

**Rocky Flats Site, Colorado**

**Quarterly Report of Site Surveillance  
and Maintenance Activities  
Second Quarter Calendar Year 2011**

**October 2011**



U.S. DEPARTMENT OF  
**ENERGY**

Legacy  
Management

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**U.S. Department of Energy  
Office of Legacy Management**

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## Abbreviations

AOC	area of concern
CAD/ROD	Corrective Action Decision/Record of Decision
CDPHE	Colorado Department of Public Health and Environment
COU	Central Operable Unit
CY	calendar year
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ETPTS	East Trenches Plume Treatment System
IC	institutional control
LANL	Los Alamos National Laboratory
LM	Office of Legacy Management
µg/L	micrograms per liter
M&M	monitoring and maintenance
MSPTS	Mound Site Plume Treatment System
OLF	Original Landfill
pCi/L	picocuries per liter
PLF	Present Landfill
PLFTS	Present Landfill Treatment System
POC	point-of-compliance
POE	point-of-evaluation
POU	Peripheral Operable Unit
RCRA	Resource Conservation and Recovery Act
RFLMA	<i>Rocky Flats Legacy Management Agreement</i>
RFSOG	<i>Rocky Flats Site Operations Guide</i>
SID	South Interceptor Ditch
Site	Rocky Flats Site
SPPTS	Solar Ponds Plume Treatment System

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## 1.0 Introduction

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) is responsible for implementing the final response action selected in the *Corrective Action Decision/Record of Decision for Rocky Flats Plant (USDOE) Peripheral Operable Unit and Central Operable Unit* (DOE, EPA, and CDPHE 2006) issued on September 29, 2006, for the Rocky Flats Site (the Site) in Colorado. DOE, the U.S. Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE) have chosen to implement the monitoring and maintenance requirements of the Corrective Action Decision/Record of Decision (CAD/ROD) as described in the *Rocky Flats Legacy Management Agreement (RFLMA)* (DOE 2007a). Attachment 2 of the RFLMA defines the Central Operable Unit (COU) remedy surveillance and maintenance requirements, the frequency for each required activity, and the monitoring and maintenance locations. The requirements include environmental monitoring; maintenance of the erosion controls, access controls (signs), landfill covers, and groundwater treatment systems; and operation of the groundwater treatment systems. The RFLMA also requires that the institutional controls, in the form of use restrictions as established in the CAD/ROD, be maintained.

This report is required in accordance with Section 7.0 of RFLMA Attachment 2. The purpose of this report is to inform the regulatory agencies and stakeholders of the remedy-related surveillance, monitoring, and maintenance activities being conducted at the Site. LM provides periodic communications through several means, such as this report, Web-based tools, and public meetings.

LM prepared the *Rocky Flats Site Operations Guide (RFSOG)* (DOE 2011a) to serve as the primary internal document to guide work to satisfy the requirements of the RFLMA and to implement best management practices at the Site.

Several other Site-specific documents provide additional detail regarding the requirements described in RFLMA Attachment 2, including all aspects of surveillance, monitoring, and maintenance activities, as well as data evaluation protocols.

Monitoring data and summaries of surveillance and maintenance activities for past quarters are available in the quarterly reports. Extensive discussion and evaluation of surveillance, monitoring, and maintenance activities are presented each calendar year in the annual report of Site surveillance and maintenance activities.

This report addresses remedy-related surveillance, monitoring, and operations and maintenance activities conducted at the Site during the second quarter of calendar year (CY) 2011 (April 1 through June 30). This report describes the following:

- Maintenance and inspection of the Original Landfill (OLF) and Present Landfill (PLF)
- Maintenance and inspection of the four groundwater treatment systems
- Erosion control and revegetation activities
- Routine (in accordance with the RFLMA and the RFSOG) water monitoring

## 1.1 Modification of RFLMA Attachment 2

As discussed in the 2010 Annual Report (DOE 2011b), a proposed modification to RFLMA Attachment 2 was released by the RFLMA Parties for public review and comment on July 20, 2010. The proposed modification establishes new surface water Point of Compliance (POC) monitoring locations in Walnut Creek and Woman Creek that will replace the existing POCs within the COU when DOE completes installation of flumes and monitoring equipment at the new POC locations. The proposed modification is discussed in Contact Record 2010-04 in Appendix G of the 2010 Annual Report, and it is also posted on the Rocky Flats website.

The RFLMA Attachment 2 modification, dated March 2011, was approved by CDPHE and EPA on May 2, 2011, and posted on the Rocky Flats website. The Document History page in RFLMA Attachment 2 summarizes the changes made in this modification. The modification establishes new surface water POC monitoring locations in Walnut Creek and Woman Creek that will replace the existing POCs within the COU when installation of flumes and monitoring equipment at the new POC locations is completed.

The modification retains the Walnut Creek and Woman Creek POCs at Indiana St. (GS01 and GS03) in the Peripheral Operable Unit (POU) for a period of 2 years after the new flumes in the COU are operational. The modification also removes two designated Boundary wells in the POU as RFLMA monitoring locations.

## 1.2 Proposed Plan for Amendment of the Corrective Action Decision/Record of Decision (CAD/ROD)

On June 3, 2011, the RFLMA Parties released a *Proposed Plan for Amendment of the Corrective Action Decision/Record of Decision* (DOE, EPA, and CDPHE 2011) (Proposed Plan) for public review and comment. The Proposed Plan would amend the September 29, 2006, CAD/ROD (DOE, EPA, and CDPHE 2006). The public comment period ended on August 2, 2011. The RFLMA Parties hosted a public meeting to discuss the proposed amendments and receive verbal comments on June 16, 2011.

The RFLMA Parties also released for public review and comment in Attachment 1 of the Proposed Plan a modification to RFLMA Attachment 2, *Legacy Management Requirements*, to implement the proposed CAD/ROD amendment.

The Proposed Plan, which includes the proposed modification to RFLMA Attachment 2, was posted on the Community Involvement page of the Rocky Flats Site website.

The response actions selected for the COU in the 2006 CAD/ROD are institutional controls (ICs), physical controls, and continued monitoring (DOE, EPA, and CDPHE 2006). The RFLMA Parties are proposing to clarify the ICs in a CAD/ROD amendment because of public comments questioning the implementation of ICs related to soil disturbance and excavation activities. The IC clarifications provide a regulatory review and approval process for soil disturbance and excavation activities to ensure the objective and rationale for the ICs as stated in the 2006 CAD/ROD are met. The IC clarifications do not change the remedy, and the objective and rationale for each IC is not proposed to change.

The regulatory review and approval process described in the Proposed Plan is essentially the same as that already implemented by the RFLMA Parties for soil disturbance and excavation activities covered by ICs to date. The Proposed Plan provides examples of this work and the documentation of regulatory approval in Contact Records based on RFLMA Party consultation.

As stipulated in the CAD/ROD, DOE also granted an environmental covenant containing the ICs to Colorado, pursuant to Colorado law. The environmental covenant would also be modified to be consistent with the CAD/ROD amendment, once approved.

## **2.0 Site Operations and Maintenance**

### **2.1 Landfills**

#### **2.1.1 Present Landfill**

The PLF is inspected quarterly in accordance with the requirements of the PLF Monitoring and Maintenance (M&M) Plan (DOE 2008a) and the RFLMA (DOE 2007a). Vegetation monitoring has been conducted on the PLF according to the requirements in RFLMA Attachment 2, Table 3. The exit strategy for vegetation monitoring, as outlined in Table 3, states that when the PLF M&M Plan grassland success criteria have been met, vegetation monitoring will be no longer required. Based on the vegetation monitoring conducted in 2009 and reported in the 2009 Annual Report (DOE 2010b), these success criteria have been met. Therefore, the specific PLF vegetation monitoring as outlined in the RFLMA will no longer be conducted; rather, the PLF vegetation will now be monitored as part of the ongoing general Site vegetation monitoring.

##### ***2.1.1.1 Inspection Results***

The routine PLF inspection for the second quarter of CY 2011 was performed on May 31, 2011. No significant problems were observed during these inspections. Copies of the landfill inspection forms are presented in Appendix A.

##### ***2.1.1.2 Settlement Monuments***

The annual settlement monument surveys were performed on December 22, 2010. The next survey of the PLF settlement monuments will be completed at the end of this calendar year. Additional information on the settlement monuments is included in the *Rocky Flats Site Quarterly Report of Site Surveillance and Maintenance Activities, First Quarter Calendar Year 2008* (DOE 2008b).

#### **2.1.2 Original Landfill**

The OLF is inspected monthly, in accordance with the requirements in the OLF M&M Plan (DOE 2009a) and the RFLMA. It was anticipated that after the first year, the inspection frequency might be reduced to quarterly for an additional 4 years. However, because of observed localized slumping and seep areas, and investigation and repairs to the OLF cover that were being planned at the time, no change to the monthly inspection frequency was recommended in the second five-year review of the Site (DOE 2007b).

### **2.1.2.1 Inspection Results**

Routine OLF inspections during the second quarter of CY 2011 were performed on April 29, May 31, and June 30, 2011. The landfill cover vegetation was evaluated on May 23, 2011. The completed inspection forms are presented in Appendix A.

### **2.1.2.2 Settlement Monuments**

The OLF settlement monuments were surveyed on June 25, 2011. Survey data indicate that settling at each monument does not exceed the limits published in the OLF M&M Plan (DOE 2009a). The survey results are presented in Appendix A.

### **2.1.2.3 Inclinerometers**

As discussed in the quarterly report for the second quarter of CY 2009 (DOE 2009b), seven inclinometers were installed in boreholes at the OLF in 2008 as part of the geotechnical investigation (Figure 1).

Movement of the inclinometers has been monitored approximately monthly since installation. Inclinometers deflect by lateral movement of the ground in which they are located and can deflect enough to cause the inclinometer tubes to break. Once an inclinometer tube breaks, the inclinometer will no longer be monitored. Inclinometer monitoring data provide information on localized soil movement and serve to focus the periodic inspections of the soil cover surface on signs of potential instability, such as cracking, vertical displacement, and slumping. A deflection of more than 1 inch is used as a trigger for evaluation of the data by a qualified geotechnical engineer. The engineer determines the significance of the deflection in relation to recommendations for maintenance or repairs to address potential instability in accordance with the OLF M&M Plan (DOE 2009a).

Inclinometer measurements were taken on April 5, April 26, May 26, and June 30, 2011. The readings showed that there was very little deflection for any inclinometer over this quarter. Two notable precipitation events occurred during this period. The site received approximately 1.4 inches of precipitation on May 11, 2011, and approximately 1.1 inches of precipitation on May 18, 2011. These events did not appear to result in any significant inclinometer deflection. Previously, large precipitation events have generally resulted in more noticeable inclinometer deflection for the inclinometers on the western side of the OLF, where localized slumping and settling occurred and lead to the geotechnical investigation. The previous quarter was fairly dry, so the May 2011 precipitation might not have lubricated the organic layer that is believed to contribute to localized instability.

### **2.1.2.4 Slumps**

As discussed in the quarterly report for the first quarter of CY 2010 (DOE 2010c), areas where the landfill cover is pushed up or rolling are noticeable on the western end of the OLF between Berms 2 and 3; however, no new slumps were observed during the second quarter of 2011.



Figure 1. Original Landfill Observed Surface Cracking Location and Inclinator Locations

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## ***Berm 1***

No new cracking was observed in the Berm 1 area during the second quarter of CY 2011. Staff continued to perform routine and nonroutine inspections of the Berm 1 area to monitor this location for any changes.

### ***2.1.2.5 Topographic Survey***

A topographic survey was completed in March 2009; the survey serves as a baseline for continued observation of berms and helps to identify areas for additional maintenance. Subsequent topographic surveys are used to identify areas that require additional soil to maintain minimum heights and to identify areas of ponding or slopes indicating channel areas that may be conducive to ponding.

In accordance with Section 3.1 of the OLF M&M Plan, "Inspection Procedures," a topographic survey will be conducted approximately every 2 years as an aid in periodically evaluating the subsidence and consolidation, slope stability, and storm water management structure conditions at the OLF.

The survey results were mapped by engineering staff during this quarter and plans were developed (1) for adding minor amounts of soil to specific areas on the diversion berms to maintain minimum berm height and (2) for minor adjustments to the slope in some locations in berm channels. The results of the survey were forwarded to a qualified geotechnical engineer for review. Berm maintenance will be completed in the third quarter and the results of the maintenance and the geotechnical engineer review will be included in the third quarterly report.

### ***2.1.2.6 Seeps***

Seeps at the OLF were evaluated during the monthly inspections as well as during unscheduled visits. Individual seep location flow rates can be found in the monthly inspection reports. After the precipitation in May 2011, Seep 7, which did not have a surface expression during the first quarter, began to show minor surface expression. As reported in the 2010 Annual Report (DOE 2011b) evaluation by a qualified geotechnical engineer concluded that the Seep 7 runoff drained by the diversion berm channels does not cause instability of the berms.

## **2.2 Groundwater Treatment Systems**

Four groundwater treatment systems are operated and maintained in accordance with requirements defined in the RFLMA and the RFSOG. Three of these systems (the Mound Site Plume Treatment System [MSPTS], East Trenches Plume Treatment System [ETPTS], and Solar Ponds Plume Treatment System [SPPTS]) include a groundwater intercept trench (collection trench), which is similar to a French drain with an impermeable membrane on the downgradient side. Groundwater entering the trench is routed through a drain pipe into one or more treatment cells, where it is treated and then discharged. The fourth system, the PLF Treatment System (PLFTS), treats water from the northern and southern components of the Groundwater Intercept System and flow from the PLF seep.

### **2.2.1 Mound Site Plume Treatment System**

Routine maintenance activities continued at the MSPTS through the second quarter of CY 2011. In February and March, prior to the second quarter, an effluent polishing component was installed as a part of this project. The polishing component is an innovative, solar-powered air stripper that is contained within the pre-existing effluent metering manhole. During the second quarter, the unit was tested for effectiveness and optimized; this testing and optimization continues. Some of the aspects tested and optimized include the number and configuration of spray nozzles, the pump rate, ventilation of the air stripper housing (the manhole), and the system flow rate. Because of the numerous variables and ongoing optimization of the unit, the component that was installed is designed for only half-time operation (during the daytime). Testing is being performed to identify adjustments needed to achieve optimal effectiveness. The results of optimization efforts will dictate additional infrastructure needs (ranging from nozzles and pumps to additional solar power infrastructure). Once optimized, the unit will be equipped for uninterrupted operation. The 2011 annual report will provide a more comprehensive discussion of the unit and its associated optimization.

The parallel upflow configuration established in June 2010 was maintained and will remain the primary flow configuration at the MSPTS until further notice.

Refer to Section 3.1.10.1 for information on water quality sampling.

### **2.2.2 East Trenches Plume Treatment System**

Routine maintenance activities continued at the ETPTS through the second quarter of CY 2011. These activities included checking influent and effluent flow conditions and water levels in the cells.

Refer to Section 3.1.10.2 for information on water quality sampling.

### **2.2.3 Solar Ponds Plume Treatment System**

Routine maintenance activities continued at the SPPTS through the second quarter of CY 2011. These activities included weekly inspections of the solar/battery systems that power the pumps, the operation of the pumps, and influent and effluent flow conditions.

The Phase II and III upgrades that were completed in the second quarter of CY 2009 continued to be a focal point for optimization efforts. Most of these efforts were directed to operation of Phase III Cell A (the cell filled with inert media, which is dosed with liquid carbon to support denitrifying bacteria), and included adjustments to recirculation, flow rates, and dosing. In addition, due to accumulation of biomass in the cell, routine maintenance included using a rod or similar tool to puncture and break apart the biomass.

In late June, Cell A was taken offline and emptied for more aggressive biofilm management. A small volume of water from the cell was set aside to act as an inoculum, then the media was removed and pressure-washed. The inside of the cell was sprayed out. The cleaned media was then returned to the cell and the inoculum was added. The cell was refilled with dosed influent,

but remained offline for several days while the water within was recirculated to allow the denitrifying bacteria to colonize the cleaned media. The cell was then put back online.

Section 3.1.10.3 summarizes the non-RFLMA sampling conducted at the SPPTS in the second quarter of CY 2011.

#### **2.2.4 Present Landfill Treatment System**

Routine maintenance activities continued at the PLFTS through the second quarter of CY 2011. These activities generally consisted of inspecting the system for potential problems.

Refer to Section 3.1.10.4 for information on water quality sampling.

### **2.3 Erosion Control and Revegetation**

Maintenance of the site erosion control features required continued effort throughout the second quarter of CY 2011, especially following high-wind or precipitation events. Erosion wattles and matting loosened and displaced by high winds or rain were repaired. Erosion controls were installed and maintained for the various projects that were ongoing during the second quarter of CY 2011. Several areas were interseeded with additional native species to increase vegetation cover.

## **3.0 Environmental Monitoring**

This section summarizes the environmental monitoring conducted in accordance with the RFLMA.

### **3.1 Water Monitoring**

This section includes:

- A discussion of analytical results for the POC, point-of-evaluation (POE), PLF, and OLF monitoring objectives.
- A summary of Area of Concern (AOC) well, Boundary well, Evaluation well, and Sentinel well monitoring; treatment system monitoring; and Resource Conservation and Recovery Act (RCRA) groundwater monitoring and Surface Water Support monitoring at the Site.

Monitoring locations, sampling criteria, and evaluation protocols for all water monitoring objectives in the following sections are detailed in RFLMA Attachment 2 and the RFSOG. Appendix B provides analytical water quality data for the second quarter of CY 2011. More detailed interpretation and discussion will be provided in the annual report for CY 2011.

#### **3.1.1 Water Monitoring Highlights**

During the second quarter of CY 2011, the water monitoring successfully met the targeted monitoring objectives as required by the RFLMA and was in conformance with RFSOG implementation guidance. The RFLMA network consists of 11 automated gaging stations,

10 surface water grab-sampling locations, 8 treatment system locations, 99 wells, and 8 precipitation gages. During the quarter, 35 flow-paced composite samples, 6 surface water grab samples, 15 treatment system samples, and 55 groundwater samples were collected (in accordance with RFLMA protocols) and submitted for analysis.<sup>1</sup> An additional three flow-paced composites were in progress during the quarter, and analytical data were not available for this report.

All water quality data at the RFLMA POCs remained well below the applicable standards through the second quarter of CY 2011.

Elevated levels of plutonium-239,240 were measured at POE SW027 during the second quarter of 2010. These data are presented and discussed further in Section 3.1.3.2. Since SW027 has seen very little flow since April 2010, no additional composite samples have been collected. Thus, no new analytical data are available to include in the 12-month rolling average, and the 12-month rolling average for plutonium remains at reportable levels. All other analyte concentrations at SW027 remained below reporting levels as of the end of the second quarter of CY 2011.

All POE analyte concentrations at GS10 and SW093 remained below reporting levels as of the end of the second quarter of CY 2011. Erosion and runoff controls, as well as extensive revegetation efforts, have been effective in measurably reducing both sediment transport and constituent concentrations. As of the end of the second quarter of CY 2011, these monitoring locations continued to show plutonium-239, 240 and americium-241 activities well below the RFLMA standards. With the removal of impervious areas (resulting in decreased runoff), the stabilization of soils within the drainages, and the progression of revegetation, water quality is expected to continue to be acceptable.

Groundwater monitoring results will be evaluated as part of the annual report for CY 2011.

### **3.1.2 POC Monitoring**

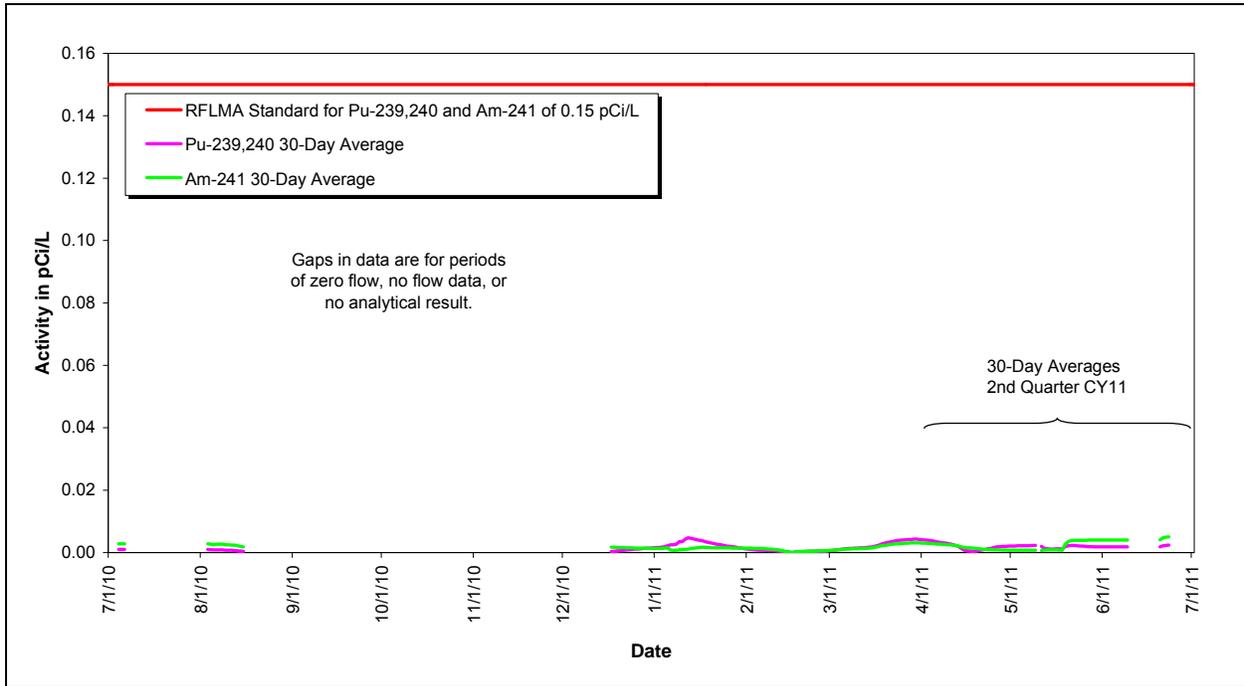
The following sections include summary tables and plots showing the applicable 30-day and 12-month rolling averages for the POC analytes.

#### **3.1.2.1 Monitoring Location GS01**

Monitoring location GS01 is on Woman Creek at Indiana Street. Figure 2 and Figure 4 show no occurrences of reportable 30-day averages for the quarter. Figure 3 and Figure 5 show sampling data from 2005 through the second quarter of CY 2011.

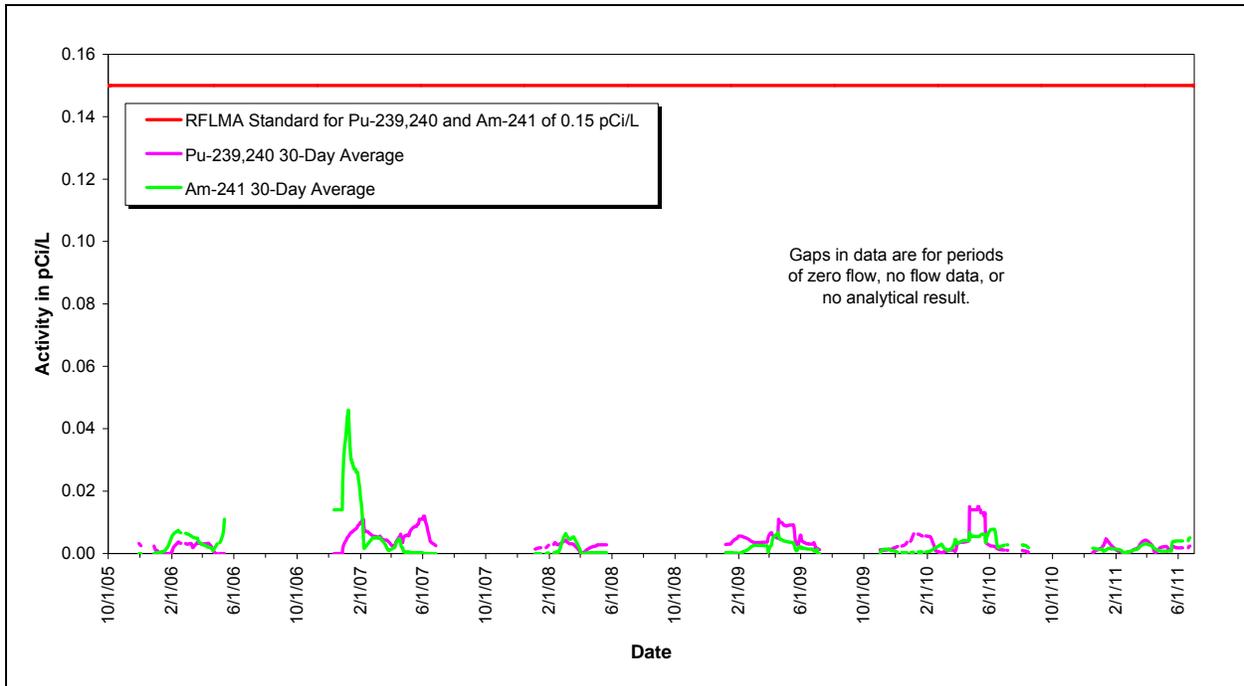
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<sup>1</sup> Composite samples consist of multiple aliquots (“grabs”) of identical volume. Each grab is delivered by the automatic sampler to the composite container at each predetermined flow volume or time interval. During the second quarter of CY 2011, the 35 flow-paced composites comprised 1,272 individual grabs.



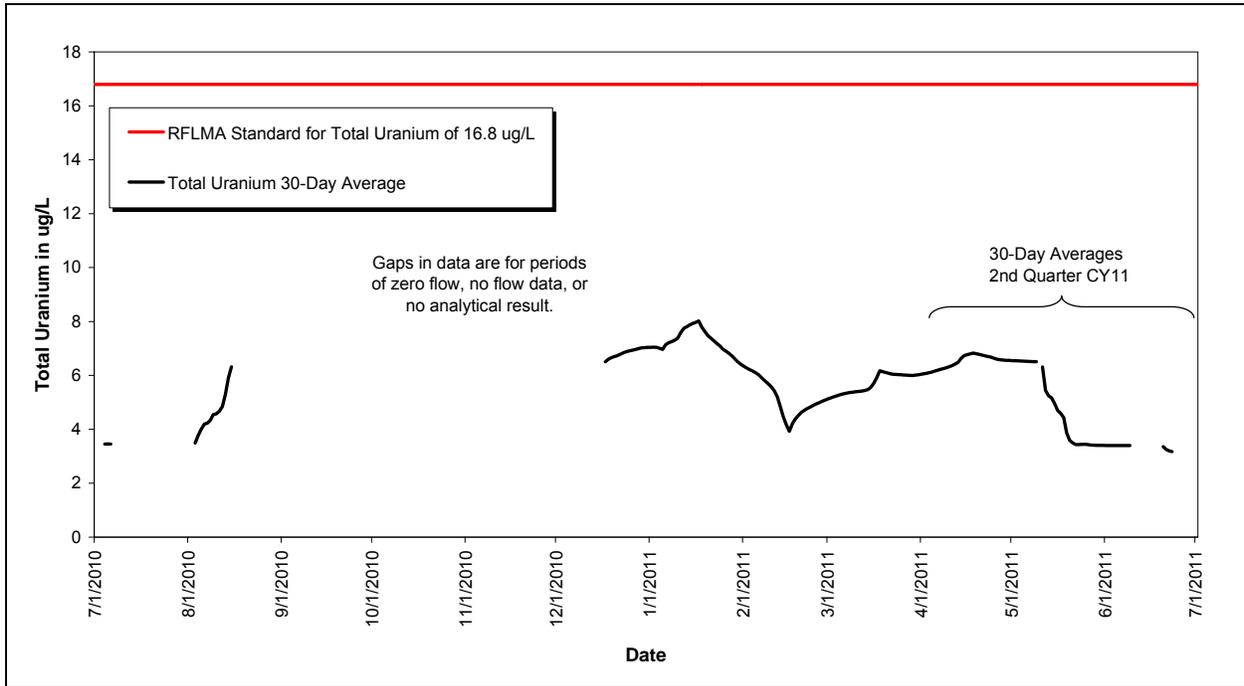
pCi/L = picocuries per liter

Figure 2. Volume-Weighted 30-Day Average Plutonium and Americium Activities at GS01: Calendar Year Ending Second Quarter CY 2011



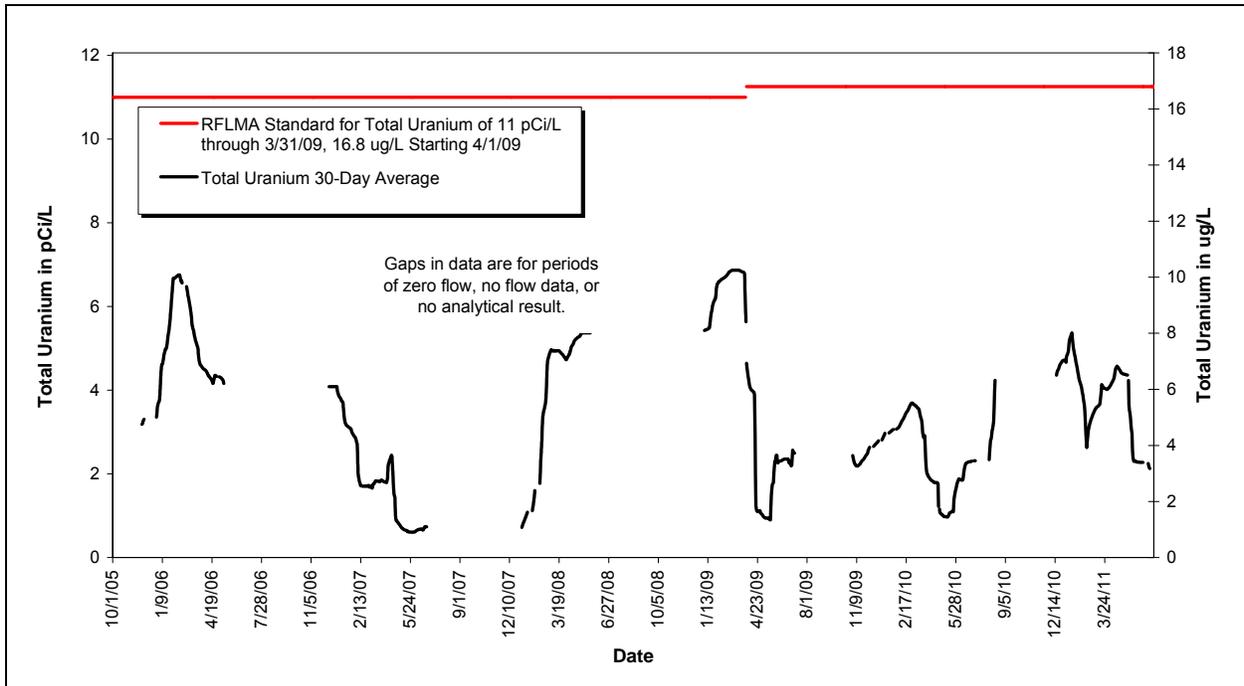
pCi/L = picocuries per liter

Figure 3. Volume-Weighted 30-Day Average Plutonium and Americium Activities at GS01: Post-Closure Period Ending Second Quarter CY 2011



µg/L = micrograms per liter

Figure 4. Volume-Weighted 30-Day Average Total Uranium Concentrations at GS01: Calendar Year Ending Second Quarter CY 2011

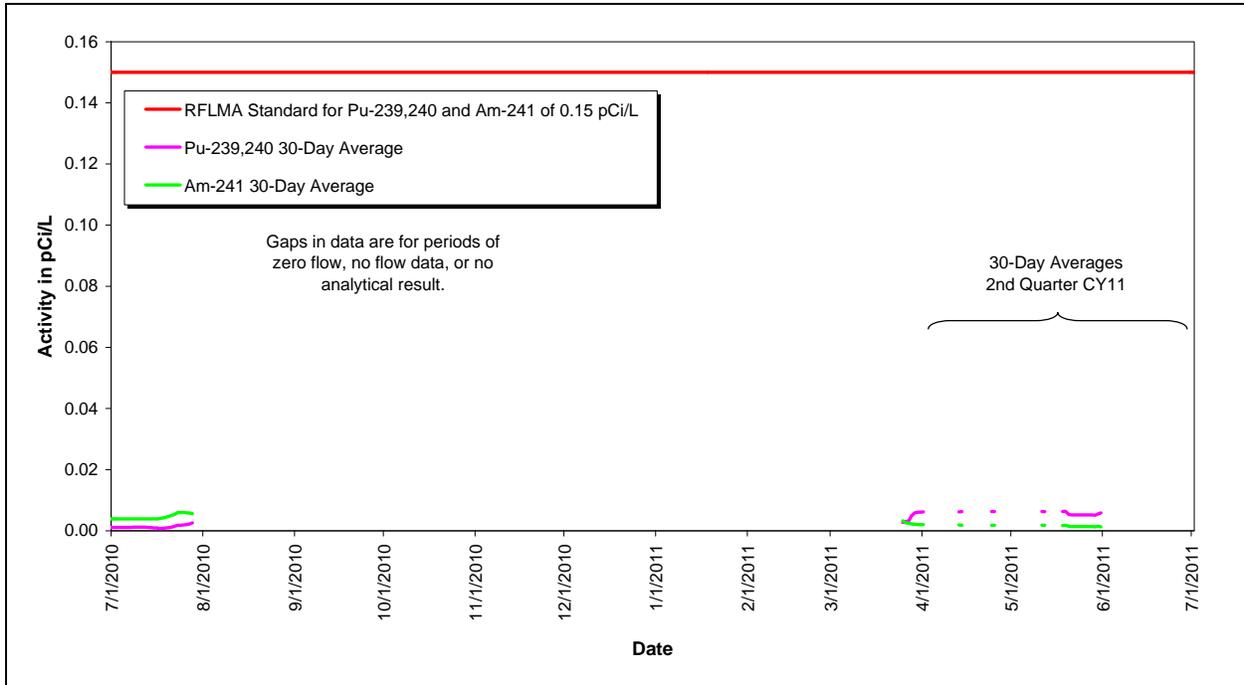


pCi/L = picocuries per liter; µg/L = micrograms per liter

Figure 5. Volume-Weighted 30-Day Average Total Uranium Concentrations at GS01: Post-Closure Period Ending Second Quarter CY 2011

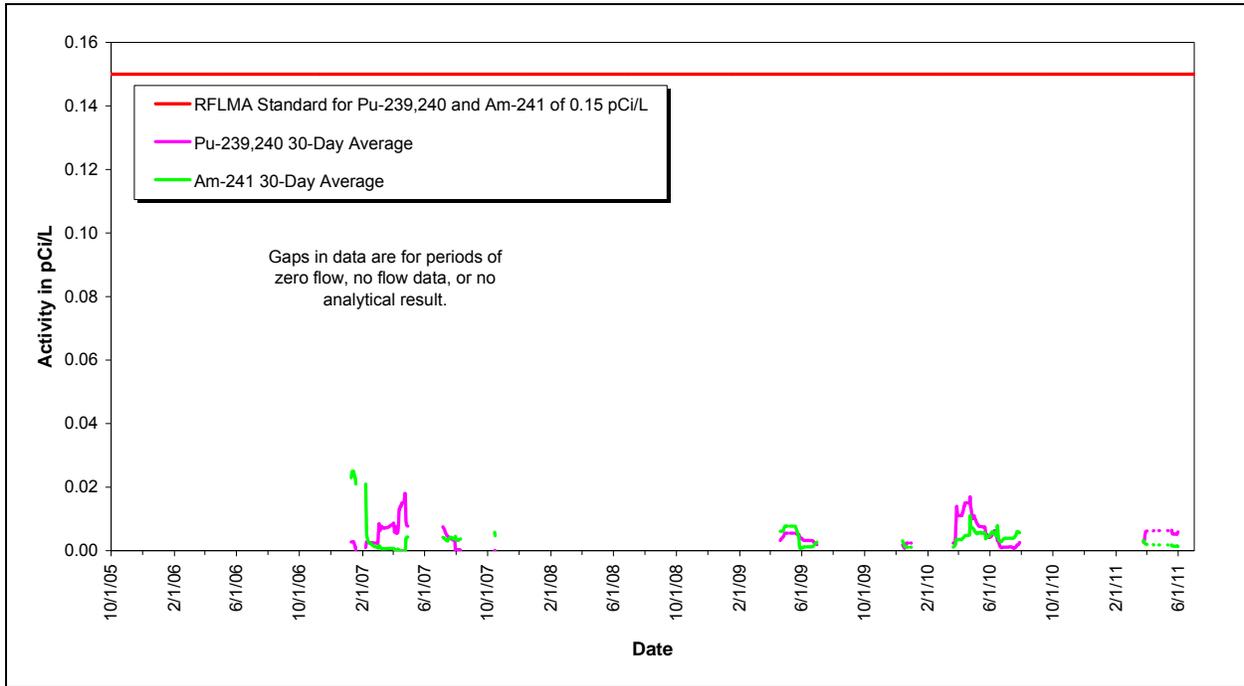
### 3.1.2.2 Monitoring Location GS03

Monitoring location GS03 is on Walnut Creek at Indiana Street. Figure 6, Figure 8, and Figure 10 show no occurrences of reportable water quality for the quarter. Figure 7, Figure 9, and Figure 11 show sampling data from 2005 through the second quarter of CY 2011.



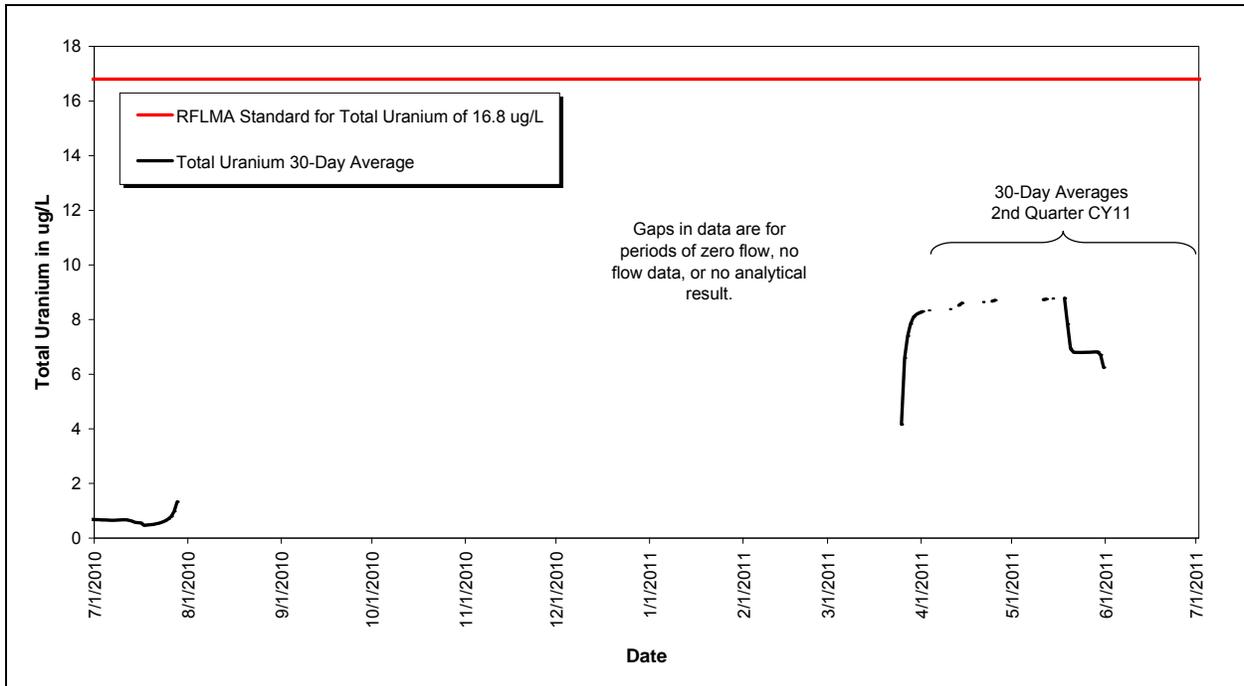
pCi/L = picocuries per liter

Figure 6. Volume-Weighted 30-Day Average Plutonium and Americium Activities at GS03: Calendar Year Ending Second Quarter CY 2011



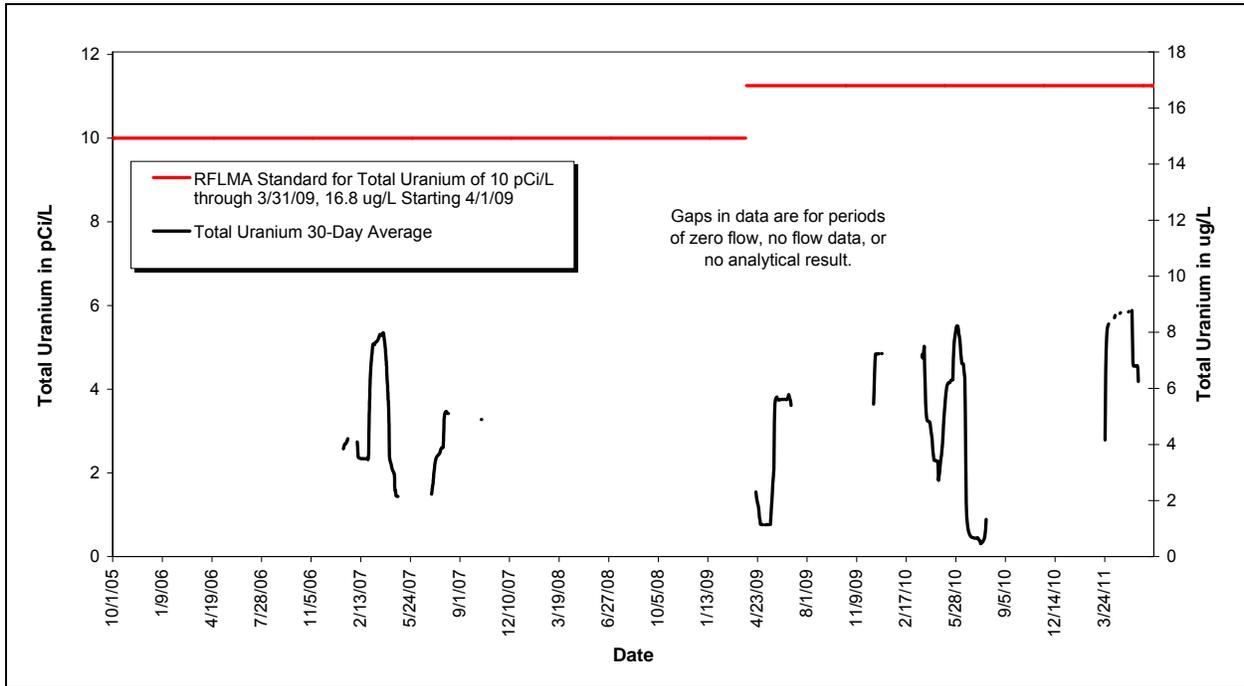
pCi/L = picocuries per liter

Figure 7. Volume-Weighted 30-Day Average Plutonium and Americium Activities at GS03: Post-Closure Period Ending Second Quarter CY 2011



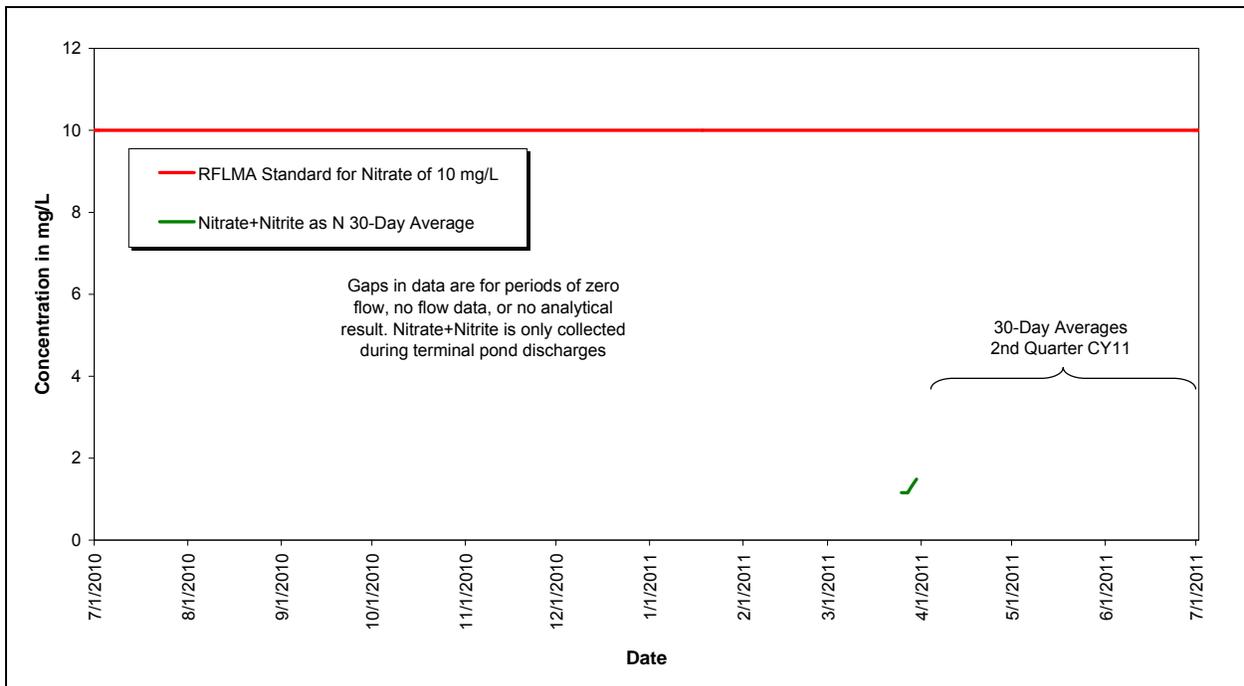
µg/L = micrograms per liter

Figure 8. Volume-Weighted 30-Day Average Total Uranium Concentrations at GS03: Calendar Year Ending Second Quarter CY 2011



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

Figure 9. Volume-Weighted 30-Day Average Total Uranium Concentrations at GS03: Post-Closure Period Ending Second Quarter CY 2011



mg/L = milligrams per liter

Figure 10. Volume-Weighted 85th Percentile of 30-Day Average Nitrate + Nitrite Concentrations at GS03: Calendar Year Ending Second Quarter CY 2011

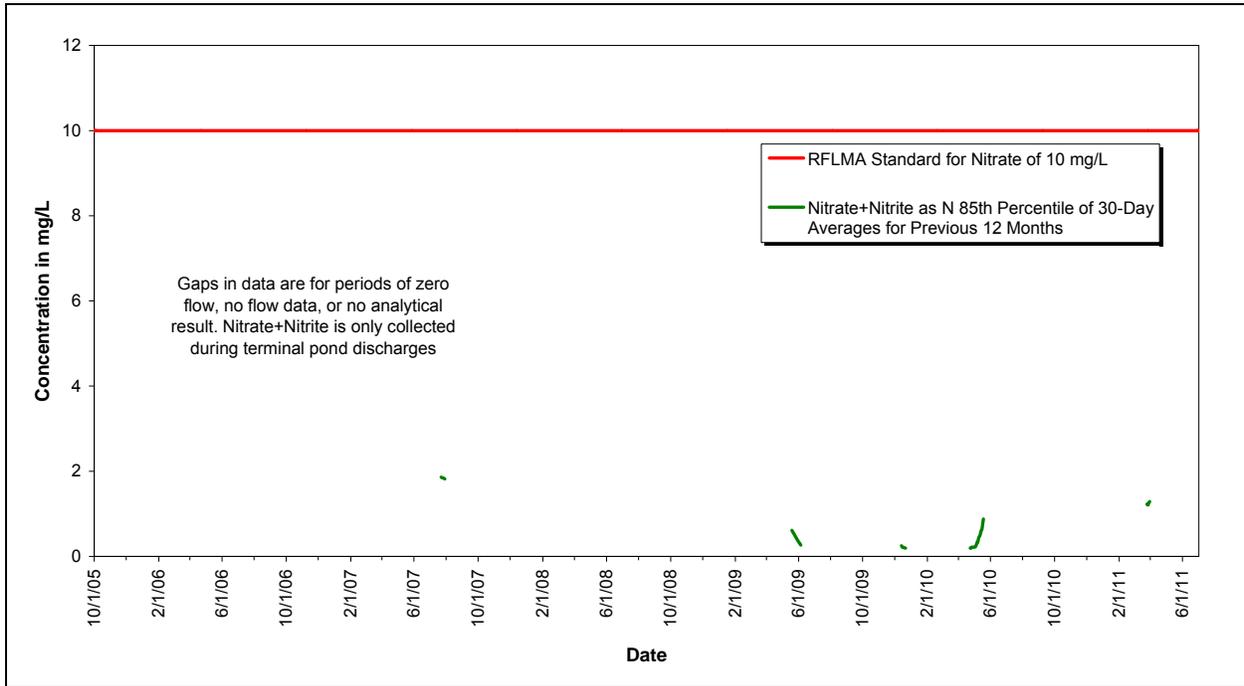
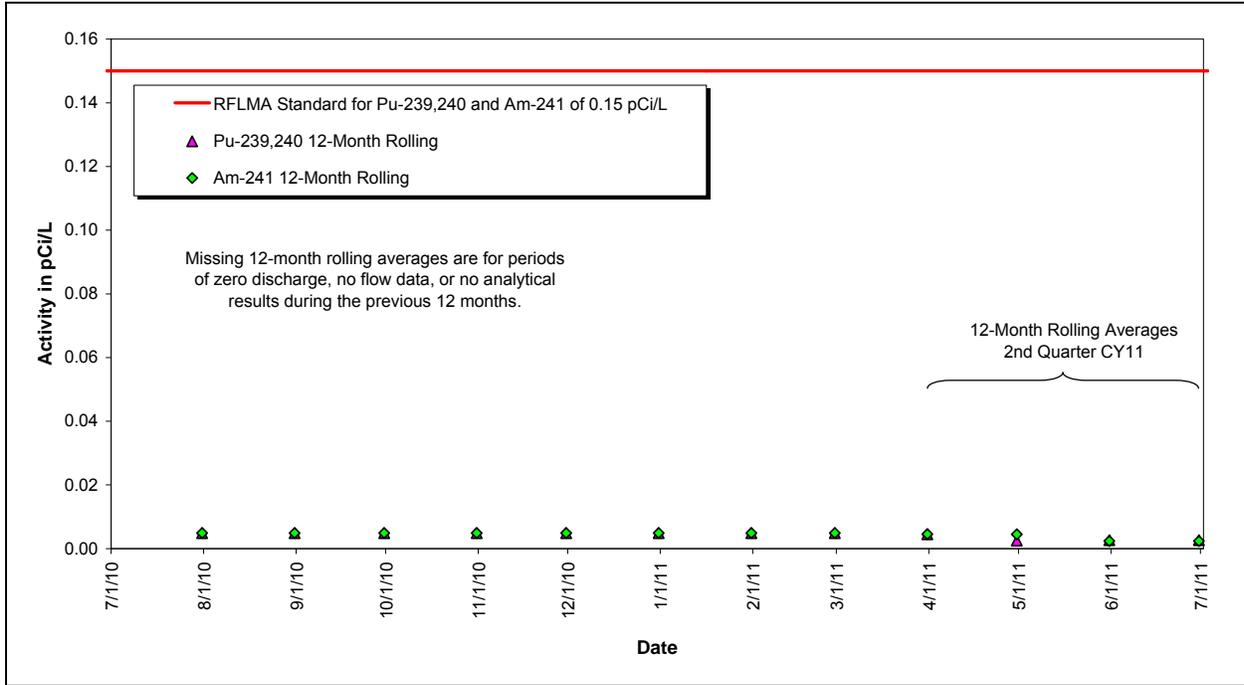


Figure 11. Volume-Weighted 85th Percentile of 30-Day Average Nitrate + Nitrite Concentrations at GS03: Post-Closure Period Ending Second Quarter CY 2011

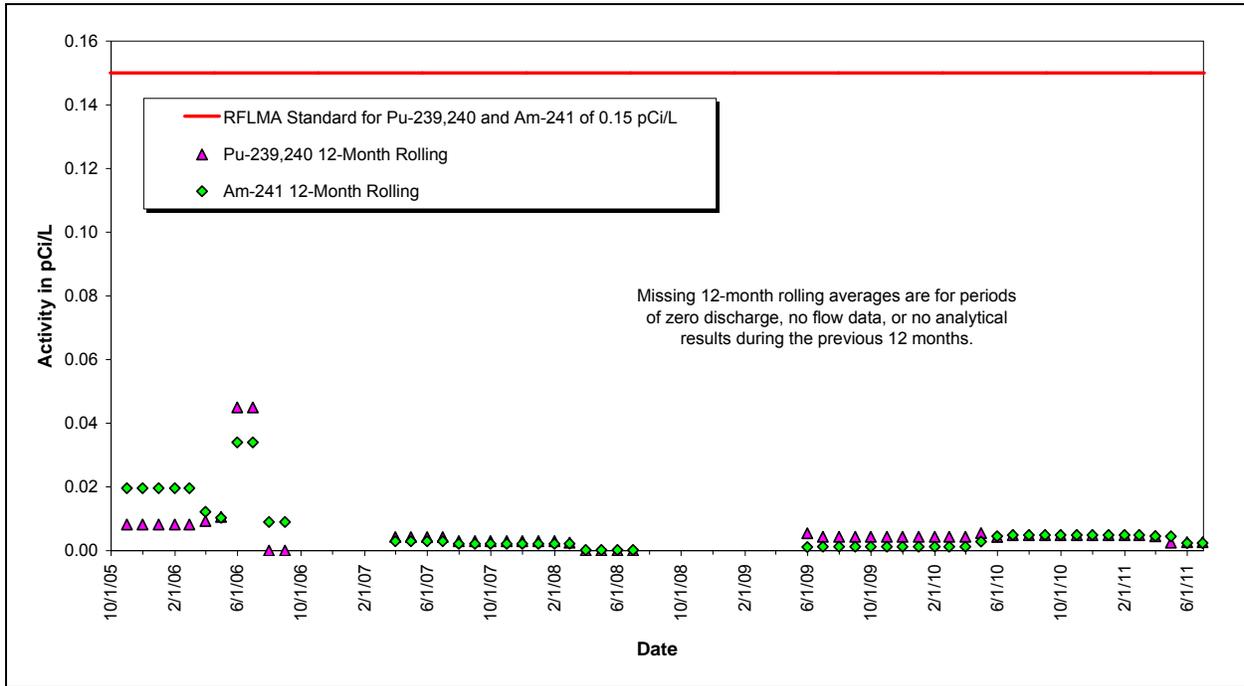
### 3.1.2.3 Monitoring Location GS08

Monitoring location GS08 is on South Walnut Creek at the outlet of Pond B-5. Figure 12, Figure 14, and Figure 16 show no occurrences of reportable 12-month rolling averages for the quarter. Figure 13, Figure 15, and Figure 17 show sampling data from 2005 through the second quarter of CY 2011.



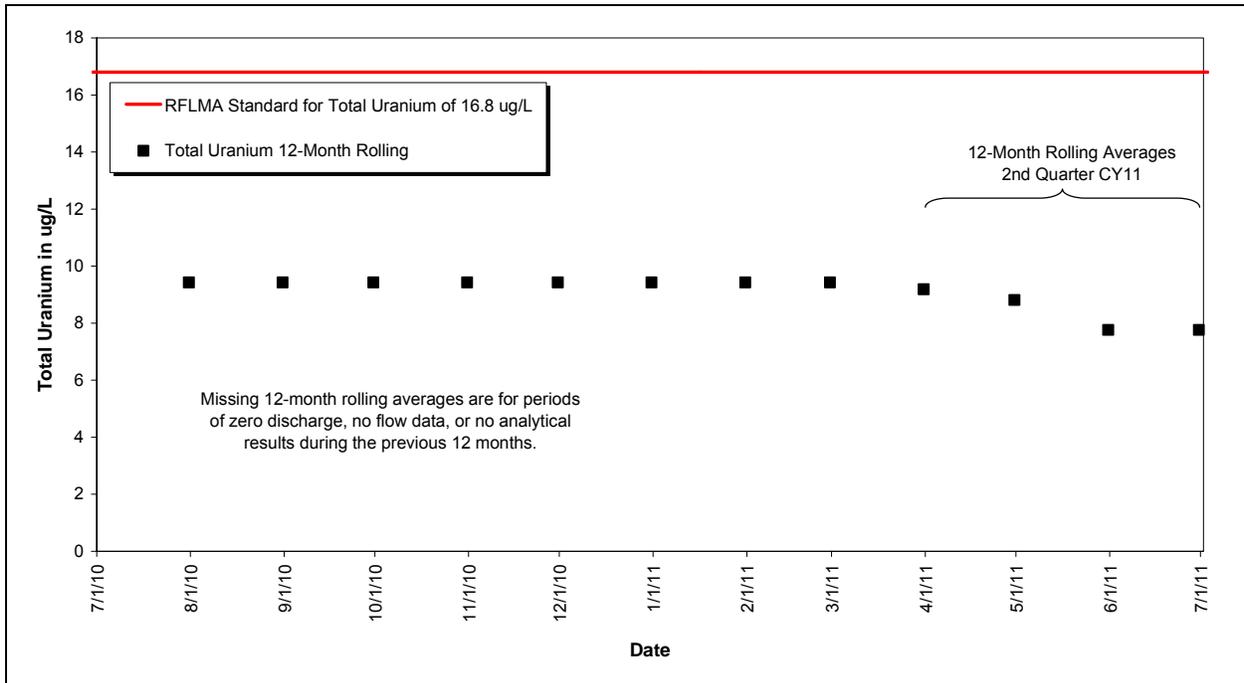
pCi/L = picocuries per liter

Figure 12. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS08: Calendar Year Ending Second Quarter CY 2011



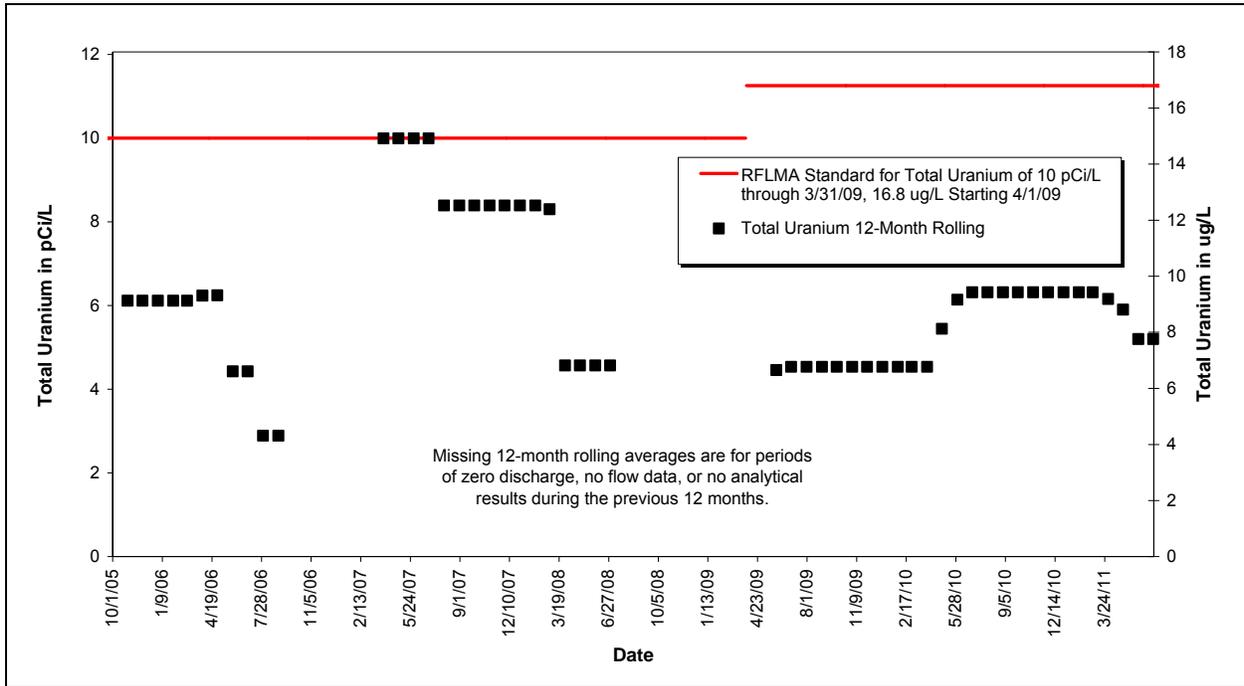
pCi/L = picocuries per liter

Figure 13. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS08: Post-Closure Period Ending Second Quarter CY 2011



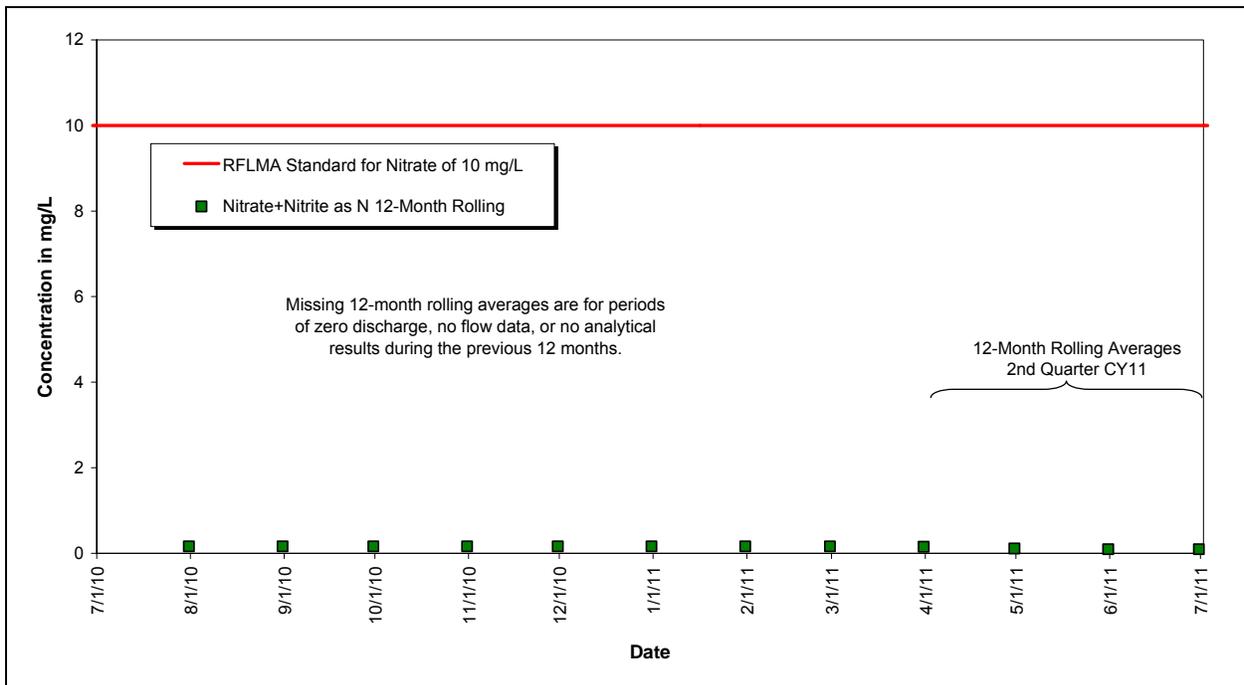
ug/L = micrograms per liter

Figure 14. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at GS08: Calendar Year Ending Second Quarter CY 2011



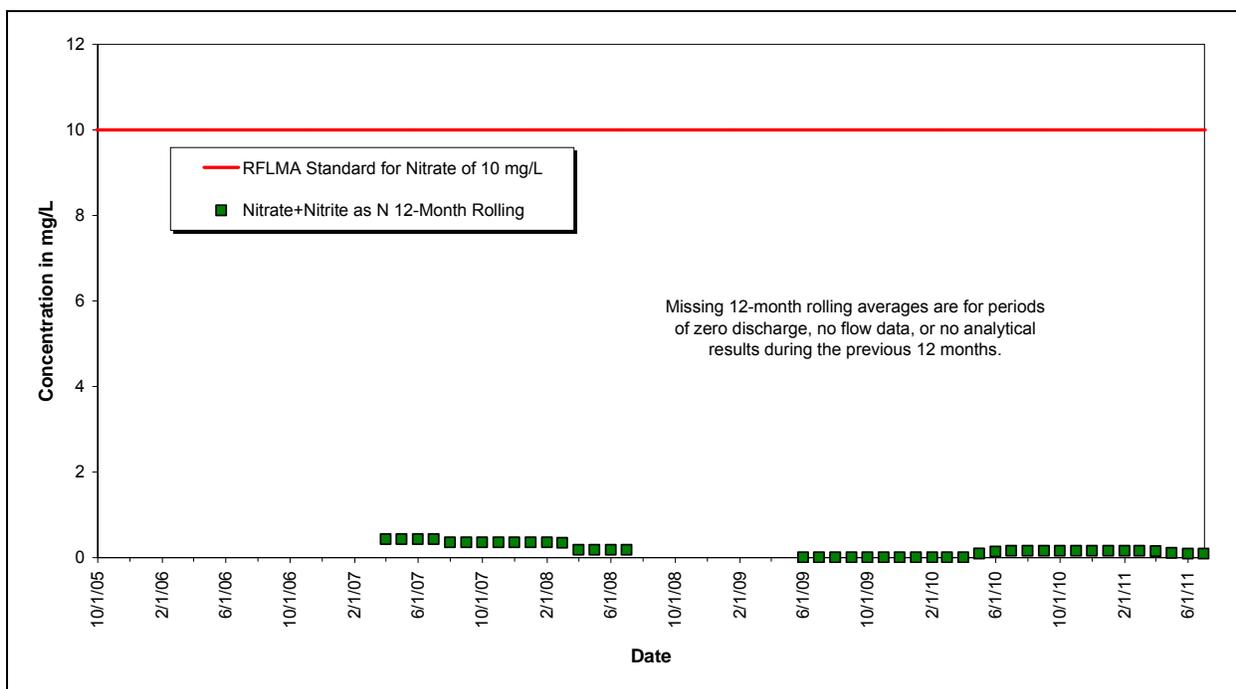
µg/L = micrograms per liter; pCi/L = picocuries per liter

Figure 15. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at GS08: Post-Closure Period Ending Second Quarter CY 2011



Note: Nitrate + nitrite as nitrogen 12-month averages are conservatively compared to the nitrate standard only.  
mg/L = milligrams per liter

Figure 16. Volume-Weighted 12-Month Rolling Average Nitrate + Nitrite as Nitrogen Concentrations at GS08: Calendar Year Ending Second Quarter CY 2011

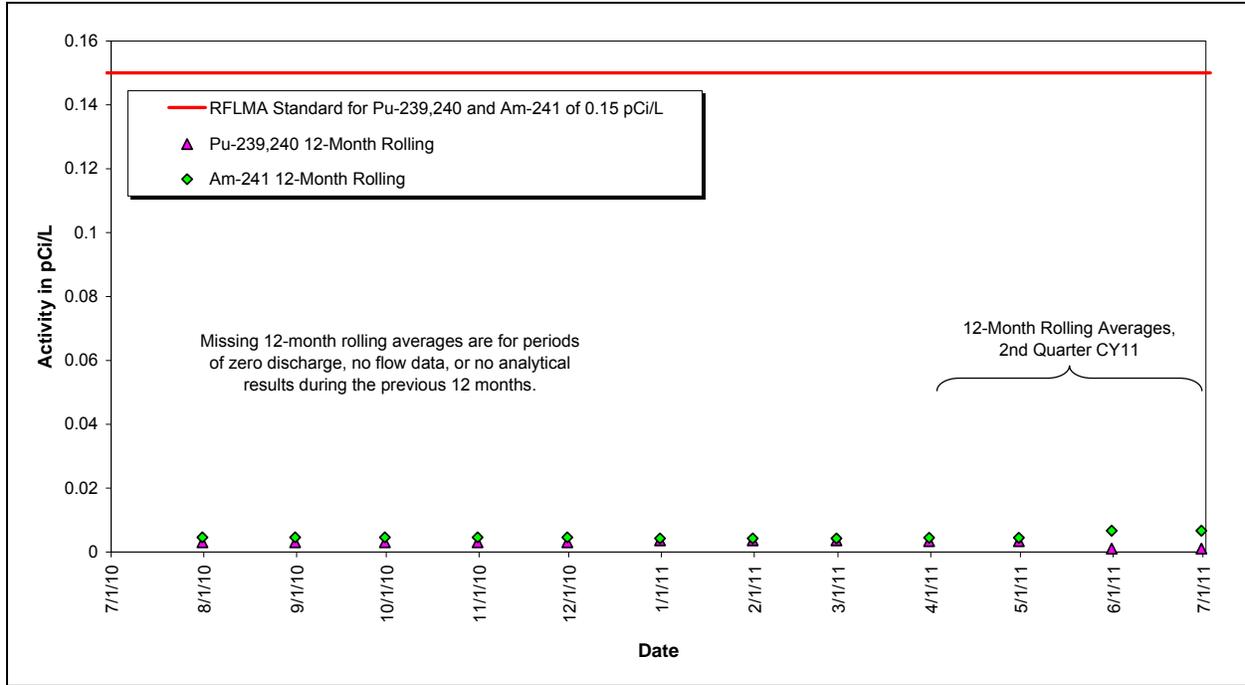


Note: Nitrate + nitrite as nitrogen 12-month averages are conservatively compared to the nitrate standard only.  
mg/L = milligrams per liter

Figure 17. Volume-Weighted 12-Month Rolling Average Nitrate + Nitrite as Nitrogen Concentrations at GS08: Post-Closure Period Ending Second Quarter CY 2011

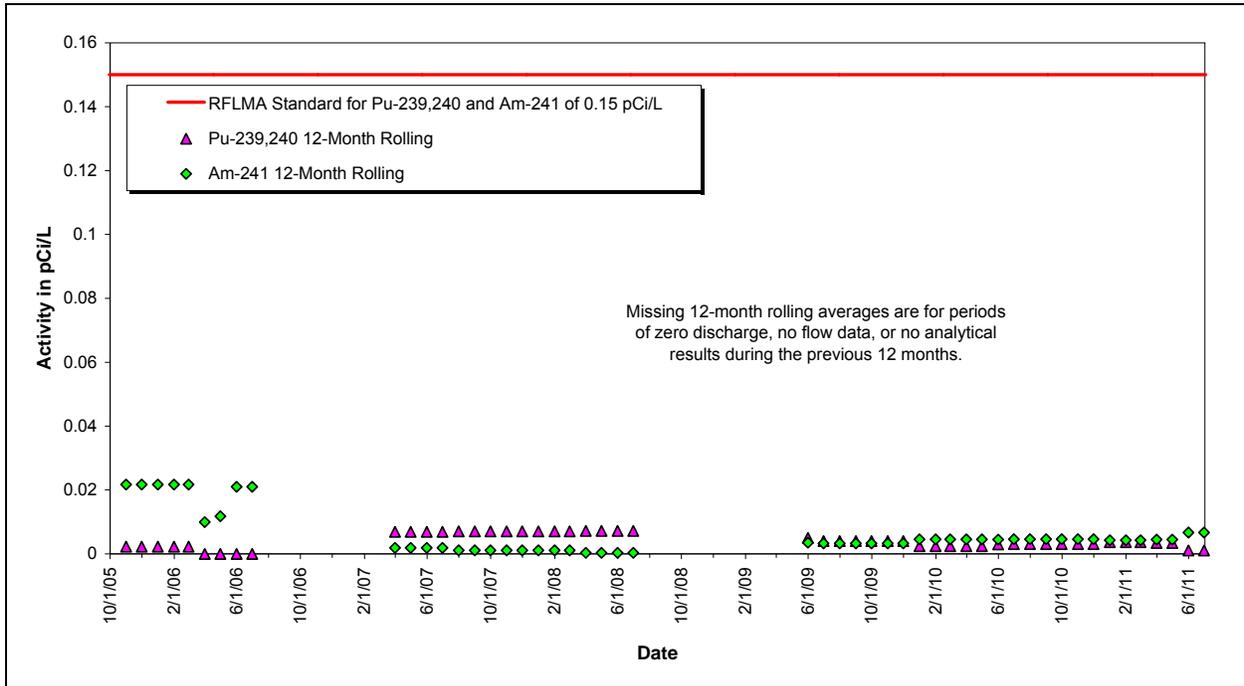
### 3.1.2.4 Monitoring Location GS11

Monitoring location GS11 is on North Walnut Creek at the outlet of Pond A-4. Figure 18, Figure 20, and Figure 22 show no occurrences of reportable 12-month rolling averages for the quarter. Figure 19, Figure 21, and Figure 23 show sampling data from 2005 through the second quarter of CY 2011.



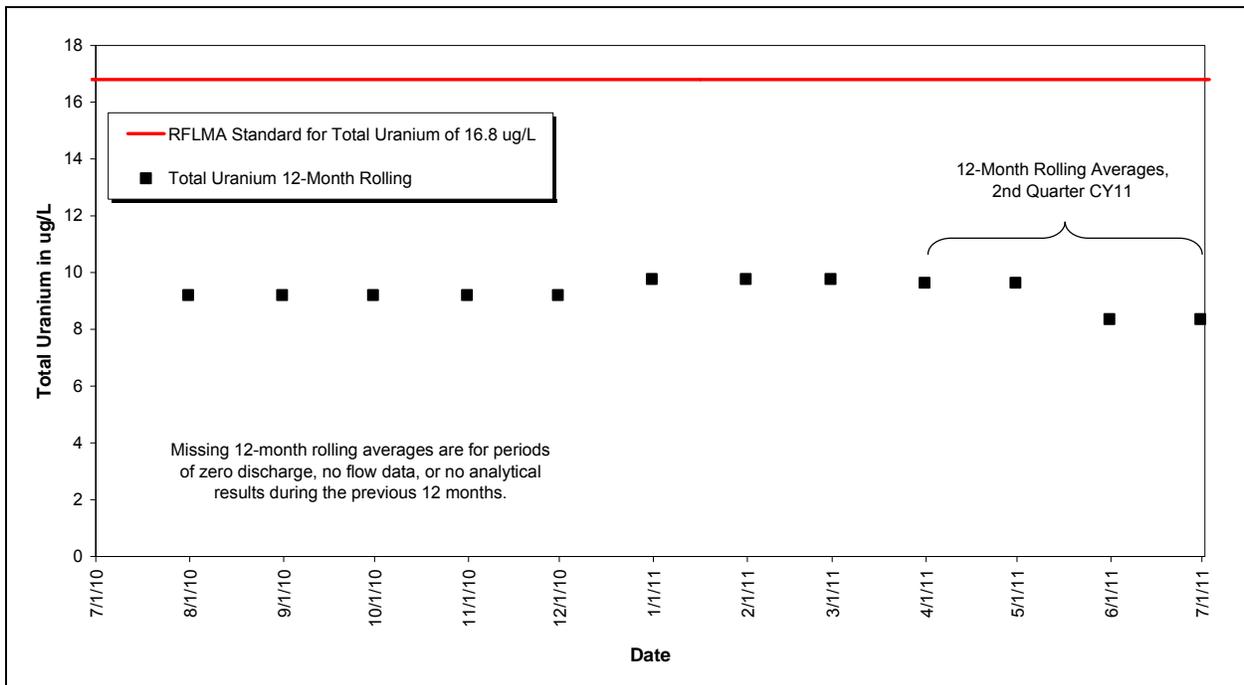
pCi/L = picocuries per liter

Figure 18. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS11: Calendar Year Ending Second Quarter CY 2011



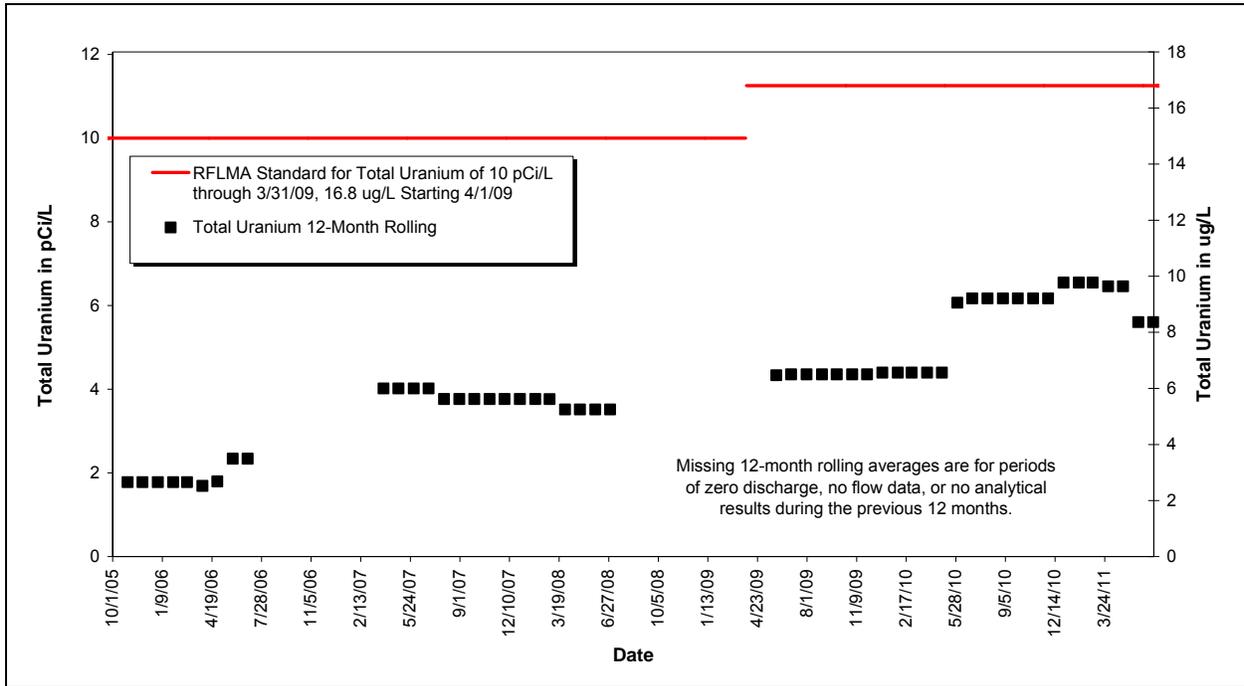
pCi/L = picocuries per liter

Figure 19. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS11: Post-Closure Period Ending Second Quarter CY 2011



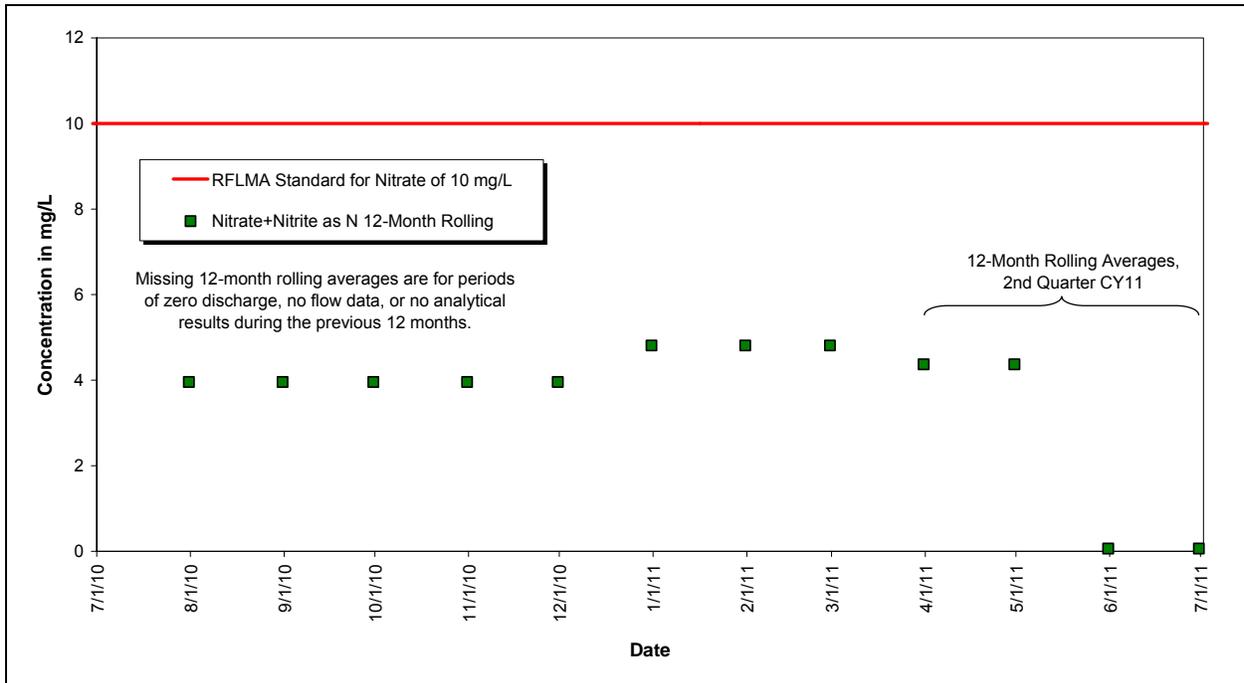
ug/L = micrograms per liter

Figure 20. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at GS11: Calendar Year Ending Second Quarter CY 2011



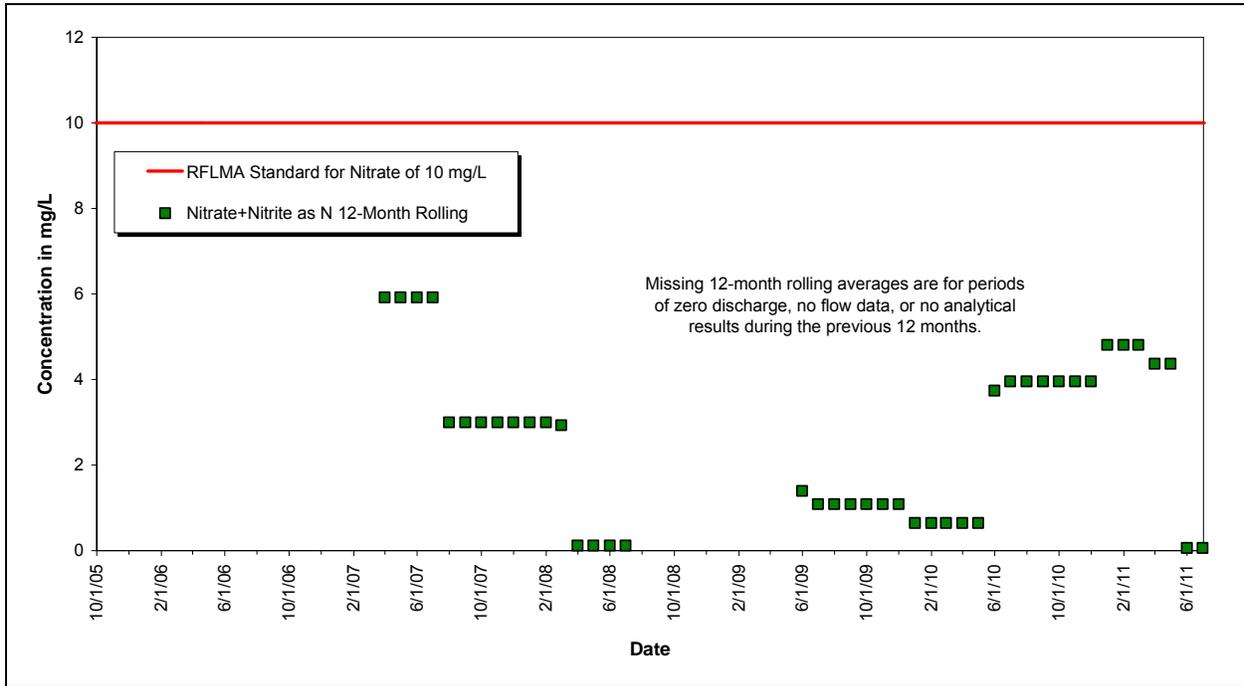
µg/L = micrograms per liter; pCi/L = picocuries per liter

Figure 21. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at GS11: Post-Closure Period Ending Second Quarter CY 2011



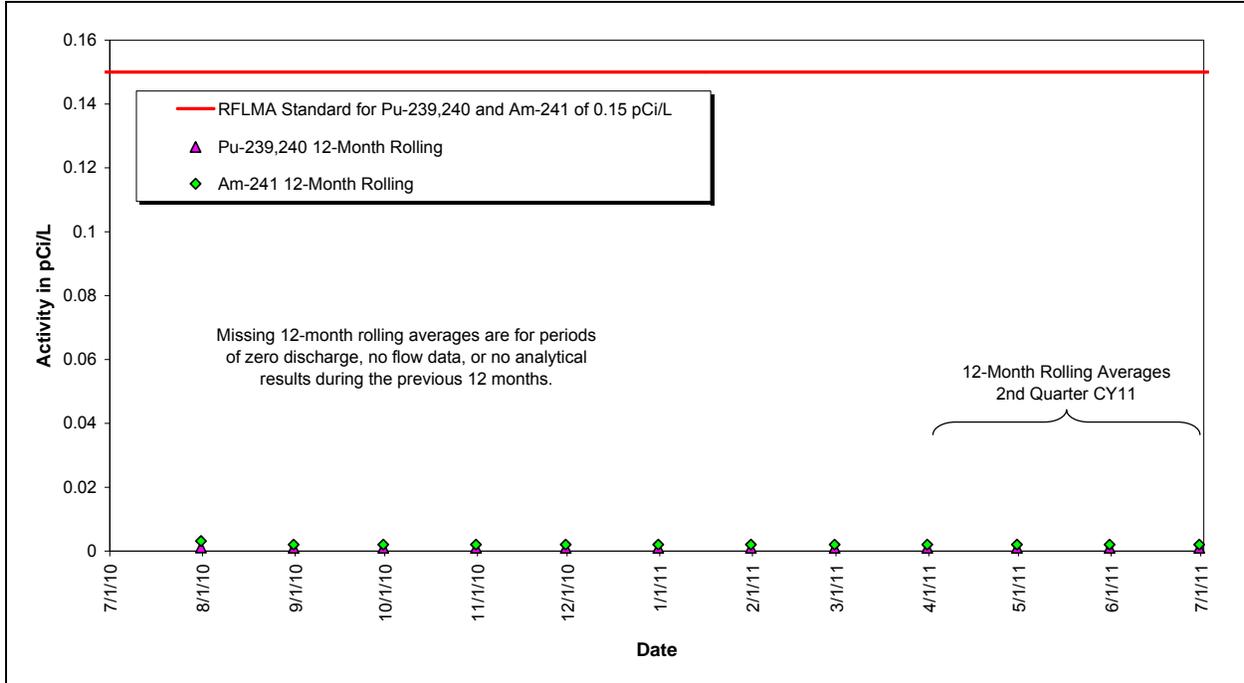
Note: Nitrate + nitrite as nitrogen 12-month averages are conservatively compared to the nitrate standard only. mg/L = milligrams per liter

Figure 22. Volume-Weighted 12-Month Rolling Average Nitrate + Nitrite as Nitrogen Concentrations at GS11: Calendar Year Ending Second Quarter CY 2011



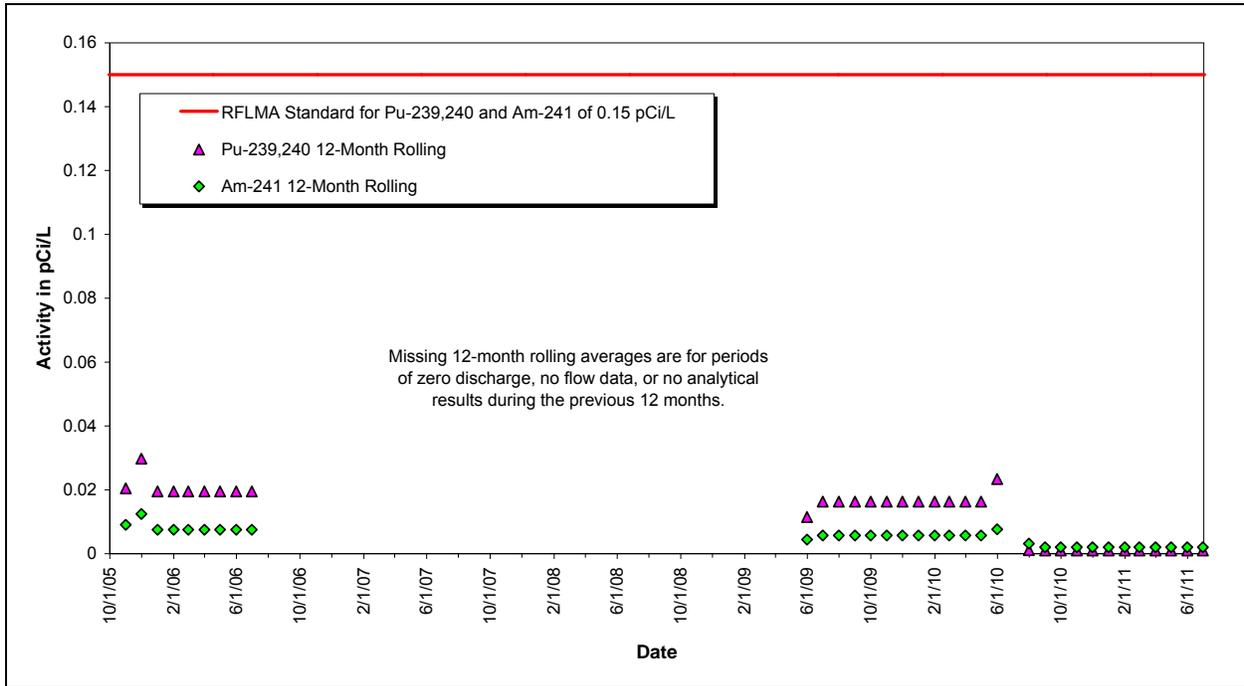
### 3.1.2.5 Monitoring Location GS31

Monitoring location GS31 is on Woman Creek at the outlet of Pond C-2. Figure 24 and Figure 26 show no occurrences of reportable 12-month rolling averages for the quarter. Figure 25 and Figure 27 show sampling data from 2005 through the second quarter of CY 2011.



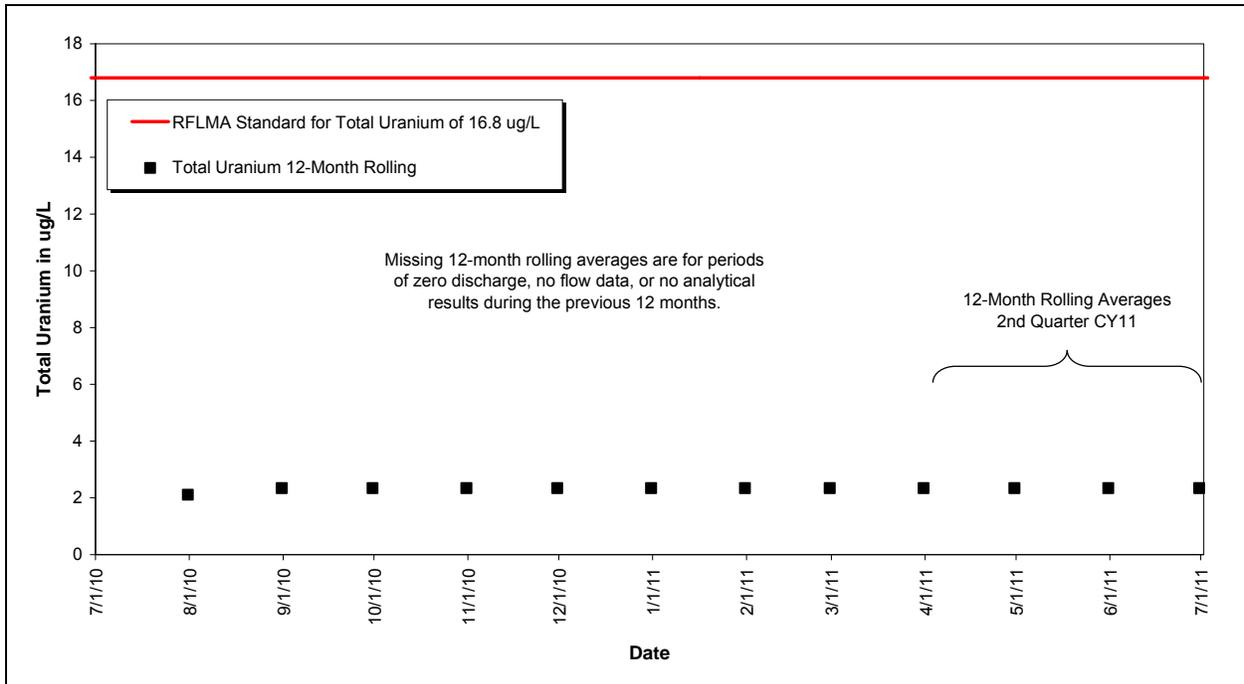
pCi/L = picocuries per liter

Figure 24. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS31: Calendar Year Ending Second Quarter CY 2011



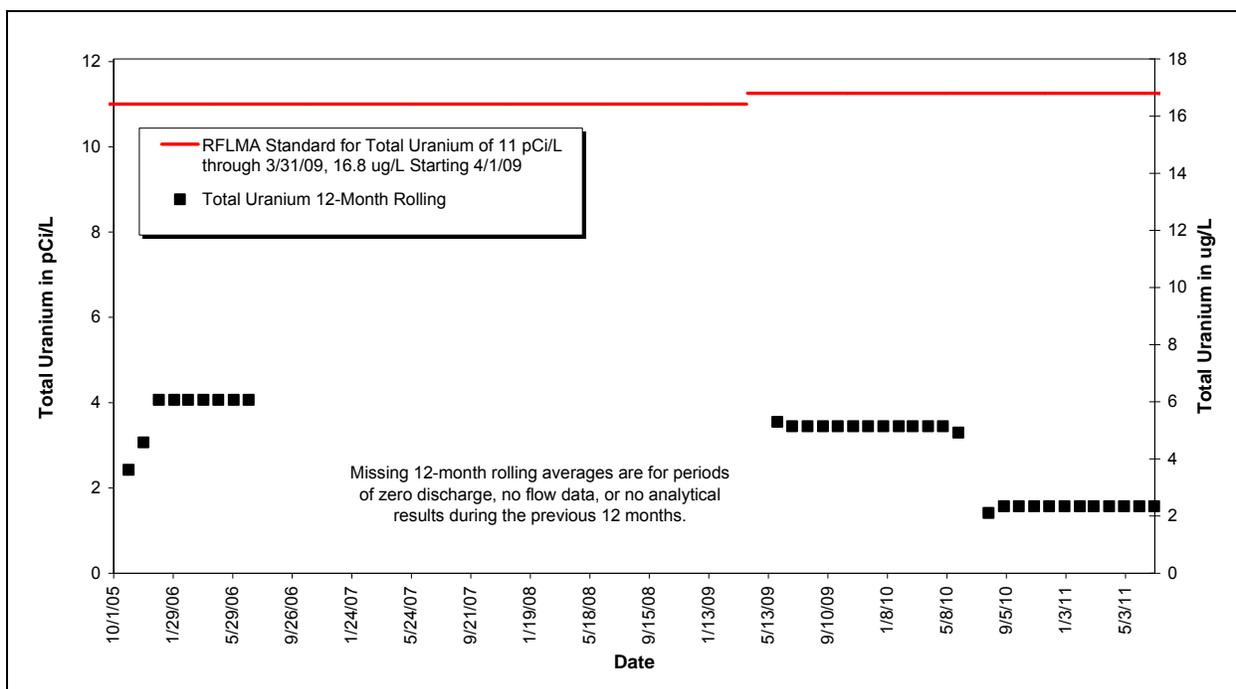
pCi/L = picocuries per liter

Figure 25. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS31: Post-Closure Period Ending Second Quarter CY 2011



µg/L = micrograms per liter

Figure 26. Volume-Weighted 12-Month Rolling Average Total Uranium Activities at GS31: Calendar Year Ending Second Quarter CY 2011



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

Figure 27. Volume-Weighted 12-Month Rolling Average Total Uranium Activities at GS31: Post-Closure Period Ending Second Quarter CY 2011

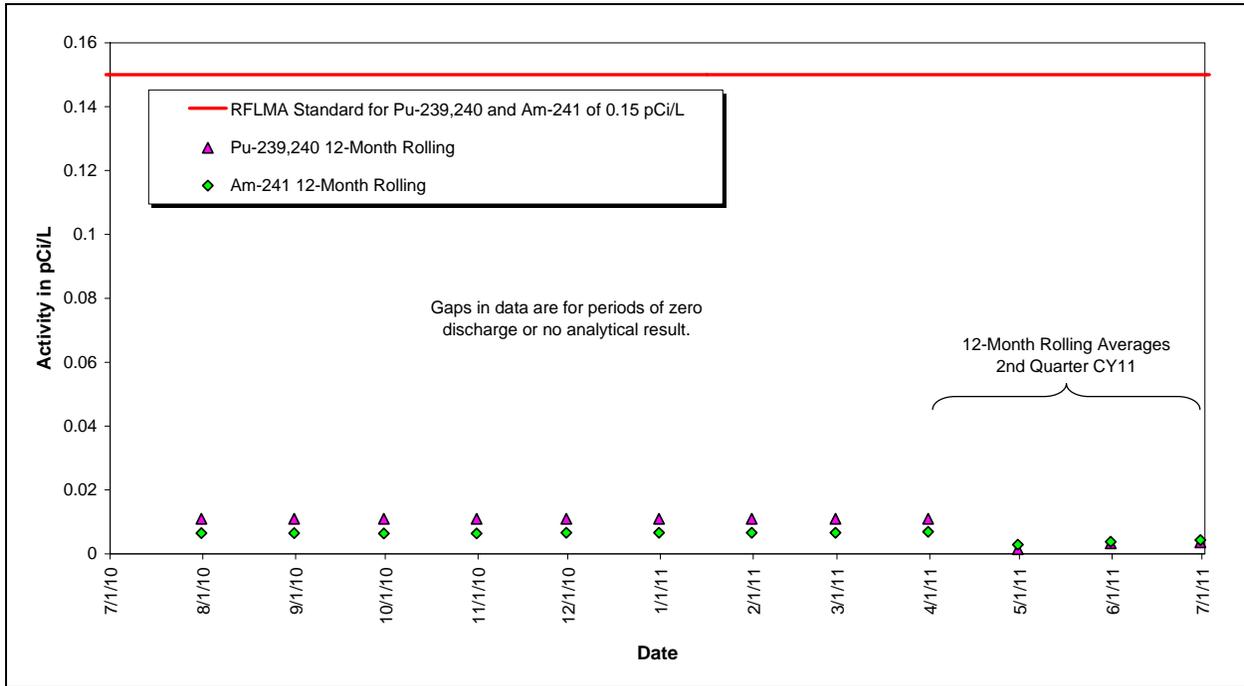
### 3.1.3 POE Monitoring

The following sections include summary plots showing the applicable 12-month rolling averages for the POE analytes.

#### 3.1.3.1 Monitoring Location GS10

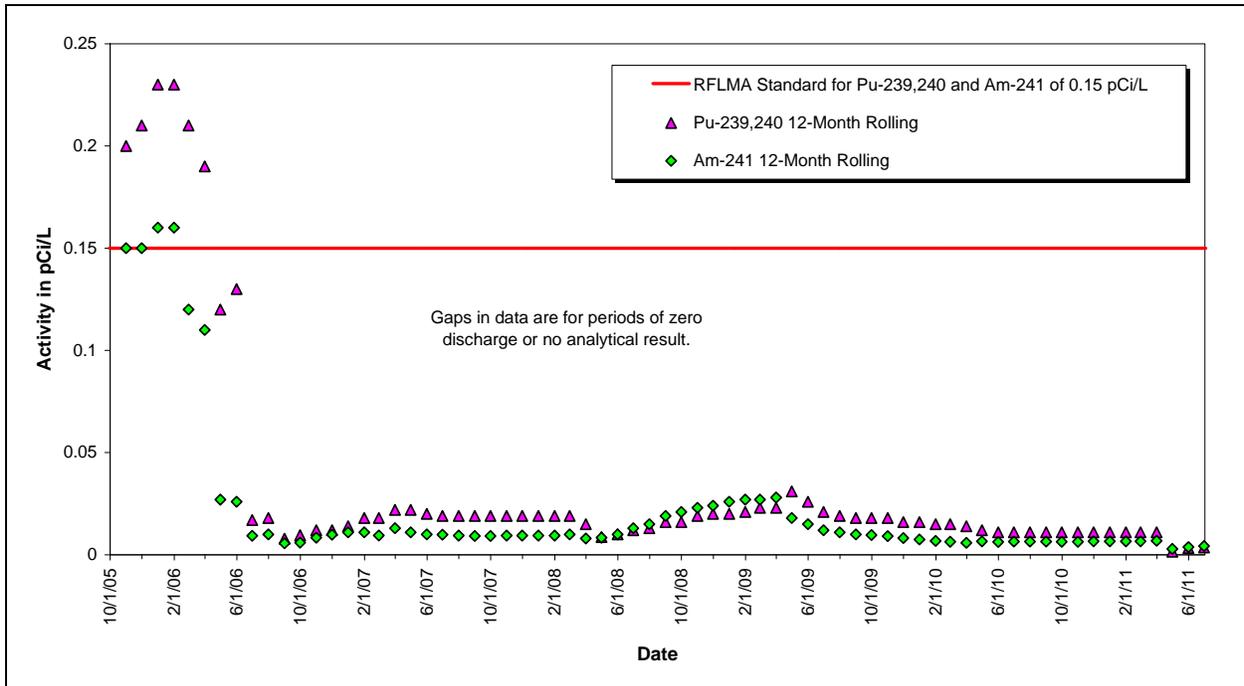
Monitoring location GS10 is on South Walnut Creek just upstream of the B-Series ponds. Figure 28 and Figure 30 show the 12-month rolling averages for plutonium, americium, and total uranium values during the quarter. Figure 29 and Figure 31 show sampling data from 2005 through the second quarter of CY 2011.

Figure 30 shows that the 12-month rolling average for uranium exceeds the RFLMA standard of 16.8 micrograms per liter (µg/L). The composite sampling results for uranium at GS10 collected during CY 2011 are given in Table 1. All other analytes were not reportable during the second quarter of CY 2011.



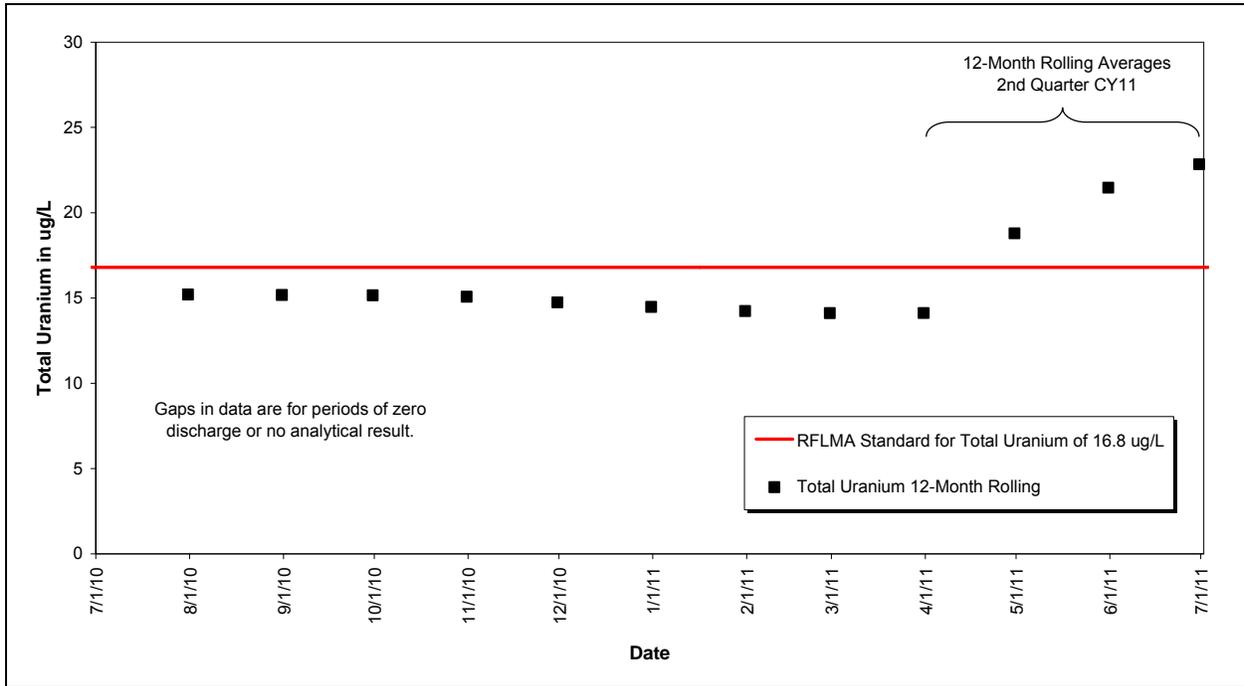
pCi/L = picocuries per liter

Figure 28. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS10: Calendar Year Ending Second Quarter CY 2011



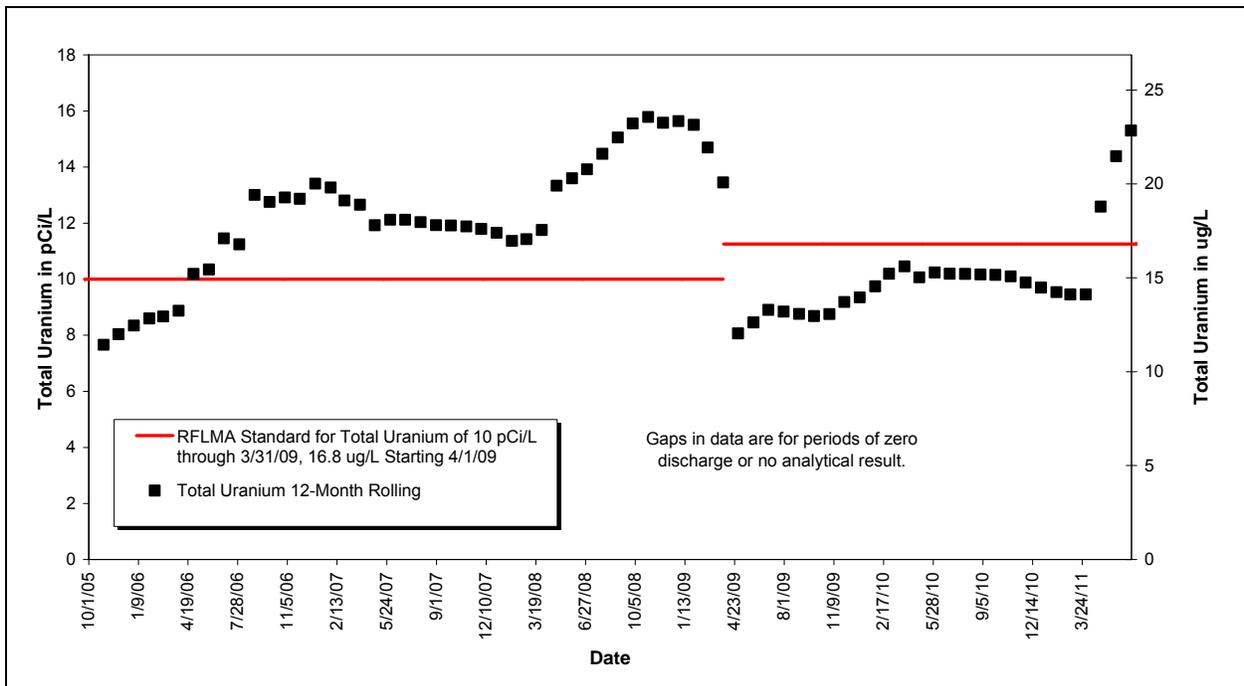
pCi/L = picocuries per liter

Figure 29. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at GS10: Post-Closure Period Ending Second Quarter CY 2011



µg/L = micrograms per liter

Figure 30. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at GS10: Calendar Year Ending Second Quarter CY 2011



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

Figure 31. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at GS10: Post-Closure Period Ending Second Quarter CY 2011

Table 1. CY 2011 Composite Sampling Results for Uranium at GS10

Date—Time Start	Date—Time End	Uranium Result (µg/L)
1/3/2011 10:25	2/16/2011 9:47	21.8
2/16/2011 9:47	4/11/2011 10:50	89.2
4/11/2011 10:50	5/4/2011 11:39	71.0
5/4/2011 11:39	5/13/2011 12:25	46.5
5/13/2011 12:25	5/20/2011 12:03	18.6
5/20/2011 12:03	6/3/2011 10:56	35.8
6/3/2011 10:56	6/13/2011 10:22	20.1
6/13/2011 10:22	7/1/2011 9:00	10.6
7/1/2011 9:00	7/8/2011 11:08	7.75
7/8/2011 11:08	7/10/2011 11:05	4.36
7/10/2011 11:05	7/11/2011 10:59	6.06
7/11/2011 10:59	7/21/2011 8:56	NA
7/21/2011 8:56	8/24/2011 9:40	NA
8/24/2011 9:40	in progress	NA

NA = data not available

The GS10 evaluation was performed in accordance with RFLMA Attachment 2, Figure 6, “Points of Evaluation,” which resulted in a calculated 12-month rolling average concentration for uranium on April 30, 2011, of 18.8 µg/L. This amount exceeds the RFLMA applicable Table 1 standard of 16.8 µg/L. Validated results were received on June 14, 2011, and notification to the regulatory agencies and the public, in accordance with RFLMA Attachment 2, Figure 6, was made by e-mail on June 16, 2011. RFLMA Contact Record 2011-04, “Reportable Condition for Uranium at Point of Evaluation GS10,” provides a discussion of the monitoring results and recaps the outcome of the RFLMA Parties consultation regarding the evaluation steps to be taken. Contact Record 2011-04 is available on the Rocky Flats website, [http://www.lm.doe.gov/Rocky\\_Flats/ContactRecords.aspx](http://www.lm.doe.gov/Rocky_Flats/ContactRecords.aspx).

The RFLMA Parties agreed that no mitigating actions are necessary while the condition is being evaluated, for the following reasons:

- Downstream monitoring indicates that the remedy remains protective. The current 12-month rolling-average uranium concentration at the Pond B-5 outlet, POC GS08, is 7.8 µg/L and includes the sample results through the last Pond B-5 discharge from March 24 to 30, 2011. Uranium results from the non-RFLMA monitoring project location B5INFLOW, which is upstream of GS08, have been reviewed, and concentrations are also below the RFLMA standard. B5INFLOW is also a flow-paced sampling station.
- The groundwater in the GS10 area has high concentrations of naturally occurring uranium as well as lower concentrations of anthropogenic uranium. Measured concentrations of uranium at GS10 include both naturally occurring as well as anthropogenic uranium. Historically, naturally occurring uranium has made up a much greater proportion of the concentration at GS10—generally about 70 percent.
- In recent years, the elevated uranium concentrations at GS10 are a result of proportionally increased groundwater contribution to surface water baseflow due to reduced surface runoff resulting from the removal of impervious surfaces (e.g., pavement, buildings) during site closure. In addition to the general increase in groundwater contribution to the stream, the

below-normal precipitation from the late fall of 2010 until mid-May 2011 resulted in a further proportional increase in groundwater contribution.

- The uranium concentrations are expected to vary due to the natural variability in environmental conditions such as the amounts of precipitation over time. Elevated uranium concentrations at GS10 above the then-effective 10 pCi/L RFLMA standard previously occurred for the period from April 30, 2006, to March 31, 2009, with the 12-month rolling averages in the range of 10.2 to 15.8 pCi/L. The RFLMA uranium standard was subsequently revised from an activity-based radionuclide parameter of 10 pCi/L to a concentration based metal parameter of 16.8 µg/L, which equates to approximately 11.3 pCi/L. Thus, the ranges in activity summarized above for 2006 to 2009 equate to approximately 15.2 to 23.5 µg/L. Levels returned to below the RFLMA standard after March 31, 2009, when precipitation increased.

However, the RFLMA Parties agreed that further evaluation should be done to help confirm the foregoing conclusions and aid in developing mitigating actions in the future if they become necessary.

As agreed by the RFLMA Parties, the following preliminary steps are being or have been taken and will inform the evaluation:

- The following samples have been sent to Los Alamos National Laboratory (LANL) for isotopic analysis to determine the percentages of natural and anthropogenic uranium to compare with percentages in pre-closure and post-closure samples previously analyzed by LANL:
  - Flow-paced surface water sample from GS10 for the period June 13 to July 1, 2011. (Historically, this location has had approximately 70 percent natural uranium.)
  - Groundwater sample from upgradient well 99405. (Historically, this location has reported uranium concentrations that typically exceed 100 µg/L and have been 99.9 to 100 percent natural uranium.)
- Non-RFLMA sampling and analysis of uranium downstream of GS10 at B5INFLOW will continue. Contact Record 2010-03 describes the non-RFLMA sampling project.

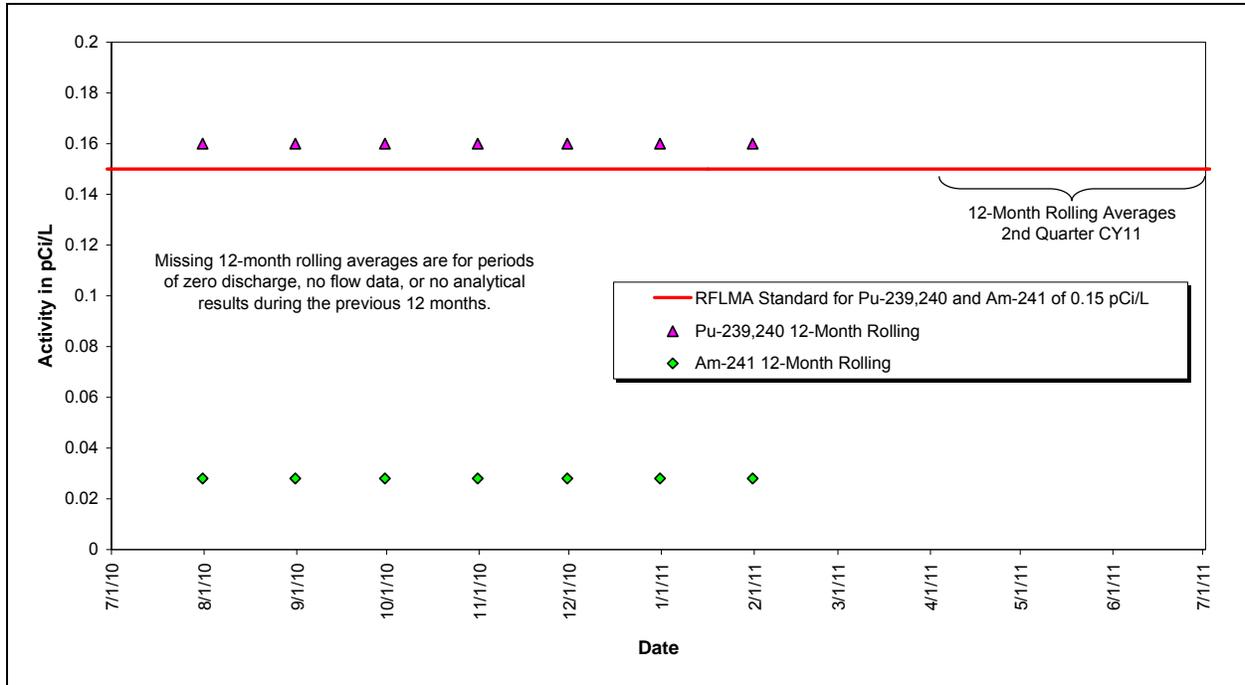
In addition to this sampling, two temporary surface water sample locations upstream of GS10 have been established for biweekly uranium grab sampling (FC4991 and FC4750). The RFLMA Parties will determine the duration of the grab sampling for these upstream locations, based on an evaluation of the results. Biweekly sampling at these locations was initiated on June 30, 2011.

LANL results will be included in the 3rd Quarter CY 2011 report as an appendix. Routine non-RFLMA sampling results will be included in the quarterly Adaptive Management Plan data reports.

### **3.1.3.2 Monitoring Location SW027**

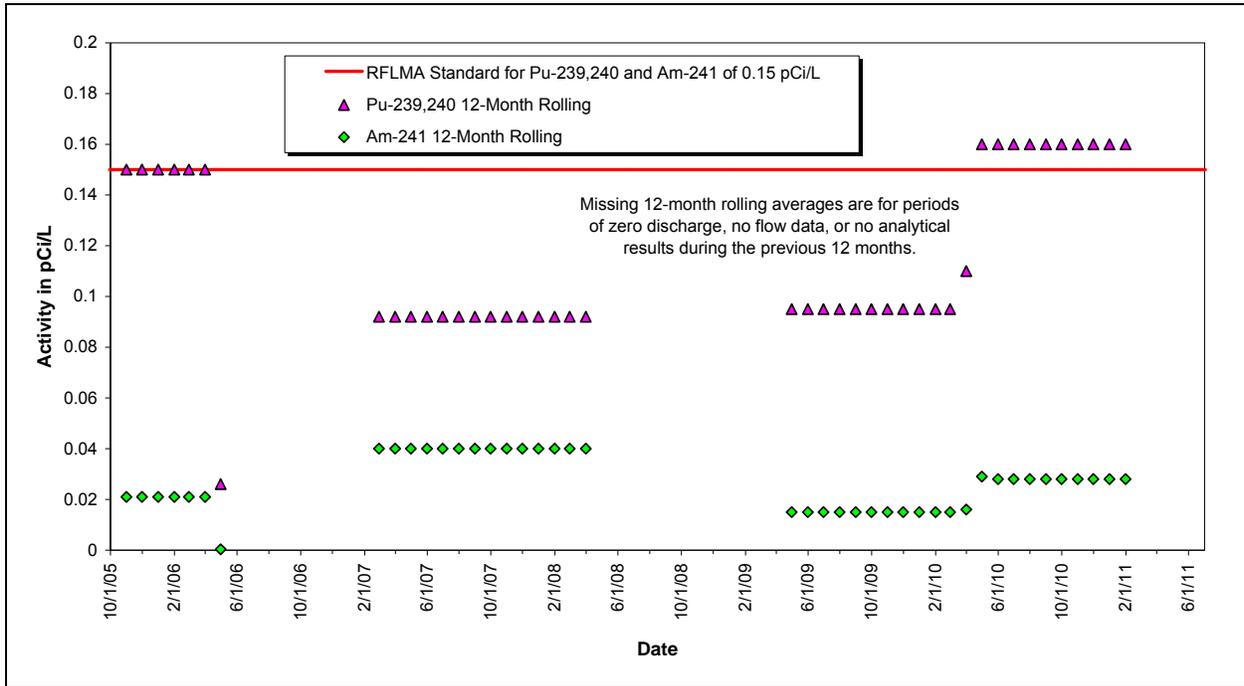
Monitoring location SW027 is at the end of the South Interceptor Ditch (SID) at the inlet to Pond C-2. Figure 32 and Figure 34 show the 12-month rolling averages for plutonium, americium, and total uranium during the quarter. Figure 33 and Figure 35 show sampling data from 2005 through the second quarter of CY 2011.

Figure 32 shows that the 12-month rolling average for plutonium exceeds the RFLMA standard of 0.15 picocuries per liter (pCi/L). The composite sampling results for plutonium at SW027 collected during 2010 and 2011 are given in Table 2. All other analytes were not reportable during the second quarter of CY 2011.



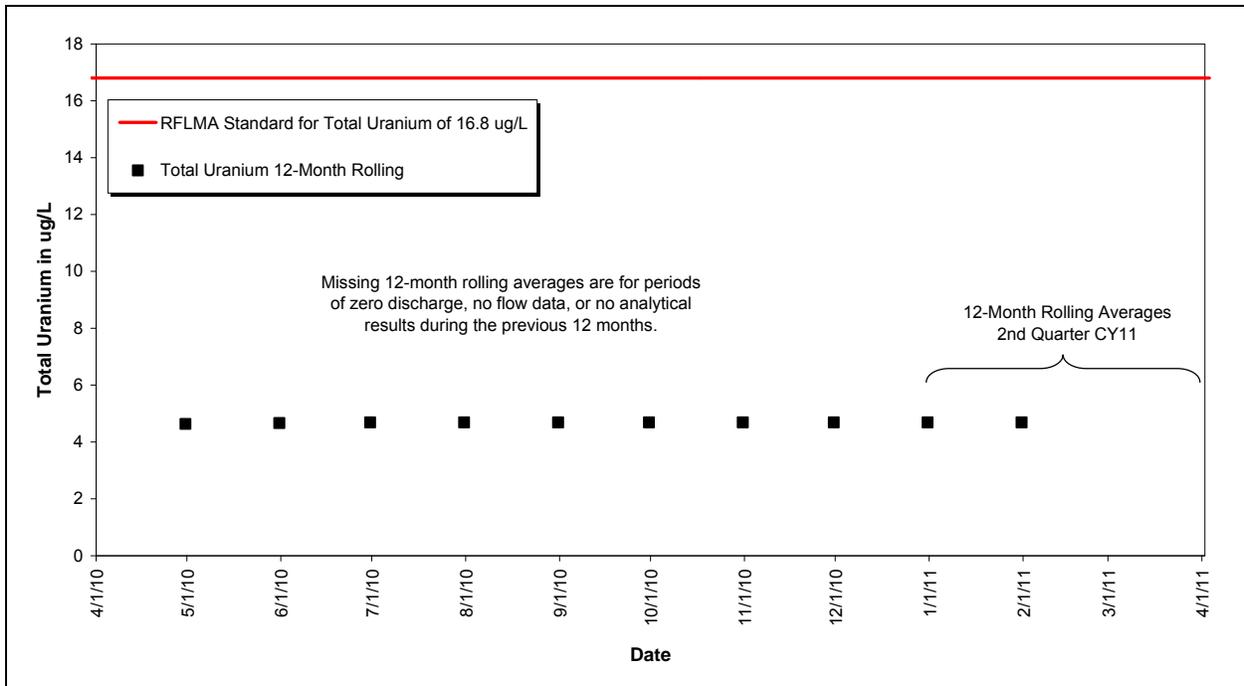
**Note:** The composite sample started on February 17, 2011, was still in progress at the time of publication, so those results for this composite sample were not available for this report.  
pCi/L = picocuries per liter

Figure 32. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at SW027: Calendar Year Ending Second Quarter CY 2011



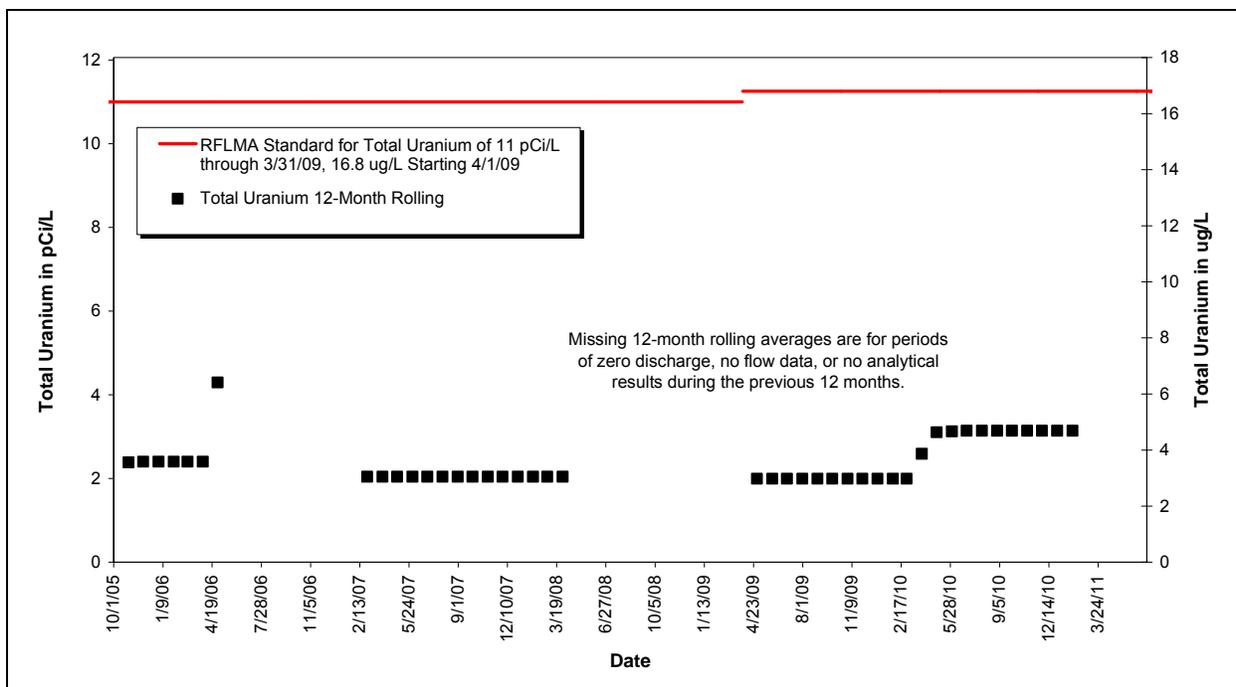
**Note:** The composite sample started on February 17, 2011, was still in progress at the time of publication, so those results for this composite sample were not available for this report.  
pCi/L = picocuries per liter

Figure 33. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at SW027: Post-Closure Period Ending Second Quarter CY 2011



**Note:** The composite sample started on February 17, 2011, was still in progress at the time of publication, so those results for this composite sample were not available for this report.  
µg/L = micrograms per liter

Figure 34. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at SW027: Calendar Year Ending Second Quarter CY 2011



**Note:** The composite sample started on February 17, 2011, was still in progress at the time of publication, so those results for this composite sample were not available for this report.  
 µg/L = micrograms per liter; pCi/L = picocuries per liter

Figure 35. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at SW027: Post-Closure Period Ending Second Quarter CY 2011

Table 2. CY 2010–2011 Composite Sampling Results for Plutonium at SW027

Date—Time Start	Date—Time End	Plutonium Result (pCi/L)
1/13/10—11:11	3/29/10—11:55	0.122
3/29/10—11:55	4/23/10—11:11	0.300
4/23/10—11:11	4/23/10—19:12	0.294
4/23/10—19:12	4/27/10—12:07	0.029
4/27/10—12:07	10/4/10—12:39	0.040
10/4/10—12:39	2/17/11—9:23	NA; No Flow
2/17/11—9:23	Sample in Progress	NA

Even though the 12-month rolling average values could not be formally calculated until complete analytical results were available for the April 27–October 4, 2010, sample, DOE initiated preemptive consultation with CDPHE on June 2, 2010. RFLMA Contact Record 2010-06, “Monitoring Results at Surface Water Point of Evaluation (POE) SW027,” provides a discussion of the monitoring results and recaps the outcome of the RFLMA Parties’ consultation regarding steps to be taken to evaluate the SW027 drainage area. Contact Record 2010-06 is available on the Rocky Flats website, [http://www.lm.doe.gov/Rocky\\_Flats/ContactRecords.aspx](http://www.lm.doe.gov/Rocky_Flats/ContactRecords.aspx).

Subsequent to Contact Record 2010-06, the *Report of Steps Taken Regarding Monitoring Results at Surface Water Point of Evaluation (POE) SW027* (DOE 2010a) was completed on

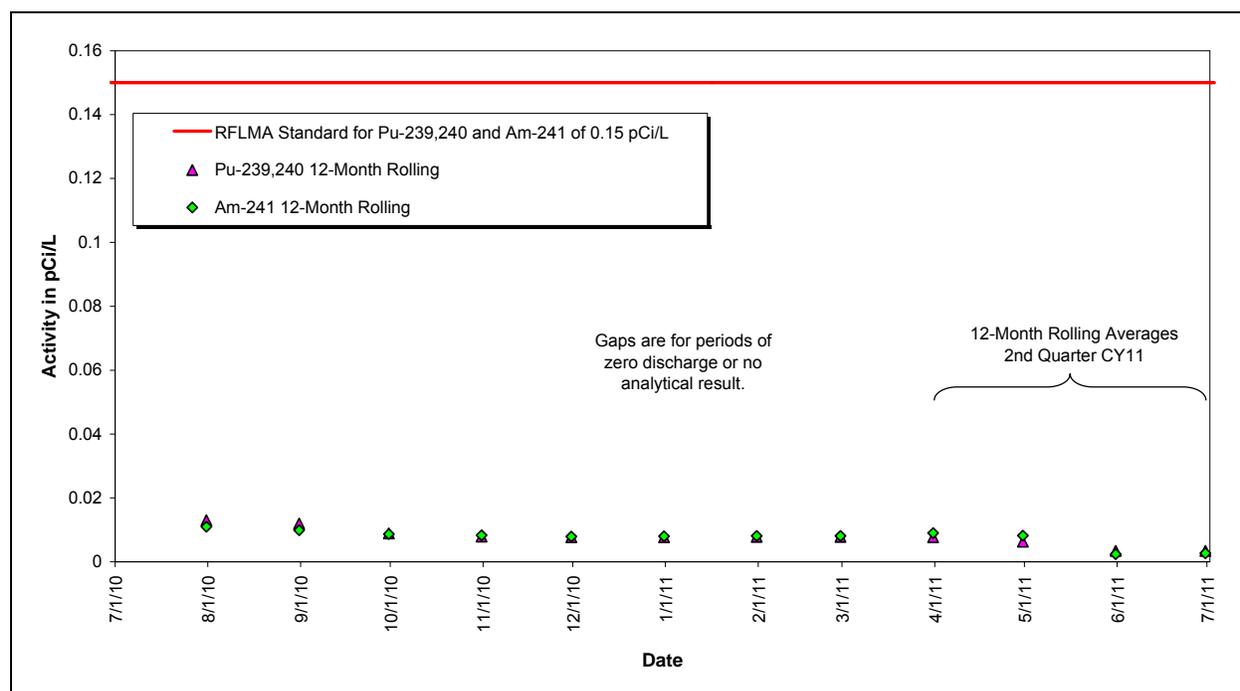
August 31, 2010. This report provides data evaluation and an update on the steps taken in accordance with Contact Record 2010-06. Recommendations beyond the actions already taken and discussed in the Contact Record are also provided. The August 31, 2010, report on the status of actions related to evaluation of the conditions is also available on the Rocky Flats website, [http://www.lm.doe.gov/Rocky\\_Flats/ContactRecords.aspx](http://www.lm.doe.gov/Rocky_Flats/ContactRecords.aspx).

The recommendations in the evaluation included installing additional erosion control wattles in locations along the hillside north of the SID, installing permanent erosion blankets, and reseeded three areas in the SID. This work was successfully completed on December 20, 2010. Approximately 2,560 linear feet of Filtrexx wattles and 8,452 square feet of permanent erosion matting were installed.

SW027 has seen very little flow since April 2010, so no additional composite samples have been collected. Thus, no new analytical data are available to include in the 12-month rolling average.

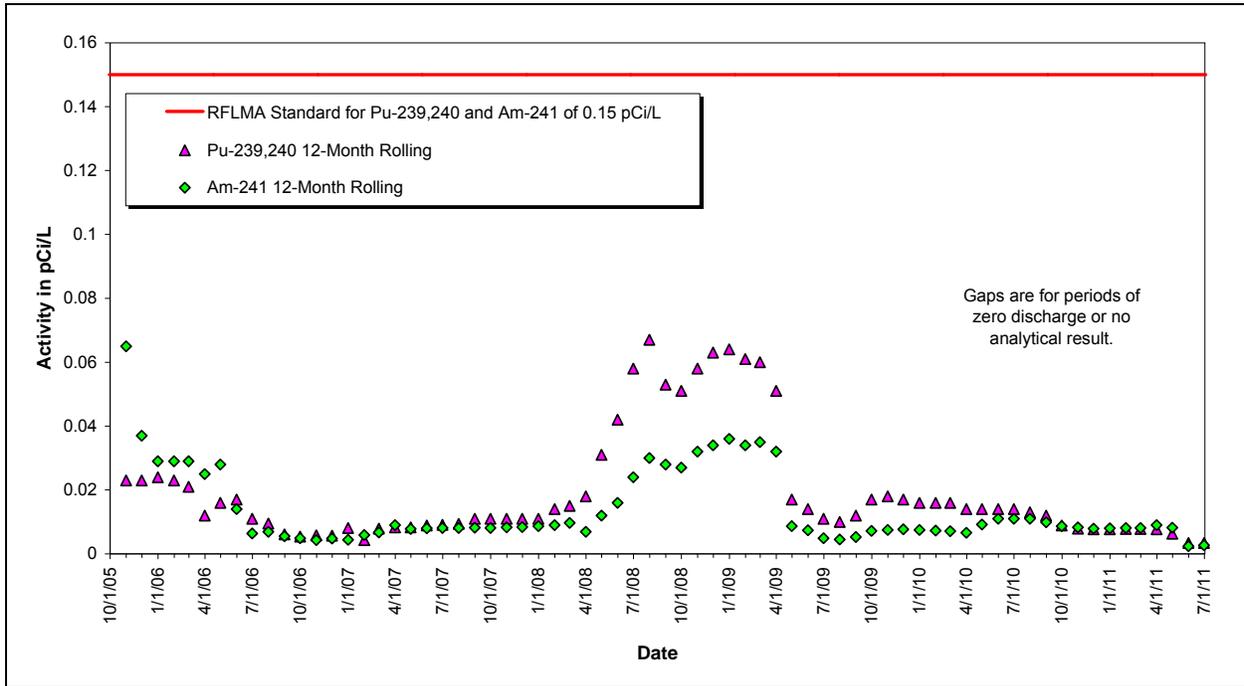
### 3.1.3.3 Monitoring Location SW093

Monitoring location SW093 is on North Walnut Creek 1,300 feet upstream of the A-Series ponds. Figure 36 and Figure 38 show no reportable plutonium, americium, or total uranium values during the quarter. Figure 37 and Figure 39 show sampling data from 2005 through the second quarter of CY 2011. None of the 85th-percentile 30-day average metals concentrations were reportable for the quarter.



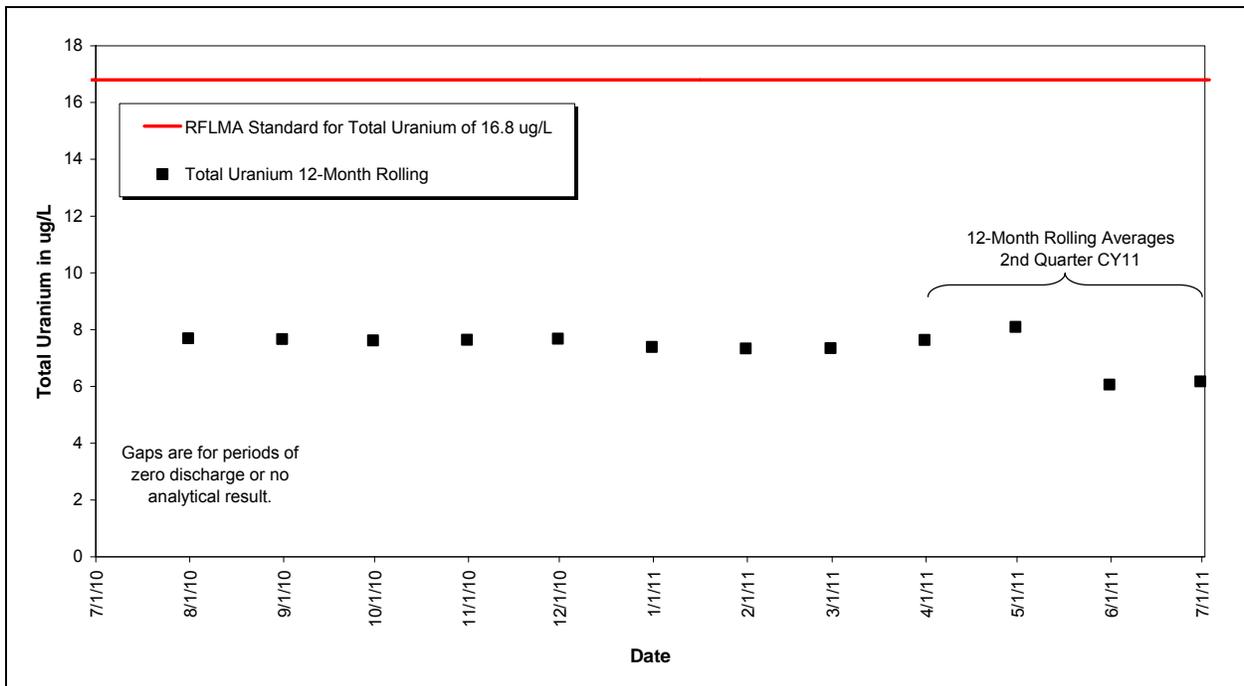
pCi/L = picocuries per liter

Figure 36. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at SW093: Calendar Year Ending Second Quarter CY 2011



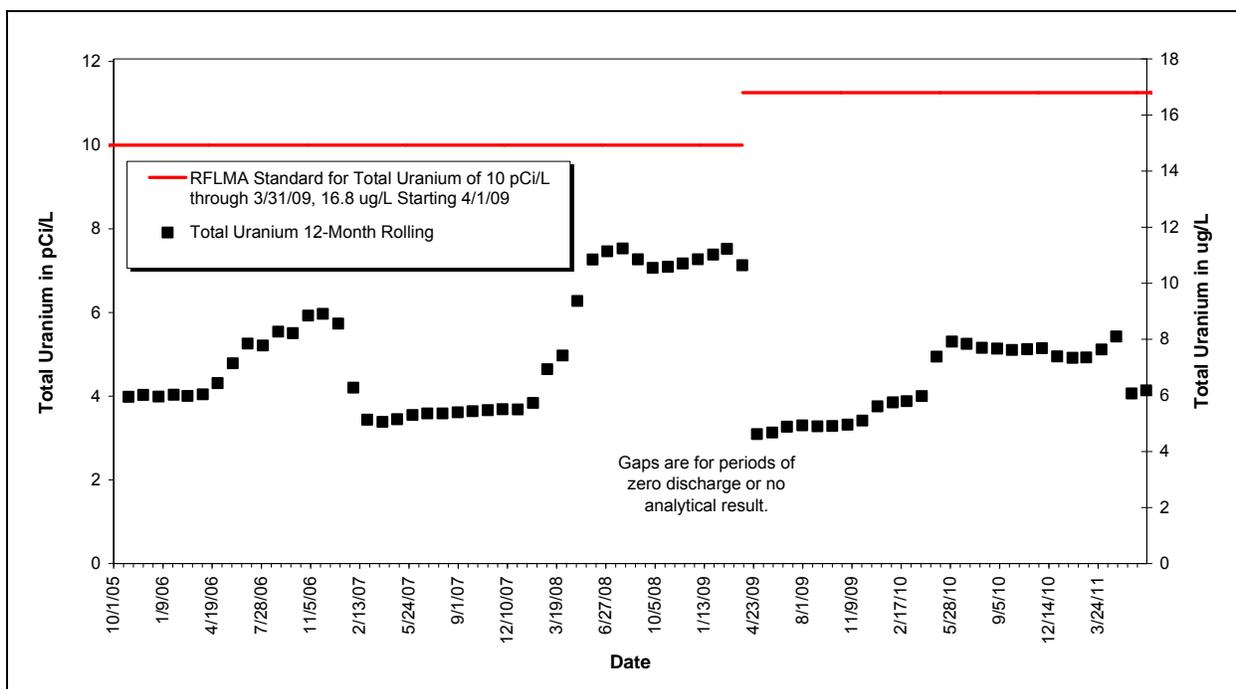
pCi/L = picocuries per liter

Figure 37. Volume-Weighted 12-Month Rolling Average Plutonium and Americium Activities at SW093: Post-Closure Period Ending Second Quarter CY 2011



µg/L = micrograms per liter

Figure 38. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at SW093: Calendar Year Ending Second Quarter CY 2011



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

Figure 39. Volume-Weighted 12-Month Rolling Average Total Uranium Concentrations at SW093: Post-Closure Period Ending Second Quarter CY 2011

### 3.1.4 AOC Wells and Surface Water Location SW018

All AOC wells and SW018 were scheduled for RFLMA monitoring in the second quarter of CY 2011. No reportable conditions were indicated. Nitrate concentrations in groundwater samples from well B206989 continue to exceed the applicable standard (DOE 2007c). Analytical results (Appendix B) will be discussed and statistically evaluated as part of the 2011 Annual Report.

### 3.1.5 Boundary Wells

Both Boundary wells were scheduled for RFLMA monitoring in the second quarter of CY 2011. On May 2, shortly after these wells were sampled, they were removed from the RFLMA monitoring network as reported in Section 1.1. In the interest of completeness, analytical results are provided in Appendix B.

### 3.1.6 Sentinel Wells

All Sentinel wells were scheduled for RFLMA monitoring in the second quarter of CY 2011. Analytical results (Appendix B) will be discussed and statistically evaluated as part of the 2011 Annual Report.

### **3.1.7 Evaluation Wells**

No Evaluation wells were scheduled for RFLMA monitoring in the second quarter of CY 2011. Non-RFLMA samples were collected from Evaluation wells 00191, 07391, 18199, 21505, 33502, 33604, and 91105. Analytical results (Appendix B) will be discussed and evaluated as part of the 2011 Annual Report.

### **3.1.8 PLF Monitoring**

All RCRA groundwater monitoring wells at the PLF were sampled during the second quarter of CY 2011. Analytical results (Appendix B) were generally consistent with past samples and will be discussed and statistically evaluated as part of the annual report for CY 2011. Section 3.1.10.4 discusses surface water monitoring at the PLF.

### **3.1.9 OLF Monitoring**

All RCRA groundwater monitoring wells at the OLF were sampled during the second quarter of CY 2011. Analytical results (Appendix B) were generally consistent with past samples and will be discussed and statistically evaluated as part of the annual report for CY 2011.

During the second quarter of CY 2011, when routine surface water sampling was performed in Woman Creek downstream of the OLF (GS59), all available analytical results were less than the applicable surface water standards. The composite sample started on June 14, 2011, is still in progress. Therefore, metals and uranium data for this sample were not available for this report.

### **3.1.10 Groundwater Treatment System Monitoring**

As described in Section 2.2, contaminated groundwater is intercepted and treated in four areas of the Site. The MSPTS, ETPTS, and SPPTS include a groundwater intercept trench. Groundwater entering the trenches is routed through a drain pipe into one or more treatment cells, where it is treated and then discharged to surface water. The PLFTS treats water from the northern and southern components of the Groundwater Intercept System and flow from the PLF seep.

#### ***3.1.10.1 Mound Site Plume Treatment System***

All MSPTS monitoring locations were scheduled for RFLMA sampling in the second quarter of CY 2011. In addition, non-RFLMA samples of the influent and effluent locations associated with the air stripper were collected. Analytical results (Appendix B) will be discussed and evaluated as part of the 2011 Annual Report.

#### ***3.1.10.2 East Trenches Plume Treatment System***

All ETPTS monitoring locations were scheduled for RFLMA sampling in the second quarter of CY 2011. Analytical results (Appendix B) will be discussed and evaluated as part of the 2011 Annual Report.

### ***3.1.10.3 Solar Ponds Plume Treatment System***

All SPPTS monitoring locations were scheduled for RFLMA sampling in the second quarter of CY 2011 (Appendix B). Non-RFLMA samples were also collected at several monitoring locations (e.g., SPILCA, SPCAE, SPZE, and others) to support continuing evaluation and optimization of the Phase II and Phase III upgrades (see also Section 2.2.3). Most of these screening/optimization samples were analyzed by the in-house Environmental Sciences Laboratory in Grand Junction, Colorado, rather than by an EPA-certified contract laboratory, and cannot be validated. All SPPTS data will be discussed in the 2011 Annual Report.

### ***3.1.10.4 PLF Treatment System***

During collection of the April 19, 2011, sample at the system influent (monitoring location PLFSEEPINF), the flow rate was 1.18 gallons per minute. As of June 30, 2011, the PLF Pond outlet remained in an open configuration.

During the second quarter of CY 2011, routine sampling of the treated effluent exiting the system (monitoring location PLFSYSEFF) showed that no analyte concentrations were greater than the applicable surface water standards.

### **3.1.11 Pre-Discharge Monitoring**

Pre-discharge samples are collected prior to discharge at Ponds A-4, B-5, and C-2 on North Walnut Creek, South Walnut Creek, and Woman Creek, respectively.

No pre-discharge samples were collected at Ponds A-4, B-5, or C-2 during the second quarter of CY 2011.

### **3.1.12 Non-RFLMA Monitoring**

In addition to the RFLMA-required monitoring discussed in the previous sections, nonregulatory monitoring is performed at the Site to further describe the fate and transport of selected constituents at the Site. Data in this section are not limited to the current quarter but include all available data.

#### ***3.1.12.1 High-Resolution Inductively Coupled Plasma/Mass Spectrometry and Thermal Ionization Mass Spectrometry Analyses***

Prior to and after Site closure, groundwater and surface water samples from select locations were sent to LANL for high-resolution inductively coupled plasma/mass spectrometry (HR ICP/MS) and/or thermal ionization mass spectrometry analyses. These analytical methods measure mass ratios of four U isotopes (masses 234, 235, 236, and 238). Isotopic ratios provide a signature that indicates whether and to what extent the uranium content is natural or anthropogenic (manmade).

In April 2011, additional samples were collected and submitted to LANL for high-resolution isotopic analyses (Table 3). Results will be evaluated in the 2011 Annual Report.

Table 3. Locations Sampled During Second Quarter 2011 for High-Resolution Uranium Analysis

Sample Location	General Area
Well 51605	Downgradient of SPPTS, adjacent to GS13
Well 70099	Northwest of SPPTS
Well 99405	South Walnut Creek near former B991
Well B210489	Downgradient of SPPTS
Well P210089	SPPTS area
SPIN	SPPTS influent
SPOUT	SPPTS effluent
SW093	Upgradient of SPPTS
GS10	South Walnut Creek upstream of B-series ponds
GS13	Downgradient of SPPTS
A1EFF	Farther downstream of SPPTS
A2EFF	Farther downstream of SPPTS
A3EFF	Farther downstream of SPPTS
A4 Pond	Farther downstream of SPPTS

## 4.0 Adverse Biological Conditions

No evidence of adverse biological conditions (e.g., unexpected mortality or morbidity) was observed during monitoring and maintenance activities in the second quarter of CY 2011.

## 5.0 References

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