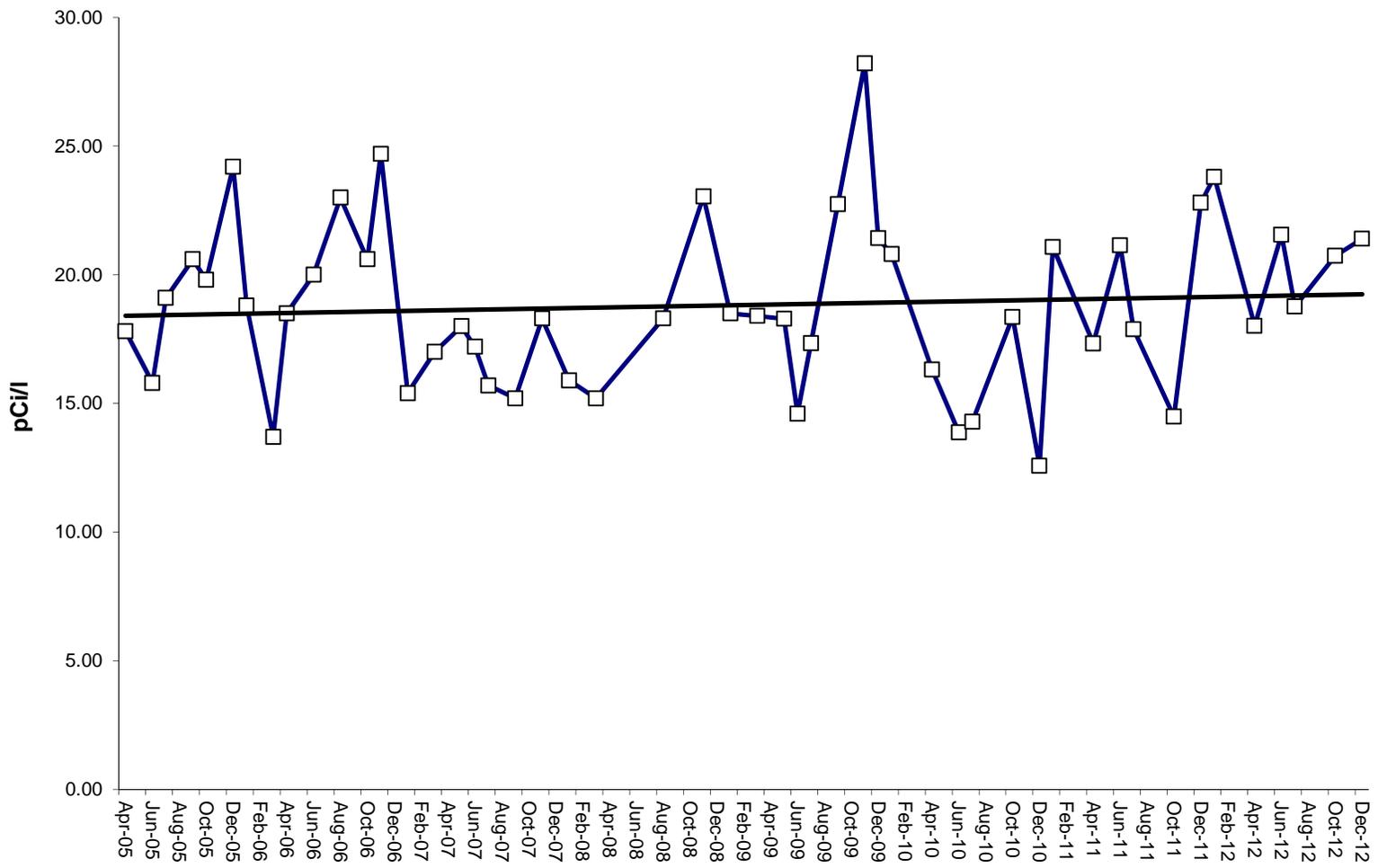
2012 Inspection Report LCRS Data

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PRIMARY LEACHATE FLOW Daily Averages



Total Uranium Levels in the Primary Leachate



Leachate Production Summary Table

Month/Year	Days	Sump Volume Start (gal)	Sump Volume End of Month (gal)	Transferred from sump (gal)	Transferred to Sump from the Burrito (gal)	Purge water transferred to Sump (gal)	East Secondary Total per Month (gal)	West Secondary Total per Month (gal)	Primary Leachate Total Volume per Month (gal)	Primary Leachate (gal/day)	East Secondary (gal/day)	West Secondary (gal/day)	Burrito Flow (gal/day)	Leachate Flow Rate from Primary, Secondary and Burrito	Combined Secondary and Burrito Leak Rate (gal/acre/day)
Jan-06	31	2,967	833	6,946	163	51	175	18	4406	142	5.6	0.6	5.3	154	0.43
Feb-06	28	833	5,292	0	154	53	165	20	4068	145	5.9	0.7	5.5	157	0.46
Mar-06	31	5,292	3,808	6,112	162	0	172	18	4275	138	5.6	0.6	5.2	149	0.43
Apr-06	30	3,808	881	7,658	155	55	175	19	4327	144	5.8	0.6	5.2	156	0.44
May-06	31	881	5,615	0	173	0	165	17	4379	141	5.3	0.5	5.6	153	0.43
Jun-06	30	5,615	2,324	7,792	198	0	171	20	4112	137	5.7	0.7	6.6	150	0.49
Jul-06	31	2,324	6,893	0	211	0	166	21	4171	135	5.4	0.7	6.8	147	0.48
Aug-06	31	6,893	4,318	6,873	217	15	149	20	3898	126	4.8	0.6	7.0	138	0.47
Sep-06	30	4,318	8,714	0	198	0	148	20	4029	134	4.9	0.7	6.6	147	0.46
Oct-06	31	8,714	4,091	8,584	211	0	148	17	3585	116	4.8	0.6	6.8	126	0.46
Nov-06	30	4,091	1,222	7,236	204	86	137	15	3925	131	4.6	0.5	6.8	143	0.45
Dec-06	31	1,222	5,500	0	194	0	146	21	3917	126	4.7	0.7	6.3	138	0.44
Jan-07	31	5,500	1,444	8,268	186	0	135	18	3874	125	4.3	0.6	6.0	136	0.41
Feb-07	28	1,444	5,333	0	144	0	119	19	3607	129	4.3	0.7	5.1	139	0.38
Mar-07	31	5,333	2,176	7,254	147	50	125	17	3759	121	4.0	0.5	4.7	131	0.35
Apr-07	30	2,176	6,571	0	142	279	124	18	3832	128	4.1	0.6	4.7	137	0.36
May-07	31	6,571	2,176	8,453	178	0	122	23	3735	120	3.9	0.8	5.7	131	0.39
Jun-07	30	2,176	6,182	0	207	0	119	16	3664	122	4.0	0.5	6.9	134	0.43
Jul-07	31	6,182	3,167	6,878	244	0	117	18	3483	112	3.8	0.6	7.9	125	0.46
Aug-07	31	3,167	7,250	0	231	0	118	18	3716	120	3.8	0.6	7.5	132	0.45
Sep-07	30	7,250	2,235	8,578	226	47	109	20	3161	105	3.6	0.7	7.5	117	0.45
Oct-07	31	2,235	6,091	0	218	0	109	17	3513	113	3.5	0.5	7.0	124	0.42
Nov-07	30	6,091	2,294	7,484	189	0	107	24	3367	112	3.6	0.8	6.3	123	0.40
Dec-07	31	2,294	6,147	0	208	0	105	16	3524	114	3.4	0.5	6.7	124	0.40
Jan-08	31	6,147	810	9,229	188	0	108	17	3579	115	3.5	0.5	6.1	126	0.38
Feb-08	29	810	4,240	0	148	0	91	14	3177	110	3.1	0.5	5.1	118	0.33
Mar-08	31	4,240	2,145	5,917	131	41	105	14	3531	114	3.4	0.5	4.2	122	0.34
Apr-08	30	2,145	5,868	0	156	0	96	14	3457	115	3.2	0.5	5.2	124	0.37
May-08	31	5,868	8,168	1,547	186	48	102	17	3495	113	3.3	0.5	6.0	123	0.41
Jun-08	30	8,168	3,559	8,288	198	0	99	14	3368	112	3.3	0.5	6.6	123	0.43
Jul-08	31	3,559	7,000	0	240	0	97	16	3088	100	3.1	0.5	7.7	111	0.47
Aug-08	31	7,000	1,778	9,168	246	22	100	15	3563	115	3.2	0.5	7.9	127	0.49
Sep-08	30	1,778	5,317	0	259	0	127	17	3136	105	4.2	0.6	8.6	118	0.56
Oct-08	31	5,317	8,835	0	203	0	87	19	3209	104	2.8	0.6	6.5	113	0.42
Nov-08	30	8,835	5,104	7,056	188	20	87	12	3018	101	2.9	0.4	6.3	110	0.40
Dec-08	31	5,104	8,755	0	198	0	92	18	3343	108	3.0	0.6	6.4	118	0.41
Jan-09	31	8,755	3,417	8,710	157	0	87	14	3114	100	2.8	0.5	5.1	109	0.35
Feb-09	28	3,417	6,542	0	125	0	78	14	2908	104	2.8	0.5	4.5	112	0.32
Mar-09	31	6,542	2,455	7,303	154	32.8	90	16	2923	94	2.9	0.5	5.0	103	0.35
Apr-09	30	2,455	5,493	0	178	0	83	14	2775	93	2.8	0.5	5.9	102	0.38
May-09	31	5,493	2,012	7,037	195	0	77	14	3270	105	2.5	0.5	6.3	115	0.38
Jun-09	30	2,012	5,338	0	220	28	86	17	2975	99	2.9	0.6	7.3	110	0.45
Jul-09	31	5,338	1,275	7,222	268	0	86	14	2741	88	2.8	0.5	8.6	100	0.49
Aug-09	31	1,275	4445	0	250	0	87	15	2818	91	2.8	0.5	8.1	102	0.47
Sep-09	30	4,445	3398	4,486	253	55.7	82	13	3035	101	2.7	0.4	8.4	113	0.48
Oct-09	31	3,398	6,509	0	292	0	83	12	2724	88	2.7	0.4	9.4	100	0.52
Nov-09	30	6,509	1815	7,578	244	0	78	12	2550	85	2.6	0.4	8.1	96	0.46
Dec-09	31	1,815	5,138	0	228	0	74	13	3008	97	2.4	0.4	7.4	107	0.42
Jan-10	31	5,138	2,149	6,250	201	0	81	18	2961	96	2.6	0.6	6.5	105	0.40
Feb-10	28	2,149	5,038	0	155	35.9	72	11	2615	93	2.6	0.4	5.5	102	0.35
Mar-10	31	5,038	8,077	0	169	0	82	13	2775	90	2.6	0.4	5.5	98	0.35
Apr-10	30	8,077	3347	7,587	177	0	77	11	2592	86	2.6	0.4	5.9	95	0.37
May-10	31	3,347	6509	0	236	0	81	13	2832	91	2.6	0.4	7.6	102	0.44
Jun-10	30	6,509	9,651	0	265	0	75	11	2791	93	2.5	0.4	8.8	105	0.49
Jul-10	31	9,651	2755	9,826	294	0	76	10	2550	82	2.5	0.3	9.5	95	0.51
Aug-10	31	2755	5906	0	301	0	73	11	2766	89	2.4	0.4	9.7	102	0.52
Sep-10	30	5906	8740	0	285	0	69	10	2470	82	2.3	0.3	9.5	94	0.51
Oct-10	31	8740	3955	7,685	255	0	69	12	2564	83	2.2	0.4	8.2	94	0.45
Nov-10	30	3955	6888	0	229	38	67	10	2589	86	2.2	0.3	7.6	97	0.43
Dec-10	31	6888	9981	0	228	0	69	10	2786	90	2.2	0.3	7.4	100	0.41
Jan-11	31	9981	3142	9586	202	0	65	8	2472	80	2.1	0.3	6.5	89	0.37
Feb-11	28	3142	5826	0	171	0	63	11	2439	87	2.3	0.4	6.1	96	0.36
Mar-11	31	5826	8744	0	178	0	71	10.5	2659	86	2.3	0.3	5.7	94	0.35
Apr-11	30	8744	3834	7536	198	23.5	56	7	2342	78	1.9	0.2	6.6	87	0.36
May-11	31	3834	6711	0	232	0	66	9.4	2570	83	2.1	0.3	7.5	93	0.41
Jun-11	30	6711	9644	0	274	0	70	11	2578	86	2.3	0.4	9.1	98	0.49
Jul-11	31	9644	2573	9696	287	0	63	9	2266	73	2.0	0.3	9.3	85	0.48
Aug-11	31	2573	5643	0	276	0	60	8	2726	88	1.9	0.3	8.9	99	0.46
Sep-11	30	5643	8621	0	250	0	52	7	2669	89	1.7	0.2	8.3	99	0.43
Oct-11	30	8621	3650	7853	260	0	62	9	2551	85	2.1	0.3	8.7	96	0.46
Nov-11	31	3650	6426	0	271	0	53	7	2445	79	1.7	0.2	8.7	90	0.44
Dec-11	31	6426	9246	0	273	0	57	9	2481	80	1.8	0.3	8.8	91	0.46
Jan-12	31	9246	2707	9069	231	0	57	8	2234	72	1.8	0.3	7.5	82	0.40
Feb-12	29	2707	5380	0	206	40.3	49	7	2371	82	1.7	0.2	7.1	91	0.38
Mar-12	31	5380	8367	0	229	0	57	11	2690	87	1.8	0.4	7.4	96	0.40
April-12	30	8367	1147	9934	267	0	49	7	2391	80	1.6	0.2	8.9	90	0.45
May-12	31	1147	3869	0	263	0	56	1.1	2402	77	1.8	0.0	8.5	88	0.43
June-12	30	3869	6530	0	281	0	51	7	2329	78	1.7	0.0	9.4	89	0.46
Jul-12	31	6530	3248	5887	277	31	45	7	2252	73	1.5	0.0	8.9	83	0.43
Aug-12	31	3248	6096	0	286	0	51	7	2511	81	1.6	0.0	9.2	92	0.45
Sep-12	30	6096	8976	0	335	0	53	7	2492	83	1.8	0.0	11.2	96	0.54
Oct-12	31	8976	2567	9179	330	0	49	7	2391	77	1.6	0.0	10.6	89	0.51
Nov-12	30	2567	5390	0	278	0	48	7	2497	83	1.6	0.0	9.3	94	0.45
Dec-12	31	5390	7953	0	283	47.4	44	6.1	2183	70	1.4	0.2	9.1	81	0.45

Notes:

L12 Probe removed in June 03 which allowed burrito water to be removed that was previously inaccessible.

Sep-04 is when the Train 3 Treatment System Began Treating Leachate prior to hauling to MSD to reduce Uranium concentration to below the MCL of 30 ug/l (approx 20.4 pCi/l)

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Appendix E

2012 Inspection Report Interviews and Contacts

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INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 11:00 am Date: 9/20/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Mark Boehle	Title: Assistant Fire Chief	Organization: Cottleville Fire Dept
Telephone No: 636-447-6655 ext. 8703	Street Address: PO Box 385	
Fax No:	City, State, Zip: Cottleville, MO 63338	
E-Mail Address:		
Summary Of Conversation		
<p>I contacted Mark Boehle of the Cottleville Fire Department and informed him that DOE would be conducting the Long-Term Surveillance and Maintenance annual inspection at the Weldon Spring Site on October 23-25, 2012. I told him that as we discussed the last several years, DOE would be conducting this inspection every year and would use this call in the future to keep in contact with the Cottleville Fire Department and to find out if they have any concerns or issues. We discussed the fact that the administration building was being demolished and I had informed Mark of this well in advance and had discussed certain issues regarding the demolition and fire protection over the past few months. We had also donated 9 fire extinguishers to the Cottleville fire department.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 2:00 pm Date: 9/20/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Jim Hudson	Title: Captain	Organization: St. Charles County Sheriff Office
Telephone No: 636-949-7325		Street Address: City, State, Zip:
Fax No: 636-949-7525		
E-Mail Address:		
Summary Of Conversation		
<p>I contacted Captain Jim Hudson of the St. Charles County Sheriff's Office and informed him that the annual LTS&M inspection would be taking place on October 23-25, 2012. I had talked to Captain Hudson the last nine years and reminded him that we would be contacting the Sheriff's office annually to keep in contact with them and check to see if they had any issues or concerns. Captain Hudson said he did not know of any concerns at this time.</p> <p>We discussed the past vandalism issues and the use of security patrols and signs which have helped curtail the vandalism. I did inform him of the recent vandalism to the wells in the prairie. I also informed him that we were demolishing the administration building at this time and the staff had moved to trailers behind the old admin building.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 9:35 am Date: 9/27/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit: Weldon Spring Site		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: John Vogel	Title: Area Manager	Organization: August A. Busch Memorial Conservation Area, Missouri Dept. of Conservation
Telephone No: 636-300-1953 ext. 4131	Street Address: 2360 Hwy D	
Fax No:	City, State, Zip: St. Charles, MO 63304	
E-Mail Address:		
Summary Of Conversation		
<p>I contacted John Vogel, to notify him of the annual inspection that was going to take place on October 23-25, 2012. DOE had previously sent John a copy of the notification and agenda for the inspection. He said he planned to participate in the inspection of the Southeast Drainage. He said that the only hunting that would be going on would be the possibility of squirrel hunters in the area. John said he did not have any issues or concerns at this time.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 10:00 am Date: 9/28/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Ryan Tilley	Title: Director, Division of Environmental Health and Protection	Organization: St. Charles County
Telephone No: 636-949-7406 Fax No: E-Mail Address: RTilley@sccmo.org	Street Address: 201 North Second Street, Suite 537 City, State, Zip: St. Charles, MO 63301	
Summary Of Conversation		
<p>I contacted Ryan Tilley, Director, Division of Environmental Health and Protection for St. Charles County. I explained that DOE conducts an annual Long-Term Surveillance and Maintenance inspection each year and as part of the inspection we would be contacting certain stakeholders to maintain contact with them and to determine if they had any concerns or issues about the site. Ryan had replaced the former Director Pieter Sheehan, but had attended a previous annual inspection with Pieter. I informed Ryan that our inspection this year would be Oct. 23-25. Also noted that we had sent him a copy of the 30-day notification and copy of the agenda. He said that he planned to attend the first day of the inspection with 1 to 2 additional inspectors from the county. I updated him on the demotion of the administration building and the installation of a new waste water treatment plant. He said he did not have any concerns to discuss at this time.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 12:05 pm Date: 10/9/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Quinn Kellner	Title: Natural Resource Manager Jones-Confluence State Park	Organization: MDNR-Parks
Telephone No: 636-899-1135 Fax No: E-Mail Address: Quinn.kellner@dnr.mo.gov	Street Address: PO Box 67 City, State, Zip: West Alton, MO 63386	
Summary Of Conversation		
<p>I contacted Quinn Kellner, MDNR-Parks and notified him of the LTS&M annual inspection at the Weldon Spring site on October 23-25, 2012. He had been previously notified by copy of the regulator 30-day notification letter and a copy of the agenda. He stated that he would not be attending the inspection this year and that he did not have any concerns. He attended the 2008 inspection and came familiar with the areas along the Katy Trail referenced in the DOE easement with MDNR-Parks. He did not foresee any work in the affected areas in the future at this time. I told Quinn I would send him an email so that he would have my email address and telephone number in case he ever had any concerns or issues.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 1:30 pm Date: 10/9/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Joel Porath	Title: Wildlife Regional Supv.	Organization: August A. Busch Memorial Conservation Area, Missouri Department of Conservation
Telephone No: 636-300-1953 x 4108	Street Address: 2360 Hwy D	
Fax No:	City, State, Zip: St. Charles, MO 63304	
E-Mail Address: joel.porath@mdc.mo.gov		
Summary Of Conversation		
<p>I contacted Joel Porath and notified him of the Weldon Spring Site's LTS&M annual inspection on October 23-25, 2012. I informed him that we would be on MDC property inspecting the Southeast Drainage, Burgermeister Spring, Spring 6303 and MW -4041. I updated him on the activities at the site, including the demolition of the administration building and the replacement of the waste water treatment system. He said John Vogel would probably attend the inspection. I emailed Joel a copy of the agenda.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 9:15 am Date: 10/9/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Kevin Wideman	Title: Sr. Environmental Specialist	Organization: Missouri Department of Transportation
Telephone No: 573-526-4171 Fax No: E-Mail Address:	Address: P.O. Box 270 City, State, Zip: Jefferson City, Mo 65102	
Summary Of Conversation		
<p>I contacted Kevin Wideman of the Missouri Department of Transportation. I discussed with Kevin that DOE conducts an annual Long-Term Surveillance and Maintenance inspection each year (which he attended the past 4 years) and as part of the inspection we would be contacting certain stakeholders to maintain contact with them and to determine if they had any concerns or issues about the site. I informed Mr. Wideman that our inspection this year would be on October 23-25. Kevin had been copied on the 30-day notification and the agenda. He stated that he planned to attend the first day of the inspection and will bring his replacement as he will be retiring on November 30. We discussed that the culvert on Hwy D would not be inspected anymore as it had been removed and the easement between MDOT and DOE had been signed this year.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 12:44 pm Date: 10/10/12
Type: ___ Telephone ___ Visit ___x___ Email		___ Incoming ___x___ Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Tom Blair	Title: Assistant District Engineer	Organization: Missouri Department of Transportation
Telephone No: 314-453-1803 Fax No: E-Mail Address: Thomas.blair@modot.mo.gov		Street Address: 1590 Woodlake Dr. City, State, Zip: Chesterfield, Mo 63017
Summary Of Conversation		
<p>I contacted Tom Blair of the Missouri Department of Transportation by email. I explained to Tom that as I had told him the past 7 years, DOE conducts an annual Long-Term Surveillance and Maintenance inspection each year and as part of the inspection we would be contacting certain stakeholders to maintain contact with them and to determine if they had any concerns or issues about the site. I informed Mr. Blair that our inspection this year would be on October 23-25. I told him that I had been in contact with Kevin Wideman, who would be attending the inspection and that I would also contact Tom Evers. I also stated the following:</p> <p>Regarding our history and relationship with MoDOT, the culvert on Highway D was removed by DOE as the shoulders were widened last August, so that is no longer a concern for DOE and will no longer be inspected. We still have the culvert on Hwy 94 where we have fixed radiological contamination inside the culvert. We cut a part of that off for MoDOT a couple years ago. We were also successful in getting the easement signed with MoDOT on the property that is next to the site. I am attaching a copy for you. The main purpose of this easement is to restrict the drilling of groundwater wells on the MoDOT property. Also to note that MoDOT vacated that property last November and we have been notified that there will be a tower constructed on the property. The representatives contacted us with questions about boring into the ground which we did not have issue with. Anyway, I just wanted to catch up with you and maintain contact. I would appreciate it if you could respond to this email and let me know if there are any issues or concerns. Thanks!</p> <p>Tom responded and thanked me for the thorough update and copied several people in MoDOT.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 3:28 pm Date: 10/10/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Randy Carter	Title: Assistant Principal	Organization: Francis Howell High School
Telephone No: 636-851-4080 x4701 Fax No: E-Mail Address: Philip.carter@fhdschools.org	Street Address: 7001 Hwy 94 South City, State, Zip: St. Charles, MO 63304	
Summary Of Conversation		
<p>I contacted Randy Carter, the assistant principal of Francis Howell High School, by email. Randy has been my contact for the past 6 years, and explained the following in the email:</p> <p>Our annual long-term surveillance and maintenance inspection will be held October 23-25 this year. This is when DOE does a thorough inspection of the site, disposal cell, records, maintenance, groundwater wells, institutional controls, etc., accompanied by the EPA and State regulators. We also use this time to contact our stakeholders to stay in contact and see if you all have any concerns or issues. I have contacted you for the last 6 years by my records. As you know we have demolished our administration building and that was completed this week. We have our interpretive center for anyone who wants to visit it and gather information and your students use the disposal cell and trail by the site for their PE classes. We are here if the school ever has any concerns or issues or any other kind of requests. I have included a link to our website below.</p> <p>http://www.lm.doe.gov/weldon/Sites.aspx</p> <p>Please respond and let me know if you have any questions, issues or concerns. Thanks!</p> <p>Randy responded and stated that he forwarded the email to his staff.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 10:36 am Date: 10/11/12
Type: ___ Telephone ___ Visit <u> x </u> Email		___ Incoming <u> x </u> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Mary Bryan	Title: Real Estate Manager	Organization: MDNR-Parks
Telephone No: 573-751-7987	Street Address: PO Box 176	
Fax No:	City, State, Zip: Jefferson City, MO 65102	
E-Mail Address:		
Summary Of Conversation		
<p>I contacted Mary Bryan MDNR-Parks by email and explained as I discussed with her the last several years, DOE conducts an annual Long-Term Surveillance and Maintenance inspection each year and as part of the inspection we contact certain stakeholders to maintain contact with them, to discuss the ICs and to determine if they had any concerns or issues about the site. I informed Ms. Bryan that our inspection this year would be on October 23-25. I told her that I had also contacted Quinn Kellner and sent him a copy of the agenda. I also stated the following:</p> <p>Regarding our history and relationship with MDNR-Parks, we have the easement that was signed a few years ago. The main purpose of this easement is to restrict the drilling of groundwater wells in certain areas of the Katy Trail. Also, we had a couple of licenses with MDNR-Parks come up for renewal recently which the real estate staff has been coordinating with your office. These were for the DOE discharge pipeline to cross MDNR-Parks property and to monitor the wells which are within the Katy Trail Easement. This discharge pipeline is not currently in use but is still in place as a contingency in case DOE ever needs to use it.</p> <p>Mary responded that there were no concerns at this time and they would certainly let us know if there are any in the future.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 1:30 pm Date: 10/12/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input checked="" type="checkbox"/> Email		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: John Downing/Marsha Keeran	Title: Material Handler/Storage Branch Supervisor	Organization: Army
Telephone No: 636-329-1243 ext2505 and 2504 Fax No: E-Mail Address: john.downingjr@usar.army.mil Marsha.j.keeran@usar.army.mil	Street Address: 7301 Hwy. 94 South City, State, Zip: St. Charles, MO 63304	
Summary Of Conversation		
<p>I contacted John Downing of the 88th Regional Readiness Command at the Weldon Spring Army site by telephone and notified him that DOE would be conducting the annual LTS&M inspection at the Weldon Spring Site on October 23-25, and that we would be on Army property on the morning of the 23th. I told him we would be driving around on the Army site and inspecting our wells. He said the gate was always open during this time as the army is doing a lot of clearing and construction to prepare for building the new Army Reserve Center. Marsha Keeran is on vacation this week. I also sent an email to Marsha Keeran on October 12 to inform her of the inspection and to let us know if they had any questions or concerns.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 10:15 am Date: 10/13/11
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Tom Evers	Title: St. Charles County Area Engineer	Organization: Missouri Department of Transportation
Telephone No: 636-240-5277	Fax No:	Address: 6780 Old Hwy. N
E-Mail Address: Thomas.Evers@modot.mo.gov		City, State, Zip: St. Charles, Mo 63304
Summary Of Conversation		
<p>I contacted Tom Evers of the Missouri Department of Transportation by email and emailed the following information to him:</p> <p>I thought it might be easier to contact you by email rather than phone. I know that Tom Blair had copied you on my email to him, but wanted to also contact you. As we spoke last year, I represent the Department of Energy as a contractor at the Weldon Spring Site and every year we conduct an annual long-term surveillance and maintenance inspection at the Site. This is our tenth inspection. We also use this time to contact our stakeholders and surrounding property owners to maintain contact with them and to determine if they have any concerns or issues about the site. Our inspection this year will be October 23 – 25 and Kevin Wideman and Stowe Johnson of MDOT plan to attend for a portion of it.</p> <p>Regarding our history and relationship with MoDOT, the culvert on Highway D was removed by DOE as the shoulders were widened last August, so that is no longer a concern for DOE and will no longer be inspected. We still have the culvert on Hwy 94 where we have fixed radiological contamination inside the culvert. We cut a part of that off for MoDOT a couple years ago. We were also successful in getting the easement signed with MoDOT on the property that is next to the site. I am attaching a copy for you. The main purpose of this easement is to restrict the drilling of groundwater wells on the MoDOT property. Also to note that MoDOT vacated that property last November and we have been notified that there will be a tower constructed on the property. The representatives contacted us with questions about boring into the ground which we did not have issue with. Anyway, I just wanted to catch up with you and maintain contact. I would appreciate it if you could respond to this email and let me know if there are any issues or concerns. Thanks!</p> <p>His response was as follows: I have no issues or concerns with this site. I do appreciate the update and information and you and the Dept. of Energy have always been great about keeping us up to speed on regular inspections and status.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 10:30 am Date: 10/15/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeier	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Wayne Anthony	Title: Director, Community Development, St. Charles County	Organization: St. Charles Planning and Zoning Department
Telephone No: 636-949-7900 x7221	Street Address: 201 N. Second St.	
Fax No:	City, State, Zip: St. Charles, MO 63301	
E-Mail Address:		
Summary Of Conversation		
<p>I contacted Wayne Anthony of the St. Charles Planning and Zoning Department. Mr. Anthony had been the project's previous contact in this department in regards to the county's master plan. I informed Mr. Anthony that DOE would be conducting their annual LTS&M inspection on October 23-25 and I asked him if there were any planning and zoning activities currently in the one-quarter mile surrounding the chemical plant and quarry properties. Mr. Anthony verified that there were not any such activities that he was aware of.</p>		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 8:30am Date: 10/19/12
Type: ___ Telephone <u> x </u> Visit ___ Other		<input type="checkbox"/> Incoming <input type="checkbox"/> Outgoing
Location of Visit: Administration Building		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: S.M. Stoller Corp.
Individual Contacted:		
Name: Randy Thompson	Title: Site Manager	Organization: S.M. Stoller Corp.
Telephone No: 636-300-2640	Street Address: 7295 Hwy. 94 South	
Fax No: 636-300-2626	City, State, Zip: St. Charles, MO 63304	
E-Mail Address: randy.thompson@lm.doe.gov		
Summary Of Conversation		
<p>I interviewed Randy Thompson, the S.M. Stoller Site Manager at the Weldon Spring Site. The interviewing of the Site Manager is a requirement included in the Annual Inspection Checklist. Most of the interview questions were from the CERCLA Five-year Review Guidance.</p> <ol style="list-style-type: none"> 1. Current Status of the Project: Long-term surveillance and maintenance. 2. Any problems encountered with the remedies? None at this time. 3. Are the remedies functioning as expected? Yes. 4. Any vandalism or trespassing issues? As discussed in past Annual Inspection interviews, public use of the site is frequent. Nighttime access of the disposal cell viewing platform and other undesirable behaviors been reduced in 2012 due a private security firm's seasonal patrol coverage of the site during evening hours. Several monitoring wells at the chemical plant were also discussed have been vandalized in September and are working to see if any modifications are necessary to secure some of the well caps. 5. What is the current on-site presence? Describe staff and activities. There are 9 full-time contractor employees and numerous part-time contractor and subcontractor employees. Activities include long-term surveillance and maintenance operations, project management, data evaluation, operation of the interpretive center, preparation of site-related regulatory documents, support in establishment of institutional controls, support of site IT and telephone issues, landscape management and general administrative support. On-site staff also provide support on other DOE sites such as Mound, Fernald, and Pinellas and to other projects such as Reuse and Property Management. Environmental sampling personnel support sampling activities at other sites in the Legacy Management system. Since April 2011 when Lindenwood University terminated the use-agreement with DOE, SM Stoller continues to operate and maintain the site facilities and associated property that Lindenwood was providing for DOE. 6. Are there any issues associated with the site at this time? None concerning site protectiveness to the environment or the public. Recently completed the demolition of the Administration Building and moved into new trailers/laboratory. Also, the replacement of the current waste water treatment plant with a smaller non-permitted plant and leachate field is close to completion. 7. Any suggestions or comments regarding annual inspection? The inspection continues to provide as useful mechanism to have regulators on-site and evaluate the site including the protectiveness to environment and public. 		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.: MO6210022830
Subject: Annual Inspection		Time: 8:00 am Date: 10/19/12
Type: <input type="checkbox"/> Telephone <input checked="" type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input type="checkbox"/> Outgoing
Location of Visit: Weldon Spring Site		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Randy Thompson/Melissa Lutz	Title: Site/Operation Manager	Organization: SM Stoller, Corp.
Telephone No: 636-300-2640 Fax No: 636-300-2626 E-Mail Address: Melissa.lutz@gjo.doe.gov	Street Address: Weldon Spring Site City, State, Zip:	
<p>I interviewed Randy Thompson, Site Manager, and Melissa Lutz, Operations Manager, who are responsible for sampling programs at the Weldon Spring Site. The interviewing of the data (operations) manager is a requirement included in the Annual Inspection Checklist.</p> <ol style="list-style-type: none"> What is the current status of data validation/reporting? Data validation and review is completed for data through August 2012. The data validation and review is being worked for samples collected during August through September 2011. October sampling has not be reported. How is the data reported? After data validation and review, the qualification flags are applied and the data is then available on the LM/Weldon Spring website the next day. We continue to prepare data validation reports and the quality control data are summarized in the annual environmental report. What is the current status of the data on the website? Are we meeting our 90-day commitment as stated in the LTSM? Yes, we are meeting our 90-day commitment. The data are reviewed and validated through August 2012 and are available online. The September/October 201 data are either not reported or are being validated. Data will be released once the validation process is completed. Are there any trends that show contaminants increasing or decreasing? Trend analysis is performed annually and summarized for the Annual Site Environmental Report. 		

INTERVIEW RECORD		
Site Name: Weldon Spring Site		EPA ID No.:MO6210022830
Subject: Annual Inspection		Time: 10:30 am Date: 10/19/12
Type: <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> Visit <input type="checkbox"/> Other		<input type="checkbox"/> Incoming <input checked="" type="checkbox"/> Outgoing
Location of Visit:		
Contact Made By:		
Name: Terri Uhlmeyer	Title: Compliance Manager	Organization: SM Stoller, Corp.
Individual Contacted:		
Name: Katie	Title:	Organization: Simplex/Grinnell
Telephone No: 888-746-7539	Street Address:	
Fax No:	City, State, Zip:	
E-Mail Address:		
Summary Of Conversation		
<p>I contacted Simplex/Grinnell, the alarm company for the project, and talked to Katie. I verified that they had the correct three people as contacts and that they also had the correct work, home and cell number for each person.</p>		

Appendix F

Data Review and Validation Reports for the Weldon Spring Site

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Data Review and Validation Report

General Information

Report Number (RIN): 12014283
Sample Event: January 4, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 293292
Analysis: Metals, Radiochemistry, and Wet Chemistry
Validator: Steve Donovan
Review Date: March 9, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Chemical Oxygen Demand (COD)	WCH-A-010	EPA 410.4	EPA 410.4
Gross Alpha/Beta	GPC-A-001	SW-846 9310 Mod	SW-846 9310
Mercury	LMM-01	SW-846 3005A	SW-846 7470A
Metals	LMM-02	SW-846 3005	SW-846 6020
Radium-226	GPC-A-018	SW-846 9315 Mod	EPA 903.1 Mod
Radium-228	GPC-A-020	SW-846 9320 Mod	SW-846 9320 Mod
Thorium Isotopes	ASP-A-008	EML A-01-R Mod	EML Th-01-RC Mod
Total Suspended Solids	WCH-A-034	SM 2540D	SM 2540D

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
293292002	LW-DC12	Mercury	J	Matrix spike failure

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received four water samples on January 5, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions. The receiving documentation included a listing of the shipping air waybill number.

Preservation and Holding Times

The sample shipment was received intact with temperature inside the iced cooler of 2 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), Decision Level Concentration (DLC), and Determination Limit (DL). The MDC is a measure of radiochemical method performance and was calculated and reported as specified in *Quality Systems for Analytical Services*. The DLC is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is estimated as 3 times the one-sigma total propagated uncertainty. Results that are greater than the MDC, but less than the DLC are qualified with a “U” flag (not detected). The DL for radiochemical results is the lowest concentration that can be reliably measured, and is defined as 3 times the MDC. Results not previously “U” qualified that are less than the DL are qualified with a “J” flag as estimated values.

The reported MDLs for all metal, organic, and wet chemical analytes; and MDCs for radiochemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for

continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Methods EPA 410.4, Chemical Oxygen Demand

The initial calibrations were performed using four calibration standards on January 24, 2012, resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the intercept of the calibration curve was less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in two verification checks. All calibration checks met the acceptance criteria.

Method SM 2540D

There are no initial or continuing calibration requirements associated with the determination of total suspended solids.

Method SW-846 6020, Metals

Calibrations were performed on January 16–17, 2012, using two calibration standards and a blank. Initial and continuing calibration verification checks were made at the required frequency resulting in eight verification checks. All calibration checks met the acceptance criteria.

Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 7470, Mercury

Calibrations were performed on January 25, 2012, using five calibration standards resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the calibration curve intercept was less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range.

Alpha Spectrometry

Alpha spectrometry calibrations and instrument backgrounds were performed within a month previous to sample analysis. Daily instrument checks met the acceptance criteria. The tracer recoveries met the acceptance criteria of 30 to 110 percent for all samples. The full width at half maximum (FWHM) was reviewed to evaluate the spectral resolution. All internal standard FWHM values were below 100 kiloelectron volts (keV), demonstrating acceptable resolution. All internal standard peaks were within 50 keV of the expected position. The regions of interest (ROIs) for analyte peaks were reviewed. No manual integrations were performed and all ROIs were satisfactory. Results were corrected for tracer impurity.

Gross Alpha/Beta

Plateau voltage determinations were performed in September 2011. Alpha and beta attenuation calibrations were performed on September 30, 2011, covering a range of 0 to 110 milligrams (mg). All standards were counted to a minimum of 10,000 counts. Daily instrument checks

performed on January 17, 2012, met the acceptance criteria. The residual mass was less than 100 mg for all samples.

Radium-226

Emanation cell plateau voltage determinations were performed in April of 2010 and cell efficiency calibrations were performed in September 2011. Daily instrument checks performed on January 13, 2012, met the acceptance criteria.

Radium-228

Plateau voltage determinations were performed in July 2009 and detector efficiency calibrations were performed in September 2011. Background determinations were performed weekly. Daily instrument checks performed on January 20, 2012, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the MDL for all analytes. The radiochemistry method blank results were less than the Decision Level Concentration.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the frequency to verify the instrumental interelement and background correction factors. All ICSAB check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spike results met the recovery and precision criteria for all analytes evaluated with the following exception. The spike recovery for mercury was below the acceptance range. The associated sample result is qualified with a "J" flag as an estimated value.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable laboratory precision. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than three, indicating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Method 6020 serial dilution data are evaluated when the concentration of the undiluted sample is greater than 100 times the practical quantitation limit. All evaluated serial dilution data were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the method detection limit (minimum detectable concentration for radiochemistry) and practical quantitation limit for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on February 2, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Equipment Blank Assessment

An equipment blank was not collected because all sampling was performed with dedicated equipment tubing.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The
-

application compares the new data set with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.

2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

The barium result for location LW-DC12 was identified as a potential outlier. The barium concentration at this location has generally been trending downward since 2005 and this result is acceptable. The data for this RIN are acceptable as qualified.

 2012.03.09
12:20:26 -07'00'

Report Prepared By: _____

Steve Donivan
Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory:

RIN: 12014283

Report Date: 3/9/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Result	Current		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
						Qualifiers		Result	Qualifiers	Lab	Data	Result	Qualifiers	Lab	Data	
WEL01	LW-DC12	N001	01/04/2012	Barium	0.069700			0.975			0.498			23	0	Yes
WEL01	LW-DC12	N001	01/04/2012	Copper	0.019000			0.00712		0.00064	B			23	5	No
WEL01	LW-DC12	N001	01/04/2012	Radium-228	0.304	U		1.26		0.51	J	J		23	9	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12014283 Lab Code: GEN Validator: Steve Donovan Validation Date: 3/9/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 4 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

There are 2 detection limit failures.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12014283 Lab Code: GEN Project: Weldon Spring Validation Date: 3/9/2012

Duplicate: LW-DC99

Sample: LW-DC10

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Uranium	35			1.00	35.3			1.00	0.85		ug/L

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12014283 Lab Code: GEN Date Due: 2/2/2012
 Matrix: Water Site Code: WEL Date Completed: 2/2/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Arsenic	ICP/MS	01/17/2012			OK	OK	OK	OK	OK	95.1	106.0			97.0		116.0
Barium	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	93.8			3.0	104.0	3.7	115.0
Chromium	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	96.9	95.5			105.0		115.0
Copper	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	102.0	97.8		2.0	104.0		123.0
Iron	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	97.9	97.1		2.0		3.5	114.0
Lead	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	98.8	96.0					118.0
Manganese	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	99.7	115.0		1.0	105.0	9.7	116.0
Mercury	CVAA	01/25/2012			OK	OK	OK	OK	OK	104.0	37.8					
Nickel	ICP/MS	01/17/2012			OK	OK	OK	OK	OK	98.5	94.0		1.0	101.0		122.0
Selenium	ICP/MS	01/17/2012			OK	OK	OK	OK	OK	106.0	106.0		2.0	92.0		119.0
Silver	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	97.5	98.2			101.0		111.0
Uranium	ICP/MS	01/17/2012			OK	OK	OK	OK	OK	106.0	113.0		0.0	102.0	5.8	118.0
Zinc	ICP/MS	01/16/2012			OK	OK	OK	OK	OK	98.3	91.0		0.0	106.0		116.0

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12014283 Lab Code: GEN Date Due: 2/2/2012
 Matrix: Water Site Code: WEL Date Completed: 2/2/2012

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
LW-DC12	ALPHA	01/17/2012						0.64
Blank_Spike	ALPHA	01/17/2012				103.00		
LW-DC12	ALPHA	01/17/2012					75.0	
Blank	ALPHA	01/17/2012	-0.2760	U				
LW-DC12	BETA	01/17/2012						0.12
Blank_Spike	BETA	01/17/2012				104.00		
LW-DC12	BETA	01/17/2012					108.0	
Blank	BETA	01/17/2012	1.1000	U				
LW-DC12	Radium-226	01/13/2012						1.34
Blank_Spike	Radium-226	01/13/2012				77.70		
LW-DC12	Radium-226	01/13/2012					75.2	
Blank	Radium-226	01/13/2012	0.6020	U				
LW-DC12	Radium-228	01/20/2012			103.0			
LW-DC12	Radium-228	01/20/2012			94.0			1.29
Blank_Spike	Radium-228	01/20/2012			99.0	83.60		
LW-DC12	Radium-228	01/20/2012			104.0		92.2	
Blank	Radium-228	01/20/2012	0.7480	U	95.0			
LW-DC12	Thorium-228	01/18/2012			73.0			
LW-DC12	Thorium-228	01/18/2012			70.0			
Blank	Thorium-228	01/18/2012	-0.0040	U	65.0			
LW-DC12	Thorium-228	01/27/2012			61.0			0.53
Blank_Spike	Thorium-230	01/18/2012				94.40		
LW-DC12	Thorium-230	01/18/2012					97.0	
Blank	Thorium-230	01/18/2012	-0.0180	U				
LW-DC12	Thorium-230	01/27/2012						2.40
LW-DC12	Thorium-232	01/18/2012						
Blank	Thorium-232	01/18/2012	-0.0080	U				
LW-DC12	Thorium-232	01/27/2012						1.55

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12014283 **Lab Code:** GEN **Date Due:** 2/2/2012
Matrix: Water **Site Code:** WEL **Date Completed:** 2/2/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Chemical Oxygen Demand	01/24/2012	0.470	0.9999	OK	OK	OK	OK	OK	102.00	106.0		5.00	
Total Suspended Solids	01/09/2012							OK	100.00				



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

Data Review and Validation Report

General Information

Report Number (RIN): 12014334
Sample Event: February 6–13, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 295927, 295938, 295943
Analysis: Metals and Wet Chemistry
Validator: Steve Donovan
Review Date: June 6, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3005A	SW-846 6010B
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3005A	SW-846 6020

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
295938003	MW-1017	Uranium	U	Less than 5 times the calibration blank

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 58 water samples on February 14, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 2 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL. The reported MDLs for all analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed using seven calibration standards on January 5, 2012. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in 15 verification checks. All calibration check results were within the acceptance criteria. Reporting limit verification checks were made

to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range.

Method SW-846 6010B, Iron

Calibrations were performed on February 27, 2012, using a two point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in 11 verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The reporting limit check result met the acceptance criteria.

Method SW-846 6020, Uranium

Calibrations were performed on February 22, 24, and 27, 2012, using a two point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in 11 verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. MS/MSD pairs could not be analyzed for organics because of the limited sample volume available. The spikes met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The results for all replicates met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all analytes.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for sulfate data. All analyte peak integrations were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on March 14, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

No values from this sampling event were identified as potential outliers. The data for this RIN are acceptable as qualified.

Sampling Protocol

Sampling at all monitoring wells met the Category I or II low-flow sampling criteria and results were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed in Table 3 were qualified with a "Q" flag in the database indicating the data are considered qualitative because of the sampling protocol (Category II).

Table 3. Category II Wells

Well	
MW-1008	MW-1046

MW-1009	MW-1047
MW-1015	MW-1051
MW-1028	MW-1052
MW-1031	

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the practical quantitation limit (PQL) should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. Duplicate samples were collected from locations MW-1013 and MW-1021. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells.



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Report Prepared By: _____

Steve Donivan
Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12014334 Lab Code: GEN Validator: Steve Donovan Validation Date: 6/6/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 58 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There were 4 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12014334 Lab Code: GEN Project: Weldon Spring Validation Date: 6/6/2012

Duplicate: MW-1113

Sample: MW-1013

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Iron	4110			1.00	4220			1.00	2.64		ug/L
Sulfate	69.8			10.00	70.0			10.00	0.29		mg/L
Uranium	403			5.00	359			5.00	11.55		ug/L

Duplicate: MW-1121

Sample: MW-1021

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Iron	16200			1.00	16600			1.00	2.44		ug/L
Sulfate	0.549	J		1.00	0.580	J		1.00	5.49		mg/L
Uranium	0.067	U		1.00	0.067	U		1.00			ug/L

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12014334 Lab Code: GEN Date Due: 3/13/2012
 Matrix: Water Site Code: WEL Date Completed: 3/13/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Iron	ICP/ES	02/27/2012			OK	OK	OK	OK	104.0	98.4		3.0	97.0	1.0	109.0	
Iron	ICP/ES	02/27/2012							104.0	102.0		2.0	97.0	1.9		
Uranium	ICP/MS	02/24/2012			OK	OK	OK	OK	109.0	106.0			108.0	0.9	130.0	
Uranium	ICP/MS	02/24/2012							111.0				105.0		126.0	
Uranium	ICP/MS	02/27/2012			OK	OK	OK	OK				4.0	103.0		124.0	

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12014334 Lab Code: GEN Date Due: 3/13/2012
 Matrix: Water Site Code: WEL Date Completed: 3/13/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R ²	ICV	CCV	ICB	CCB						
Sulfate	02/17/2012	0.000	1.0000	OK	OK	OK	OK	98.90					
Sulfate	02/20/2012			OK	OK	OK	OK		103.0		0		
Sulfate	02/20/2012								102.0		0		
Sulfate	02/22/2012			OK	OK	OK	OK	94.40	92.6		3.00		



Data Review and Validation Report

General Information

Report Number (RIN): 12024360
Sample Event: February 13–15, 2012
Site(s): Weldon Spring
Laboratory: TestAmerica, Denver, Colorado
Work Order No.: 280-25765
Analysis: Metals, Organics, and Wet Chemistry
Validator: Steve Donovan
Review Date: June 6, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data,” GT-9(P). The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3010A	SW-846 6010B
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3010A	SW-846 6020
Volatiles	LMV-06	SW-846 5030B	SW-846 8260B

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-25765-1	MW-3034	All field measurements	J	Calibration check not performed
280-25765-2	MW-3030	All field measurements	J	Calibration check not performed
280-25765-3	MW-3040	All field measurements	J	Calibration check not performed
280-25765-4	MW-4026	All field measurements	J	Calibration check not performed
280-25765-5	MW-4040	All field measurements	J	Calibration check not performed
280-25765-6	MW-4043	Dissolved oxygen	J	Calibration check failure
280-25765-7	SP-6201	All field measurements	J	Calibration check not performed
280-25765-8	SP-6301	Dissolved oxygen	J	Calibration check failure
280-25765-11	MW-1002	Dissolved oxygen	J	Calibration check failure
280-25765-14	MW-1004	Dissolved oxygen	J	Calibration check failure
280-25765-14	MW-1004	1,3,5-Trinitrobenzene	J	Calibration drift greater than 20%
280-25765-16	MW-1005	Dissolved oxygen	J	Calibration check failure
280-25765-18	MW-1006	Dissolved oxygen	J	Calibration check failure
280-25765-18	MW-1006	1,3,5-Trinitrobenzene	J	Poor analyte peak resolution
280-25765-19	MW-1012	Dissolved oxygen	J	Calibration check failure
280-25765-22	MW-1027	Dissolved oxygen	J	Calibration check failure
280-25765-22	MW-1027	1,3,5-Trinitrobenzene	J	Poor analyte peak resolution
280-25765-23	MW-1030	Dissolved oxygen	J	Calibration check failure
280-25765-25	MW-1032	Dissolved oxygen	J	Calibration check failure
280-25765-28	MW-1045	Dissolved oxygen	J	Calibration check failure
280-25765-30	MW-1049	Dissolved oxygen	J	Calibration check failure
280-25765-30	MW-1049	Uranium	U	Less than 5 times the calibration blank
280-25765-32	MW-1004 Duplicate	1,3,5-Trinitrobenzene	J	Poor analyte peak resolution

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 32 water samples on February 17, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced coolers at 1.3 and 2.3 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

The reported MDLs for all metal, organic, and wet chemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed using six calibration standards on February 27, 2012. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration check results were within the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the practical quantitation limit and all results were acceptable.

Method EPA 353.2, Nitrate + Nitrite as N

Calibrations were performed on February 22, 2012, using six calibration standards. The absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the practical quantitation limit and all results were acceptable.

Method SW-846 6010B, Iron

Calibrations were performed on February 22, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in 10 verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The reporting limit check result met the acceptance criteria.

Method SW-846 6020, Uranium

Calibrations were performed on February 23, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in seven verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8260B, Volatiles

The volatile compounds requested were 1,2-dichloroethane, cis-1,2-dichloroethene, tetrachloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride. Initial calibration was performed February 15, 2012, using seven calibration standards. The average response factor and associated relative standard deviation met the acceptance criteria for all analytes. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on February 29, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent with the exception of 1,3,5-trinitrotoluene. Sample 1,3-5 trinitrotoluene results that are greater than the MDL are qualified with a "J" flag as estimated values.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Metals and Wet Chemistry

All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

Organics

The method blank results were below the MDL for all target compounds.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Nitroaromatics and Volatiles Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries were within the acceptance ranges. The recovery of the internal standards added to the samples is monitored to measure the purging efficiency. Internal standard recoveries associated with target compounds were stable and within acceptance ranges.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spikes met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The results for all replicates met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the practical quantitation limit for method 6010 or greater than 100 times the practical quantitation limit for method 6020. All evaluated serial dilution data were acceptable.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all analytes.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics, sulfate, and volatiles data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results associated with analyte peaks that do not meet this criteria are qualified with a "J" flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each reported volatile and nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on March 12, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

The pH value measured at location SP-6201 was identified as an anomalous value. The field data from this were qualified with a "J" flag as estimated values because there was no daily calibration check performed.

Sampling Protocol

All monitoring wells were purged and sampled using the low-flow sampling method, meeting the Category I, II, or III low-flow sampling criteria, with the exception of well MW-1005 which was sampled with a bailer. Sample results from wells meeting the low-flow criteria are qualified with an “F” flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed in Table 3 are further qualified with a “Q” flag indicating the data are considered qualitative because they are Category II or III wells.

Table 3. Category II or III Wells

Category II	Category III
MW-3024	MW-1027
MW-3040	MW-1030
MW-4040	
MW-4043	
MW-1002	
MW-1012	
MW-1032	

Trip Blank

A trip blank was prepared and analyzed for volatile organics to document contamination attributable to shipping and field handling procedures. There were no target analytes detected in the trip blank.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. Duplicate samples were collected from locations MW-1004 and SP-6301. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells.

There was no daily calibration check performed on February 13, 2012. The associated field measurement results are qualified with a “J” flag as estimated values.

The dissolved oxygen daily calibration check did not meet the acceptance criteria on February 14 and 15, 2012. The associated dissolved oxygen results are qualified with a “J” flag as estimated values.



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Report Prepared By: _____

Steve Donivan
Laboratory Coordinator

Data Validation Outliers Report - Field Parameters Only

Comparison: All Historical Data

Laboratory: Field Measurements

RIN: 12024360

Report Date: 6/6/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab	Data	Result	Qualifiers Lab	Data	Result	Qualifiers Lab	Data	N	N Below Detect	
WEL01	MW-3024	N001	02/13/2012	Dissolved Oxygen	1.32			21.48		FQ	1.87		FQ	45	0	No
WEL01	MW-3040	N001	02/13/2012	Turbidity	0.45			13.7		FQ	0.47		FQ	36	0	No
WEL01	MW-4036	N001	02/13/2012	Dissolved Oxygen	0.5			6.5			0.61		F	40	0	No
WEL01	MW-4043	N001	02/15/2012	Oxidation Reduction Potential	84.5			269.8		FQ	87.2		FQ	16	0	No
WEL01	SP-6201	N001	02/13/2012	pH	9.27			8.02			7.07			15	0	Yes
WEL01	SP-6201	N001	02/13/2012	Specific Conductance	266			366			288			15	0	No
WEL02	MW-1005	N001	02/14/2012	Turbidity	1.97			1000	>	FQ	10		FQ	31	0	No
WEL02	MW-1006	N001	02/14/2012	Dissolved Oxygen	0.78			26.5		F	0.87			44	0	No
WEL02	MW-1030	N001	02/14/2012	Dissolved Oxygen	0.55			10.78			0.99			34	0	No
WEL02	MW-1049	N001	02/14/2012	Dissolved Oxygen	0.12			26.79		FQ	0.19		F	47	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12024360 Lab Code: STD Validator: Steve Donovan Validation Date: 6/6/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 32 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There was 1 trip/equipment blank evaluated.

There were 3 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12024360 Lab Code: STD Project: Weldon Spring Validation Date: 6/6/2012

Duplicate: MW-1104

Sample: MW-1004

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	0.030	J		1	0.027	J		1			ug/L
1,3-Dinitrobenzene	0.014	U		1	0.014	U		1			ug/L
2,4,6-Trinitrotoluene	0.022	U		1	0.021	U		1			ug/L
2,4-Dinitrotoluene	0.051	J		1	0.044	J		1			ug/L
2,6-Dinitrotoluene	0.069	J		1	0.068	J		1			ug/L
Iron	270			1	260			1	3.77		ug/L
Nitrobenzene	0.033	U		1	0.032	U		1			ug/L
Sulfate	95			5	95			5	0		mg/L
Uranium	800			1	750			1	6.45		ug/L

Duplicate: SP-6311

Sample: SP-6301

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,2-Dichloroethane	0.13	U		1	0.13	U		1			ug/L
cis-1,2-Dichloroethene	0.15	U		1	0.15	U		1			ug/L
Nitrate+Nitrite as N	1.5			1	1.5			1	0		mg/L
Tetrachloroethene	0.20	U		1	0.20	U		1			ug/L
trans-1,2-Dichloroethene	0.15	U		1	0.15	U		1			ug/L
Trichloroethene	0.16	U		1	0.16	U		1			ug/L
Vinyl Chloride	0.10	U		1	0.10	U		1			ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12024360

Project: Weldon Spring

Lab Code: STD

Validation Date: 6/7/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: All surrogate recoveries were within the laboratory acceptance limits.

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12024360 Lab Code: STD Date Due: 3/16/2012
 Matrix: Water Site Code: WEL Date Completed: 3/14/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Nitrate+Nitrite as N	02/22/2012	0.000	0.9998	OK	OK	OK	OK	OK	103.00	104.0	105.0	0	
Sulfate	02/27/2012	0.000	1.0000	OK	OK	OK	OK	OK	98.00	99.0	99.0	0	
Sulfate	02/28/2012			OK	OK	OK	OK	OK	99.00				
Sulfate	02/28/2012								99.00			0	

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12024360 Lab Code: STD Date Due: 3/16/2012
 Matrix: Water Site Code: WEL Date Completed: 3/14/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Iron	ICP/ES	02/22/2012			OK	OK	OK	OK	99.0	93.0	96.0	3.0	94.0		114.0	
Uranium	ICP/MS	02/23/2012						OK	103.0	117.0		1.0	96.0	2.0	104.0	
Uranium	ICP/MS	02/23/2012			OK	OK	OK			96.0						



Data Review and Validation Report

General Information

Report Number (RIN): 12034445
Sample Event: April 2–25, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 303397, 303401
Analysis: Metals, Radiochemistry, and Wet Chemistry
Validator: Steve Donovan
Review Date: June 27, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Chemical Oxygen Demand (COD)	WCH-A-010	EPA 410.4	EPA 410.4
Gross Alpha/Beta	GPC-A-001	SW-846 9310 Mod	SW-846 9310
Mercury	LMM-01	SW-846 3005A	SW-846 7470A
Metals	LMM-02	SW-846 3005	SW-846 6020
Radium-226	GPC-A-018	SW-846 9315 Mod	EPA 903.1 Mod
Radium-228	GPC-A-020	SW-846 9320 Mod	SW-846 9320 Mod
Thorium Isotopes	ASP-A-008	EML A-01-R Mod	EML Th-01-RC Mod
Total Suspended Solids	WCH-A-034	SM 2540D	SM 2540D

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
303397002	LW-DC12	Chromium	U	Less than 5 times the method blank
303397002	LW-DC12	Gross alpha	J	Less than the determination limit
303397002	LW-DC12	Mercury	J	Matrix spike failure
303397002	LW-DC12	Radium-226	J	Less than the determination limit
303397002	LW-DC12	Radium-228	J	Less than the determination limit
303397002	LW-DC12	Thorium-230	J	Less than the determination limit
303397020	LW-DC12 duplicate	Chromium	U	Less than 5 times the method blank
303397020	LW-DC12 duplicate	Gross alpha	J	Less than the determination limit
303397020	LW-DC12 duplicate	Mercury	J	Matrix spike failure
303397020	LW-DC12 duplicate	Radium-226	U	Less than the decision level
303397020	LW-DC12 duplicate	Thorium-230	U	Less than the decision level

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 26 water samples on April 27, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions. The receiving documentation included a listing of the shipping air waybill number.

Preservation and Holding Times

The sample shipment was received intact with temperature inside the iced cooler of 3 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), Decision Level Concentration (DLC), and Determination Limit (DL). The MDC is a measure of radiochemical method performance and was calculated and reported as specified in *Quality Systems for Analytical Services*. The DLC is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is estimated as 3 times the one-sigma total propagated uncertainty. Results that are greater than the MDC, but less than the DLC are qualified with a “U” flag (not detected). The DL for radiochemical results is the lowest concentration that can be reliably measured, and is defined as 3 times the MDC. Results not previously “U” qualified that are less than the DL are qualified with a “J” flag as estimated values.

The reported MDLs for all metal, organic, and wet chemical analytes; and MDCs for radiochemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Methods EPA 410.4, Chemical Oxygen Demand

The initial calibrations were performed using four calibration standards on May 8, 2012, resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the intercept of the calibration curve was less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in two verification checks. All calibration checks met the acceptance criteria.

Method SM 2540D

There are no initial or continuing calibration requirements associated with the determination of total suspended solids.

Method SW-846 6020, Metals

Calibrations were performed on May 3–8, 2012, using two calibration standards and a blank. Initial and continuing calibration verification checks were made at the required frequency resulting in five verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 7470, Mercury

Calibrations were performed on May 9, 2012, using five calibration standards resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the calibration curve intercept was less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in seven verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range.

Alpha Spectrometry

Alpha spectrometry calibrations and instrument backgrounds were performed within a month previous to sample analysis. Daily instrument checks met the acceptance criteria. The tracer recoveries met the acceptance criteria of 30 to 110 percent for all samples. The full width at half maximum (FWHM) was reviewed to evaluate the spectral resolution. All internal standard

FWHM values were below 100 kiloelectron volts (keV), demonstrating acceptable resolution. All internal standard peaks were within 50 keV of the expected position. The regions of interest (ROIs) for analyte peaks were reviewed. No manual integrations were performed and all ROIs were satisfactory. Results were corrected for tracer impurity.

Gross Alpha/Beta

Plateau voltage determinations were performed in September 2011. Alpha and beta attenuation calibrations were performed in September 2011, covering a range of 0 to 119 milligrams (mg). All standards were counted to a minimum of 10,000 counts. Daily instrument checks performed on May 10, 2012, met the acceptance criteria. The residual mass was less than 100 mg for all samples.

Radium-226

Emanation cell plateau voltage determinations were performed in November 2011 and cell efficiency calibrations were performed in November 2011. Daily instrument checks performed on May 7, 2012, met the acceptance criteria.

Radium-228

Plateau voltage determinations were performed in September 2011 and detector efficiency calibrations were performed in September 2011. Background determinations were performed weekly. Daily instrument checks performed on May 2, 2012, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the MDL for all analytes. The radiochemistry method blank results were less than the Decision Level Concentration.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the frequency to verify the instrumental interelement and background correction factors. All ICSAB check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spike results met the recovery and precision criteria for all analytes evaluated with the following exception. The spike recovery for mercury was below the acceptance range. The associated sample results are qualified with a "J" flag as estimated values.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than

5 times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable laboratory precision. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than three, indicating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Method 6020 serial dilution data are evaluated when the concentration of the undiluted sample is greater than 100 times the practical quantitation limit. All evaluated serial dilution data were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the method detection limit (minimum detectable concentration for radiochemistry) and practical quantitation limit for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on May 12, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Equipment Blank Assessment

An equipment blank was not collected because all sampling was performed with dedicated equipment tubing.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should

only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

None of the analytical results were identified as outliers and the data for this RIN are acceptable as qualified.

Sampling Protocol

All monitoring wells were purged and sampled using the low-flow sampling method, meeting the Category I or II low-flow sampling criteria. Sample results from wells meeting the low-flow criteria are qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed in Table 3 are further qualified with a "Q" flag indicating the data are considered qualitative because they are Category II wells.

Table 3. Category II Wells

Category II	
MW-3006	MW-3024
MW-3040	MW-4007
MW-4040	MW-4043
MWD-2	MWS-2

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than

the PQL. A duplicate sample was collected from location LW-DC12. The duplicate results met the criteria, demonstrating acceptable overall precision.



Digitally signed by Stephen E. Donivan
DN: c=us, o=u.s. government,
ou=department of energy, ou=headquarters,
ou=people, cn=Stephen E. Donivan
Date: 2012.06.27 14:20:29 -06'00'

Report Prepared By: _____

Steve Donivan
Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory:

RIN: 12034445

Report Date: 6/27/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers <i>Lab Data</i>	Result	Qualifiers <i>Lab Data</i>	Result	Qualifiers <i>Lab Data</i>	N	N Below Detect			
WEL01	LW-DC12	N001	04/25/2012	Chemical Oxygen Demand	13.6		76		15		24	0	No		
WEL01	LW-DC12	N001	04/25/2012	Manganese	0.103000		1.26		0.222	N	26	0	No		
WEL01	LW-DC12	N001	04/25/2012	Nickel	0.004680	B	0.0108		0.0048	B	24	5	No		

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12034445 Lab Code: GEN Validator: Steve Donovan Validation Date: 6/27/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 26 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

There are 0 detection limit failures.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12034445 Lab Code: GEN Project: Weldon Spring Validation Date: 6/27/2012

Duplicate: LW-DC99

Sample: LW-DC12

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
ALPHA	2.59		1.46	1.00	2.98		1.70	1.00		0.3	pCi/L
Arsenic	1.70	U		1.00	1.70	U		1.00			ug/L
Barium	350			1.00	356			1.00	1.70		ug/L
BETA	6.02		1.64	1.00	7.31		1.85	1.00		1.0	pCi/L
Chemical Oxygen Demand	13.6			1.00	27.3			1.00	66.99		mg/L
Chromium	2.11	B		1.00	2.58	B		1.00			ug/L
Copper	6.94			1.00	6.49			1.00	6.70		ug/L
Iron	321			1.00	325			1.00	1.24		ug/L
Lead	0.500	U		1.00	0.500	U		1.00			ug/L
Manganese	103			1.00	103			1.00	0		ug/L
Mercury	0.067	UN		1.00	0.067	UN		1.00			ug/L
Nickel	4.68	B		1.00	4.74	B		1.00	1.27		ug/L
Radium-226	0.772		0.373	1.00	0.442		0.304	1.00		1.3	pCi/L
Radium-228	0.769		0.435	1.00	0.342	U	0.446	1.00		1.3	pCi/L
Selenium	3.34	B		1.00	2.91	B		1.00			ug/L
Silver	0.200	U		1.00	0.200	U		1.00			ug/L
Thorium-228	0.102	U	0.175	1.00	-0.0197	U	0.0835	1.00		1.2	pCi/L
Thorium-230	0.423		0.187	1.00	0.214		0.148	1.00		1.7	pCi/L
Thorium-232	-0.0378	U	0.0688	1.00	-0.024	U	0.0676	1.00		0.3	pCi/L
Total Suspended Solids	1.14	U		1.00	1.03	U		1.00			mg/L
Uranium	3.13			1.00	3.21			1.00	2.52		ug/L
Zinc	12.8	B		1.00	13.3	B		1.00			ug/L

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12034445 Lab Code: GEN Date Due: 5/11/2012
 Matrix: Water Site Code: WEL Date Completed: 5/11/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Arsenic	ICP/MS	05/08/2012			OK	OK	OK	OK	OK	102.0	105.0			98.0		87.0
Barium	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	96.0	121.0		2.0	97.0	5.0	102.0
Chromium	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	101.0	95.3			91.0		99.0
Copper	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	98.4	89.6		6.0	96.0	6.0	102.0
Iron	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	95.1	91.5		2.0	99.0		96.0
Lead	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	101.0	98.7			96.0		104.0
Manganese	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	97.2	96.0		3.0	98.0	3.0	99.0
Mercury	CVAA	05/09/2012			OK	OK	OK	OK	OK	116.0	21.8					107.0
Nickel	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	97.2	89.5		5.0	94.0	1.0	107.0
Selenium	ICP/MS	05/08/2012			OK	OK	OK	OK	OK	104.0	101.0			93.0		93.0
Silver	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	98.1	96.6			97.0		101.0
Uranium	ICP/MS	05/02/2012			OK	OK	OK	OK	OK	109.0	111.0		1.0	103.0	1.0	103.0
Uranium	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	101.0	102.0		3.0	103.0	6.0	117.0
Zinc	ICP/MS	05/04/2012			OK	OK	OK	OK	OK	100.0	94.9		3.0	96.0		102.0

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12034445 **Lab Code:** GEN **Date Due:** 5/11/2012
Matrix: Water **Site Code:** WEL **Date Completed:** 5/11/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R ²	ICV	CCV	ICB	CCB						
Chemical Oxygen Demand	05/08/2012							OK	98.50	102.0		5.00	
Total Suspended Solids	05/02/2012							OK	101.00				

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12034445 **Lab Code:** GEN **Date Due:** 5/11/2012
Matrix: Water **Site Code:** WEL **Date Completed:** 5/11/2012

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
LW-DC12	ALPHA	05/10/2012						1.15
Blank_Spike	ALPHA	05/10/2012				98.10		
LW-DC12	ALPHA	05/10/2012					114.0	
Blank	ALPHA	05/10/2012	0.0500	U				
LW-DC12	BETA	05/10/2012						0.66
Blank_Spike	BETA	05/10/2012				102.00		
LW-DC12	BETA	05/10/2012					111.0	
Blank	BETA	05/10/2012	0.6690	U				
LW-DC12	Radium-226	05/07/2012						1.62
Blank_Spike	Radium-226	05/07/2012				102.00		
LW-DC12	Radium-226	05/07/2012					90.9	
Blank	Radium-226	05/07/2012	0.2020	U				
LW-DC12	Radium-228	05/02/2012			91.0			
LW-DC99	Radium-228	05/02/2012			89.0			
LW-DC12	Radium-228	05/02/2012			92.0			0.47
Blank_Spike	Radium-228	05/02/2012			102.0	102.00		
LW-DC12	Radium-228	05/02/2012			98.0		107.0	
Blank	Radium-228	05/02/2012	0.1520	U	90.0			
LW-DC12	Thorium-228	05/02/2012			86.0			
LW-DC99	Thorium-228	05/02/2012			81.0			
LW-DC12	Thorium-228	05/02/2012			76.0			0.02
LW-DC12	Thorium-228	05/02/2012			84.0			
Blank	Thorium-228	05/02/2012	-0.0266	U	57.0			
LW-DC12	Thorium-230	05/02/2012						0.73
Blank_Spike	Thorium-230	05/02/2012				105.00		
LW-DC12	Thorium-230	05/02/2012					95.6	
Blank	Thorium-230	05/02/2012	0.0460	U				
LW-DC12	Thorium-232	05/02/2012						1.68
LW-DC12	Thorium-232	05/02/2012						
Blank	Thorium-232	05/02/2012	-0.0080	U				

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Data Review and Validation Report

General Information

Report Number (RIN): 12044511
Sample Event: April 30-May 9, 2012
Site(s): Weldon Spring
Laboratory: TestAmerica, Denver, Colorado
Work Order No.: 280-28734
Analysis: Metals, Organics, and Wet Chemistry
Validator: Gretchen Baer
Review Date: August 3, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data,” GT-9(P). The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3010A	SW-846 6010B
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3010A	SW-846 6020

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-28734-1	MW-2012	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-28734-4	MW-2050	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-28734-5	MW-2052	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-28734-7	MW-2054	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-28734-9	MW-2052 Duplicate	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-28734-12	MW-1006	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-28734-15	MW-1008	Iron	J	Reporting limit verification failure
280-28734-21	MW-1014	Iron	J	Reporting limit verification failure
280-28734-23	MW-1015	Iron	J	Reporting limit verification failure
280-28734-25	MW-1016	Iron	J	Reporting limit verification failure
280-28734-28	MW-1028	Iron	J	Reporting limit verification failure
280-28734-30	MW-1031	Iron	J	Reporting limit verification failure
280-28734-32	MW-1032	Iron	J	Reporting limit verification failure
280-28734-35	MW-1045	Iron	J	Reporting limit verification failure
280-28734-37	MW-1046	Iron	J	Reporting limit verification failure
280-28734-39	MW-1047	Iron	J	Reporting limit verification failure
280-28734-43	MW-1049	1,3-Dinitrobenzene	J	Matrix spike failure
280-28734-43	MW-1049	2,4-Dinitrotoluene	J	Matrix spike failure
280-28734-43	MW-1049	2,6-Dinitrotoluene	J	Matrix spike failure
280-28734-46	MW-1051	Iron	J	Reporting limit verification failure

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 56 water samples on May 10, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced coolers at 2.4, 2.7, and 3.9 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably

measured, and is defined as 5 times the MDL. The reported MDLs for all analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed using six calibration standards on May 21, 2012. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in nine verification checks. All calibration check results were within the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the PQL and all results were acceptable.

Method SW-846 6010B, Iron

Calibrations were performed on May 16, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL. The reporting limit check result was below the acceptance range. Affected results less than 5 times the PQL are qualified with a "J" flag (estimated).

Method SW-846 6020, Uranium

Calibrations were performed on May 17 and 18, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in seven verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on May 11, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Metals and Wet Chemistry

All method blank and calibration blank results associated with the samples were below the PQLs for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than 5 times the blank concentration.

Organics

The method blank results were below the MDL for all target compounds.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interference and background correction factors. All check sample results met the acceptance criteria.

Nitroaromatics Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries *for undiluted samples* were within the acceptance ranges, with one exception. A recovery for a matrix spike was slightly below criteria; associated sample results are qualified with a “J” flag as estimated because the matrix spike recoveries were also below criteria. The recovery of the internal standards added to the samples is monitored to measure the purging efficiency. Internal standard recoveries associated with target compounds were stable and within acceptance ranges.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration or when the spike was performed on a sample that required dilution. The spike recoveries met the acceptance criteria for all analytes evaluated with the following exception. The MS/MSD recoveries for some nitroaromatics were below the acceptance range. There is no evidence of systematic matrix interference; the sample results associated with the failed spikes results are qualified with a “J” flag as estimated values.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics and sulfate data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results associated with analyte peaks that do not meet this criterion are qualified with a "J" flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each reported nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on May 30, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the

requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

No values from this sampling event were identified as potential outliers. The data for this RIN are acceptable as qualified.

Sampling Protocol

Sample results for all monitoring wells met the Category I, II, or III low-flow sampling criteria and were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells MW-1009, MW-1028, MW-1031, MW-1032, MW-1046, MW-1047, MW-2014, MW-2017, MW-2050, MW-2056, and MW-4039 were further qualified with a "Q" flag in the database, indicating the data are considered qualitative because these are Category II or III wells.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells.

The daily calibration check performed on April 30, 2012 was reported with RIN 12034445.



2012.10.02

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Report Prepared By: _____

Gretchen Baer
Data Validator

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory: TestAmerica Denver

RIN: 12044511

Report Date: 8/3/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data		Result	Qualifiers Lab Data		Result	Qualifiers Lab Data		N	N Below Detect	
WEL01	MW-2054	N001	05/07/2012	1,3-Dinitrobenzene	0.013	U		0.19		F	0.014	J	F	30	20	No
WEL02	MW-1046	N001	05/01/2012	Uranium	0.0014			0.225			0.0016		FQ	51	1	No

Data Validation Outliers Report - Field Parameters Only

Comparison: All Historical Data

Laboratory: Field Measurements

RIN: 12044511

Report Date: 8/3/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data		Result	Qualifiers Lab Data		Result	Qualifiers Lab Data		N	N Below Detect	
WEL01	MW-4039	N001	05/07/2012	Turbidity	5.41			359			5.69		FQ	26	0	No
WEL02	MW-1018	N001	04/30/2012	Dissolved Oxygen	0.16			5.6			0.18		F	35	0	No
WEL02	MW-1018	N001	04/30/2012	Specific Conductance	1222			1208		F	460			58	0	No
WEL02	MW-1044	N001	04/30/2012	Dissolved Oxygen	0.09			3.04		F	0.1		F	26	0	No
WEL02	MW-1049	N001	05/08/2012	Dissolved Oxygen	0.09			26.79		FQ	0.12		FJ	48	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM
General Data Validation Report

RIN: 12044511 Lab Code: STD Validator: Gretchen Baer Validation Date: 8/3/2012
Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics
of Samples: 56 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There were 5 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

Page 1 of 1

RIN: 12044511 Lab Code: STD Project: Weldon Spring Validation Date: 8/3/2012

Duplicate: MW-1113

Sample: MW-1013

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Iron	4000			1	4000			1	0		ug/L
Sulfate	73			5	74			5	1.36		mg/L
Uranium	440			1	420			1	4.65		ug/L

Duplicate: MW-1149

Sample: MW-1049

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	0.017	U		1	0.016	U		1			ug/L
1,3-Dinitrobenzene	0.014	U		1	0.013	U		1			ug/L
2,4,6-Trinitrotoluene	0.022	U		1	0.021	U		1			ug/L
2,4-Dinitrotoluene	0.019	U		1	0.018	U		1			ug/L
2,6-Dinitrotoluene	0.022	U		1	0.021	U		1			ug/L
Iron	47000			1	48000			1	2.11		ug/L
Nitrobenzene	0.033	U		1	0.032	U		1			ug/L
Sulfate	1.5	J		1	1.4	J		1	6.90		mg/L
Uranium	0.050	U		1	0.12			1			ug/L

Duplicate: MW-2152

Sample: MW-2052

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	1.7			2	1.8			2	5.71		ug/L
1,3-Dinitrobenzene	0.060	J		1	0.047	J		1			ug/L
2,4,6-Trinitrotoluene	0.18			1	0.18			1	0		ug/L
2,4-Dinitrotoluene	0.063	J		1	0.050	J		1			ug/L
2,6-Dinitrotoluene	0.14			1	0.15			1	6.90		ug/L
Nitrobenzene	0.033	U		1	0.032	U		1			ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12044511

Project: Weldon Spring

Lab Code: STD

Validation Date: 8/3/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: There were 6 MS/MSD failures.

Surrogate Recovery: There were 2 surrogate failures.

SAMPLE MANAGEMENT SYSTEM

RIN: 12044511 Lab Code: STD

Non-Compliance Report: Surrogate Recovery

Project: Weldon Spring

Validation Date: 8/3/2012

Ticket	Location	Lab Sample ID	Method	Dilution	Surrogate	Recovery	Lower Limit	Upper Limit
KFT 081 MS			8321A		Nitrobenzene-d5	44.0	48.0	130.0
KFT 102	MW-2053	280-28734-6	8321A	100	Nitrobenzene-d5	-74.0	48.0	130.0

SAMPLE MANAGEMENT SYSTEM

Non-Compliance Report: MS/MSD Performance

RIN: 12044511 Lab Code: STD

Project: Weldon Spring

Validation Date: 8/3/2012

MS/MSD	Date Analyzed	Method	Analyte	Recovery MS	Recovery MSD	Lower Limit	Upper Limit	MSD RPD	RPD Limit
KFT 101	05/15/2012	8321A	1,3,5-Trinitrobenzene	191.0	83.0	41.0	138.0		
KFT 081	05/15/2012	8321A	1,3-Dinitrobenzene	65.0	75.0	71.0	130.0		
KFT 081	05/15/2012	8321A	2,4-Dinitrotoluene	56.0	58.0	68.0	130.0	4.00	27.0
KFT 081	05/15/2012	8321A	2,6-Dinitrotoluene	64.0	64.0	67.0	132.0	0	46.0

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 12044511Lab Code: STDDate Due: 6/7/2012Matrix: WaterSite Code: WELDate Completed: 5/31/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Iron	ICP/ES	05/16/2012			OK	OK	OK	OK	94.0	93.0	85.0	2.0	93.0	1.7	57.0	
Iron	ICP/ES	05/16/2012										2.0				
Uranium	ICP/MS	05/18/2012			OK	OK	OK	OK	98.0			2.0	97.0	0.3	102.0	
Uranium	ICP/MS	05/18/2012			OK	OK	OK	OK	98.0	95.0	95.0	0.0	98.0		104.0	

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12044511

Lab Code: STDDate Due: 6/7/2012Matrix: WaterSite Code: WELDate Completed: 5/31/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Sulfate	05/14/2012	0.140	1.0000	OK		OK							
Sulfate	05/19/2012	-0.030	0.9999	OK		OK							
Sulfate	05/21/2012				OK		OK	98	104	104	0		
Sulfate	05/21/2012				OK		OK	104					
Sulfate	05/22/2012								106	106	0		

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Data Review and Validation Report

General Information

Report Number (RIN): 12054545
Sample Event: May 14-17, 2012
Site(s): Weldon Spring
Laboratory: TestAmerica, Denver, Colorado
Work Order No.: 280-29053
Analysis: Metals, Organics, and Wet Chemistry
Validator: Gretchen Baer
Review Date: August 3, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data,” GT-9(P). The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A
Uranium	LMM-02	SW-846 3010A	SW-846 6020
Volatiles	LMV-06	SW-846 5030B	SW-846 8260B

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-29053-10	MW-3037	Specific Conductance	R	Field measurement error
280-29053-14	MW-4013	1,3,5-Trinitrobenzene	J	Low surrogate recovery
280-29053-14	MW-4013	1,3-Dinitrobenzene	J	Low surrogate recovery
280-29053-14	MW-4013	2,4,6-Trinitrotoluene	J	Low surrogate recovery
280-29053-14	MW-4013	2,4-Dinitrotoluene	J	Low surrogate recovery
280-29053-14	MW-4013	2,6-Dinitrotoluene	J	Low surrogate recovery
280-29053-14	MW-4013	Nitrobenzene	J	Low surrogate recovery
280-29053-16	MW-4015	2,4-Dinitrotoluene	J	Poor Chromatographic resolution

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 23 water samples on May 18, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced coolers at 2.8 and 3.8 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL. High concentrations of trichloroethene present in three samples required analysis using reduced sample aliquot sizes. The MDLs were elevated accordingly. The reported MDLs for all analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be

capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 353.2, Nitrate + Nitrite as N

Calibrations were performed on May 29 and June 1, 2012, using six calibration standards. The absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the PQL and all results were acceptable.

Method SW-846 6020, Uranium

Calibrations were performed on May 23, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in three verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8260B, Volatiles

The volatile compounds requested were 1,2-dichloroethane, cis-1,2-dichloroethene, tetrachloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride. Initial calibration was performed April 13, May 7 and 21, 2012, using seven calibration standards. The average response factor and associated relative standard deviation met the acceptance criteria for all analytes. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on May 11, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. One target compound (nitrobenzene) had a percent drift value greater than 20 percent. This compound was not detected in any of the samples and no further qualification is necessary.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Metals and Wet Chemistry

All method blank and calibration blank results associated with the samples were below the PQLs for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than 5 times the blank concentration.

Organics

The method blank results were below the MDL for all target compounds.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Nitroaromatics and Volatiles Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries *for undiluted samples* were within the acceptance ranges, with one exception. A surrogate recovery for sample MW-4013 did not meet the acceptance criteria when analyzed undiluted. The associated sample results are qualified with a “J” flag as estimated values. The recovery of the internal standards added to the samples is monitored to measure the purging efficiency. Internal standard recoveries associated with target compounds were stable and within acceptance ranges.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration or when the spike was performed on a sample that required dilution. The spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics and volatiles data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results associated with analyte peaks that do not meet this criterion are qualified with a "J" flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each reported volatile and nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on June 13, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or

measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

No laboratory results from this sampling event were identified as potential outliers. The field measurement for pH at location MW-3031 was identified as a high outlier. The associated field data were further reviewed and there were no errors noted. The field measurement for specific conductance at location MW-3037 was recorded as 19 $\mu\text{mhos/cm}$. This value is much lower than both the historical minimum at this location and a typical specific conductance reading for a groundwater sample. All other specific conductance measurements by the field equipment for this sampling event are acceptable, which indicates that the flow cell was not filled sufficiently high to cover the specific conductance probe at this location only. The specific conductance result for MW-3037 is qualified with an "R" flag as rejected. The data for this RIN are acceptable as qualified.

Sampling Protocol

Sample results for all monitoring wells met the Category I, II, or III low-flow sampling criteria and were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells MW-2021, MW-2022, MW-2023, MW-2035, MW-2040, MW-3003, MW-3031, MW-3037, MW-4015, MW-4022, and MWS-1 were further qualified with a "Q" flag in the database, indicating the data are considered qualitative because these are Category II or III wells.

Trip Blank

A trip blank was prepared and analyzed for volatile organics to document contamination attributable to shipping and field handling procedures. There were no target analytes detected in the trip blank.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells.

Report Prepared By:  2012.10.02
15:41:33 -06'00'

Gretchen Baer
Data Validator

Data Validation Outliers Report - Field Parameters Only

Comparison: All Historical Data

Laboratory: Field Measurements

RIN: 12054545

Report Date: 8/6/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data		Result	Qualifiers Lab Data		Result	Qualifiers Lab Data		N	N Below Detect	
WEL01	MW-2023	N001	05/16/2012	Turbidity	0.72			61		FQ	1		F	16	0	No
WEL01	MW-2038	N001	05/16/2012	Temperature	17.77			17.1			11			79	0	No
WEL01	MW-3031	N001	05/14/2012	pH	8.11			7.76		FQ	6.47			34	0	Yes
WEL01	MW-3037	N001	05/16/2012	Specific Conductance	19			3117		FQ	27.31		FQ	20	0	No
WEL01	MW-3039	N001	05/16/2012	Specific Conductance	4449			7953		F	4520			27	0	No
WEL01	MW-4015	N001	05/15/2012	Specific Conductance	723			710		FQ	5.74		FQ	39	0	No
WEL01	MWS-1	N001	05/16/2012	pH	7.64			7.59		FQ	6.81		FQ	22	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM
General Data Validation Report

RIN: 12054545 Lab Code: STD Validator: Gretchen Baer Validation Date: 8/3/2012
Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics
of Samples: 23 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

There are 3 detection limit failures.

There was 1 trip/equipment blank evaluated.

There were 2 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM

Non-Compliance Report: Detection Limits

RIN: 12054545 Lab Code: STD

Project: Weldon Spring

Validation Date: 8/3/2012

Ticket	Location	Lab Sample ID	Method Code	Lab Method	Analyte Name	Result	Qualifier	Reported Detection Limit	Required Detection Limit	Units
KGT 786	MW-3034	280-29053-9	LMV-06	8260B	Trichloroethene	140		1.6	1	ug/L
KGT 818	MW-3134	280-29053-12	LMV-06	8260B	Trichloroethene	160		1.6	1	ug/L
KGT 780	MW-4029	280-29053-19	LMV-06	8260B	Trichloroethene	270		3.2	1	ug/L

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

Page 1 of 1

RIN: 12054545 Lab Code: STD Project: Weldon Spring Validation Date: 8/3/2012

Duplicate: MW-3134

Sample: MW-3034

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,2-Dichloroethane	0.13	U		1	0.13	U		1			ug/L
1,3,5-Trinitrobenzene	0.10			1	0.095	J		1	5.13		ug/L
1,3-Dinitrobenzene	0.082	J		1	0.079	J		1	3.73		ug/L
2,4,6-Trinitrotoluene	0.022	U		1	0.021	U		1			ug/L
2,4-Dinitrotoluene	0.057	J		1	0.058	J		1			ug/L
2,6-Dinitrotoluene	0.053	J		1	0.052	J		1			ug/L
cis-1,2-Dichloroethene	2.8			1	2.6			1	7.41		ug/L
Nitrate+Nitrite as N	190			20	210			50	10.00		mg/L
Nitrobenzene	0.033	U		1	0.032	U		1			ug/L
Tetrachloroethene	0.51	J		1	0.43	J		1			ug/L
trans-1,2-Dichloroethene	0.26	J		1	0.24	J		1			ug/L
Trichloroethene	140			1	160			1	13.33		ug/L
Vinyl Chloride	0.10	U		1	0.10	U		1			ug/L

Duplicate: MW-4123

Sample: MW-4023

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Nitrate+Nitrite as N	0.69			1	0.69			1	0		mg/L
Uranium	3.2			1	3.3			1	3.08		ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12054545

Project: Weldon Spring

Lab Code: STD

Validation Date: 8/6/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): There were 2 method blank results above the MDL.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: There were 2 surrogate failures.

SAMPLE MANAGEMENT SYSTEM

RIN: 12054545 Lab Code: STD

Non-Compliance Report: Surrogate Recovery

Project: Weldon Spring

Validation Date: 8/6/2012

Ticket	Location	Lab Sample ID	Method	Dilution	Surrogate	Recovery	Lower Limit	Upper Limit
KGT 788	MW-4013	280-29053-14	8321A	20	Nitrobenzene-d5	3	48	130
KGT 788	MW-4013	280-29053-14	8321A	1	Nitrobenzene-d5	41	48	130

SAMPLE MANAGEMENT SYSTEM
Non-Compliance Report: Method Blanks

Page 1 of 1

RIN: 12054545 Lab Code: STD

Project: Weldon Spring

Validation Date: 8/6/2012

Method Blank	Date Analyzed	Method	Analyte	Result	Flag(s)	MDL
MB 280-12080	5/22/2012	8260B	Methylene Chloride	0.42	J	0.32
MB 280-12131	5/23/2012	8260B	Methylene Chloride	0.57	J	0.32

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 12054545Lab Code: STDDate Due: 6/15/2012Matrix: WaterSite Code: WELDate Completed: 6/14/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Uranium	ICP/MS	05/23/2012			OK	OK	OK	OK	OK	103.0	100.0	101.0	1.0	97.0	0.4	100.0

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12054545

Lab Code: STDDate Due: 6/15/2012Matrix: WaterSite Code: WELDate Completed: 6/14/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Nitrate+Nitrite as N	05/29/2012	-0.007	0.9999	OK	OK	OK	OK	OK	102	102	103	0	
Nitrate+Nitrite as N	05/29/2012							OK	104				
Nitrate+Nitrite as N	06/01/2012	-0.038	0.9993	OK	OK	OK	OK	OK	106	84	83	0	



Data Review and Validation Report

General Information

Report Number (RIN): 12064641
Sample Event: June 19–21, 2012
Site(s): Weldon Spring
Laboratory: TestAmerica, Denver, Colorado
Work Order No.: 280-30343
Analysis: Metals, Organics, and Wet Chemistry
Validator: Steve Donovan
Review Date: August 6, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-30343-2	MW-2032	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-30343-3	MW-2046	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-30343-4	MW-2047	1,3,5-Trinitrotoluene	J	Low internal recovery
280-30343-5	MW-2051	2,4-Dinitrotoluene	J	Poor chromatographic resolution

Sample Number	Location	Analyte(s)	Flag	Reason
280-30343-9	MW-4036	2,4-Dinitrotoluene	J	Poor chromatographic resolution
280-30343-13	SP-6301	2,4-Dinitrotoluene	J	Poor chromatographic resolution

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 14 water samples on June 22, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced coolers at 2.3 and 5.8 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL. The reported MDLs for all analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on June 26, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. The method blank results were below the MDL for all target compounds.

Nitroaromatics Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries were within the acceptance ranges. The recovery of the internal standards added to the samples is monitored to measure the instrument stability. Recoveries for the two early eluting internal standards were below the acceptance range for most samples. Sample results for compounds associated with these standards that are greater than the MDL are qualified with a "J" flag as estimated values.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration or when the spike was performed on a sample that required dilution. The spike recoveries met the acceptance criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the PQL should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics and volatiles data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results

associated with analyte peaks that do not meet this criterion are qualified with a “J” flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each reported nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on June 28, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
 2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric
-

test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.

3. Scientifically review statistical outliers and decide on their disposition.

No laboratory results from this sampling event were identified as potential outliers. The data for this RIN are acceptable as qualified.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. A duplicate sample was collected at location SP-6301. The duplicate results met the criteria, demonstrating acceptable overall precision.



Digitally signed by Stephen E. Donivan
DN: c=us, o=u.s. government, ou=department
of energy, ou=headquarters, ou=people,
cn=Stephen E. Donivan
Date: 2012.08.06 14:11:20 -06'00'

Report Prepared By: _____

Steve Donivan
Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory: TestAmerica Denver

RIN: 12064641

Report Date: 8/6/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect	
WEL01	MW-4036	N002	06/20/2012	2,4-Dinitrotoluene	0.13		0.12		F	0.046			19	12	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12064641 Lab Code: STD Validator: Steve Donovan Validation Date: 8/6/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 14 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

Page 1 of 1

RIN: 12064641 Lab Code: STD Project: Weldon Spring Validation Date: 8/6/2012

Duplicate: SP-6311

Sample: SP-6301

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	0.016	U		1	0.016	U		1			ug/L
1,3-Dinitrobenzene	0.014	U		1	0.013	U		1			ug/L
2,4,6-Trinitrotoluene	0.021	U		1	0.021	U		1			ug/L
2,4-Dinitrotoluene	0.026	J		1	0.018	U		1			ug/L
2,6-Dinitrotoluene	0.059	J		1	0.050	J		1			ug/L
Nitrobenzene	0.032	U		1	0.031	U		1			ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12064641

Project: Weldon Spring

Lab Code: STD

Validation Date: 8/6/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: All surrogate recoveries were within the laboratory acceptance limits.

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Data Review and Validation Report

General Information

Report Number (RIN): 12064642
Sample Event: June 18–21, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 306505, 306507
Analysis: Metals, Organics, Radiochemistry, and Wet Chemistry
Validator: Steve Donovan
Review Date: August 7, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1. All analyses were successfully completed.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Chemical Oxygen Demand	WCH-A-010	EPA 410.4	EPA 410.4
Chloride	MIS-A-045	EPA 300.0A	EPA 300.0A
Fluoride	MIS-A-045	EPA 300.0A	EPA 300.0A
Metals: As, Ba, Co, Cr, Fe, Mn, Ni, Pb, Se, Ti, U	LMM-02	SW-846 3005A	SW-846 6020
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
PAH Compounds	LMS-02	SW-846 3510	SW-846 8310
PCBs	PEP-A-006	SW-846 3510C	SW-846 8082
Radium-226	GPC-A-018	SW-846 9315 Mod	SW-846 9315 Mod
Radium-228	GPC-A-020	SW-846 9320 Mod	SW-846 9320 Mod
Sulfate	MIS-A-045	EPA 300.0A	EPA 300.0A
Thorium Isotopes	ASP-A-008	EML A-01-R Mod	EML A-01-R Mod
Total Dissolved Solids	WCH-A-033	EPA 160.1	EPA 160.1
Volatiles (VOA)	LMV-06	SW-846 5030B	SW-846 8260B

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
306505001	MW-2051	Radium-228	J	Less than the Determination Limit
306505002	LW-DC10	Radium-226	J	Less than the Determination Limit
306505002	LW-DC10	Radium-228	J	Less than the Determination Limit
306505003	MW-2032	Radium-226	J	Less than the Determination Limit
306505003	MW-2032	Radium-228	U	Less than the decision level concentration
306505005	MW-2047	Radium-228	J	Less than the Determination Limit
306505005	MW-2047	Thorium-230	J	Less than the Determination Limit
306505006	MW-2055	Radium-226	J	Less than the Determination Limit
306505006	MW-2055	Radium-228	J	Less than the Determination Limit
306505007	MW-2046	Radium-228	J	Less than the Determination Limit
306505016	SP-6311	Radium-228	J	Less than the Determination Limit
306505019	MW-4041	Nitrate + Nitrite as N	R	Suspected sample preservation error
306505020	MW-4042	Uranium	U	Less than 5 times the method blank
306505021	MWD-2	Uranium	U	Less than 5 times the method blank

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 22 water samples on June 22, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperatures inside the iced coolers at 5 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), Decision Level Concentration (DLC), and Determination Limit (DL). The MDC is a measure of radiochemical method performance and was calculated and reported as specified in *Quality Systems for Analytical Services*. The DLC is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is estimated as 3 times the one-sigma total propagated uncertainty. Results that are greater than the MDC, but less than the DLC are qualified with a “U” flag (not detected). The DL for radiochemical results is the lowest concentration that can be reliably measured, and is

defined as 3 times the MDC. Results not previously “U” qualified that are less than the DL are qualified with a “J” flag as estimated values.

The reported MDLs for all metal, organic, and wet chemical analytes; and MDCs for radiochemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All initial calibration and calibration check standards were prepared from independent sources.

Method EPA 160.1, Total Dissolved Solids

There is no initial or continuing calibration requirement associated with the determination of total dissolved solids.

Method EPA 300.0A, Chloride, Fluoride, Sulfate

The initial calibrations were performed using six calibration standards on May 11, 2012. The correlation coefficient values were greater than 0.995 and intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in nine verification checks. All calibration checks met the acceptance criteria.

Method EPA 353.2, Nitrate + Nitrite as N

The initial calibrations were performed using five calibration standards on June 26, 2012, resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the intercept of the calibration curve was less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria.

Method EPA 410.4, Chemical Oxygen Demand

The initial calibration was performed using a single point calibration on December 15, 2011. Initial and continuing calibration verification checks were made at the required frequency resulting in two verification checks. All calibration checks met the acceptance criteria.

Method SW-846 6020, Metals

Calibrations were performed on July 5, 13, 16, and 17, 2012, using two calibration standards. The absolute values of the intercepts were less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency resulting in 10 verification checks. All calibration checks associated with sample results met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8082, PCBs

The initial calibration for PCBs was performed using five calibration standards on June 6, 2012. The initial calibration data met the acceptance criteria for all analytes on both gas chromatography columns. Initial and continuing calibration checks were made at the required frequency resulting in two calibration checks. All continuing calibration verifications were within the acceptance criteria with the following exception. The Aroclor 1260 CCV verification failed on the secondary column. Aroclor 1260 was not detected in any of the associated samples and no qualification is required.

Method SW-846 8260B, Volatiles

The volatile compounds requested were 1,2-dichloroethane, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride. Initial calibration of instrument VOA3 was performed on June 14, 2012 using seven calibration standards. The average response factor and associated relative standard deviation met the acceptance criteria for all analytes where the averaged response factor approach was used. In cases where the linear calibration curve approach was used, the calibration curve correlation coefficient value was greater than 0.99 and the intercept was less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All target compounds had percent drift values less than 20 percent. The mass spectrometer calibration and resolution were checked at the beginning of each analytical run in accordance with the procedure. Internal standard recoveries were stable and within acceptance ranges. All surrogate recoveries were within the acceptance ranges.

Method SW-846 8310, PAH Compounds

The initial calibration for PAHs was performed using eight calibration standards on June 28, 2012. The initial calibration data met the acceptance criteria for all analytes. Initial and continuing calibration checks were made at the required frequency resulting in four verification checks. All continuing calibration verifications were within the acceptance criteria.

Radiochemical Analysis

Thorium Isotopes

Alpha spectrometry calibrations and instrument backgrounds were performed within a month previous to sample analysis. Calibration standards were counted to obtain a minimum of 10,000 counts per peak. Daily instrument checks met the acceptance criteria. The tracer recoveries met the acceptance criteria of 30 to 110 percent for all samples. The full width at half maximum (FWHM) was reviewed to evaluate the spectral resolution. None of the tracer FWHM values exceeded 100 kiloelectron volts (keV). All ROIs were satisfactory.

Radium-226

Emanation cell plateau voltage determinations and cell efficiency calibrations were performed within a year previous to sample analysis.

Radium-228

Plateau voltage determinations and detector efficiency calibrations were performed within a year previous to sample analysis. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration. The radiochemistry method blank results were less than the DLC for all analytes.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the frequency to verify the instrumental interelement and background correction factors. All ICSAB check sample results met the acceptance criteria.

Volatiles, PAHs, and PCBs Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate spike recoveries are evaluated to identify data quality effects due to such factors as interference or high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. Internal standard recoveries were stable and within acceptance ranges. All surrogate recoveries were within the acceptance ranges for all samples.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spike results met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable laboratory precision. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than three, indicating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for ion chromatography, PAH, PCB, and volatiles data. All peak integrations, including manual integrations, were satisfactory.

Compound Identification

The mass spectral data were reviewed for each reported organic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the method detection limit (minimum detectable concentration for radiochemistry) and practical quantitation limit for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on July 20, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Field Measurements

The pre-sampling purge criteria were met for all wells.

Sampling Protocol

Sample results for all monitor wells met the Category I, II, or III low-flow sampling criteria and were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method.

The ground water sample results for the wells listed in Table 3 were qualified with a "Q" flag in the database indicating the data are considered qualitative because of the sampling protocol (either category II or category III).

Table 3. Category II and III Wells

Well	Category II	Category III
MW-2046	X	
MW-2047		X
MW-2055		X
MW-3006	X	
MW-3024	X	
MW-3040	X	
MW-4007	X	
MW-4040	X	
MW-4043	X	
MWD-2	X	
MWS-2	X	

Equipment Blank Assessment

An equipment blank was not collected because all sampling was performed with dedicated equipment or new pump tubing.

Trip Blank Assessment

Trip blanks are prepared and analyzed to document contamination attributable to shipping and field handling procedures. One trip blank was submitted with these samples. There were no analytes detected in the trip blank.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical duplicate results, the relative error ratio for duplicate results (calculated using the one-sigma total propagated uncertainty) should be less than three. A duplicate sample was collected from location SP-6301. The duplicate results met these criteria demonstrating acceptable overall precision.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

The radion-228 result from well MW-2051 and four nitrate + nitrite as N results were identified as a potential outliers. The radium-228 result from well MW-2051 has been previously qualified as an estimated value. The nitrate + nitrite as N result for well MW-4041 is "R" flagged as rejected because it is suspected that the sample was improperly preserved. A replacement sample for nitrate + nitrite as N will be collected from this location at a later date. All other nitrate + nitrite as N results are acceptable as qualified.

Report Prepared By: _____



Digitally signed by Stephen E. Donivan
DN: c=us, o=u.s. government,
ou=department of energy, ou=headquarters,
ou=people, cn=Stephen E. Donivan
Date: 2012.08.07 14:12:24 -06'00'

Steve Donivan
Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory: GEL Laboratories

RIN: 12064642

Report Date: 8/7/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	Result	Qualifiers Lab Data	N	N Below Detect			
WEL01	LW-DC10	N001	06/20/2012	Nitrate + Nitrite as Nitrogen	2.76		1.92			0.0137	B	11	0	No	
WEL01	LW-DC10	N001	06/20/2012	Selenium	0.00779		0.00712			0.00024	U	50	28	No	
WEL01	MW-2051	N001	06/19/2012	Barium	0.262		0.25	F		0.144	FQ	25	1	No	
WEL01	MW-2051	N001	06/19/2012	Radium-228	2.2		1.86	F		0.133	U	25	17	Yes	
WEL01	MW-3006	N001	06/21/2012	Nitrate + Nitrite as Nitrogen	0.272		0.05	U F		0.0031	U F	6	6	Yes	
WEL01	MW-3030	N001	06/21/2012	trans-1,2-Dichloroethene	0.54	J	2	F		0.56	J F	10	0	No	
WEL01	MW-3040	N001	06/18/2012	Nitrate + Nitrite as Nitrogen	95.2		150	FQJ		100	QF	16	0	No	
WEL01	MW-4007	N001	06/18/2012	Nitrate + Nitrite as Nitrogen	0.615		0.112	J FQ		0.05	U FQ	6	1	Yes	
WEL01	MW-4041	N001	06/20/2012	Nitrate + Nitrite as Nitrogen	1310		0.28	F		0.113	F	6	0	Yes	
WEL01	MW-4042	N001	06/18/2012	Nitrate + Nitrite as Nitrogen	0.113		0.05	U FQ		0	UF	14	13	Yes	
WEL01	MW-4042	N001	06/18/2012	Uranium	0.000361		0.0046	F		0.000362	FQ	20	0	No	

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test
 Outliers are identified using Dixon's Test when there are 25 or fewer data points.
 Outliers are identified using Rosner's Test when there are 26 or more data points.
 See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12064642 Lab Code: GEN Validator: Steve Donovan Validation Date: 8/7/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 22 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

There are 0 detection limit failures.

There was 1 trip/equipment blank evaluated.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12064642 Lab Code: GEN Project: Weldon Spring Validation Date: 8/7/2012

Duplicate: SP-6311

Sample: SP-6301

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,2-Dichloroethane	0.300	U		1.00	0.300	U		1.00			ug/L
Acenaphthene	0.150	U		1.00	0.150	U		1.00			ug/L
Acenaphthylene	0.150	U		1.00	0.150	U		1.00			ug/L
Anthracene	0.150	U		1.00	0.150	U		1.00			ug/L
Aroclor 1016	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1221	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1232	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1242	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1248	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1254	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1260	0.0333	U		1.00	0.0333	U		1.00			ug/L
Arsenic	1.70	U		1.00	1.70	U		1.00			ug/L
Barium	123			1.00	125			1.00	1.61		ug/L
Benzo(a)anthracene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(a)pyrene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(b)fluoranthene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(g,h,i)perylene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(k)fluoranthene	0.008	U		1.00	0.008	U		1.00			ug/L
Chromium	2.00	U		1.00	2.00	U		1.00			ug/L
Chrysene	0.016	U		1.00	0.016	U		1.00			ug/L
cis-1,2-Dichloroethene	0.300	U		1.00	0.300	U		1.00			ug/L
Cobalt	0.187	B		1.00	0.185	B		1.00			ug/L
Dibenz(a,h)anthracene	0.016	U		1.00	0.016	U		1.00			ug/L
Fluoranthene	0.016	U		1.00	0.016	U		1.00			ug/L
Fluorene	0.150	U		1.00	0.150	U		1.00			ug/L
Indeno(1,2,3-cd)pyrene	0.016	U		1.00	0.016	U		1.00			ug/L
Iron	412			1.00	404			1.00	1.96		ug/L
Lead	0.500	U		1.00	0.500	U		1.00			ug/L
Manganese	3.03	B		1.00	3.17	B		1.00			ug/L
Naphthalene	0.150	U		1.00	0.150	U		1.00			ug/L
Nickel	2.27	B		1.00	2.26	B		1.00			ug/L
NO2+NO3 as N	3.52			5.00	3.92			10.00	10.75		mg/L
Phenanthrene	0.182	U		1.00	0.182	U		1.00			ug/L
Pyrene	0.016	U		1.00	0.016	U		1.00			ug/L
Radium-226	0.212	U	0.181	1.00	0.449	U	0.325	1.00		1.2	pCi/L
Radium-228	0.751	U	0.613	1.00	0.808		0.513	1.00		0.1	pCi/L
Selenium	1.50	U		1.00	1.50	U		1.00			ug/L
Tetrachloroethene	0.300	U		1.00	0.300	U		1.00			ug/L
Thallium	0.450	U		1.00	0.450	U		1.00			ug/L
Thorium-228	-0.0032	U	0.328	1.00	0.0886	U	0.468	1.00		0.3	pCi/L

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12064642 Lab Code: GEN Project: Weldon Spring Validation Date: 8/7/2012

Duplicate: SP-6311

Sample: SP-6301

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Thorium-230	0.177	U	0.170	1.00	0.00287	U	0.188	1.00		1.3	pCi/L
Thorium-232	0.0136	U	0.0419	1.00	-0.0379	U	0.129	1.00		0.7	pCi/L
trans-1,2-Dichloroethene	0.300	U		1.00	0.300	U		1.00			ug/L
Trichloroethene	0.300	U		1.00	0.300	U		1.00			ug/L
Uranium	52			1.00	51.6			1.00	0.77		ug/L
Vinyl Chloride	0.300	U		1.00	0.300	U		1.00			ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12064642

Project: Weldon Spring

Lab Code: GEN

Validation Date: 8/7/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: All surrogate recoveries were within the laboratory acceptance limits.

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12064642 Lab Code: GEN Date Due: 7/20/2012
 Matrix: Water Site Code: WEL Date Completed: 7/20/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Arsenic	ICP/MS	07/17/2012			OK	OK	OK	OK	109.0	105.0			110.0		101.0	
Barium	ICP/MS	07/13/2012			OK	OK	OK	OK	94.5	91.2		2.0	98.0	2.0	104.0	
Chromium	ICP/MS	07/13/2012			OK	OK	OK	OK	95.4	95.6			104.0		105.0	
Cobalt	ICP/MS	07/13/2012			OK	OK	OK	OK	99.6	95.1			102.0		105.0	
Iron	ICP/MS	07/13/2012			OK	OK	OK	OK	98.4	98.5		5.0	99.0	3.0	112.0	
Lead	ICP/MS	07/13/2012			OK	OK	OK	OK	98.7	100.0			96.0		107.0	
Manganese	ICP/MS	07/13/2012			OK	OK	OK	OK	98.2	96.3			103.0		106.0	
Nickel	ICP/MS	07/13/2012			OK	OK	OK	OK	101.0	91.9		1.0	101.0		108.0	
Selenium	ICP/MS	07/13/2012			OK	OK	OK	OK	100.0	98.5			99.0		107.0	
Thallium	ICP/MS	07/13/2012			OK	OK	OK	OK	92.6	92.8			95.0		99.0	
Uranium	ICP/MS	07/05/2012			OK	OK	OK	OK	103.0	102.0		2.0	104.0	2.0	112.0	
Uranium	ICP/MS	07/13/2012			OK	OK	OK	OK	101.0	101.0		2.0	103.0		110.0	

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12064642 Lab Code: GEN Date Due: 7/20/2012
 Matrix: Water Site Code: WEL Date Completed: 7/20/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Chemical Oxygen Demand	07/03/2012							OK	97.90	101.0		12.00	
Chloride	07/12/2012	0.000	1.0000	OK	OK	OK	OK	OK	99.70	110.0		1.00	
Fluoride	07/12/2012	0.000	1.0000	OK	OK	OK	OK	OK	102.00				
Fluoride	07/13/2012									98.9		3.00	
NO2+NO3 as N	06/26/2012	0.000	1.0000	OK	OK	OK	OK	OK	110.00	99.0		0	
NO2+NO3 as N	06/26/2012									92.6		2.00	
Sulfate	07/12/2012	0.000	1.0000	OK	OK	OK	OK	OK	102.00	105.0		0	
Total Dissolved Solids	06/26/2012							OK	98.60			5.00	

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12064642 Lab Code: GEN Date Due: 7/20/2012
 Matrix: Water Site Code: WEL Date Completed: 7/20/2012

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
SP-6301	Radium-226	07/09/2012						0.07
Blank_Spike	Radium-226	07/09/2012				96.80		
SP-6301	Radium-226	07/09/2012					91.8	
Blank	Radium-226	07/09/2012	0.2530	U				
LW-DC10	Radium-228	07/03/2012			66.0			
MW-2032	Radium-228	07/03/2012			87.0			
MW-2046	Radium-228	07/03/2012			81.0			
MW-2047	Radium-228	07/03/2012			87.0			
MW-2051	Radium-228	07/03/2012			87.0			
MW-2055	Radium-228	07/03/2012			79.0			
SP-6301	Radium-228	07/03/2012			86.0			
SP-6311	Radium-228	07/03/2012			83.0			
SP-6301	Radium-228	07/03/2012			81.0			2.04
Blank_Spike	Radium-228	07/03/2012			92.0	122.00		
SP-6301	Radium-228	07/03/2012			96.0		112.0	
Blank	Radium-228	07/03/2012	0.7160	U	100.0			
LW-DC10	Thorium-228	07/03/2012			71.0			
MW-2032	Thorium-228	07/03/2012			72.0			
MW-2046	Thorium-228	07/03/2012			70.0			
MW-2047	Thorium-228	07/03/2012			90.0			
MW-2051	Thorium-228	07/03/2012			77.0			
MW-2055	Thorium-228	07/03/2012			87.0			
SP-6301	Thorium-228	07/03/2012			78.0			
SP-6311	Thorium-228	07/03/2012			56.0			
SP-6301	Thorium-228	07/03/2012			70.0			
Blank	Thorium-228	07/03/2012	-0.1360	U	76.0			
SP-6301	Thorium-228	07/11/2012			67.0			0.23
Blank_Spike	Thorium-230	07/03/2012				100.00		
SP-6301	Thorium-230	07/03/2012					106.0	
Blank	Thorium-230	07/03/2012	-0.0500	U				
SP-6301	Thorium-230	07/11/2012						0.04
SP-6301	Thorium-232	07/03/2012						

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12064642 **Lab Code:** GEN **Date Due:** 7/20/2012
Matrix: Water **Site Code:** WEL **Date Completed:** 7/20/2012

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
Blank	Thorium-232	07/03/2012	0.0400	U				
SP-6301	Thorium-232	07/11/2012						1.44

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Data Review and Validation Report

General Information

Report Number (RIN): 12074691
Sample Event: July 31–August 2, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 309032, 309046
Analysis: Metals and Wet Chemistry
Validator: Steve Donovan
Review Date: October 4, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3005A	SW-846 6010B
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3005A	SW-846 6020

Data Qualifier Summary

None of the analytical results required qualification.

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 54 water samples on August 3, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that

all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 5 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL. The reported MDLs for all analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed using seven calibration standards on July 11, 2012. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in 15 verification checks. All calibration check results were within the acceptance criteria. Reporting limit verification checks were made to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range.

Method SW-846 6010B, Iron

Calibrations were performed on August 20, 2012, using a two point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in 17 verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration

curve near the practical quantitation limit. The reporting limit check result met the acceptance criteria.

Method SW-846 6020, Uranium

Calibrations were performed on August 24 and 30, 2012, using a two point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in nine verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are evaluated when the concentration of the unspiked sample is less than four times the spike concentration, the acceptance range for spike recovery is 75% to 125%. The spikes met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The results for all replicates met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all analytes.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for sulfate data. All analyte peak integrations were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on September 4, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should

only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

Four values from this sampling event were identified as potential outliers. The values observed are likely related to the field conditions observed during sampling such as low water levels at all locations and high turbidity at location MW-1048. Surface location SW-1010 was actually dry, and a pooled area north of location SW-1010 was sampled. There were no laboratory errors associated with these data and the data for this RIN are acceptable as qualified.

Data Validation Outliers Report - No Field Parameters
Comparison: All historical Data Beginning 1/1/2005

Laboratory:

RIN: 12074691

Report Date: 10/5/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab	Data	Result	Qualifiers Lab	Data	Result	Qualifiers Lab	Data	N	N Below Detect	
WEL02	MW-1008	0001	07/31/2012	Iron	0.229000			0.122		FQ	0.016	U	F	28	20	No
WEL02	MW-1015	0001	07/31/2012	Iron	0.226000			0.186		F	0.0188	UN	FJ	32	16	Yes
WEL02	MW-1017	N001	08/01/2012	Sulfate	1.29	J		1.23	J	JF	0.05	U	F	16	4	No
WEL02	MW-1030	N001	08/02/2012	Sulfate	43.6			158		FQ	59		FQ	23	0	No
WEL02	MW-1030	N001	08/02/2012	Uranium	0.003430			0.0179		FQ	0.0046		FQ	23	0	No
WEL02	MW-1047	N001	08/01/2012	Sulfate	68.2			97.2	H	FQJ	70.9		FQ	30	0	No
WEL02	MW-1048	N001	08/01/2012	Sulfate	39.7			79.2	H	FJ	54.5		F	34	0	Yes
WEL02	SW-1003	N001	08/02/2012	Sulfate	42.4			31			13.2			8	0	No
WEL02	SW-1003	N001	08/02/2012	Uranium	0.024800			0.174			0.0255	E		26	0	No
WEL02	SW-1004	N001	08/02/2012	Sulfate	39.3			29			13.4			7	0	Yes
WEL02	SW-1010	N001	08/02/2012	Sulfate	39.1			29			14.6			7	0	Yes
WEL02	SW-1010	N001	08/02/2012	Uranium	0.016800			0.128			0.0188			21	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

Sampling Protocol

Sampling at all monitoring wells met the Category I, II, or III low-flow sampling criteria and results were qualified with an “F” flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed in Table 3 were qualified with a “Q” flag in the database indicating the data are considered qualitative because of the sampling protocol (Category II or III).

Table 3. Category I or III Wells

Category II	Category III
MW-1012	MW-1007
MW-1028	MW-1008
MW-1030	MW-1009
MW-1031	MW-1016
MW-1046	MW-1051
MW-1047	MW-1052

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the practical quantitation limit (PQL) should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. Duplicate samples were collected from locations MW-1044 and MW-1048. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells.



Digitally signed by Stephen E. Donovan
DN: c=us, o=u.s. government,
ou=department of energy,
ou=headquarters, ou=people, cn=Stephen
E. Donovan
Date: 2012.10.05 10:31:31 -06'00'

Report Prepared By: _____

Steve Donovan
Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12074691 Lab Code: GEN Validator: Steve Donovan Validation Date: 10/4/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 54 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There were 4 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12074691 Lab Code: GEN Project: Weldon Spring Validation Date: 10/4/2012

Duplicate: MW-1144

Sample: MW-1044

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Iron	34500			1.00	35900			1.00	3.98		ug/L
Sulfate	76.9			10.00	77.0			10.00	0.13		mg/L
Uranium	0.067	U		1.00	0.11	B		1.00			ug/L

Duplicate: MW-1148

Sample: MW-1048

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Iron					1660			1.00			ug/L
Sulfate	39.7			10.00	42.8			10.00	7.52		mg/L
Uranium	303			5.00	311			10.00	2.61		ug/L

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12074691 Lab Code: GEN Date Due: 8/31/2012
 Matrix: Water Site Code: WEL Date Completed: 8/31/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Iron	ICP/ES	08/20/2012			OK	OK	OK	OK	OK	96.6	99.8		3.0	93.0	3.8	102.0
Iron	ICP/ES	08/20/2012														103.0
Iron	ICP/ES	08/21/2012			OK	OK	OK	OK	OK	99.0	104.0		3.0	98.0	2.9	108.0
Uranium	ICP/MS	08/24/2012			OK	OK	OK	OK	OK	106.0	115.0		7.0	106.0	1.2	98.0
Uranium	ICP/MS	08/30/2012			OK	OK	OK	OK	OK	105.0	110.0			105.0		95.0
Uranium	ICP/MS	08/30/2012												104.0		101.0

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12074691 Lab Code: GEN Date Due: 8/31/2012
 Matrix: Water Site Code: WEL Date Completed: 8/31/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Sulfate	08/10/2012	0.000	0.9995	OK	OK	OK	OK	93.10	94.5		0		
Sulfate	08/11/2012							93.20					
Sulfate	08/13/2012			OK		OK	OK	91.90			1.00		
Sulfate	08/14/2012								89.9		11.00		
Sulfate	08/14/2012								94.9				

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Data Review and Validation Report

General Information

Report Number (RIN): 12084753
Sample Event: August 7–14, 2012
Site(s): Weldon Spring
Laboratory: TestAmerica, Denver, Colorado
Work Order No.: 280-32156
Analysis: Metals, Organics, and Wet Chemistry
Validator: Steve Donovan
Review Date: October 24, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3010A	SW-846 6010B
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3010A	SW-846 6020
Volatiles	LMV-06	SW-846 5030B	SW-846 8260B

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-32156-16	SP-6301	2,4-Dinitrotoluene	J	Poor analyte peak resolution
280-32156-24	MW-1006	2,4-Dinitrotoluene	J	Poor analyte peak resolution

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 34 water samples on August 15, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced coolers at 3.2 and 3.8 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

The reported MDLs for all metal, organic, and wet chemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed using six calibration standards on August 17, 2012. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks. All calibration

check results were within the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the practical quantitation limit and all results were acceptable.

Method EPA 353.2, Nitrate + Nitrite as N

Calibrations were performed on August 17, 2012, using six calibration standards. The absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in five verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the practical quantitation limit and all results were acceptable.

Method SW-846 6010B, Iron

Calibrations were performed on August 22, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The reporting limit check result met the acceptance criteria.

Method SW-846 6020, Uranium

Calibrations were performed on August 17, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in seven verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8260B, Volatiles

The volatile compounds requested were 1,2-dichloroethane, cis-1,2-dichloroethene, tetrachloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride. Initial calibration was performed August 20, 2012, using seven calibration standards. The average response factor and associated relative standard deviation met the acceptance criteria for all analytes. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent. The mass spectrometer calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on August 20, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Metals and Wet Chemistry

All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

Organics

The method blank results were below the MDL for all target compounds.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Nitroaromatics and Volatiles Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries were within the acceptance ranges. The recovery of the internal standards added to the samples is monitored to measure the purging efficiency. Internal standard recoveries associated with target compounds were stable and within acceptance ranges.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spikes met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The results for all replicates met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the practical quantitation limit for method 6010 or greater than 100 times the practical quantitation limit for method 6020. All evaluated serial dilution data were acceptable.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all analytes.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics, sulfate, and volatiles data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results associated with analyte peaks that do not meet this criteria are qualified with a "J" flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each reported volatile and nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on August 28, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

There were no outliers identified and the data from this event are acceptable as qualified.

Sampling Protocol

All monitoring wells were purged and sampled using the low-flow sampling method, meeting the Category I, II, or III low-flow sampling criteria. Sample results from wells meeting the low-flow criteria are qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed in Table 3 are further qualified with a "Q" flag indicating the data are considered qualitative because they are Category II or III wells.

Table 3. Category II or III Wells

Category II	Category III
MW-3006	MW-1005
MW-3024	MW-1006
MW-3040	MW-1027
MW-4007	

Category II	Category III
MW-4040	
MW-4043	
MWD-2	
MWS-2	
MW-1002	
MW-1032	
MW-1045	

Trip Blank

A trip blank was prepared and analyzed for volatile organics to document contamination attributable to shipping and field handling procedures. There were no target analytes detected in the trip blank.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. Duplicate samples were collected from locations MW-1002, MW-4042 and MWD-2. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. Daily calibration checks were performed as required with acceptable results.



Digitally signed by Stephen E. Donovan
 DN: c=us, o=u.s. government, ou=department of energy, ou=headquarters, ou=people, cn=Stephen E. Donovan
 Date: 2012.10.24 09:08:32 -06'00'

Report Prepared By: _____

Stephen Donovan
 Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory: TestAmerica Denver

RIN: 12084753

Report Date: 10/23/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect	
WEL01	MW-3030	N001	08/07/2012	Uranium	0.038		0.108			0.039	F	61	0	No	
WEL01	MW-4041	N001	08/08/2012	Uranium	0.0019		0.0049	F		0.0021	B F	25	1	No	
WEL01	MW-4042	N001	08/07/2012	Uranium	0.00034		0.0046	F		0.000361	UF	21	1	No	
WEL01	MW-4043	N002	08/14/2012	Nitrate + Nitrite as Nitrogen	0.58		7.02	F		0.73	FQ	15	0	No	
WEL01	MW-4043	N001	08/14/2012	Nitrate + Nitrite as Nitrogen	0.55		7.02	F		0.73	FQ	15	0	No	
WEL01	MWS-2	N001	08/07/2012	Uranium	0.0021		0.00248	FQ		0.00214	FQ	5	0	No	
WEL01	SP-6301	N001	08/14/2012	Nitrate + Nitrite as Nitrogen	5.4		5.01			0.06	J	31	0	No	
WEL02	MW-1004	N001	08/13/2012	Uranium	0.71		12.7			0.75	F	108	0	No	

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12084753 Lab Code: STD Validator: Steve Donovan Validation Date: 10/23/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 34 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There was 1 trip/equipment blank evaluated.

There were 4 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12084753 Lab Code: STD Project: Weldon Spring Validation Date: 10/23/2012

Duplicate: MW-1102

Sample: MW-1002

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	0.016	U		1	0.016	U		1			ug/L
1,3-Dinitrobenzene	0.013	U		1	0.013	U		1			ug/L
2,4,6-Trinitrotoluene	0.021	U		1	0.021	U		1			ug/L
2,4-Dinitrotoluene	0.018	U		1	0.018	U		1			ug/L
2,6-Dinitrotoluene	0.094	J		1	0.10			1			ug/L
Iron	22	U		1	22	U		1			ug/L
Nitrobenzene	0.032	U		1	0.032	U		1			ug/L
Sulfate	89			5	87			5	2.27		mg/L
Uranium	3.7			1	3.5			1	5.56		ug/L

Duplicate: MW-4143

Sample: MW-4043

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,2-Dichloroethane	0.13	U		1	0.13	U		1			ug/L
cis-1,2-Dichloroethene	0.15	U		1	0.15	U		1			ug/L
Nitrate+Nitrite as N	0.55			1	0.58			1	5.31		mg/L
Tetrachloroethene	0.20	U		1	0.20	U		1			ug/L
trans-1,2-Dichloroethene	0.15	U		1	0.15	U		1			ug/L
Trichloroethene	0.16	U		1	0.16	U		1			ug/L
Vinyl Chloride	0.10	U		1	0.10	U		1			ug/L

Duplicate: MWD-2A

Sample: MWD-2

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Uranium	0.27			1	0.27			1	0		ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12084753

Project: Weldon Spring

Lab Code: STD

Validation Date: 10/24/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): There was 1 method blank result above the MDL.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: All surrogate recoveries were within the laboratory acceptance limits.

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12084753 Lab Code: STD Date Due: 9/12/2012
 Matrix: Water Site Code: WEL Date Completed: 8/31/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Iron	ICP/ES	08/23/2012			OK	OK	OK	OK	OK	100.0	103.0	98.0	5.0	92.0		125.0
Uranium	ICP/MS	08/18/2012			OK	OK	OK	OK	OK	101.0	100.0	99.0	1.0	97.0		99.0
Uranium	ICP/MS	08/18/2012							OK	101.0	99.0	98.0	1.0		3.0	

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12084753 **Lab Code:** STD **Date Due:** 9/12/2012
Matrix: Water **Site Code:** WEL **Date Completed:** 8/31/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Nitrate+Nitrite as N	08/17/2012	0.000	1.0000	OK	OK	OK	OK	104.00	109.0	108.0	1.00		
Nitrate+Nitrite as N	08/23/2012	0.000	1.0000	OK	OK	OK	OK	106.00	106.0	107.0	1.00		
Sulfate	08/20/2012	0.000	1.0000	OK	OK	OK	OK	99.00	99.0	100.0	0		

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Data Review and Validation Report

General Information

Report Number (RIN): 12094877
Sample Event: September 13 – October 4, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 312544
Analysis: Metals, Radiochemistry, and Wet Chemistry
Validator: Stephen Donovan
Review Date: December 12, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1. All analyses were successfully completed.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Chemical Oxygen Demand	WCH-A-010	EPA 410.4	EPA 410.4
Gross Alpha/Beta	GPC-A-001	EPA 900.0	EPA 900.0
Metals: Hg	LMM-01	SW-846 7470A	SW-846 7470A
Metals: Ag, As, Ba, Cr, Cu, Fe, Mn, Ni, Pb, Se, U, Zn	LMM-02	SW-846 3005A	SW-846 6020
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
Radium-226	GPC-A-018	SW-846 9315 Mod	SW-846 9315 Mod
Radium-228	GPC-A-020	SW-846 9320 Mod	SW-846 9320 Mod
Thorium Isotopes	ASP-A-008	EML A-01-R Mod	EML A-01-R Mod
Total Suspended Solids	WCH-A-034	SM 2540D	SM 2540D

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
312544002	LW-DC-12	Arsenic	U	Less than 5 times the method blank
312544002	LW-DC-12	Copper	J	Field duplicate precision
312544002	LW-DC-12	Gross Beta	J	Less than the Determination Limit
312544002	LW-DC-12	Mercury	J	Matrix spike recovery
312544002	LW-DC-12	Radium-226	J	Less than the Determination Limit
312544002	LW-DC-12	Thorium-230	U	Less than the decision level concentration
312544003	LW-DC-12 Duplicate	Arsenic	U	Less than 5 times the method blank
312544003	LW-DC-12 Duplicate	Copper	J	Field duplicate precision
312544003	LW-DC-12 Duplicate	Gross Beta	J	Less than the Determination Limit
312544003	LW-DC-12 Duplicate	Mercury	J	Matrix spike recovery
312544003	LW-DC-12 Duplicate	Thorium-230	J	Less than the Determination Limit

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 24 water samples on October 5, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperatures inside the iced coolers at 3 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), Decision Level Concentration (DLC), and Determination Limit (DL). The MDC is a measure of radiochemical method performance and was calculated and reported as specified in *Quality Systems for Analytical Services*. The DLC is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is estimated as 3 times the one-sigma total propagated uncertainty. Results that are greater than the MDC, but less than the DLC are qualified with a “U” flag (not detected). The DL for radiochemical results is the lowest concentration that can be reliably measured, and is defined as 3 times the MDC. Results not previously “U” qualified that are less than the DL are qualified with a “J” flag as estimated values.

The reported MDLs for all metal, organic, and wet chemical analytes; and MDCs for radiochemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All initial calibration and calibration check standards were prepared from independent sources.

Method SM 2540D, Total Suspended Solids

There is no initial or continuing calibration requirement associated with the determination of total suspended solids.

Method EPA 353.2, Nitrate + Nitrite as N

The initial calibrations were performed using five calibration standards on October 11, 2012, resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the intercept of the calibration curve was less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency resulting in nine verification checks. All calibration checks met the acceptance criteria.

Method EPA 410.4, Chemical Oxygen Demand

The initial calibration was performed using a single point calibration on December 15, 2011. Initial and continuing calibration verification checks were made at the required frequency resulting in two verification checks. All calibration checks met the acceptance criteria.

Method SW-846 6020, Metals

Calibrations were performed on October 26, 29, and 31, 2012, using two calibration standards. The absolute values of the intercepts were less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency resulting in 11 verification checks. All calibration checks associated with sample results met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 7470A, Mercury

Calibrations were performed on October 29, 2012, using five calibration standards. The absolute values of the intercepts were less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency resulting in five verification checks. All calibration checks associated with sample results met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range.

Radiochemical Analysis

Thorium Isotopes

Alpha spectrometry calibrations and instrument backgrounds were performed within a month previous to sample analysis. Calibration standards were counted to obtain a minimum of 10,000 counts per peak. Daily instrument checks met the acceptance criteria. The tracer recoveries met the acceptance criteria of 30 to 110 percent for all samples. The full width at half maximum (FWHM) was reviewed to evaluate the spectral resolution. None of the tracer FWHM values exceeded 100 kiloelectron volts (keV). All ROIs were satisfactory.

Radium-226

Emanation cell plateau voltage determinations and cell efficiency calibrations were performed within a year previous to sample analysis.

Gross Alpha/Beta and Radium-228

Plateau voltage determinations and detector efficiency calibrations were performed within a year previous to sample analysis. The radium-228 chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration. The radiochemistry method blank results were less than the DLC for all analytes.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the frequency to verify the instrumental interelement and background correction factors. All ICSAB check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spike results met the recovery and precision criteria for all analytes evaluated with the exception of mercury. The associated sample mercury results are qualified with a "J" flag as estimated values.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating

acceptable laboratory precision. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than three, indicating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the method detection limit (minimum detectable concentration for radiochemistry) and practical quantitation limit for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on November 5, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Field Measurements

The pre-sampling purge criteria were met for all wells.

Sampling Protocol

Sample results for all monitor wells met the Category I, or II low-flow sampling criteria and were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method.

The ground water sample results for the wells listed in Table 3 were qualified with a "Q" flag in the database indicating the data are considered qualitative because of the sampling protocol (category II).

Table 3. Category II Wells

Well	Category II
MW-3003	X
MW-3006	X
MW-3024	X
MW-3040	X
MW-4007	X
MW-4040	X
MW-4043	X
MWD-2	X
MWS-2	X

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical duplicate results, the relative error ratio for duplicate results (calculated using the one-sigma total propagated uncertainty) should be less than three. Duplicate samples were collected from locations LW-DC12 and MW-4036. The copper duplicate results for sample LW-DC12 did not meet these criteria. All other duplicate results met these criteria demonstrating acceptable overall precision.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the environmental database. The application compares the new data set (in standard environmental database units) with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

There were no potential outliers identified and the data from this event are acceptable as qualified.



Stephen E.

Donivan

2012.12.12

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Report Prepared By: _____

Stephen Donivan
Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All historical Data Beginning 1/1/2002

Laboratory:

RIN: 12094877

Report Date: 12/12/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current	Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier		
					Result	Qualifiers		Result	Qualifiers		Result	Qualifiers			N	N Below Detect
						Lab	Data		Lab	Data		Lab	Data			
WEL01	LW-DC12	N001	10/02/2012	BETA	3.49			15.9		J	3.6	J	J	26	9	No
WEL01	MW-3040	N001	10/01/2012	NO2+NO3 as N	82.0			150		FQJ	95.2		FQ	17	0	No
WEL01	MW-4036	N001	10/03/2012	NO2+NO3 as N	47.0			45.5		F	0.0031	U	F	21	1	No
WEL01	MW-4040	N001	10/03/2012	NO2+NO3 as N	103			195		FQ	109		FQ	19	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12094877 Lab Code: GEN Validator: Stephen Donovan Validation Date: 12/12/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 24 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

Holding Times

All analyses were completed within the applicable holding times.

Detection Limits

There are 0 detection limit failures.

Field/Trip Blanks

Field Duplicates

There were 2 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12094877 Lab Code: GEN Project: Weldon Spring Validation Date: 12/12/2012

Duplicate: LW-DC99

Sample: LW-DC12

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
ALPHA	1.53	U	1.46	1.00	1.77	U	1.48	1.00		0.2	pCi/L
Arsenic	3.12	B		1.00	4.35	B		1.00			ug/L
Barium	459			1.00	453			1.00	1.32		ug/L
BETA	3.49		1.24	1.00	3.44		1.03	1.00		0.1	pCi/L
Chemical Oxygen Demand	34.6			1.00	32.1			1.00			mg/L
Chromium	2.00	U		1.00	2.00	U		1.00			ug/L
Copper	6.82			1.00	11.3			1.00	NA		ug/L
Iron	341			1.00	354			1.00	3.74		ug/L
Lead	0.773	B		1.00	1.04	B		1.00			ug/L
Manganese	491			1.00	485			1.00	1.23		ug/L
Mercury	0.067	UN		1.00	0.067	UN		1.00			ug/L
Nickel	7.15	B		1.00	7.28	B		1.00	1.80		ug/L
Radium-226	0.788		0.464	1.00	1.20		0.525	1.00		1.2	pCi/L
Radium-228	0.554	U	0.486	1.00	0.362	U	0.352	1.00		0.6	pCi/L
Selenium	5.81			1.00	6.65			1.00			ug/L
Silver	0.200	U		1.00	0.200	U		1.00			ug/L
Thorium-228	0.0963	U	0.154	1.00	-0.0241	U	0.260	1.00		0.8	pCi/L
Thorium-230	0.381		0.263	1.00	0.697		0.322	1.00		1.5	pCi/L
Thorium-232	0.0167	U	0.0832	1.00	0.0972	U	0.109	1.00		1.2	pCi/L
Total Suspended Solids	1.14	U		1.00	1.14	U		1.00			mg/L
Uranium	3.14			1.00	3.1			1.00	1.28		ug/L
Zinc	18			1.00	23.5			1.00	NA		ug/L

Duplicate: MW-4136

Sample: MW-4036

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
NO2+NO3 as N	47.0			500.00	43.4			100.00	7.96		mg/L
Uranium	4.96			1.00	5.3			1.00	6.63		ug/L

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12094877 Lab Code: GEN Date Due: 11/2/2012
 Matrix: Water Site Code: WEL01 Date Completed: 11/2/2012

Analyte	Method Type	Date Analyzed	CALIBRATION					Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB								
Arsenic	ICP/MS	10/26/2012			OK	OK	OK	OK	102.0	99.7			104.0		120.0
Arsenic	ICP/MS	10/26/2012								101.0					
Barium	ICP/MS	10/26/2012			OK	OK	OK	OK	95.1			3.0	98.0	4.0	129.0
Barium	ICP/MS	10/26/2012								75.4		0.0		5.0	
Chromium	ICP/MS	10/26/2012			OK	OK	OK	OK	96.8	94.6			96.0		110.0
Chromium	ICP/MS	10/30/2012			OK	OK	OK	OK		93.9			94.0		113.0
Copper	ICP/MS	10/26/2012			OK	OK	OK	OK	101.0	89.9		3.0	91.0		114.0
Copper	ICP/MS	10/30/2012			OK	OK	OK	OK		91.2			90.0		120.0
Iron	ICP/MS	10/26/2012			OK	OK	OK	OK	97.4	93.0		2.0	98.0	5.0	112.0
Iron	ICP/MS	10/30/2012			OK	OK	OK	OK		93.1		0.0	99.0	6.0	113.0
Lead	ICP/MS	10/26/2012			OK	OK	OK	OK	101.0	94.9			97.0		114.0
Lead	ICP/MS	10/26/2012								101.0					
Manganese	ICP/MS	10/26/2012			OK	OK	OK	OK	98.2			3.0	98.0	4.0	105.0
Manganese	ICP/MS	10/30/2012			OK	OK	OK	OK		91.3		1.0	95.0	6.0	111.0
Mercury	CVAA	10/29/2012	0.0000	1.0000	OK	OK	OK	OK	103.0	21.3					94.0
Mercury	CVAA	10/29/2012								16.8					
Nickel	ICP/MS	10/26/2012			OK	OK	OK	OK	101.0	88.9		1.0	97.0	3.0	114.0
Nickel	ICP/MS	10/30/2012			OK	OK	OK	OK		87.9		0.0	91.0	1.0	113.0

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 12094877

Lab Code: GEN

Date Due: 11/2/2012

Matrix: Water

Site Code: WEL01

Date Completed: 11/2/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Selenium	ICP/MS	10/26/2012			OK	OK	OK	OK	OK	103.0	100.0		0.0	108.0		121.0
Selenium	ICP/MS	10/26/2012									101.0					
Silver	ICP/MS	10/26/2012			OK	OK	OK	OK	OK	102.0	98.6			98.0		108.0
Silver	ICP/MS	10/30/2012			OK	OK	OK	OK	OK		96.2			92.0		105.0
Uranium	ICP/MS	10/26/2012			OK	OK	OK	OK	OK	102.0	99.3		2.0	101.0	6.0	117.0
Uranium	ICP/MS	10/26/2012									104.0		2.0		0.4	
Uranium	ICP/MS	10/31/2012			OK	OK	OK	OK	OK	103.0	96.6		1.0	103.0	0.5	112.0
Zinc	ICP/MS	10/26/2012			OK	OK	OK	OK	OK	101.0	125.0		3.0	93.0		114.0
Zinc	ICP/MS	10/26/2012									96.0					

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12094877 **Lab Code:** GEN **Date Due:** 11/2/2012
Matrix: Water **Site Code:** WEL01 **Date Completed:** 11/2/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Chemical Oxygen Demand	10/11/2012							OK	105.00	96.0		0	
NO2+NO3 as N	10/11/2012	0.000	1.0000	OK	OK	OK	OK	OK	101.00	99.6		17.00	
Total Suspended Solids	10/09/2012							OK	99.40				

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12094877 Lab Code: GEN Date Due: 11/2/2012
 Matrix: Water Site Code: WEL01 Date Completed: 11/2/2012

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
Blank	ALPHA	10/28/2012	-0.4020	U				
Blank_Spike	ALPHA	10/28/2012				110.00		
LW-DC12	ALPHA	10/29/2012						1.78
LW-DC12	ALPHA	10/29/2012					107.0	
Blank	BETA	10/28/2012	-0.7850	U				
Blank_Spike	BETA	10/28/2012				103.00		
LW-DC12	BETA	10/29/2012						0.29
LW-DC12	BETA	10/29/2012					105.0	
LW-DC12	Radium-226	10/12/2012						1.71
Blank	Radium-226	10/12/2012	0.3250	U				
LW-DC12	Radium-226	10/12/2012					92.4	
Blank_Spike	Radium-226	10/12/2012				90.70		
LW-DC12	Radium-228	10/17/2012			75.0			
LW-DC99	Radium-228	10/17/2012			89.0			
LW-DC12	Radium-228	10/17/2012			62.0			0.57
Blank_Spike	Radium-228	10/17/2012			73.0	83.10		
LW-DC12	Radium-228	10/17/2012			105.0		83.1	
Blank	Radium-228	10/17/2012	0.2700	U	89.0			
LW-DC12	Thorium-228	10/12/2012			67.0			
LW-DC99	Thorium-228	10/12/2012			80.0			
LW-DC12	Thorium-228	10/12/2012			80.0			0.85
LW-DC12	Thorium-228	10/12/2012			80.0			
Blank	Thorium-228	10/12/2012	-0.0030	U	86.0			
LW-DC12	Thorium-230	10/12/2012						0.96
Blank_Spike	Thorium-230	10/12/2012				116.00		
LW-DC12	Thorium-230	10/12/2012					97.0	
Blank	Thorium-230	10/12/2012	0.1710	U				
LW-DC12	Thorium-232	10/12/2012						0.29
LW-DC12	Thorium-232	10/12/2012						
Blank	Thorium-232	10/12/2012	0.0320	U				



Data Review and Validation Report

General Information

Report Number (RIN): 12104890
 Sample Event: October 8–15, 2012
 Site(s): Weldon Spring
 Laboratory: TestAmerica, Denver, Colorado
 Work Order No.: 280-34552
 Analysis: Metals, Organics, and Wet Chemistry
 Validator: Steve Donovan
 Review Date: December 13, 2012

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3010A	SW-846 6010B
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3010A	SW-846 6020

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-34552-1	MW-1006	2,4-Dinitrotoluene	J	Poor analyte peak resolution

Sample Number	Location	Analyte(s)	Flag	Reason
280-34552-11	MW-2012	2,4-Dinitrotoluene	J	Poor analyte peak resolution
280-34552-15	MW-2050	2,4-Dinitrotoluene	J	Poor analyte peak resolution
280-34552-23	MW-2052	2,4-Dinitrotoluene	J	Poor analyte peak resolution

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 23 water samples on October 11, 2012 accompanied by a Chain of Custody (COC) form. A sample from location MW-2052 was received on October 16, 2012 under chain of custody to replace the original sample that was broken during shipment. The COC forms were checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC forms were complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received with the temperature inside the iced coolers between 1.4 and 4.9 °C, which complies with requirements. The sample from location MW-2052 was broken during shipment. A replacement sample was received on October 16, 2012. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

The reported MDLs for all metal, organic, and wet chemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed using six calibration standards on October 17, 2012. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration

check results were within the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the practical quantitation limit and all results were acceptable.

Method EPA 353.2, Nitrate + Nitrite as N

Calibrations were performed on October 27, 2012, using six calibration standards. The absolute values of the intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in two verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made to verify the linearity of the calibration curve near the practical quantitation limit and all results were acceptable.

Method SW-846 6010B, Iron

Calibrations were performed on October 16, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The reporting limit check result met the acceptance criteria.

Method SW-846 6020, Uranium

Calibrations were performed on October 18, 2012, using a single point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on October 18 and 25, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Metals and Wet Chemistry

All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

Organics

The method blank results were below the MDL for all target compounds.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interference and background correction factors. All check sample results met the acceptance criteria.

Nitroaromatics Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries were within the acceptance ranges with the following exceptions. The surrogate recovery for sample MW-1049 failed the recovery criteria, biased high. There were no nitroaromatic compounds detected in this sample; no qualification was required. The surrogate recovery calculated for the dilution prepared for sample MW-2012 is not valid and not evaluated.

The recovery of the internal standards added to the samples is monitored to measure the purging efficiency. Internal standard recoveries associated with target compounds were stable and within acceptance ranges with the following exception. The recovery of internal standard 1 from many of the samples was below the acceptance criteria. There were no analytes detected in these samples associated with this internal standard and no qualification is required.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spikes met the recovery and precision criteria for all analytes evaluated with the following exceptions.

The spike recovery of 1,3-dinitrobenzene from sample MW-1049 failed the acceptance criteria biased high. 1,3-Dinitrobenzene was not detected in the associated sample and no qualification is required.

The spike duplicate recovery of sulfate from sample MW-1045 was above the laboratory acceptance criteria but within the validation criteria of 125%, requiring no qualification.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The results for all replicates met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the practical quantitation limit for method 6010 or greater than 100 times the practical quantitation limit for method 6020. All evaluated serial dilution data were acceptable.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all analytes.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics and sulfate data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results associated with analyte peaks that do not meet this criteria are qualified with a "J" flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on October 30, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the environmental database. The application compares the new data set (in standard environmental database units) with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

The sulfate result from location MW-1049 was identified as a potential outlier. There were no errors identified associated with this result. Additionally, this location was sampled in duplicate with reproducible results. The data from this event are acceptable as qualified.

Sampling Protocol

All monitoring wells were purged and sampled using the low-flow sampling method, meeting the Category I, II, or III low-flow sampling criteria. Sample results from wells meeting the low-flow criteria are qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed in Table 3 are further qualified with a "Q" flag indicating the data are considered qualitative because they are Category II or III wells.

Table 3. Category II or III Wells

Category II	Category III
MW-1032	MW-1006
MW-1045	MW-4039
MW-2014	

Category II	Category III
MW-2040	
MW-2050	

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. Duplicate samples were collected from locations MW-1049 and MW-4013. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. Daily calibration checks were performed as required with acceptable results.

 Stephen E. Donivan
2012.12.13 15:02:45
-07'00'

Report Prepared By: _____

Stephen Donivan
Laboratory Coordinator

Data Validation Outliers Report - No Field Parameters

Comparison: All historical Data Beginning 1/1/2002

Laboratory: TestAmerica Denver

RIN: 12104890

Report Date: 12/13/2012

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current	Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier		
					Result	Qualifiers		Result	Qualifiers		Result	Qualifiers			N	N Below Detect
						Lab	Data		Lab	Data	Result	Lab	Data			
WEL01	MW-2050	N001	10/08/2012	2,4-Dinitrotoluene	12			58		F	13		FQJ	29	1	No
WEL02	MW-1049	N001	10/09/2012	Sulfate	12			6		F	0.0175	U	F	56	20	Yes

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12104890 Lab Code: STD Validator: Stephen Donovan Validation Date: 12/13/2012

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 23 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There were 3 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12104890 Lab Code: STD Project: Weldon Spring Validation Date: 12/13/2012

Duplicate: MW-1149

Sample: MW-1049

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	0.016	U		1	0.016	U		1			ug/L
1,3-Dinitrobenzene	0.013	U		1	0.014	U		1			ug/L
2,4,6-Trinitrotoluene	0.021	U		1	0.021	U		1			ug/L
2,4-Dinitrotoluene	0.018	U		1	0.018	U		1			ug/L
2,6-Dinitrotoluene	0.021	U		1	0.021	U		1			ug/L
Iron	44000			1	44000			1	0		ug/L
Nitrobenzene	0.032	U		1	0.032	U		1			ug/L
Sulfate	12			1	12			1	0		mg/L
Uranium	0.050	J		1	0.050	U		1			ug/L

Duplicate: MW-4113

Sample: MW-4013

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Nitrate+Nitrite as N	82	B		20	77	B		20	6.29		mg/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12104890

Project: Weldon Spring

Lab Code: STD

Validation Date: 12/13/2012

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: There was 1 MS/MSD failure.

Surrogate Recovery: There were 2 surrogate failures.

SAMPLE MANAGEMENT SYSTEM

RIN: 12104890 Lab Code: STD

Non-Compliance Report: Surrogate Recovery

Project: Weldon Spring

Validation Date: 12/13/2012

Ticket	Location	Lab Sample ID	Method	Dilution	Surrogate	Recovery	Lower Limit	Upper Limit
KLR 348	MW-1049	280-34552-7	8321A	1	Nitrobenzene-d5	131	48	130
KLR 338	MW-2012	280-34552-11	8321A	100	Nitrobenzene-d5	-38	48	130

SAMPLE MANAGEMENT SYSTEM

Non-Compliance Report: MS/MSD Performance

RIN: 12104890 Lab Code: STD

Project: Weldon Spring

Validation Date: 12/13/2012

MS/MSD	Date Analyzed	Method	Analyte	Recovery MS	Recovery MSD	Lower Limit	Upper Limit	MSD RPD	RPD Limit
KLR 348	10/20/2012	8321A	1,3-Dinitrobenzene	150	112	71	130		

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 12104890 Lab Code: STD Date Due: 11/8/2012
 Matrix: Water Site Code: WEL01 Date Completed: 11/1/2012

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Iron	ICP/ES	10/16/2012			OK	OK	OK	OK	OK	98.0		74.0	2.0	94.0	4.0	110.0
Uranium	ICP/MS	10/19/2012			OK	OK	OK	OK	OK	101.0	107.0	111.0	4.0	115.0		99.0
Uranium	ICP/MS	10/19/2012									103.0					

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12104890 **Lab Code:** STD **Date Due:** 11/8/2012
Matrix: Water **Site Code:** WEL01 **Date Completed:** 11/1/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Nitrate+Nitrite as N	10/27/2012	0.000	1.0000	OK	OK	OK	OK	OK	104.00	107.0	101.0	3.00	
Sulfate	10/24/2012	0.000	0.9996	OK	OK	OK	OK	OK	97.00	116.0	118.0	1.00	
Sulfate	10/25/2012			OK	OK	OK	OK	OK	101.00	120.0	122.0	1.00	

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Data Review and Validation Report

General Information

Report Number (RIN): 12114954
Sample Event: November 13-26, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 315871
Analysis: Metals and Wet Chemistry
Validator: Gretchen Baer
Review Date: January 18, 2013

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) "Standard Practice for Validation of Laboratory Data." The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Iron	LMM-01	SW-846 3005A	SW-846 6010B
Sulfate	WCH-A-036	EPA 300.0	EPA 300.0
Uranium	LMM-02	SW-846 3005A	SW-846 6020

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the attached validation worksheets and the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
315871-021	MW-1048	Sulfate	J	Purge criteria not met during sampling
315871-021	MW-1048	Uranium	J	Purge criteria not met during sampling
315871-024	MW-1048	Iron	J	Purge criteria not met during sampling
315871-027	MW-1048 Dup, MW-1148	Iron	J	Purge criteria not met during sampling
315871-028	MW-1048 Dup, MW-1148	Sulfate	J	Purge criteria not met during sampling
315871-028	MW-1048 Dup, MW-1148	Uranium	J	Purge criteria not met during sampling

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 35 water samples on November 28, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 3 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 300.0, Sulfate

Calibrations were performed on October 8, 2012, using three calibration standards. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in five verification checks. All calibration check results were within the acceptance criteria. Reporting limit verification checks were made to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range.

Method SW-846 6010B, Iron

Calibrations were performed on December 4, 2012, using three calibration standards. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in nine verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The reporting limit check result met the acceptance criteria.

Method SW-846 6020, Uranium

Calibrations were performed on December 8, 18, and 20, 2012, using a two point calibration. Initial and continuing calibration verification checks were made at the required frequency resulting in 12 verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration.

Inductively Coupled Plasma Interference Check Sample Analysis

Interference check samples were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike (MS) samples are used to measure method performance in the sample matrix. The MS data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike. The spike recoveries met the acceptance criteria of 75 to 125 percent for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for replicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. All replicate results met these criteria, demonstrating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for sulfate data. All analyte peak integrations were acceptable.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on December 27, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists all new data that fall outside the historical data range. Data listed in the report are highlighted if the concentration detected is not within 50 percent of historical minimum or maximum values. A determination is also made if the data are normally distributed using the Studentized Range Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

One result was identified as potentially anomalous. The iron result for location MW-1009 had a concentration higher than previously observed. Historical results for iron indicate upward trending at this location since 2006. The data for this RIN are acceptable as qualified.

Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory:

RIN: 12114954

Report Date: 1/18/2013

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current	Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier		
					Result	Qualifiers		Result	Qualifiers		Result	Qualifiers			N	N Below Detect
						Lab	Data		Lab	Data		Lab	Data			
WEL02	MW-1009	0001	11/14/2012	Iron	45.20000 1			43.4		FQ	3.88	N	FQJ	60	0	Yes
WEL02	MW-1009	N001	11/14/2012	Uranium	0.000188	B		0.149		J	0.00021	UJ		122	37	No
WEL02	MW-1013	N001	11/15/2012	Sulfate	53.4			9300			56		F	109	0	No
WEL02	SW-1004	N001	11/20/2012	Sulfate	481			228			13.4			20	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

Sampling Protocol

Sampling at all monitoring wells met the Category I, II, or III low-flow sampling criteria and results were qualified with an “F” flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. The groundwater sample results for the wells listed below were qualified with a “Q” flag in the database indicating the data are considered qualitative because of the sampling protocol (Category II or III).

MW-1007
MW-1009
MW-1016
MW-1028
MW-1031
MW-1046
MW-1047
MW-1051
MW-1052
MW-3037
MWS-1

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. Duplicate samples were collected from locations MW-1048 and MW-3037. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells, with the exception of the water level at MW-1048. The water level drop exceeded acceptance criteria for this category I well while being purged at a rate of 280 milliliters per minute. The associated laboratory results are qualified with a “J” flag (estimated).

A calibration parameter at pH 4 was below the acceptance criterion; however, the calibration parameters at pH 7 were acceptable. Since all samples had pH values near 7, no pH results will be qualified.



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Report Prepared By: _____

Gretchen Baer
Data Validator

SAMPLE MANAGEMENT SYSTEM
General Data Validation Report

RIN: 12114954 Lab Code: GEN Validator: Gretchen Baer Validation Date: 1/18/2013

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 35 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There were 3 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12114954 Lab Code: GEN Project: Weldon Spring Validation Date: 1/18/2013

Duplicate: MW-1148		Sample: MW-1048				Duplicate					
Analyte	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution	RPD	RER	Units
Iron	1340			1.00	1320			1.00	1.50		ug/L
Sulfate	45.0			10.00	44.2			10.00	1.79		mg/L
Uranium	319			5.00	315			5.00	1.26		ug/L

Duplicate: MW-3137		Sample: MW-3037				Duplicate					
Analyte	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution	RPD	RER	Units
Uranium	4.57			1.00	4.4			1.00	3.79		ug/L

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 12114954Lab Code: GENDate Due: 12/26/2012Matrix: WaterSite Code: WEL01Date Completed: 12/27/2012

Analyte	Method Type	Date Analyzed	CALIBRATION							Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB									
Iron	ICP/ES	12/04/2012	0.0000	1.0000	OK	OK	OK	OK	OK	98.5	95.5		1.0	93.0	2.0	98.0	
Iron	ICP/ES	12/04/2012												94.0		104.0	
Uranium	ICP/MS	12/08/2012			OK	OK	OK	OK	OK	112.0	112.0		1.0	119.0	7.0	126.0	
Uranium	ICP/MS	12/20/2012			OK	OK	OK	OK						84.0		119.0	
Uranium	ICP/MS	12/18/2012			OK	OK	OK	OK	OK	110.0	122.0		4.0	106.0	0.3	119.0	

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12114954 **Lab Code:** GEN **Date Due:** 12/26/2012
Matrix: Water **Site Code:** WEL01 **Date Completed:** 12/27/2012

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
Sulfate	12/06/2012	0.400	0.9986	OK	OK	OK	OK	OK	104.00				
Sulfate	12/07/2012									101.0		0	
Sulfate	12/07/2012									101.0		0	

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Data Review and Validation Report

General Information

Report Number (RIN): 12114986
Sample Event: December 3–12, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 316789
Analysis: Metals, Organics, Radiochemistry, and Wet Chemistry
Validator: Steve Donovan
Review Date: February 8, 2013

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1. All analyses were successfully completed.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Chemical Oxygen Demand	WCH-A-010	EPA 410.4	EPA 410.4
Chloride	MIS-A-045	EPA 300.0A	EPA 300.0A
Fluoride	MIS-A-045	EPA 300.0A	EPA 300.0A
Metals: As, Ba, Co, Cr, Fe, Mn, Ni, Pb, Se, Ti, U	LMM-02	SW-846 3005A	SW-846 6020
Nitrate + Nitrite as N	WCH-A-022	EPA 353.2	EPA 353.2
PAH Compounds	LMS-02	SW-846 3510	SW-846 8310
PCBs	PEP-A-006	SW-846 3510C	SW-846 8082
Radium-226	GPC-A-018	SW-846 9315 Mod	SW-846 9315 Mod
Radium-228	GPC-A-020	SW-846 9320 Mod	SW-846 9320 Mod
Sulfate	MIS-A-045	EPA 300.0A	EPA 300.0A
Thorium Isotopes	ASP-A-008	EML A-01-R Mod	EML A-01-R Mod
Total Dissolved Solids	WCH-A-033	EPA 160.1	EPA 160.1
Total Organic Carbon	WVH-A-025	EPA 415.1	EPA 415.1
Volatiles (VOA)	LMV-06	SW-846 5030B	SW-846 8260B

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
316789001	MW-2051	Cobalt	U	Less than 5 times the method blank
316789001	MW-2051	Radium-226	J	Less than the Determination Limit
316789001	MW-2051	Radium-228	J	Less than the Determination Limit
316789002	LW-DC10	Arsenic	U	Less than 5 times the method blank
316789002	LW-DC10	Manganese	J	Serial dilution result
316789002	LW-DC10	Radium-226	J	Less than the Determination Limit
316789002	LW-DC10	Radium-228	J	Less than the Determination Limit
316789003	MW-2032	Cobalt	U	Less than 5 times the method blank
316789003	MW-2032	Radium-226	J	Less than the Determination Limit
316789003	MW-2032	Radium-228	J	Less than the Determination Limit
316789004	SP-6301	Cobalt	U	Less than 5 times the method blank
316789004	SP-6301	Radium-228	J	Less than the Determination Limit
316789005	MW-2047	Cobalt	U	Less than 5 times the method blank
316789005	MW-2047	Radium-228	J	Less than the Determination Limit
316789006	MW-2055	Cobalt	U	Less than 5 times the method blank
316789006	MW-2055	Radium-226	J	Less than the Determination Limit
316789006	MW-2055	Radium-228	J	Less than the Determination Limit
316789007	MW-2046	Cobalt	U	Less than 5 times the method blank
316789007	MW-2046	Radium-226	J	Less than the Determination Limit
316789007	MW-2046	Radium-228	J	Less than the Determination Limit
316789008	LW-DC10 Duplicate	Arsenic	U	Less than 5 times the method blank
316789008	LW-DC10 Duplicate	Radium-226	J	Less than the Determination Limit
316789008	LW-DC10 Duplicate	Radium-228	J	Less than the Determination Limit

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 27 water samples on December 14, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample aliquot for PCB and PAH analysis from location SP6301 was broken during shipment. This location was re-sampled and submitted for PCB and PAH under a different RIN. The sample shipment was received with the temperatures inside the iced coolers at 2 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), Decision Level Concentration (DLC), and Determination Limit (DL). The MDC is a measure of radiochemical method performance and was calculated and reported as specified in *Quality Systems for Analytical Services*. The DLC is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is estimated as 3 times the one-sigma total propagated uncertainty. Results that are greater than the MDC, but less than the DLC are qualified with a “U” flag (not detected). The DL for radiochemical results is the lowest concentration that can be reliably measured, and is defined as 3 times the MDC. Results not previously “U” qualified that are less than the DL are qualified with a “J” flag as estimated values.

The reported MDLs for all metal, organic, and wet chemical analytes; and MDCs for radiochemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All initial calibration and calibration check standards were prepared from independent sources.

Method EPA 160.1, Total Dissolved Solids

There is no initial or continuing calibration requirement associated with the determination of total dissolved solids.

Method EPA 300.0A, Chloride, Fluoride, Sulfate

The initial calibrations were performed using six calibration standards on November 14, 2012. The correlation coefficient values were greater than 0.995 and intercepts were less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in nine verification checks. All calibration checks met the acceptance criteria.

Method EPA 353.2, Nitrate + Nitrite as N

The initial calibrations were performed using five calibration standards on December 18, 2012, resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the intercept of the calibration curve was less than three times the method detection limit.

Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria.

Method EPA 410.4, Chemical Oxygen Demand

The initial calibration was performed using a single point calibration on December 20, 2012. Initial and continuing calibration verification checks were made at the required frequency resulting in two verification checks. All calibration checks met the acceptance criteria.

Method EPA 415.1, Total Organic Carbon

The initial calibrations were performed using five calibration standards on December 17, 2012, resulting in calibration curve correlation coefficient values greater than 0.995. The absolute value of the intercept of the calibration curve was less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria.

Method SW-846 6020, Metals

Calibrations were performed on January 2–9, 2013, using two calibration standards. The absolute values of the intercepts were less than three times the method detection limit. Initial and continuing calibration verification checks were made at the required frequency with all calibration checks meeting the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 8082, PCBs

The initial calibration for PCBs was performed using five calibration standards on December 14, 2012. The initial calibration data met the acceptance criteria for all analytes on both gas chromatography columns. Initial and continuing calibration checks were made at the required frequency resulting in two calibration checks. All continuing calibration verifications were within the acceptance criteria with the following exception. The Aroclor 1260 CCV verification failed on the secondary column. Aroclor 1260 was not detected in any of the associated samples and no qualification is required.

Method SW-846 8260B, Volatiles

The volatile compounds requested were 1,2-dichloroethane, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride. Initial calibration of instrument VOA3 was performed on December 5, 2012 using seven calibration standards. The average response factor and associated relative standard deviation met the acceptance criteria for all analytes where the averaged response factor approach was used. In cases where the linear calibration curve approach was used, the calibration curve correlation coefficient value was greater than 0.99 and the intercept was less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All target compounds had percent drift values less than 20 percent. The mass spectrometer calibration and resolution were checked at the beginning of each analytical run in accordance with the procedure. Internal standard recoveries were stable and within acceptance ranges. All surrogate recoveries were within the acceptance ranges.

Method SW-846 8310, PAH Compounds

The initial calibration for PAHs was performed using eight calibration standards on October 2, 2012. The initial calibration data met the acceptance criteria for all analytes. Initial and continuing calibration checks were made at the required frequency resulting in three verification checks. All continuing calibration verifications were within the acceptance criteria.

Radiochemical Analysis

Thorium Isotopes

Alpha spectrometry calibrations and instrument backgrounds were performed within a month previous to sample analysis. Calibration standards were counted to obtain a minimum of 10,000 counts per peak. Daily instrument checks met the acceptance criteria. The tracer recoveries met the acceptance criteria of 30 to 110 percent for all samples. The full width at half maximum (FWHM) was reviewed to evaluate the spectral resolution. None of the tracer FWHM values exceeded 100 kiloelectron volts (keV). All ROIs were satisfactory.

Radium-226

Emanation cell plateau voltage determinations and cell efficiency calibrations were performed within a year previous to sample analysis.

Radium-228

Plateau voltage determinations and detector efficiency calibrations were performed within a year previous to sample analysis. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method blank and calibration blank results associated with the samples were below the practical quantitation limits for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than five times the blank concentration. The radiochemistry method blank results were less than the DLC for all analytes.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the frequency to verify the instrumental interference and background correction factors. All ICSAB check sample results met the acceptance criteria.

Volatiles, PAHs, and PCBs Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate spike recoveries are evaluated to identify data quality effects due to such factors as interference or high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. Internal standard recoveries were stable and within acceptance ranges. All sample surrogate recoveries were within the acceptance ranges.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spike results met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable laboratory precision. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than three, indicating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable with the following exception. The recovery naphthalene from the PAH control sample did not meet the acceptance criteria. Naphthalene was not detected in any of the associated samples, not requiring qualification.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 50 times the MDL. All evaluated serial dilution data were acceptable with the exception of manganese. The associated sample manganese result is qualified with a "J" flag as an estimated value.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for ion chromatography, PAH, PCB, and volatiles data. All peak integrations, including manual integrations, were satisfactory.

Compound Identification

The mass spectral data were reviewed for each reported organic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the method detection limit (minimum detectable concentration for radiochemistry) and practical quantitation limit for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on January 15, 2013. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Field Measurements

The pre-sampling purge criteria were met for all wells.

Sampling Protocol

Sample results for all monitor wells met the Category I, II, or III low-flow sampling criteria and were qualified with an “F” flag in the database, indicating the wells were purged and sampled using the low-flow sampling method.

The ground water sample results for the wells listed in Table 3 were qualified with a “Q” flag in the database indicating the data are considered qualitative because of the sampling protocol (either category II or category III).

Table 3. Category II and III Wells

Well	Category II	Category III
MW-2046	X	
MW-2047	X	
MW-2055		X
MW-3003	X	
MW-3006	X	
MW-3024	X	
MW-3040	X	
MW-4007	X	
MW-4040	X	
MW-4043	X	
MWD-2	X	
MWS-2	X	

Equipment Blank Assessment

An equipment blank was not collected because all sampling was performed with dedicated equipment or new pump tubing.

Trip Blank Assessment

Trip blanks are prepared and analyzed to document contamination attributable to shipping and field handling procedures. One trip blank was submitted with these samples. There were no analytes detected in the trip blank.

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical duplicate results, the relative error ratio for duplicate results (calculated using the one-sigma total propagated uncertainty) should be less than three. Duplicate samples were collected from locations LW-DC10 MWD-2, and MW-4029. The duplicate results met these criteria demonstrating acceptable overall precision.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the environmental database. The application compares the new data set (in standard environmental database units) with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
 2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric
-

test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.

3. Scientifically review statistical outliers and decide on their disposition.

There were no potential outliers identified and the data from this event are acceptable as qualified.

 Stephen E. Donivan
2013.02.12 10:11:53
-07'00'

Report Prepared By: _____
Stephen Donivan
Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12114986 Lab Code: GEN Validator: Stephen Donovan Validation Date: 02/08/2013
Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics
of Samples: 27 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

There are 0 detection limit failures.

There was 1 trip/equipment blank evaluated.

There were 3 duplicates evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12114986 Lab Code: GEN Project: Weldon Spring Validation Date: 02/08/2013

Duplicate: LW-DD10

Sample: LW-DC10

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Acenaphthene	0.150	U		1.00	0.150	U		1.00			ug/L
Acenaphthylene	0.150	U		1.00	0.150	U		1.00			ug/L
Anthracene	0.150	U		1.00	0.150	U		1.00			ug/L
Aroclor 1016	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1221	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1232	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1242	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1248	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1254	0.0333	U		1.00	0.0333	U		1.00			ug/L
Aroclor 1260	0.0333	U		1.00	0.0333	U		1.00			ug/L
Arsenic	3.5	B		1.00	1.93	B		1.00			ug/L
Barium	651			1.00	608			1.00	6.83		ug/L
Benzo(a)anthracene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(a)pyrene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(b)fluoranthene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(g,h,i)perylene	0.016	U		1.00	0.016	U		1.00			ug/L
Benzo(k)fluoranthene	0.008	U		1.00	0.008	U		1.00			ug/L
Chemical Oxygen Demand	26.6			1.00	37.0			1.00	NA		mg/L
Chloride	46.9			25.00	49.9			25.00	6.20		mg/L
Chromium	2.00	U		1.00	2.00	U		1.00			ug/L
Chrysene	0.016	U		1.00	0.016	U		1.00			ug/L
Cobalt	3.7	B		1.00	3.56	B		1.00	3.86		ug/L
Dibenz(a,h)anthracene	0.016	U		1.00	0.016	U		1.00			ug/L
Fluoranthene	0.016	U		1.00	0.016	U		1.00			ug/L
Fluorene	0.150	U		1.00	0.150	U		1.00			ug/L
Fluoride	1.65	U		50.00	1.65	U		50.00			mg/L
Indeno(1,2,3-cd)pyrene	0.016	U		1.00	0.016	U		1.00			ug/L
Iron	3060			1.00	2660			1.00	13.99		ug/L
Lead	0.500	U		1.00	0.500	U		1.00			ug/L
Manganese	590	E		1.00	604	E		1.00	2.35		ug/L
Naphthalene	0.150	U		1.00	0.150	U		1.00			ug/L
Nickel	10.2			1.00	10.3			1.00	0.98		ug/L
NO2+NO3 as N	1.14			5.00	1.13			5.00	0.88		mg/L
Phenanthrene	0.182	U		1.00	0.182	U		1.00			ug/L
Pyrene	0.016	U		1.00	0.016	U		1.00			ug/L
Radium-226	0.372		0.228	1.00	0.404		0.177	1.00		0.2	pCi/L
Radium-228	0.940		0.526	1.00	0.749		0.434	1.00		0.5	pCi/L
Selenium	7.92			1.00	7.37			1.00			ug/L
Sulfate	70.5			50.00	72.9			50.00	3.35		mg/L
Thallium	0.450	U		1.00	0.450	U		1.00			ug/L

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 12114986 Lab Code: GEN Project: Weldon Spring Validation Date: 02/08/2013

Duplicate: LW-DD10

Sample: LW-DC10

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Thorium-228	-0.0186	U	0.136	1.00	-0.0196	U	0.0996	1.00		0	pCi/L
Thorium-230	0.185	U	0.187	1.00	0.328	U	0.239	1.00		0.9	pCi/L
Thorium-232	0.0237	U	0.0755	1.00	-0.058	U	0.0868	1.00		1.4	pCi/L
Total Dissolved Solids	684			1.00	703			1.00	2.74		mg/L
Total Organic Carbon	13.1			1.00	13.1			1.00	0		mg/L
Uranium	31.4			1.00	31.6			1.00	0.63		ug/L

Duplicate: MW-4129

Sample: MW-4029

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,2-Dichloroethane	0.300	U		1.00	0.300	U		1.00			ug/L
1,2-Dichloroethane	0.300	U		1.00	1.50	U		5.00			ug/L
cis-1,2-Dichloroethene	4.24			1.00	4.15			1.00	2.15		ug/L
cis-1,2-Dichloroethene	4.24			1.00	4.15	J		5.00			ug/L
NO2+NO3 as N	461			500.00	427			500.00	7.66		mg/L
Tetrachloroethene	0.300	U		1.00	0.300	U		1.00			ug/L
Tetrachloroethene	0.300	U		1.00	1.50	U		5.00			ug/L
trans-1,2-Dichloroethene	0.380	J		1.00	0.370	J		1.00			ug/L
trans-1,2-Dichloroethene	0.380	J		1.00	1.50	U		5.00			ug/L
Trichloroethene	318	E		1.00	310	E		1.00	2.55		ug/L
Trichloroethene	318	E		1.00	373			5.00	15.92		ug/L
Vinyl Chloride	0.300	U		1.00	0.300	U		1.00			ug/L
Vinyl Chloride	0.300	U		1.00	1.50	U		5.00			ug/L

Duplicate: MWR-2

Sample: MWD-2

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Uranium	0.317			1.00	0.306			1.00			ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12114986

Project: Weldon Spring

Lab Code: GEN

Validation Date: 02/08/2013

LCS Recovery: There was 1 LCS failure.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: There was 1 surrogate failure.

SAMPLE MANAGEMENT SYSTEM

Non-Compliance Report: LCS Recovery

RIN: 12114986 Lab Code: GEN

Project: Weldon Spring

Validation Date: 02/08/2013

LCS/LCSD	Date Analyzed	Method	Analyte	Recovery	Lower Limit	Upper Limit
LCS	12/20/2012	EPA 8310	Naphthalene	48.1	54.0	108.0

SAMPLE MANAGEMENT SYSTEM

RIN: 12114986 Lab Code: GEN

Non-Compliance Report: Surrogate Recovery

Project: Weldon Spring

Validation Date: 02/08/2013

Ticket	Location	Lab Sample ID	Method	Dilution	Surrogate	Recovery	Lower Limit	Upper Limit
Method Blank		1202799150	EPA 8310	1.00	Decafluorobiphenyl	20.5	21.0	96.0

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 12114986

Lab Code: GEN

Date Due: 01/11/2013

Matrix: Water

Site Code: WEL01

Date Completed: 01/11/2013

Analyte	Method Type	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	CCV	CCB								
Arsenic	ICP/MS	01/07/2013			OK	OK	OK	113.0	109.0			109.0		110.0
Barium	ICP/MS	01/07/2013			OK	OK	OK	107.0			13.0	102.0	2.2	113.0
Chromium	ICP/MS	01/05/2013			OK	OK	OK	97.9	95.1			97.0		108.0
Cobalt	ICP/MS	01/07/2013			OK	OK	OK	108.0	102.0		9.0	100.0		111.0
Iron	ICP/MS	01/05/2013			OK	OK	OK	99.6	94.9		1.0	98.0		114.0
Lead	ICP/MS	01/05/2013			OK	OK	OK	101.0	94.0			101.0		116.0
Manganese	ICP/MS	01/05/2013			OK	OK	OK	98.8	79.2		2.0	103.0	10.8	112.0
Nickel	ICP/MS	01/07/2013			OK	OK	OK	107.0	101.0		9.0	100.0		116.0
Selenium	ICP/MS	01/05/2013			OK	OK	OK	107.0	103.0		3.0	112.0		130.0
Thallium	ICP/MS	01/05/2013			OK	OK	OK	90.7	89.7			97.0		113.0
Uranium	ICP/MS	01/02/2013			OK	OK	OK	110.0	113.0		3.0	108.0	4.2	115.0
Uranium	ICP/MS	01/05/2013			OK	OK	OK	103.0	94.2		2.0	108.0	1.6	110.0
Uranium	ICP/MS	01/09/2013			OK	OK	OK	112.0	109.0		18.0	108.0		120.0

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 12114986 **Lab Code:** GEN **Date Due:** 01/11/2013
Matrix: Water **Site Code:** WEL01 **Date Completed:** 01/11/2013

Analyte	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	CCV	CCB						
Chemical Oxygen Demand	12/20/2012			OK	OK	OK	109.00	103.0		5.00	
Chloride	12/20/2012	0.000	0.9974	OK	OK	OK	98.30				
Chloride	01/08/2013									1.00	
Chloride	01/09/2013							105.0			
Fluoride	12/20/2012	0.000	0.9999	OK	OK	OK	107.00			14.00	
Fluoride	12/20/2012							101.0			
NO2+NO3 as N	12/18/2012	0.000	1.0000	OK	OK	OK	91.30	105.0		1.00	
NO2+NO3 as N	12/18/2012							103.0		7.00	
Sulfate	12/20/2012	0.000	0.9985	OK	OK	OK	101.00	92.6		1.00	
Total Dissolved Solids	12/17/2012					OK	96.20			0	
Total Organic Carbon	12/17/2012	0.000	0.9994	OK	OK			108.0		0	
Total Organic Carbon	12/18/2012					OK	106.00				

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12114986 Lab Code: GEN Date Due: 01/11/2013
 Matrix: Water Site Code: WEL01 Date Completed: 01/11/2013

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
LW-DC10	Radium-226	01/03/2013						1.77
Blank_Spike	Radium-226	01/03/2013				84.70		
LW-DC10	Radium-226	01/03/2013					79.0	
Blank	Radium-226	01/03/2013	0.1230	U		84.70		
LW-DC10	Radium-228	01/02/2013			96.0			
LW-DD10	Radium-228	01/02/2013			91.0			
MW-2032	Radium-228	01/02/2013			85.0			
MW-2046	Radium-228	01/02/2013			92.0			
MW-2047	Radium-228	01/02/2013			94.0			
MW-2051	Radium-228	01/02/2013			89.0			
MW-2055	Radium-228	01/02/2013			92.0			
SP-6301	Radium-228	01/02/2013			82.0			
LW-DC10	Radium-228	01/02/2013			95.0			1.42
Blank_Spike	Radium-228	01/02/2013			92.0	111.00		
LW-DC10	Radium-228	01/02/2013			95.0		98.2	
Blank	Radium-228	01/02/2013	0.2280	U	85.0			
LW-DC10	Thorium-228	12/22/2012			90.0			
LW-DD10	Thorium-228	12/22/2012			74.0			
MW-2047	Thorium-228	12/22/2012			76.0			
MW-2051	Thorium-228	12/22/2012			79.0			
SP-6301	Thorium-228	12/22/2012			89.0			
LW-DC10	Thorium-228	12/22/2012			85.0			
Blank	Thorium-228	12/22/2012	0.0120	U	95.0			
MW-2032	Thorium-228	12/27/2012			84.0			
MW-2046	Thorium-228	12/27/2012			88.0			
MW-2055	Thorium-228	12/27/2012			54.0			
LW-DC10	Thorium-228	12/27/2012			83.0			0.42
Blank_Spike	Thorium-230	12/22/2012				101.00		
LW-DC10	Thorium-230	12/22/2012					97.4	
Blank	Thorium-230	12/22/2012	0.2580	U				
LW-DC10	Thorium-230	12/27/2012						0.14
LW-DC10	Thorium-232	12/22/2012						

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 12114986 **Lab Code:** GEN **Date Due:** 01/11/2013
Matrix: Water **Site Code:** WEL01 **Date Completed:** 01/11/2013

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
Blank	Thorium-232	12/22/2012	-0.0220	U				
LW-DC10	Thorium-232	12/27/2012						0.49

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Data Review and Validation Report

General Information

Report Number (RIN): 12114987
Sample Event: December 10–12, 2012
Site(s): Weldon Spring
Laboratory: TestAmerica, Denver, Colorado
Work Order No.: 280-37010
Analysis: Organics
Validator: Stephen Donivan
Review Date: February 11, 2013

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Nitroaromatics	LMN-03	SW-846 3535	SW-846 8321A

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
280-37010-5	MW-2047	2,4-Dinitrotoluene	J	Poor analyte peak resolution

Sample Shipping/Receiving

TestAmerica in Denver, Colorado, received 11 water samples on December 13, 2012 accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received with the temperature inside the iced cooler at 3.0 °C, which complies with requirements. The samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

The reported MDLs for all metal, organic, and wet chemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method SW-846 8321, Nitroaromatics

Initial calibrations for nitroaromatics were performed on December 20, 2012, using seven calibration standards. Linear or higher order regression calibrations had correlation coefficient values greater than 0.99 and intercepts less than three times the MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria. All target compounds had percent drift values less than 20 percent.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Organics

The method blank results were below the MDL for all target compounds.

Nitroaromatics Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate recoveries are used to monitor factors such as interference and high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. All surrogate recoveries were within the acceptance ranges. The surrogate recovery calculated for the dilution prepared for sample MW-2046 is not valid and not evaluated.

The recovery of the internal standards added to the samples is monitored to measure the purging efficiency. Internal standard recoveries associated with target compounds were stable and within acceptance ranges with the following exception. The recovery of internal standards one and two from many of the samples was below the acceptance criteria. There were no analytes detected in these samples associated with this internal standard and no qualification is required.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spikes met the recovery and precision criteria for all analytes.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The results for all replicates met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for nitroaromatics data. Manual peak integrations were performed during nitroaromatics analysis. All analyte peak integrations were acceptable.

Nitroaromatic analyte peaks that share a common ion mass should be resolved such that the height of the valley between peaks is less than 20% of the analyte peak height. Sample results associated with analyte peaks that do not meet this criteria are qualified with a "J" flag as estimated values.

Compound Identification

The mass spectral and retention time data were reviewed for each nitroaromatic compound to verify that analytes were identified correctly.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on December 28, 2012. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Potential Outliers

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the environmental database. The application compares the new data set (in standard environmental database units) with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

None of the analytical results were identified as potential outliers. The data from this event are acceptable as qualified.

Field Measurements

The pre-sampling purge criteria were met for all wells.

Sampling Protocol

Sample results for all monitor wells met the Category I, II, or III low-flow sampling criteria and were qualified with an “F” flag in the database, indicating the wells were purged and sampled using the low-flow sampling method.

The ground water sample results for the wells listed in Table 3 were qualified with a “Q” flag in the database indicating the data are considered qualitative because of the sampling protocol (either category II or category III).

Table 3. Category II and III Wells

Well	Category II	Category III
MW-2046	X	
MW-2047	X	
MW-2055		X
MW-4043	X	

Field Duplicate Analysis

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. The relative percent difference for duplicate results that are greater than five times the PQL should be less than 20 percent. For results that are less than the PQL, the range should be no greater than the PQL. A duplicate samples was collected from location LW-DC10. The duplicate results met the criteria, demonstrating acceptable overall precision.

Field Measurements

The pre-sampling purge criteria were met for all wells. Daily calibration checks were performed as required with acceptable results.


 Stephen E. Donivan
 2013.02.08
 14:14:07 -07'00'

Report Prepared By: _____
 Stephen Donivan
 Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12114987 Lab Code: STD Validator: Stephen Donovan Validation Date: 02/08/2013

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 11 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

Page 1 of 1

RIN: 12114987 Lab Code: STD Project: Weldon Spring Validation Date: 02/08/2013

Duplicate: LW-DD10

Sample: LW-DC10

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
1,3,5-Trinitrobenzene	0.017	U		1	0.017	U		1			ug/L
1,3-Dinitrobenzene	0.014	U		1	0.014	U		1			ug/L
2,4,6-Trinitrotoluene	0.021	U		1	0.022	U		1			ug/L
2,4-Dinitrotoluene	0.019	U		1	0.019	U		1			ug/L
2,6-Dinitrotoluene	0.021	U		1	0.022	U		1			ug/L
Nitrobenzene	0.032	U		1	0.033	U		1			ug/L

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12114987

Project: Weldon Spring

Lab Code: STD

Validation Date: 02/08/2013

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: All MS/MSD recoveries were within the laboratory acceptance limits.

Surrogate Recovery: All surrogate recoveries were within the laboratory acceptance limits.



Data Review and Validation Report

General Information

Report Number (RIN): 12125028
Sample Event: December 18, 2012
Site(s): Weldon Spring
Laboratory: GEL Laboratories, Charleston, South Carolina
Work Order No.: 316978
Analysis: Organics
Validator: Stephen Donovan
Review Date: February 9, 2013

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1. All analyses were successfully completed.

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
PAH Compounds	LMS-02	SW-846 3510	SW-846 8310
PCBs	PEP-A-006	SW-846 3510C	SW-846 8082

Data Qualifier Summary

None of the analytical results required qualification.

Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received one water sample on December 19, 2012, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that the sample was listed with sample collection dates and times. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperatures inside the iced coolers at 4 °C, which complies with requirements. The samples were received in the correct container types and

had been preserved correctly for the requested analyses. The sample was analyzed within the applicable holding times.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal, organic, and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

The reported MDLs for all organic analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All initial calibration and calibration check standards were prepared from independent sources.

Method SW-846 8082, PCBs

The initial calibration for PCBs was performed using five calibration standards on December 17, 2012. The initial calibration data met the acceptance criteria for all analytes on both gas chromatography columns. Initial and continuing calibration checks were made at the required frequency resulting in two calibration checks. All continuing calibration verifications were within the acceptance criteria with the following exception. The Aroclor 1260 CCV verification failed on the secondary column. Aroclor 1260 was not detected in any of the associated samples and no qualification is required.

Method SW-846 8310, PAH Compounds

The initial calibration for PAHs was performed using eight calibration standards on January 3, 2013. The initial calibration data met the acceptance criteria for all analytes. Initial and continuing calibration checks were made at the required frequency resulting in two verification checks. All continuing calibration verifications were within the acceptance criteria.

Method Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. All method blank results associated with the samples were below the MDL for all analytes.

PAHs and PCBs Internal Standard and Surrogate Recovery

Laboratory performance for individual samples is evaluated by means of surrogate spikes. All samples are spiked with surrogate compounds prior to sample preparation. Surrogate spike

recoveries are evaluated to identify data quality effects due to such factors as interference or high concentrations of analytes. Surrogate recoveries may also be influenced by the success in recoveries of the internal standards. Internal standard recoveries were stable and within acceptance ranges. All sample surrogate recoveries were within the acceptance ranges.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than four times the spike concentration. The spike results met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent (or less than the laboratory-derived control limits for organics). For results that are less than the PQL, the range should be no greater than the PQL. The replicate results met these criteria, demonstrating acceptable laboratory precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for PAH and PCB data. All peak integrations, including manual integrations, were satisfactory.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the method detection limit and practical quantitation limit for all analytes and all required supporting documentation.

Electronic Data Deliverable (EDD) File

The EDD file arrived on January 17, 2013. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

Stephen E. Donovan

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Report Prepared By: _____

Stephen Donovan
Laboratory Coordinator

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 12125028 Lab Code: GEN Validator: Stephen Donovan Validation Date: 02/08/2013

Project: Weldon Spring Analysis Type: Metals General Chem Rad Organics

of Samples: 1 Matrix: Water Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

SAMPLE MANAGEMENT SYSTEM
Organics Data Validation Summary

RIN: 12125028

Project: Weldon Spring

Lab Code: GEN

Validation Date: 02/08/2013

LCS Recovery: All LCS recoveries were within the laboratory acceptance limits.

Method Blank(s): All method blanks results were below the method detection limit.

MS/MSD Recovery: There were no MS/MSD failures.

Surrogate Recovery: All surrogate recoveries were within the laboratory acceptance limits.

Appendix G

CD of Report

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