Overview of the Third Quarter 2010 Surveillance and Maintenance Report for the LM Rocky Flats Site

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Surface Water Monitoring and Operations

Pond Operations – Third Quarter 2010

- Terminal Pond Discharges:
  - Pond C-2: July 31 through August 12, 2010, 7.0 MG
- Transfers:
  - A-3 to A-4: intermittently during the quarter; total of 3.0 MG
- Pond Levels:
  - As of October 1, 2010, Ponds A-3, A-4, B-5, and C-2 and the Landfill Pond were holding approximately 15.3 MG (15.4 percent of capacity)

December 31, 2010, Pond Levels

- Landfill (21.5 percent)
- A-3 (0.0 percent)
- A-4 (22.6 percent)
- B-5 (23.8 percent)
- C-2 (2.4 percent)

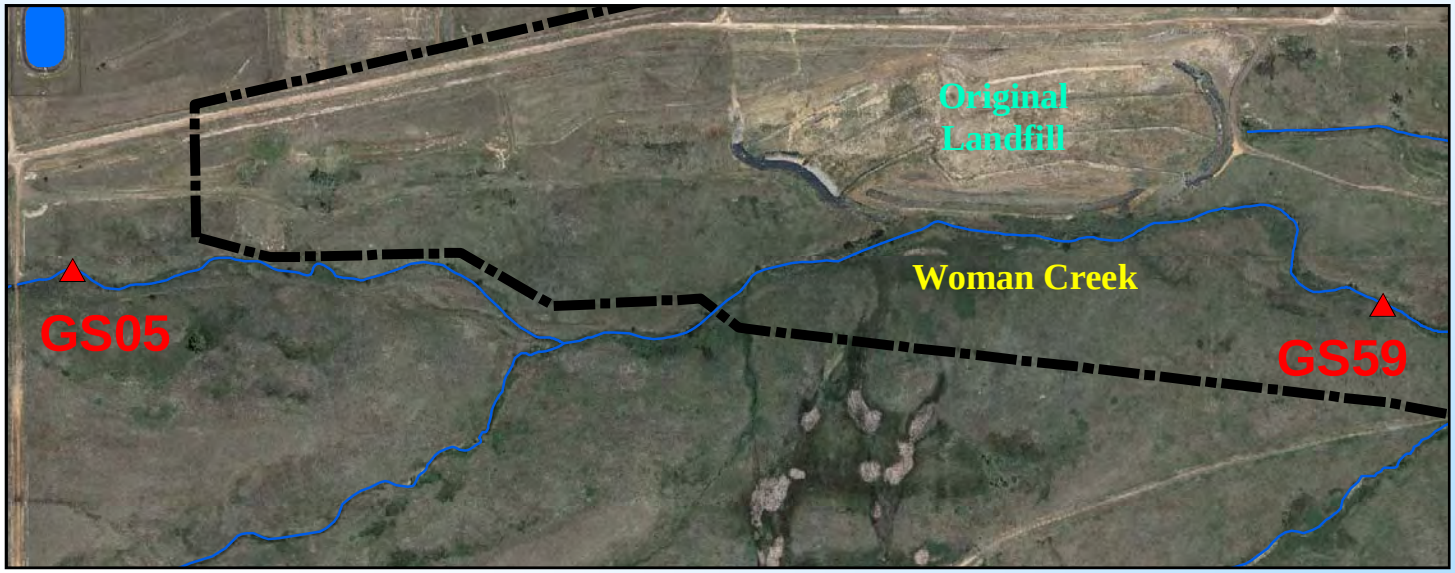
Hydrologic Data – Third Quarter 2010

- Precipitation
  - 2.4 inches total precipitation
  - 59 percent of WY 1993–2009 average
- Flow rates (percentage of average)
  - GS01 (1 percent; not including Pond C-2 discharge)
  - GS03 (6 percent)
  - GS10 (28 percent)
  - SW027 (no flow)
  - SW093 (26 percent)

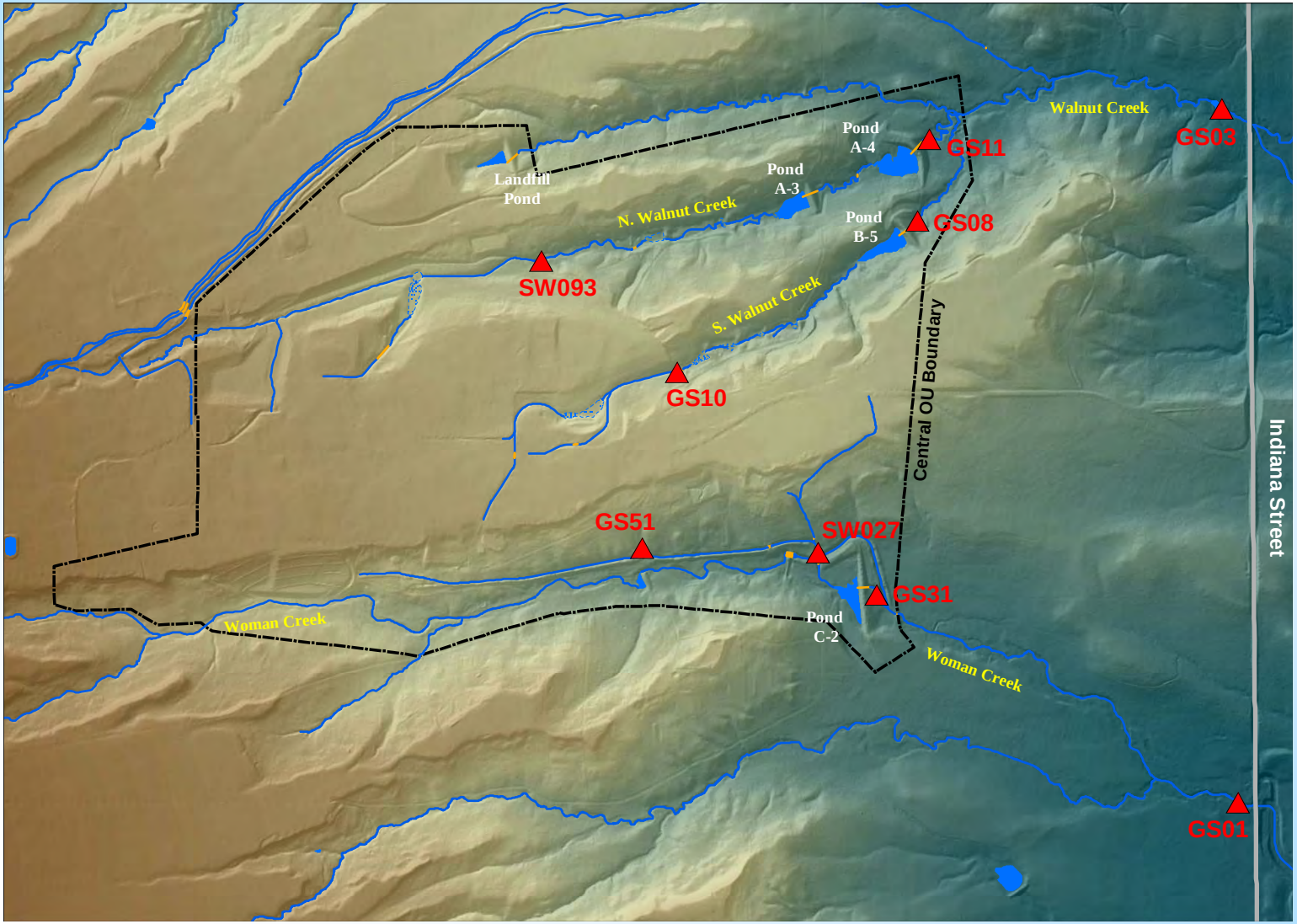
Performance Monitoring – Third Quarter 2010 Original and Present Landfills

- **Original Landfill (OLF)**: Surface water quality results were all below standards for the quarter*
- **Present Landfill (PLF)**: Surface water quality results were all below standards for the quarter

*Grab samples only; results for the composite sample started on July 1, 2010 are pending

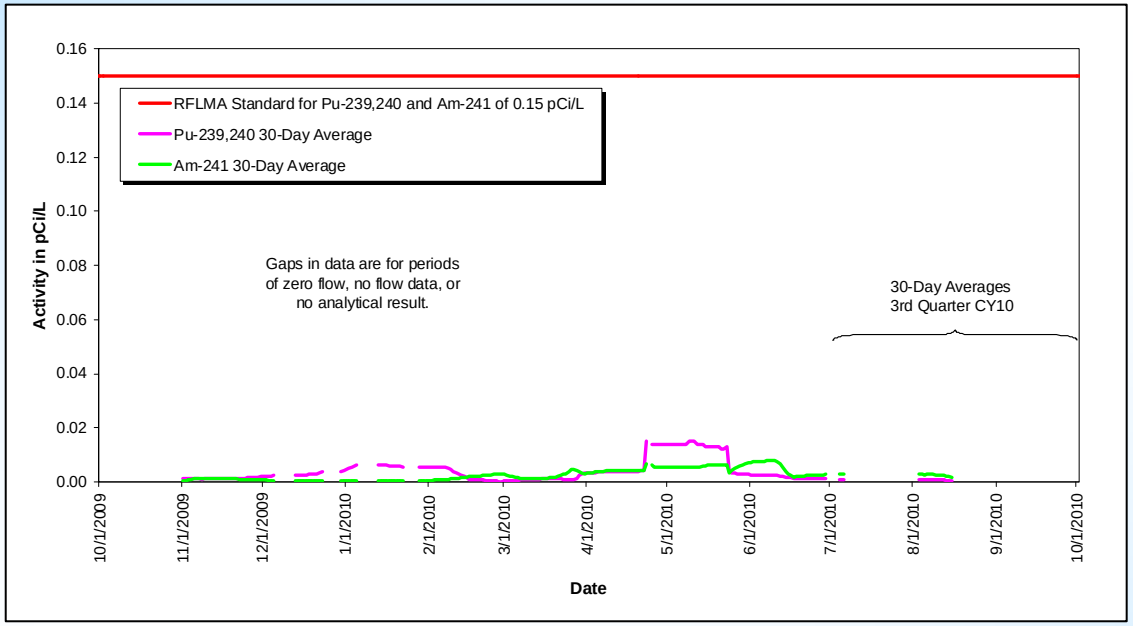


Selected Surface Water Monitoring Locations

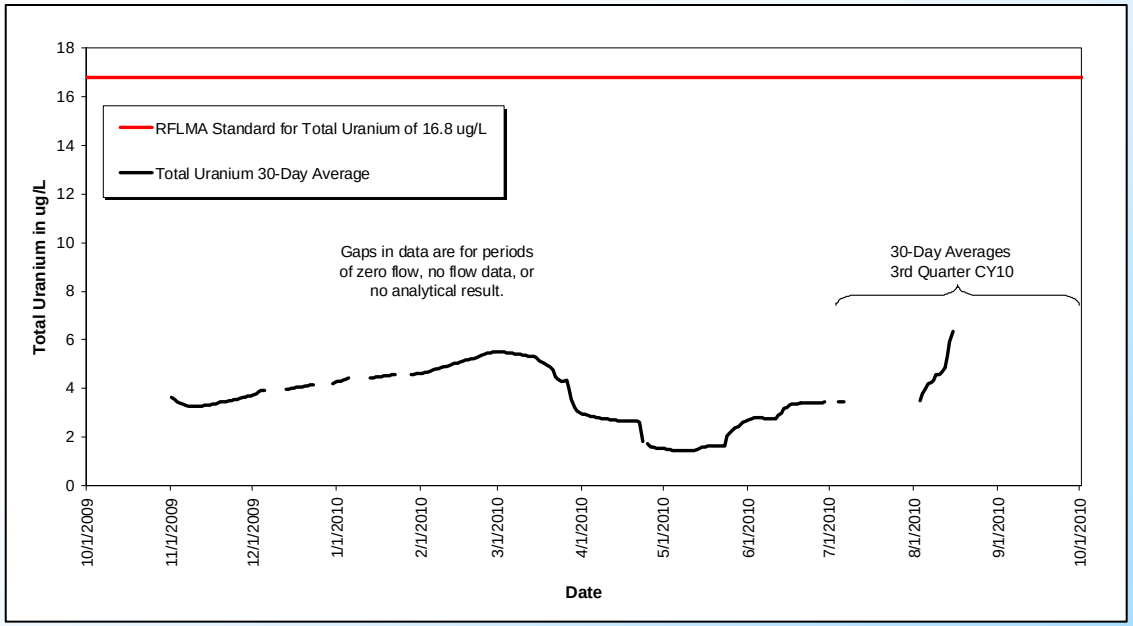


POC GS01

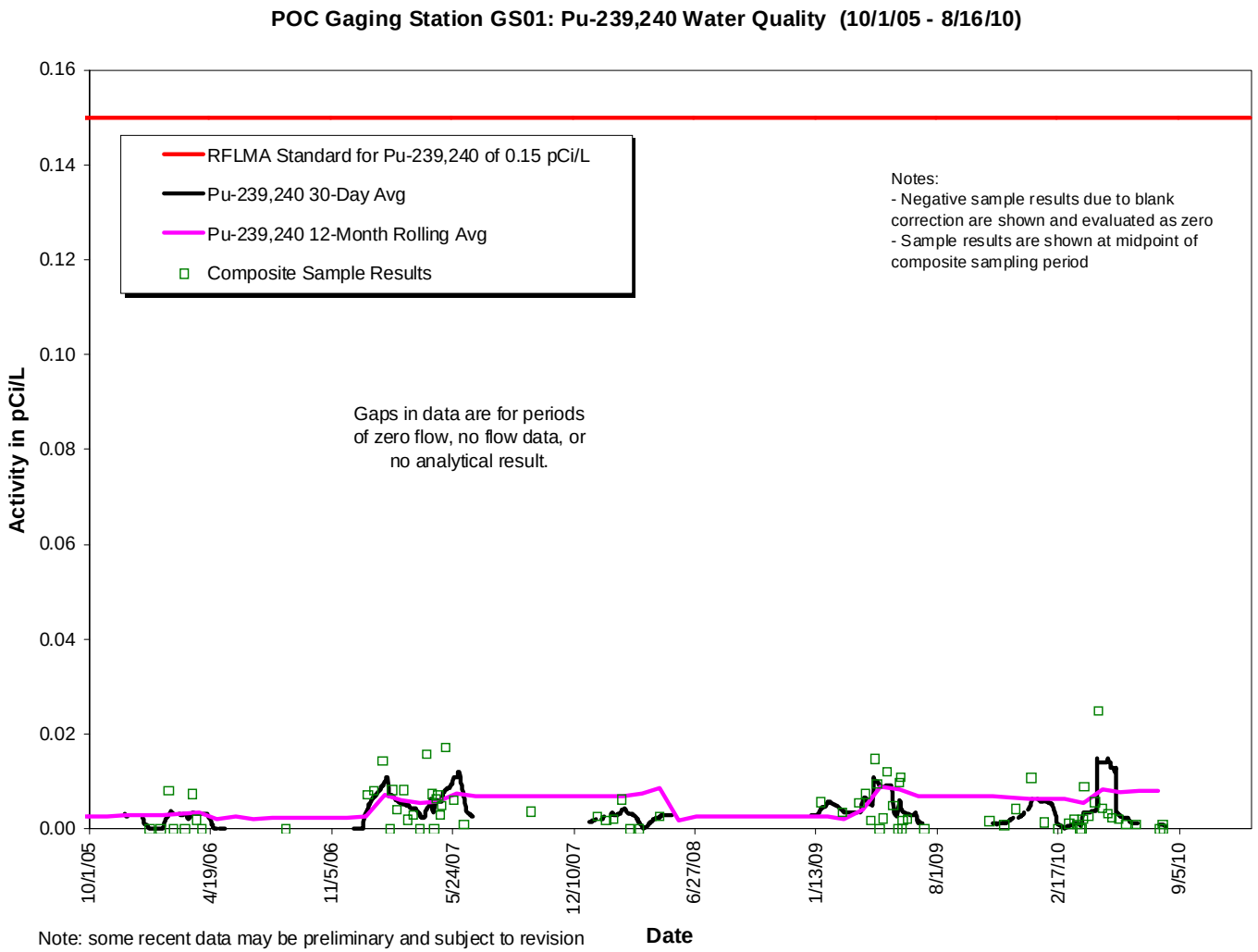
- Plutonium and Americium



- Total Uranium



POC GS01



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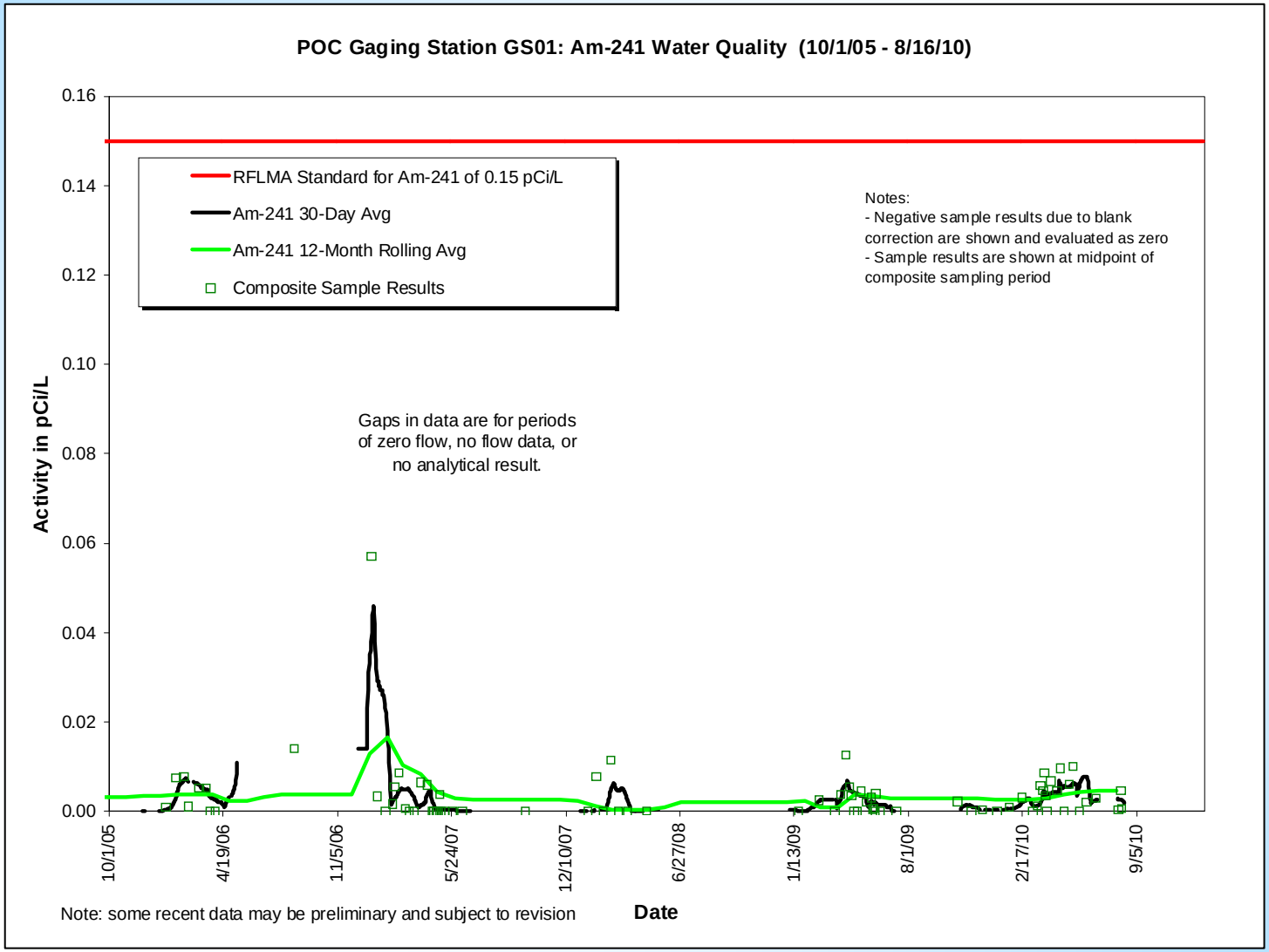
POC GS01


POC Gaging Station GS01: Am-241 Water Quality (10/1/05 - 8/16/10)
RFLMA Standard for Am-241 of 0.15 pCi/L
Am-241 30-Day Avg
Am-241 12-Month Rolling Avg
Composite Sample Results
Notes:
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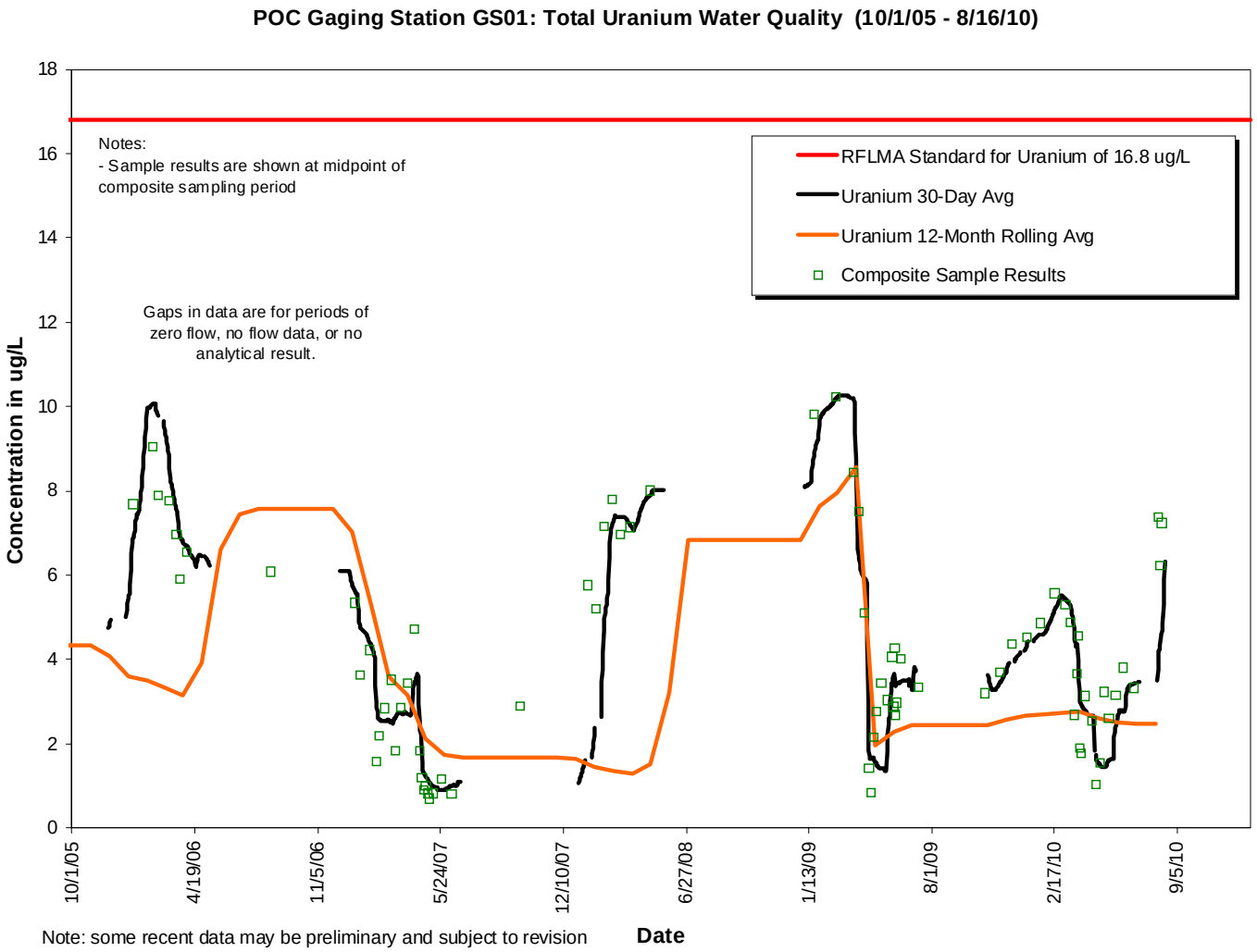
Gaps in data are for periods of zero flow, no flow data, or no analytical result.
Activity in pCi/L
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
10/1/05
4/19/06
11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
2/17/10
9/5/10
Date
Note: some recent data may be preliminary and subject to revision

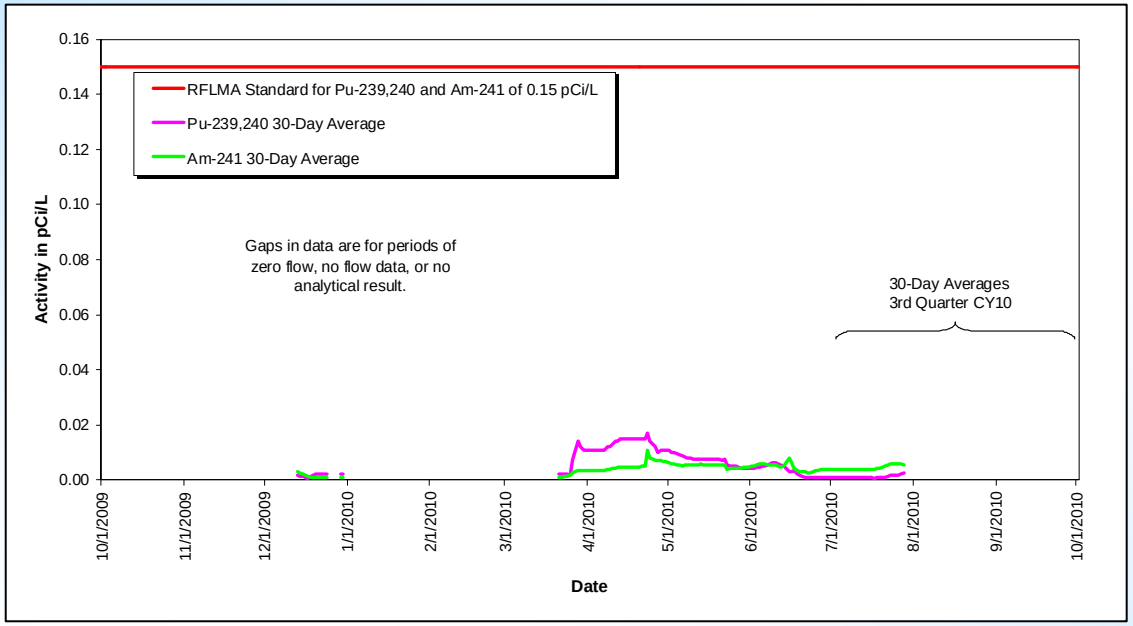
POC GS01



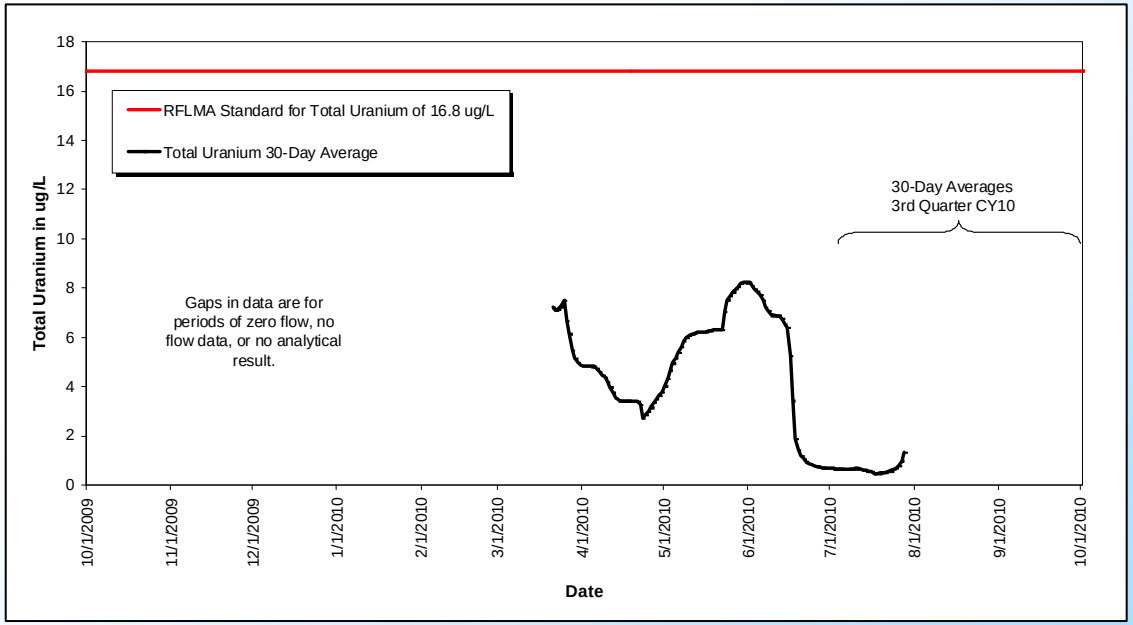
Note: some recent data may be preliminary and subject to revision

POC GS03

- Plutonium and Americium



- Total Uranium



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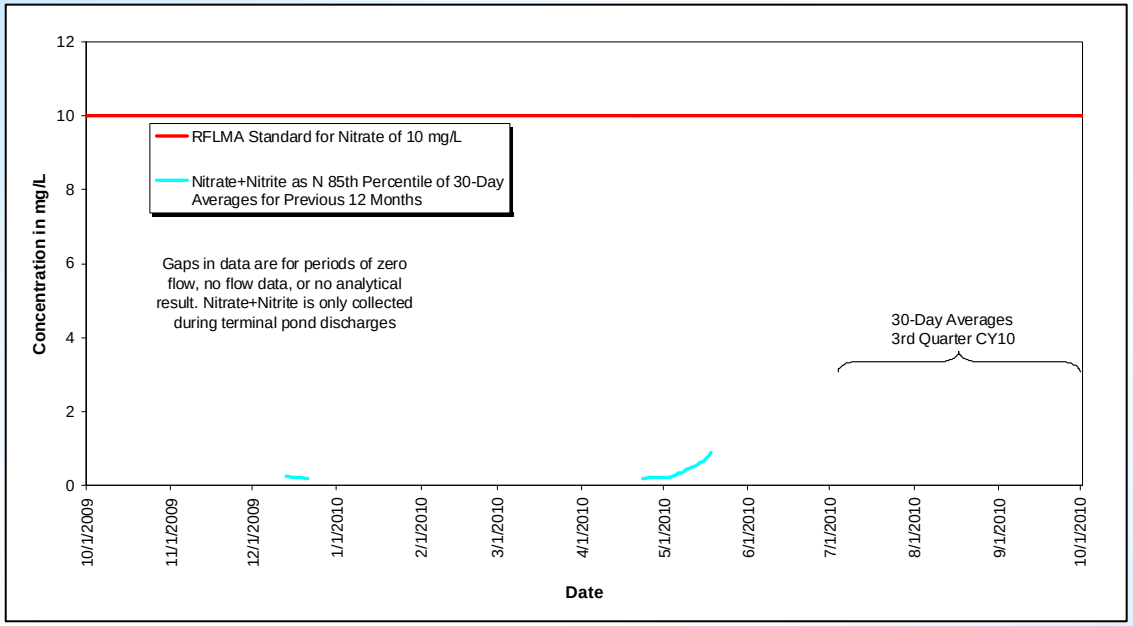
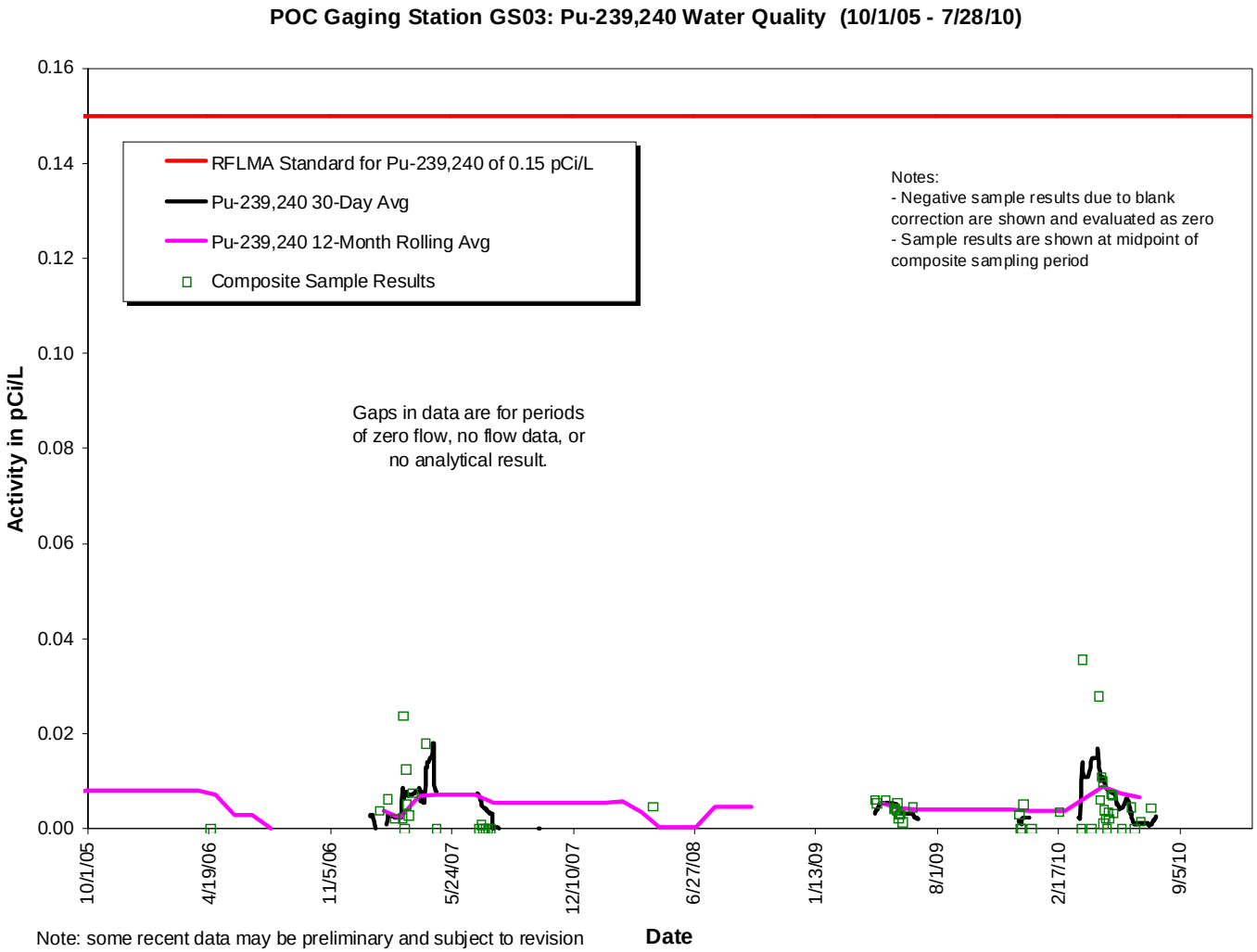
POC GS03

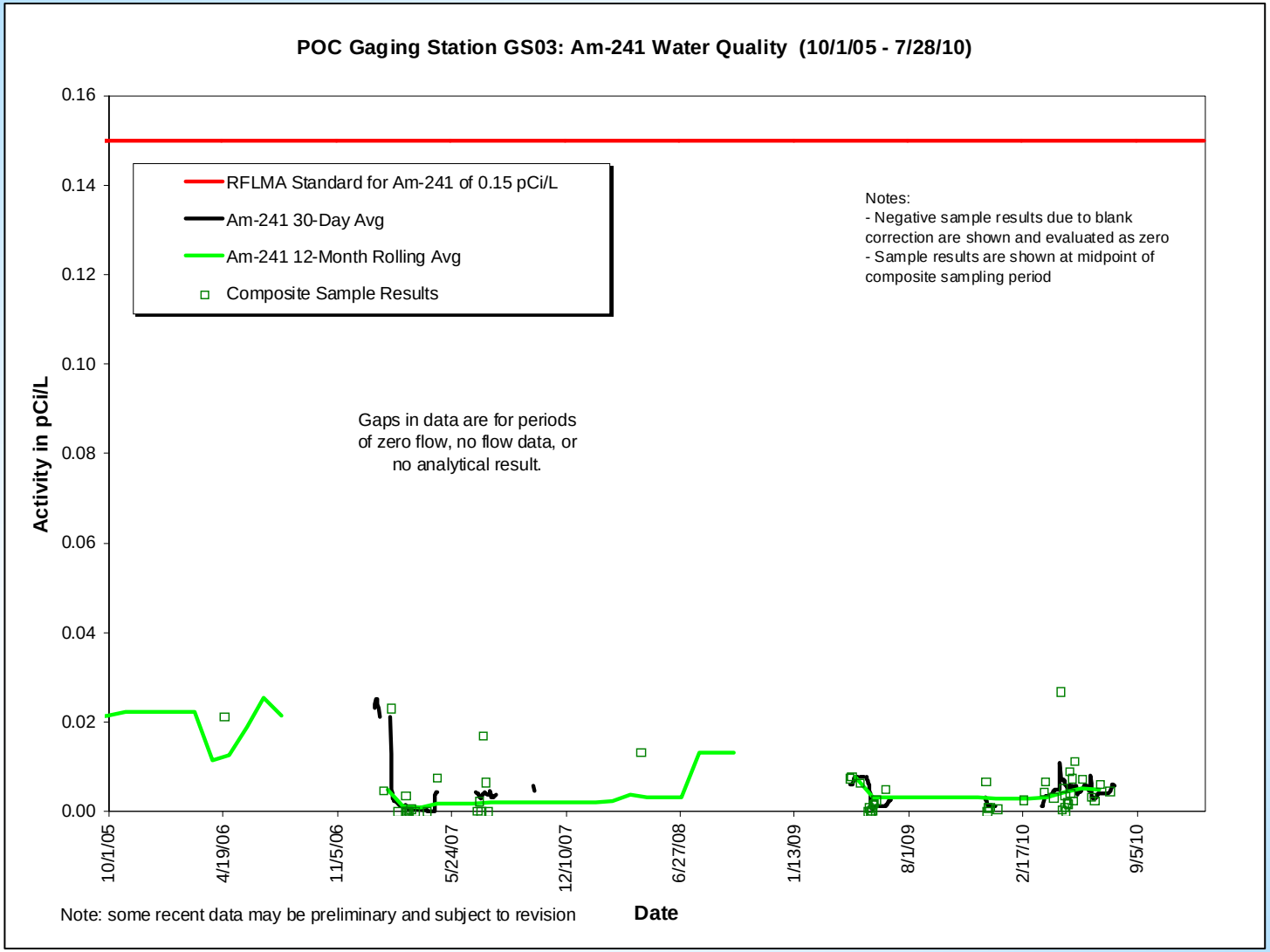
- Nitrate + Nitrite as Nitrogen



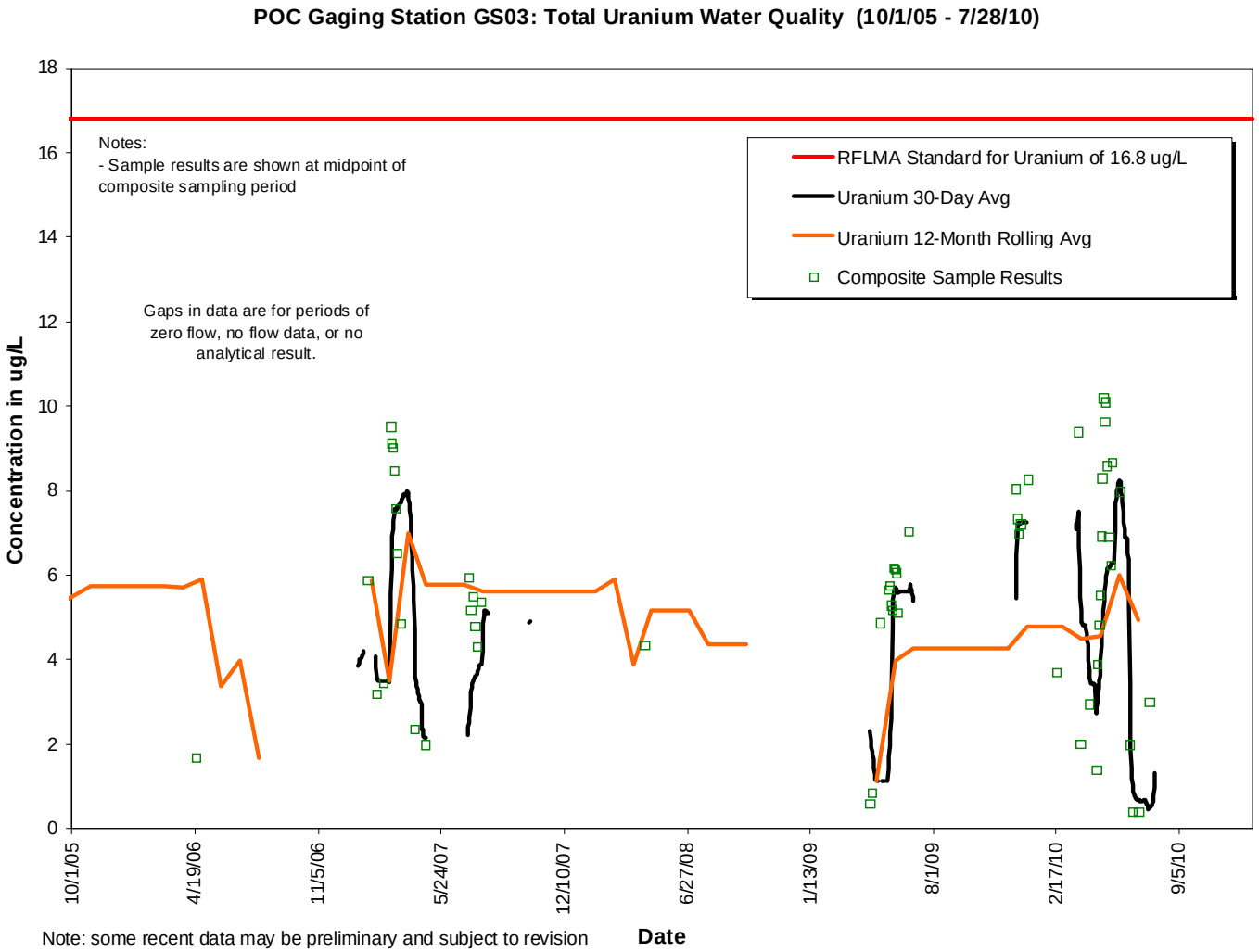
POC GS03


POC Gaging Station GS03: Pu-239,240 Water Quality (10/1/05 - 7/28/10)
RFLMA Standard for Pu-239,240 of 0.15 pCi/L
Pu-239,240 30-Day Avg
Pu-239,240 12-Month Rolling Avg
Composite Sample Results
Notes:
- Negative sample results due to blank correction are shown and evaluated as zero
- Sample results are shown at midpoint of composite sampling period
Gaps in data are for periods of zero flow, no flow data, or no analytical result.
Activity in pCi/L
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
10/1/05
4/19/06
11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
2/17/10
9/5/10
Date
Note: some recent data may be preliminary and subject to revision

POC GS03


POC Gaging Station GS03: Am-241 Water Quality (10/1/05 - 7/28/10)
RFLMA Standard for Am-241 of 0.15 pCi/L
Am-241 30-Day Avg
Am-241 12-Month Rolling Avg
Composite Sample Results
Notes:
- Negative sample results due to blank correction are shown and evaluated as zero
- Sample results are shown at midpoint of composite sampling period
Gaps in data are for periods of zero flow, no flow data, or no analytical result.
Activity in pCi/L
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
10/1/05
4/19/06
11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
2/17/10
9/5/10
Date
Note: some recent data may be preliminary and subject to revision

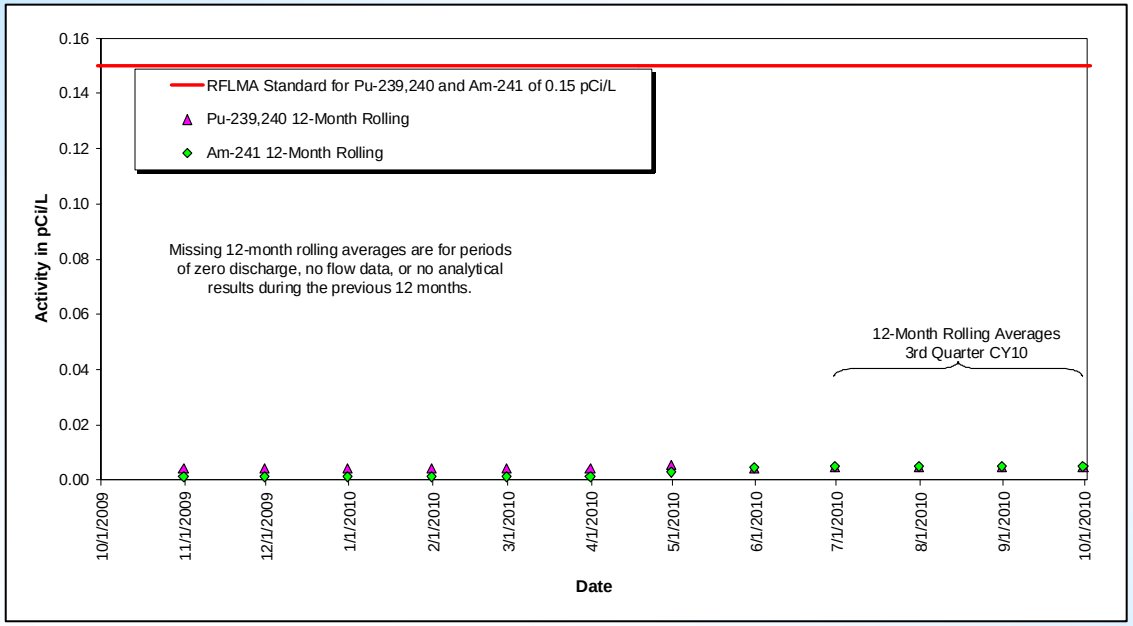
POC GS03



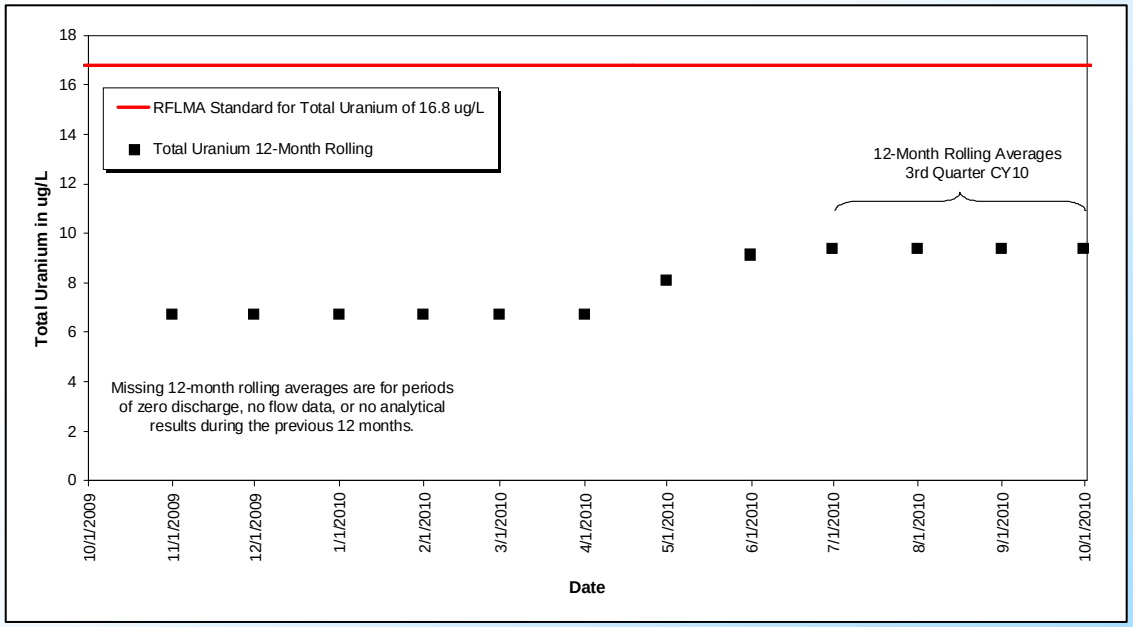
Note: some recent data may be preliminary and subject to revision

POC GS08

- Plutonium and Americium

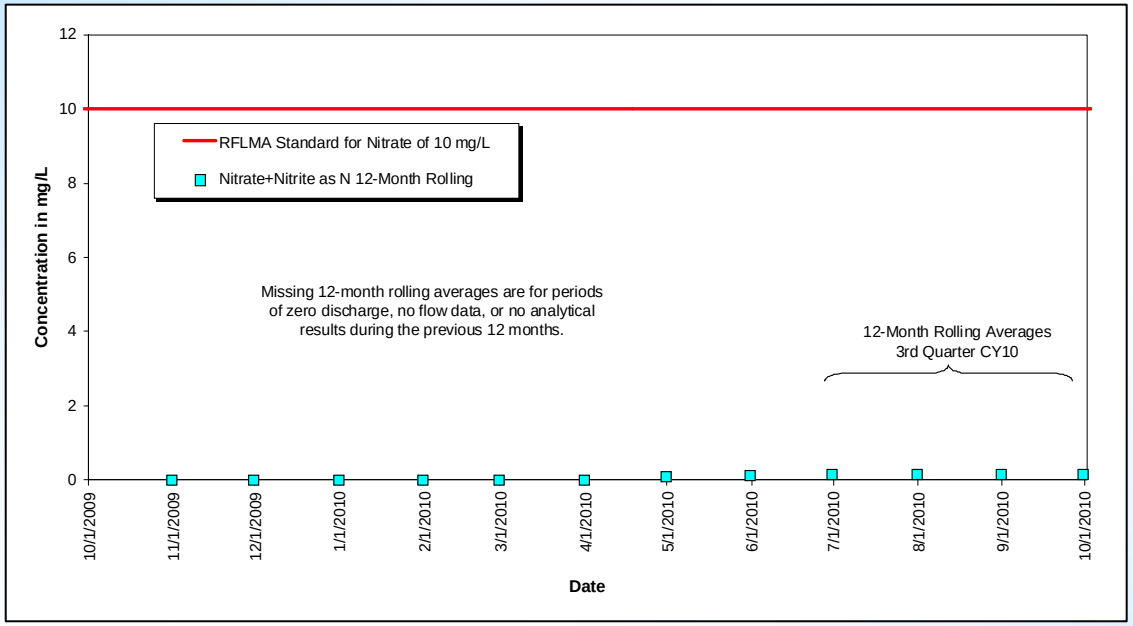


- Total Uranium

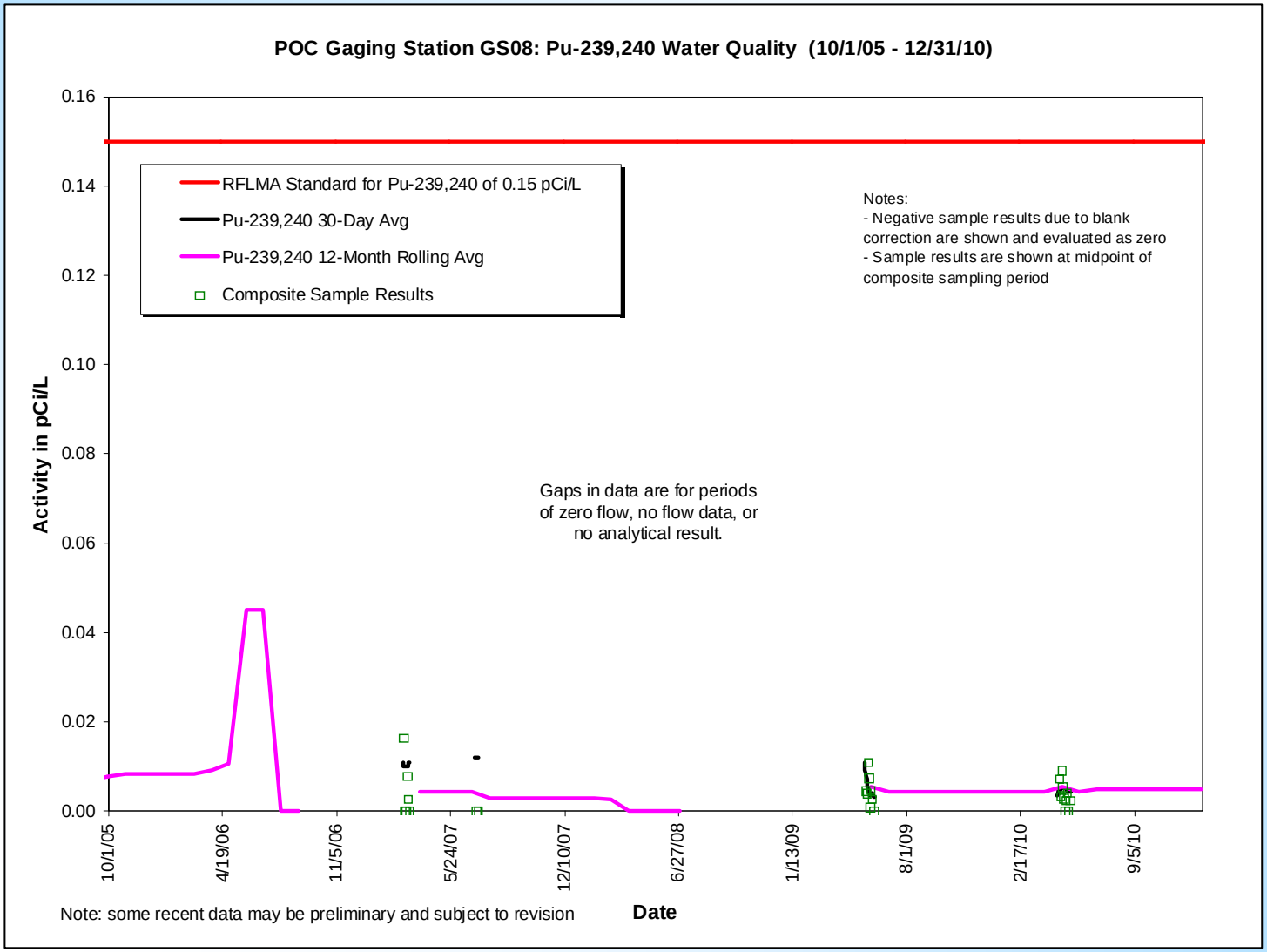


POC GS08

- Nitrate + Nitrite as Nitrogen



POC GS08



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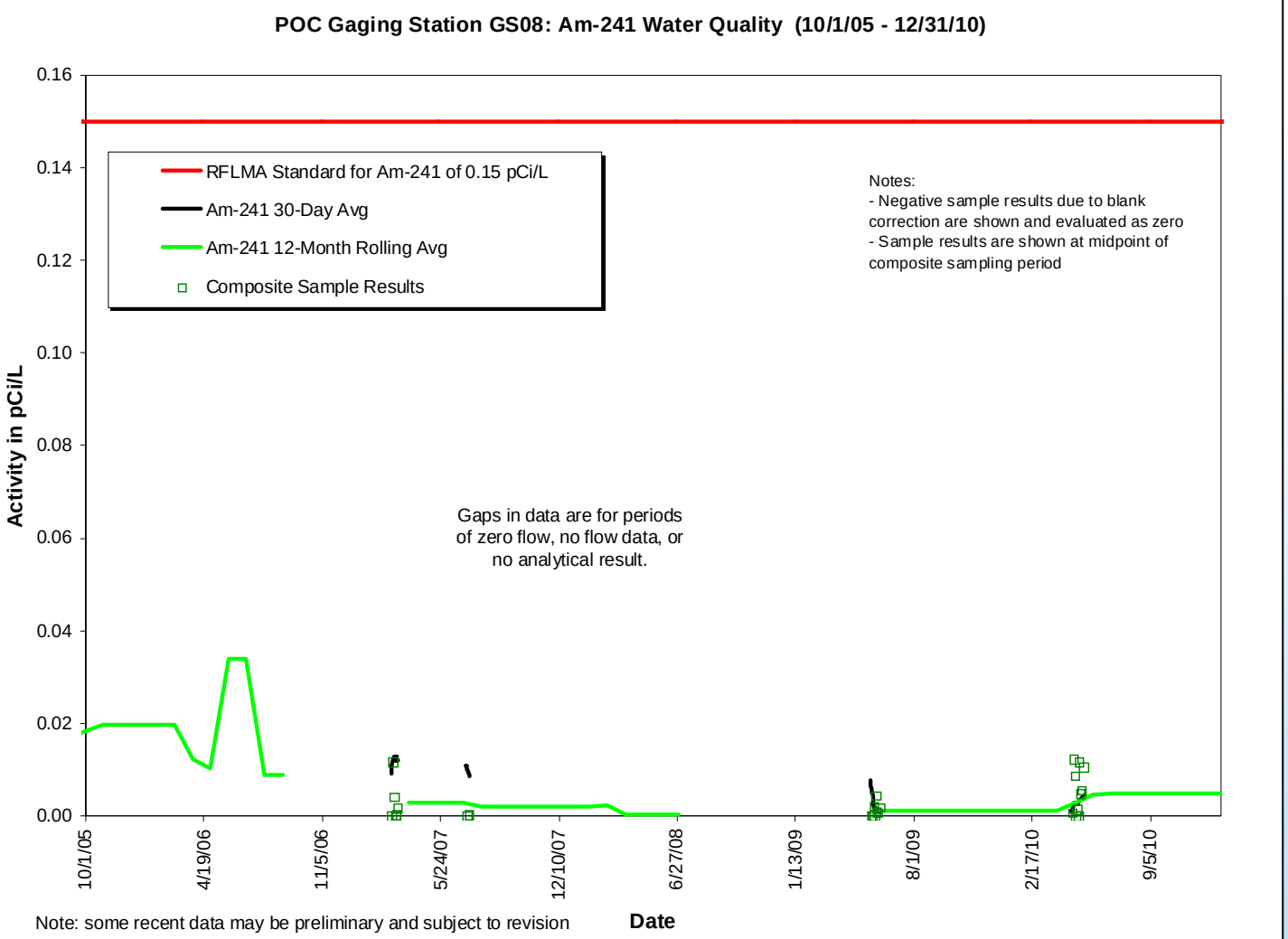
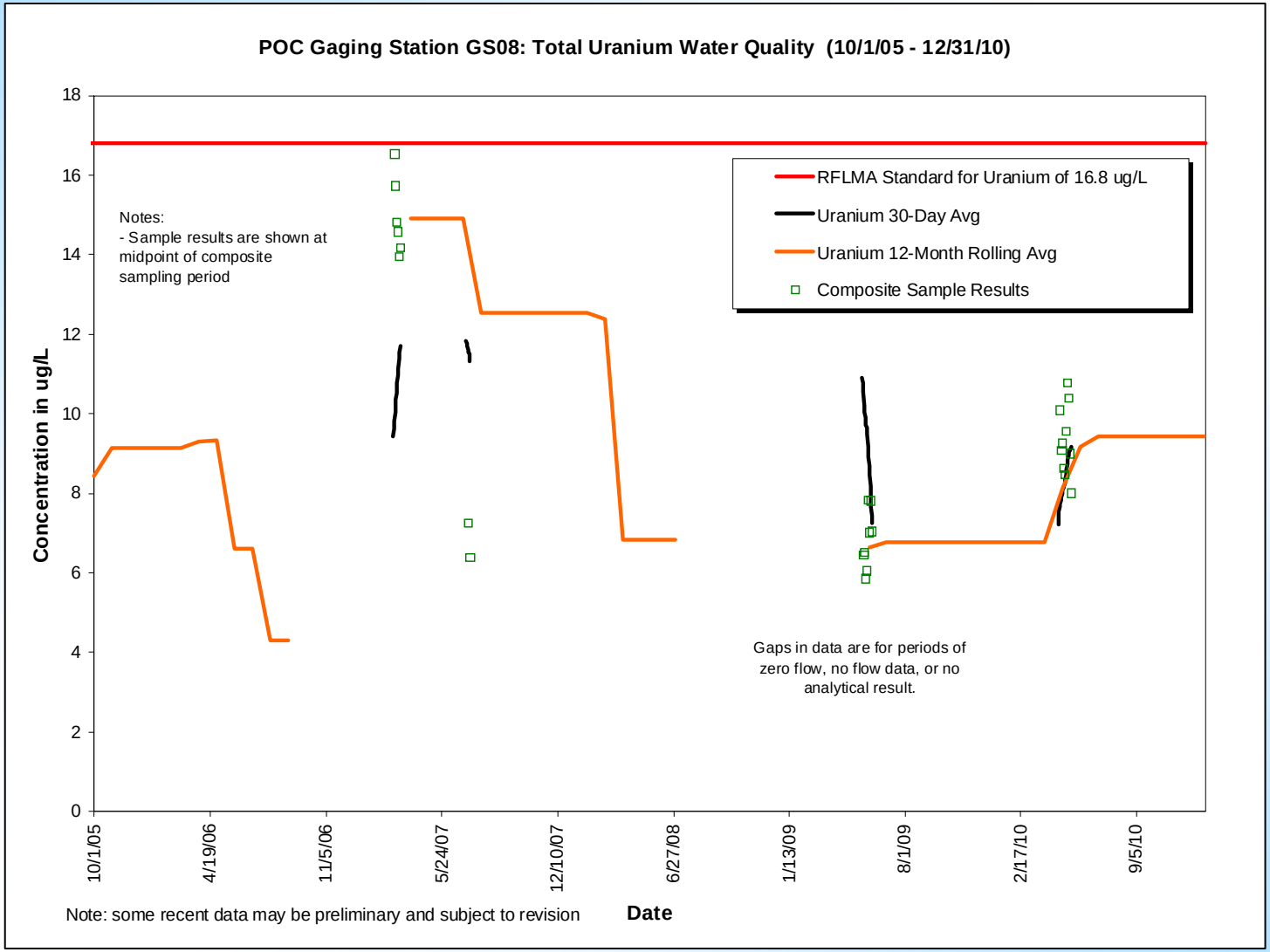
POC GS08



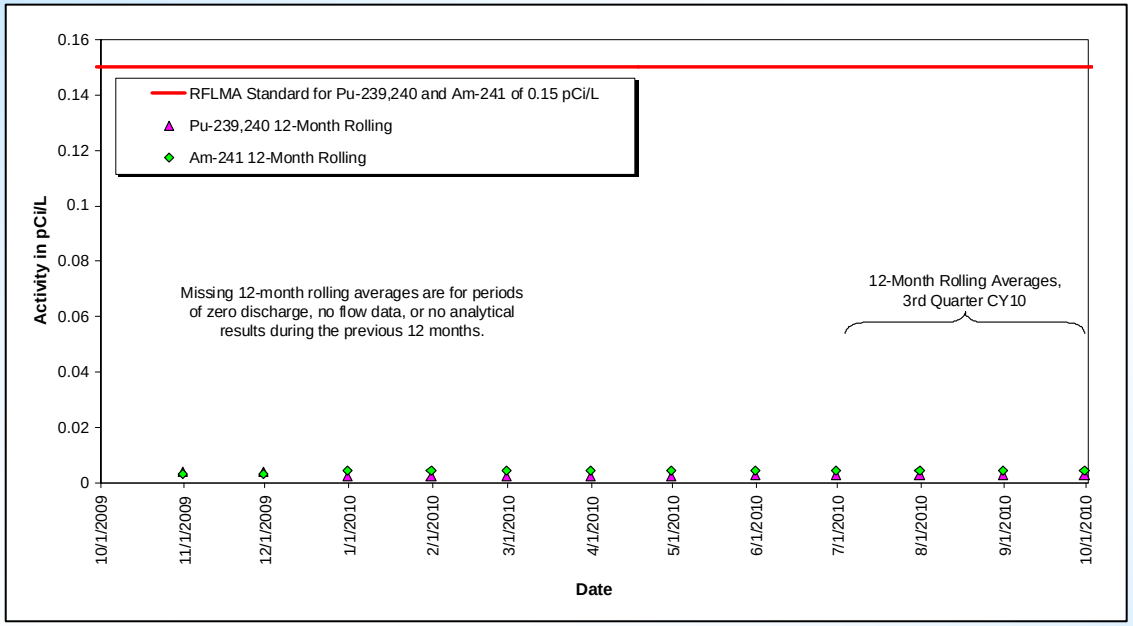
Note: some recent data may be preliminary and subject to revision

POC GS08

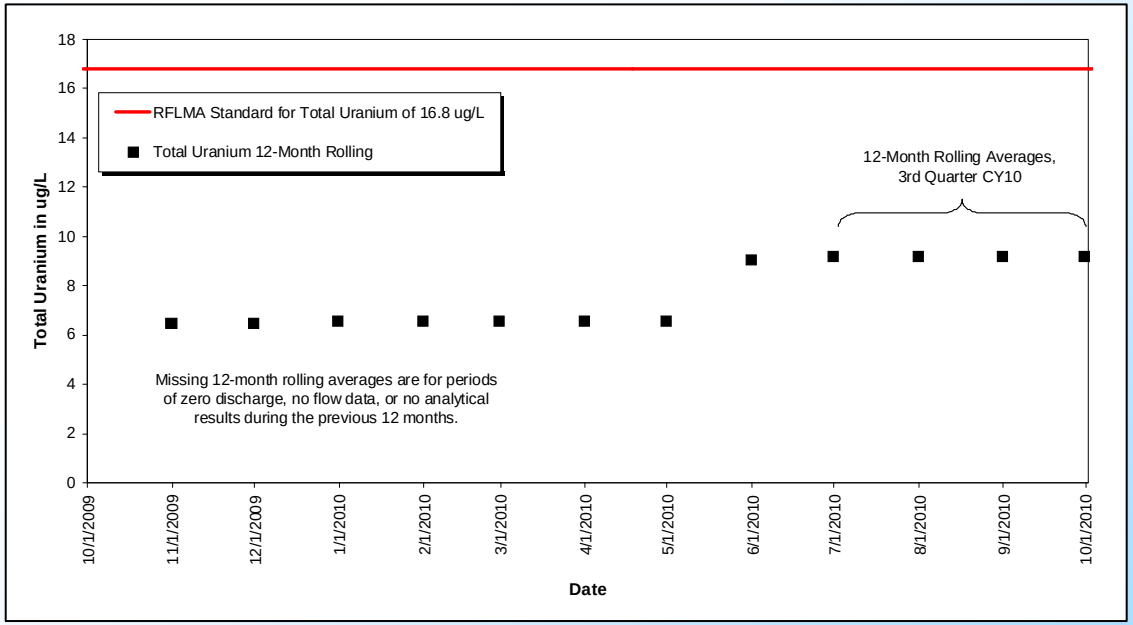

POC Gaging Station GS08: Total Uranium Water Quality (10/1/05 - 12/31/10)
Concentration in ug/L
18
16
14
12
10
8
6
4
2
0
10/1/05
4/19/06
11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
2/17/10
9/5/10
Date
RFLMA Standard for Uranium of 16.8 ug/L
Uranium 30-Day Avg
Uranium 12-Month Rolling Avg
Composite Sample Results
Notes:
- Sample results are shown at midpoint of composite sampling period
Gaps in data are for periods of zero flow, no flow data, or no analytical result.
Note: some recent data may be preliminary and subject to revision

POC GS11

- Plutonium and Americium

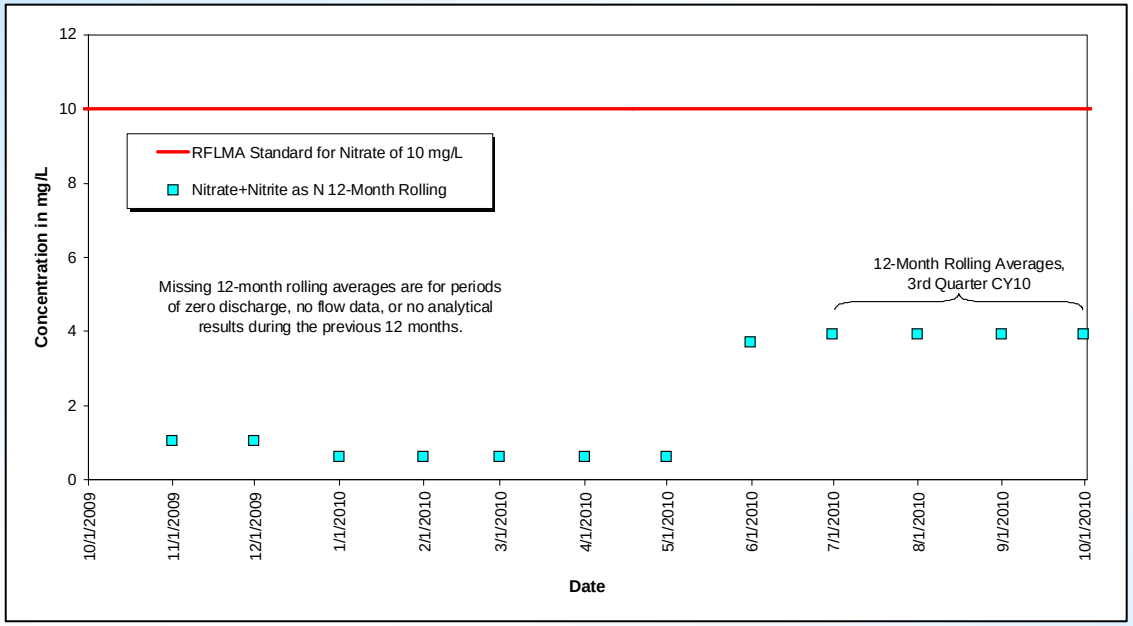


- Total Uranium

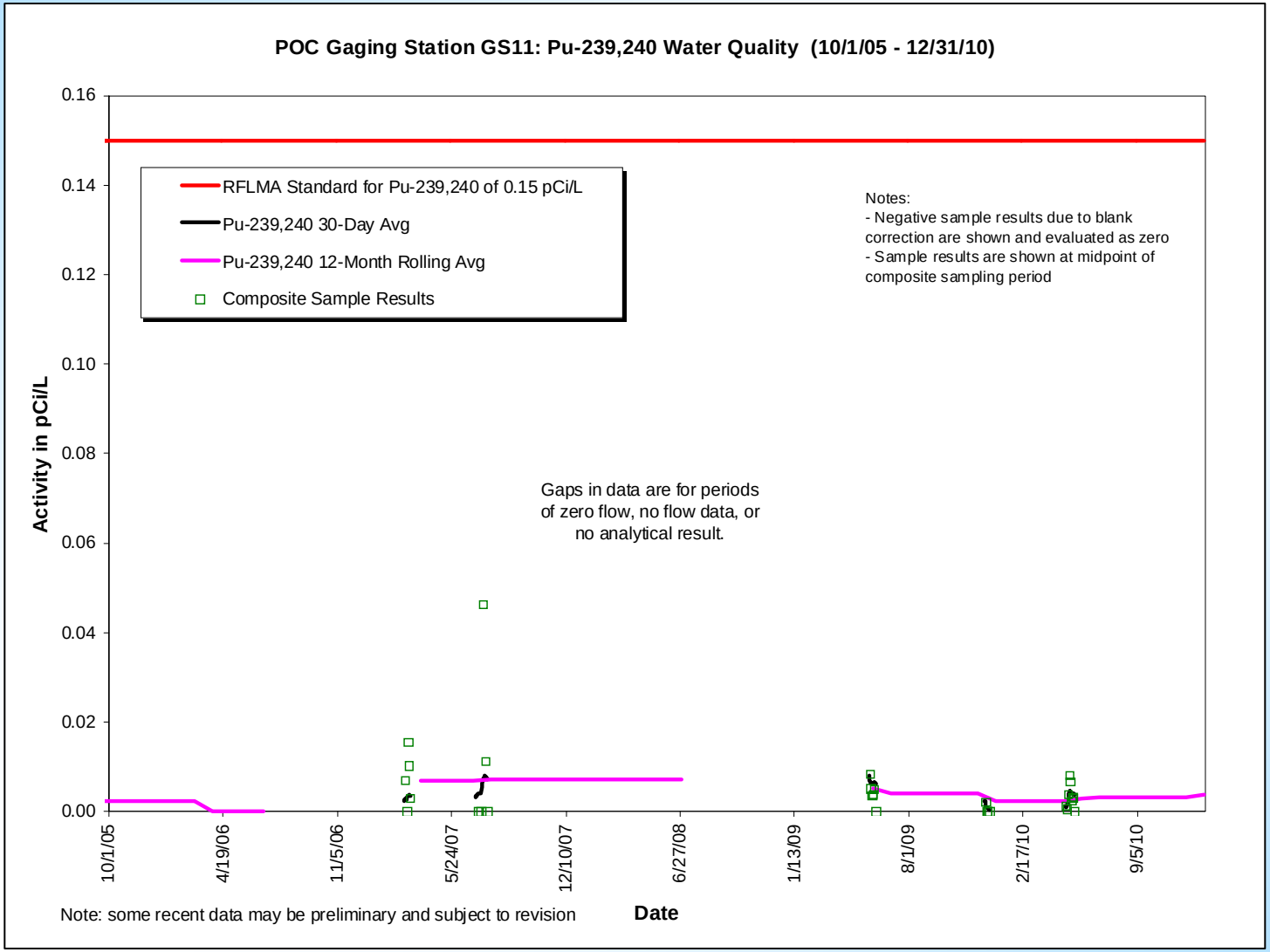


POC GS11

- Nitrate + Nitrite as Nitrogen



POC GS11



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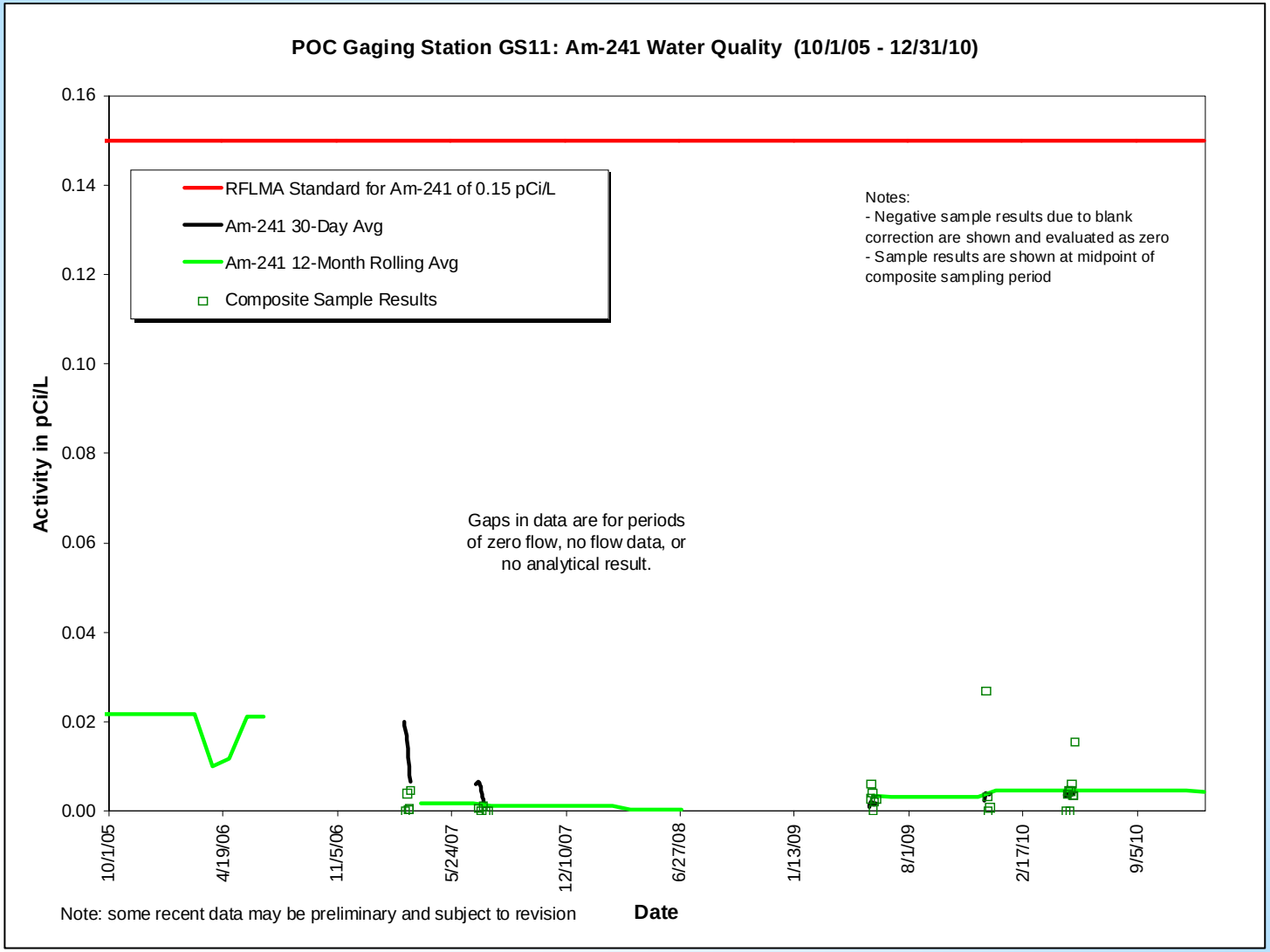
POC GS11


POC Gaging Station GS11: Am-241 Water Quality (10/1/05 - 12/31/10)
RFLMA Standard for Am-241 of 0.15 pCi/L
Am-241 30-Day Avg
Am-241 12-Month Rolling Avg
Composite Sample Results
Notes:
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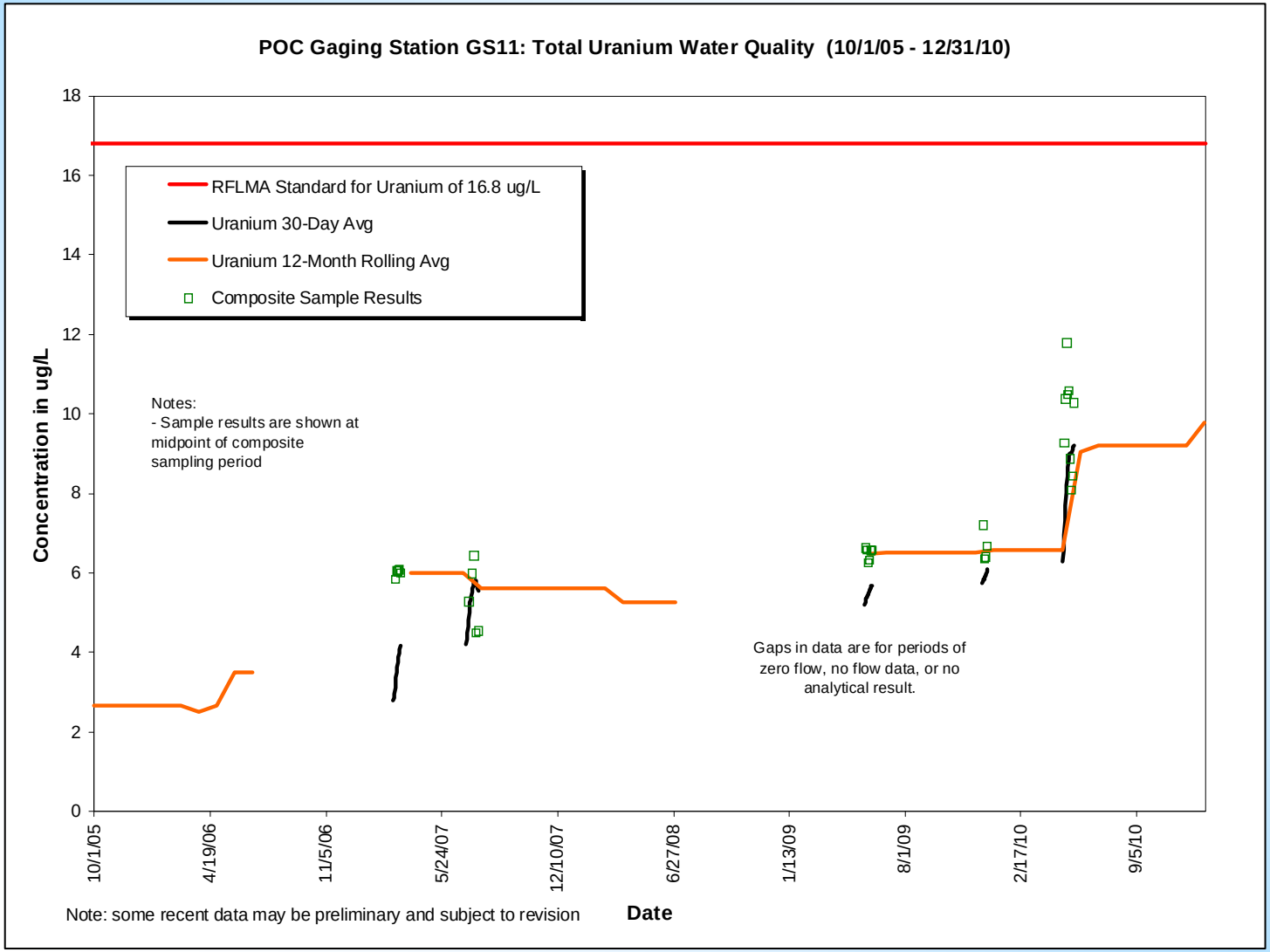
Gaps in data are for periods of zero flow, no flow data, or no analytical result.
Activity in pCi/L
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
10/1/05
4/19/06
11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
2/17/10
9/5/10
Date
Note: some recent data may be preliminary and subject to revision

POC GS11



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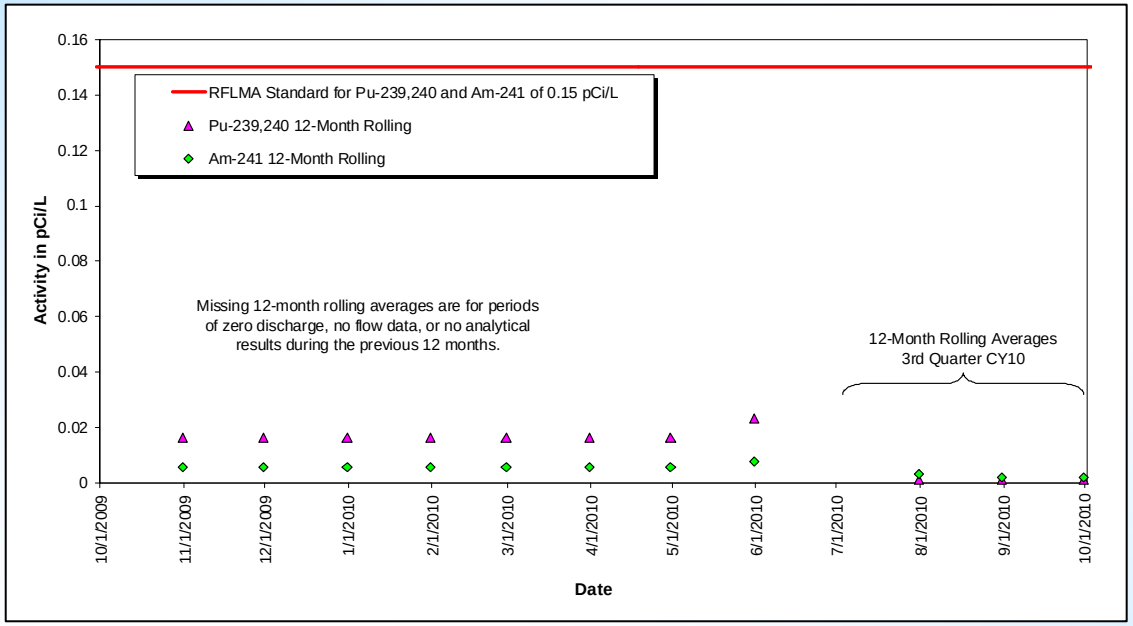
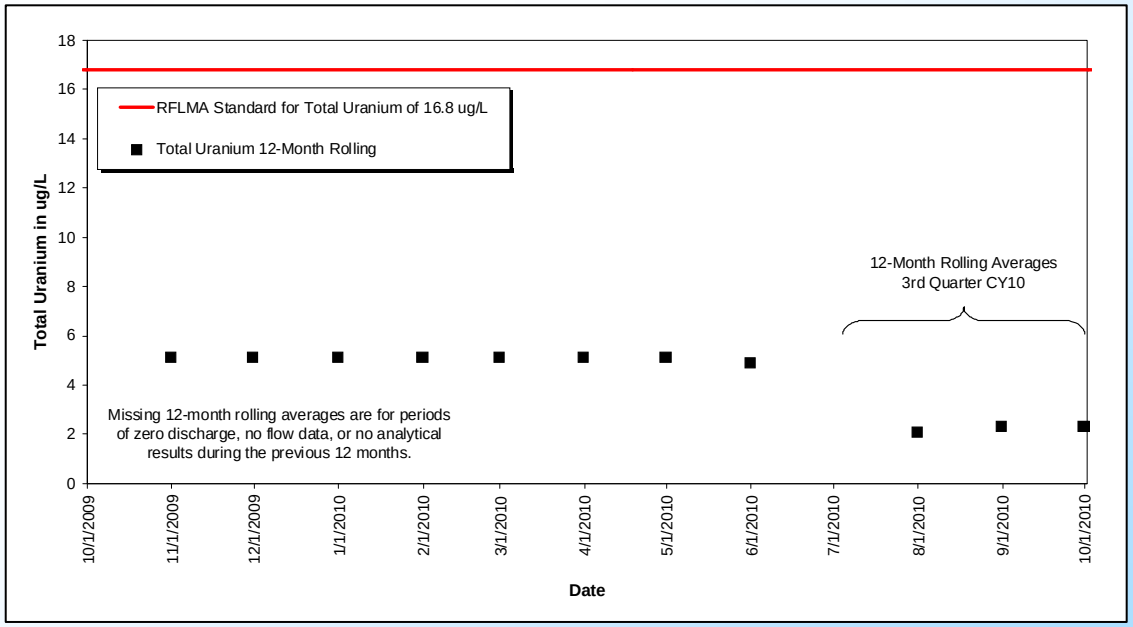
POC GS31

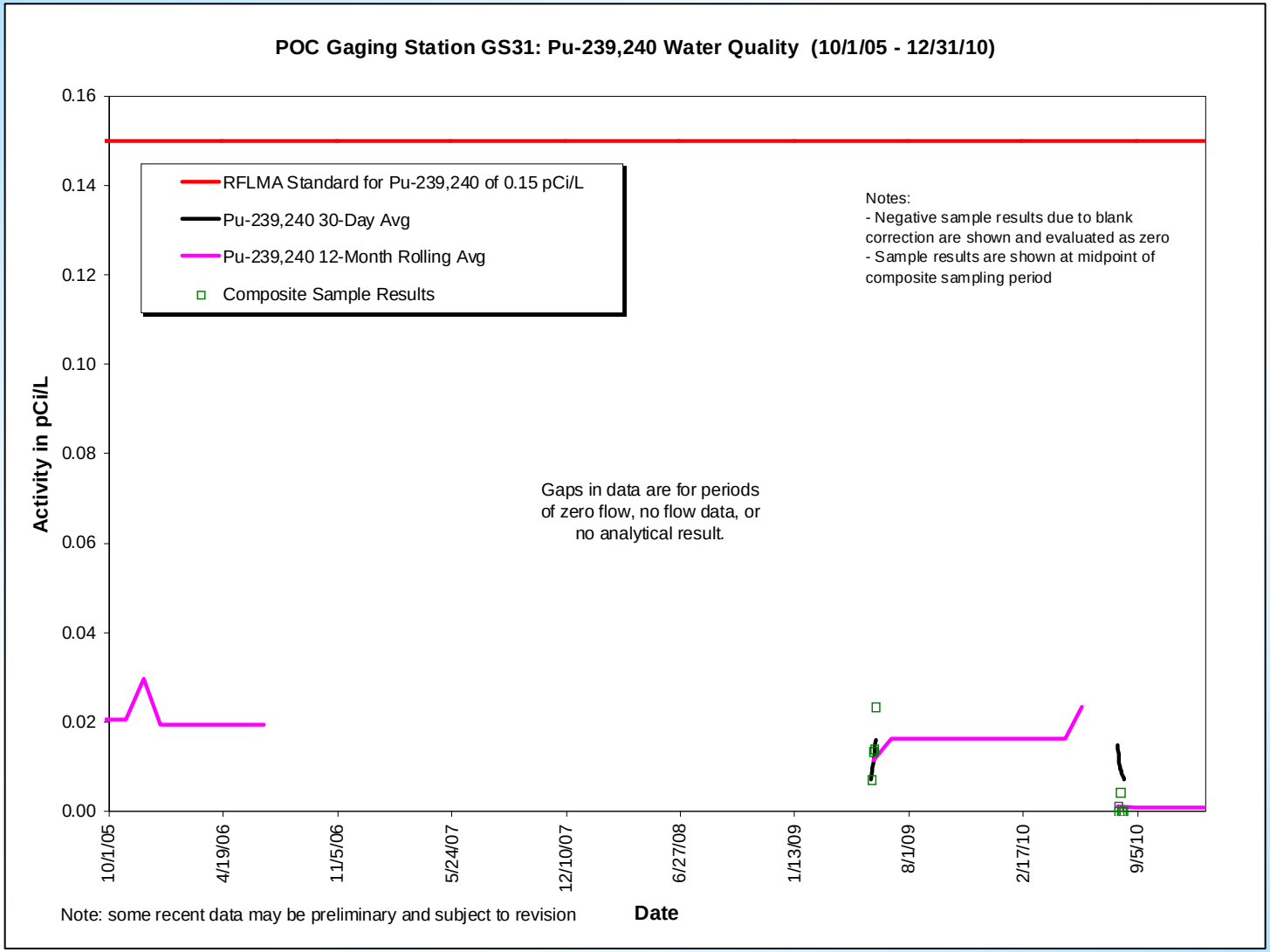
- Plutonium and Americium



- Total Uranium



POC GS31


POC Gaging Station GS31: Pu-239,240 Water Quality (10/1/05 - 12/31/10)
RFLMA Standard for Pu-239,240 of 0.15 pCi/L
Pu-239,240 30-Day Avg
Pu-239,240 12-Month Rolling Avg
Composite Sample Results
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0.12
0.10
0.08
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0.04
0.02
0.00
10/1/05
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11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
2/17/10
9/5/10
Date
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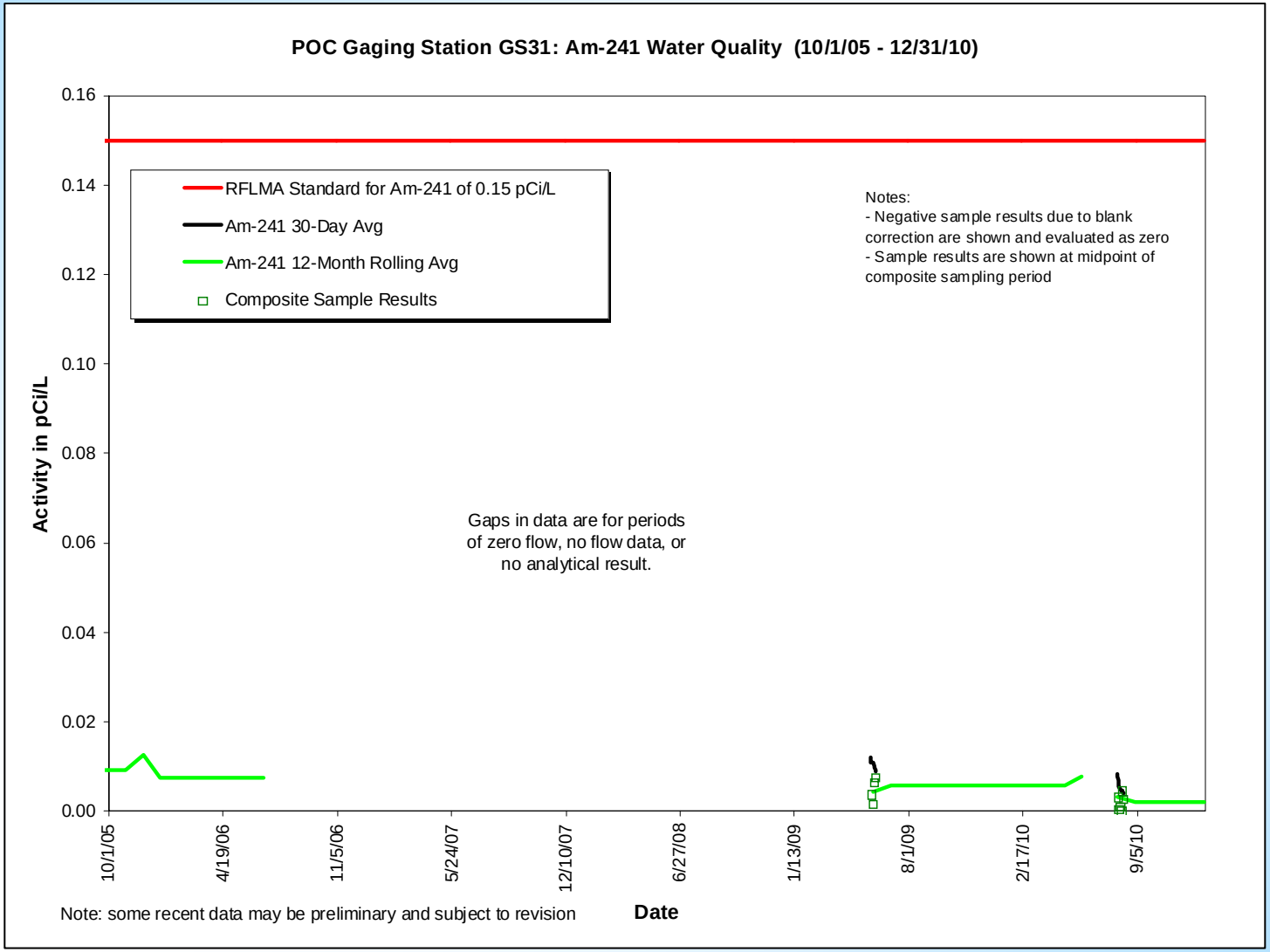
POC GS31



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POC GS31

POC Gaging Station GS31: Total Uranium Water Quality (10/1/05 - 12/31/10)
Concentration in ug/L
18
16
14
12
10
8
6
4
2
0
10/1/05
4/19/06
11/5/06
5/24/07
12/10/07
6/27/08
1/13/09
8/1/09
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RFLMA Standard for Uranium of 16.8 ug/L
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Composite Sample Results
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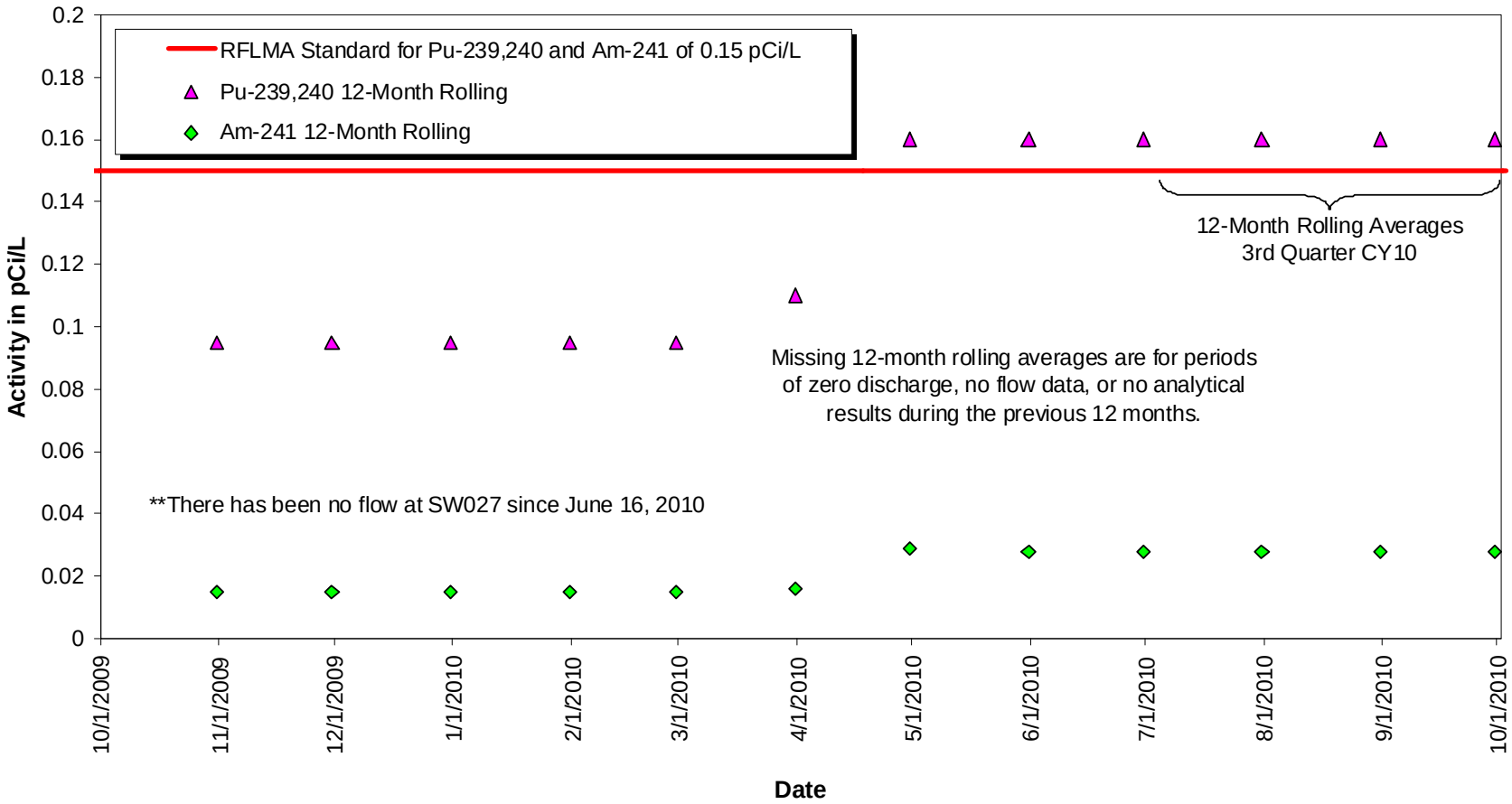
Point of Evaluation (POE) Monitoring – Third Quarter 2010

- 12-month rolling averages at POE SW027 exceed the standard for Pu-239,-240 (0.15 pCi/L) as of April 30, 2010. The formal notification and proposed actions are included in Contact Record (CR) 2010-06 and the subsequent August 31, 2010, Status Report.
- Water quality at all other POEs was below applicable standards during the quarter.

POE Monitoring – Plutonium at POE SW027



Grab Sampling for Nitrate + Nitrite and Uranium

- Designed to evaluate spatial variation of water quality
- Started sampling January 27, 2010; have conducted 26 sampling events as of January 4, 2011

North Walnut Creek

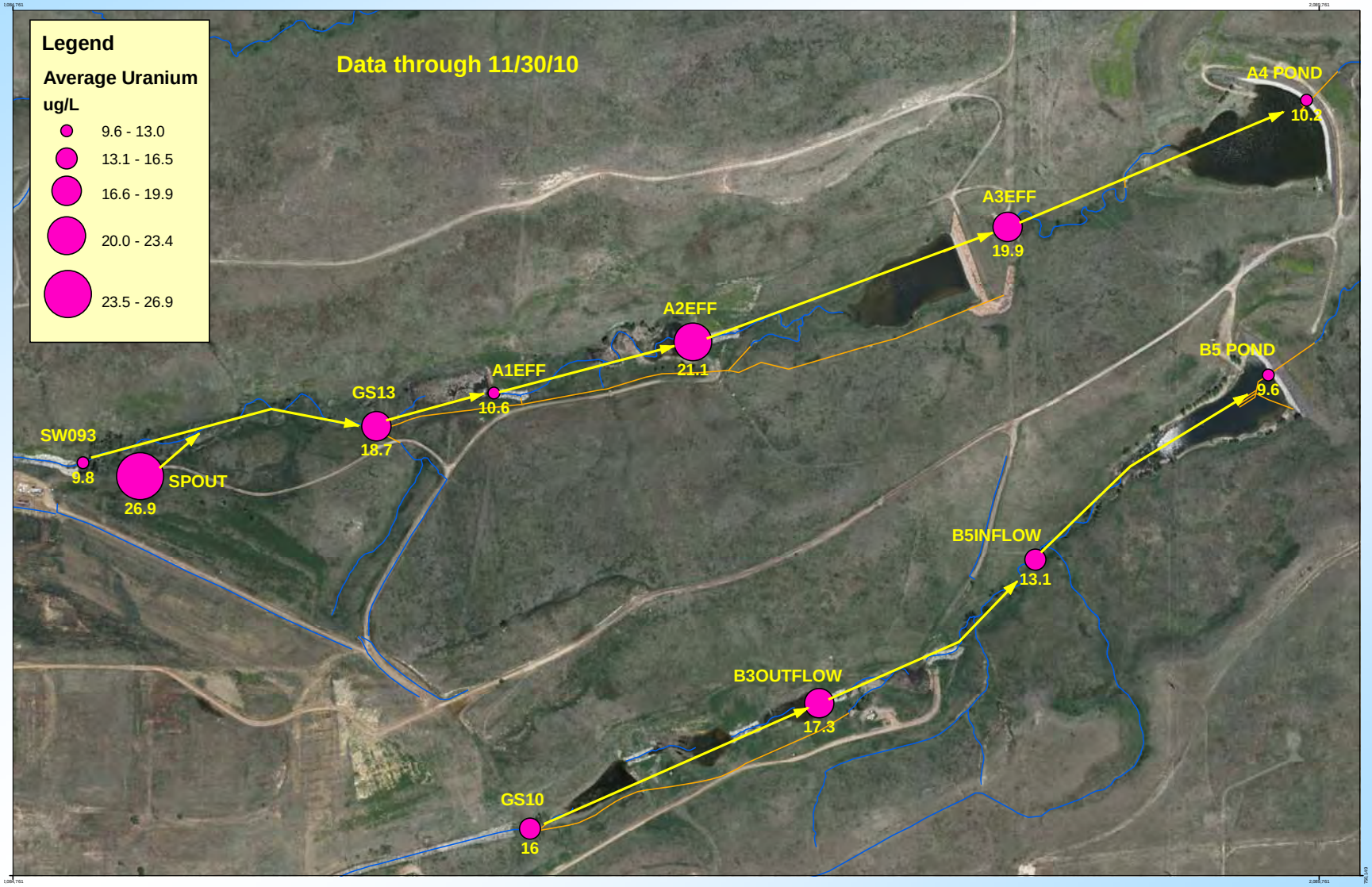
			NO3+NO2 as N (mg/L)		Uranium (ug/L)	
	Location Code	Location Description	Average	Sample Count	Average	Sample Count
Upstream	SW093	POE at downstream end of Functional Channel 3	9.5	22	9.8	23
⬇	SPOUT*	Effluent from SPPTS	83.2	24	26.9	24
⬇	GS13	SPPTS Performance Monitoring Loc; influent to Pond A-1	20.5	17	18.7	17
⬇	A1EFF	Effluent from Pond A-1	12.8	18	10.6	19
⬇	A2EFF	Effluent from Pond A-2	13.4	13	21.1	15
⬇	A3EFF	Effluent from Pond A-3	6.1	13	19.9	14
⬇	A4INFLOW^	Influent to Pond A-4	7.6	10	21.9	10
Downstream	A4 POND	Pond A-4 at center of dam face	1.45	24	10.2	24

South Walnut Creek

			Uranium (ug/L)	
	Location Code	Location Description	Average	Sample Count
Upstream	GS10	POE at downstream end of Functional Channel 4	16.0	24
⬇	B3OUTFLOW	Effluent from Pond B-3	17.3	21
⬇	B5INFLOW	Influent to Pond B-5	13.1	21
Downstream	B5 POND	Pond B-5 at center of dam face	9.6	24

Notes:
*SPOUT (SPPTS effluent) is not located in North Walnut Creek but is tributary to North Walnut between monitoring locations SW093 and GS13.
^A4INFLOW sampling was terminated on June 30, 2010, since data indicate that this monitoring location is essentially redundant with A3EFF.
Sample counts vary because some locations are periodically dry.
Summary includes all data available as of January 4, 2011; some recent results are not validated (preliminary and subject to revision).

Grab Sampling for Uranium



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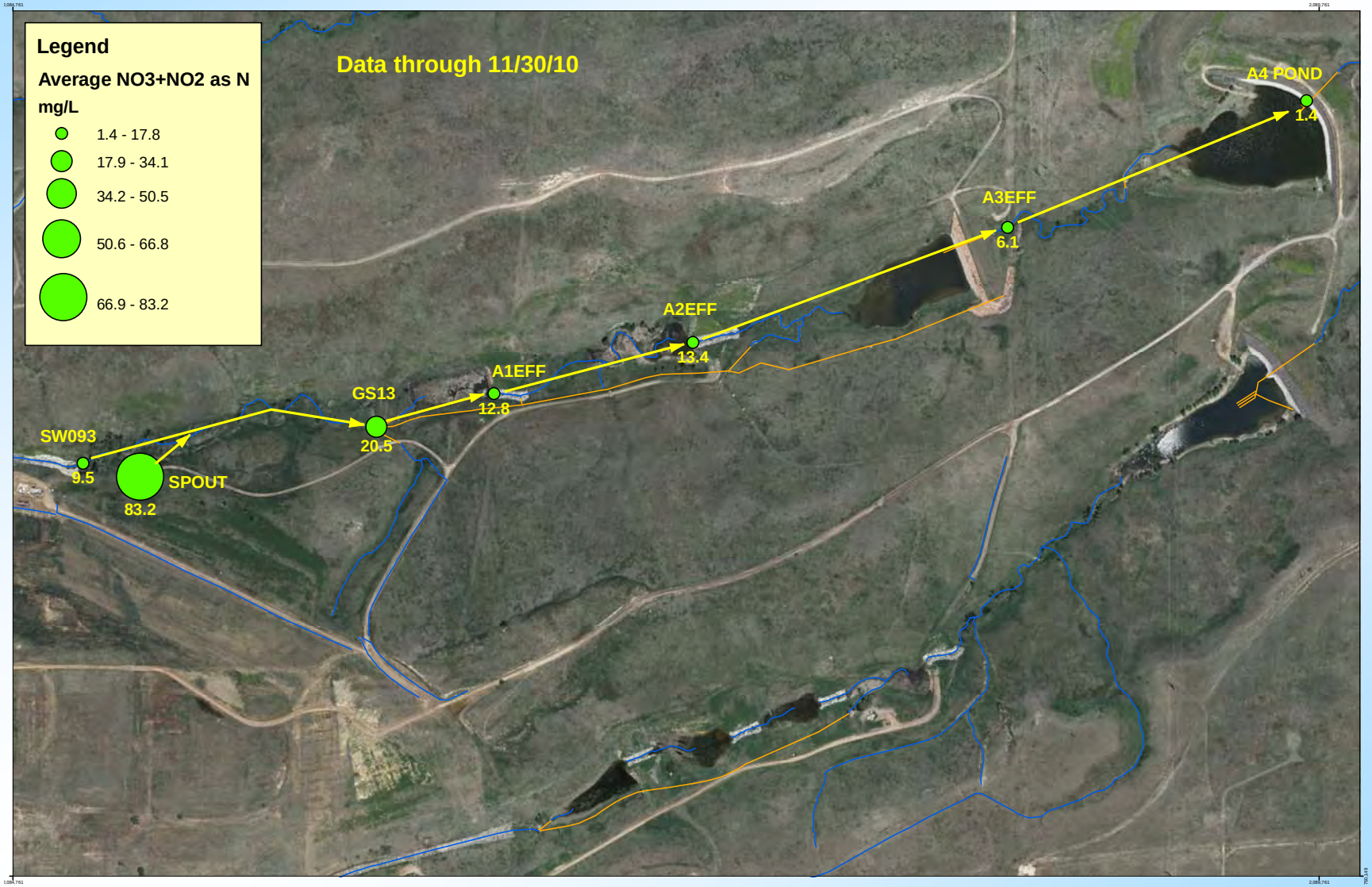
Grab Sampling for Nitrate + Nitrite



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Continuous Flow-Paced Composite Sampling for Uranium

- Designed to evaluate longer-term variation of water quality (e.g., 12-month average)

North Walnut Creek

	Location Code	Location Description	Uranium (ug/L) Volume-Weighted Average	Uranium (ug/L) Sample Count
Upstream	SW093*	POE at downstream end of Functional Channel 3	6.9	14
⬇	GS13*	SPPTS Performance Monitoring Loc; influent to Pond A-1	8.4	13
⬇	GS12	Effluent from Pond A-3	11.5	15
Downstream	GS11*	Effluent from Pond A-4	9.8	9

Data start on 3/10/10

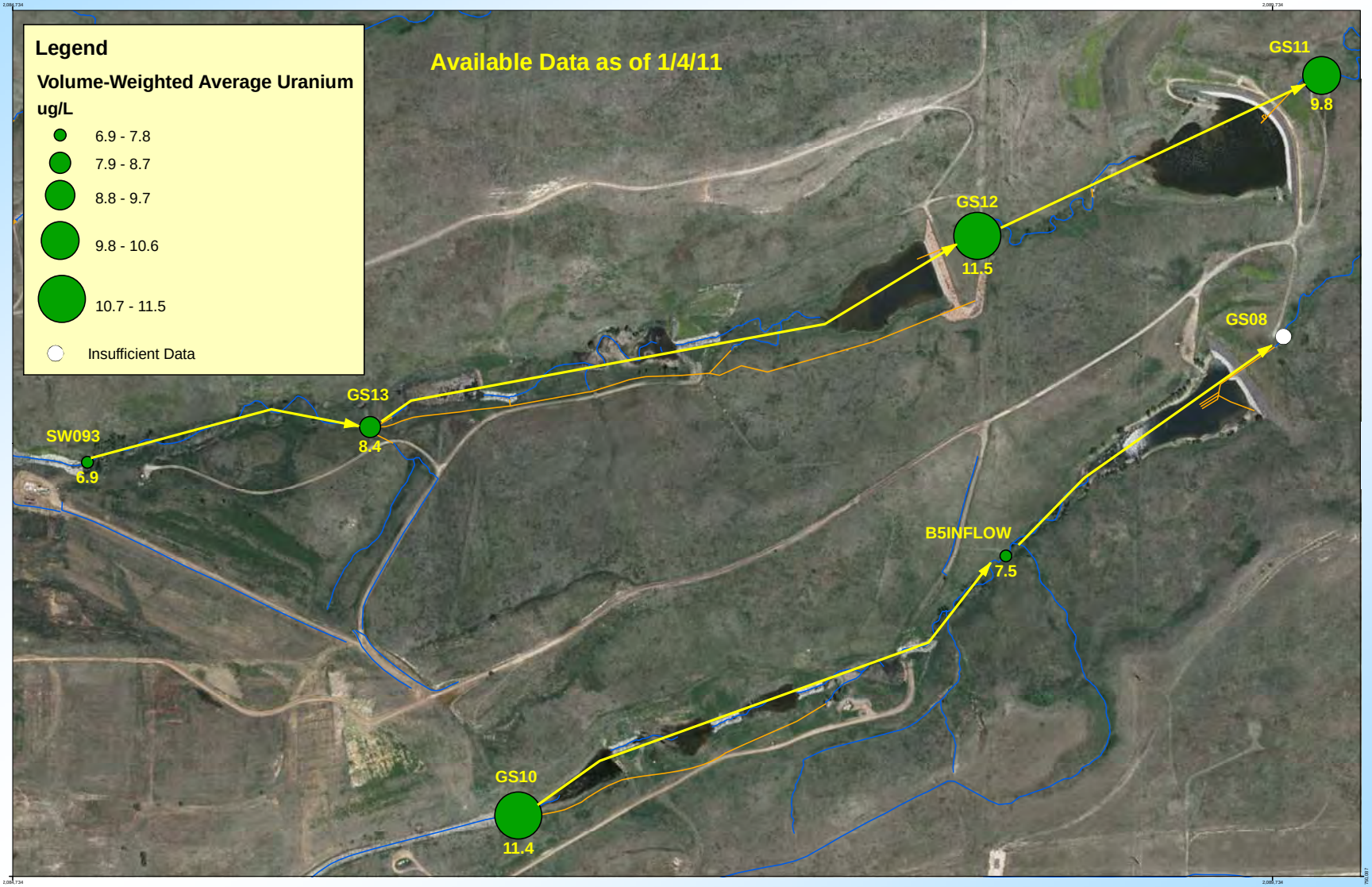
South Walnut Creek

	Location Code	Location Description	Uranium (ug/L) Volume-Weighted Average	Uranium (ug/L) Sample Count
Upstream	GS10*	POE at downstream end of Functional Channel 4	11.4	3
⬇	B5INFLOW	Influent to Pond B-5	7.5	2
Downstream	GS08*	Effluent from Pond B-5	Insufficient Data	0

Data start on 6/16/10

Notes:
*Data for SW093, GS13, GS11, GS10, and GS08 are acquired through the routine RFLMA-required monitoring at these locations.
Sample counts vary because composite sampling periods vary with water availability.
Summary includes all data available as of January 4, 2011; some recent results are not validated (preliminary and subject to revision).

Automated Sampling for Uranium



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Synoptic Storm-Event Sampling

- Designed to evaluate spatial variation of water quality during storm events – specifically targeted at previously breached Dams A-1, A-2, B-1, B-2, and B-3
- Sampling is suspended until spring runoff begins

North Walnut Creek

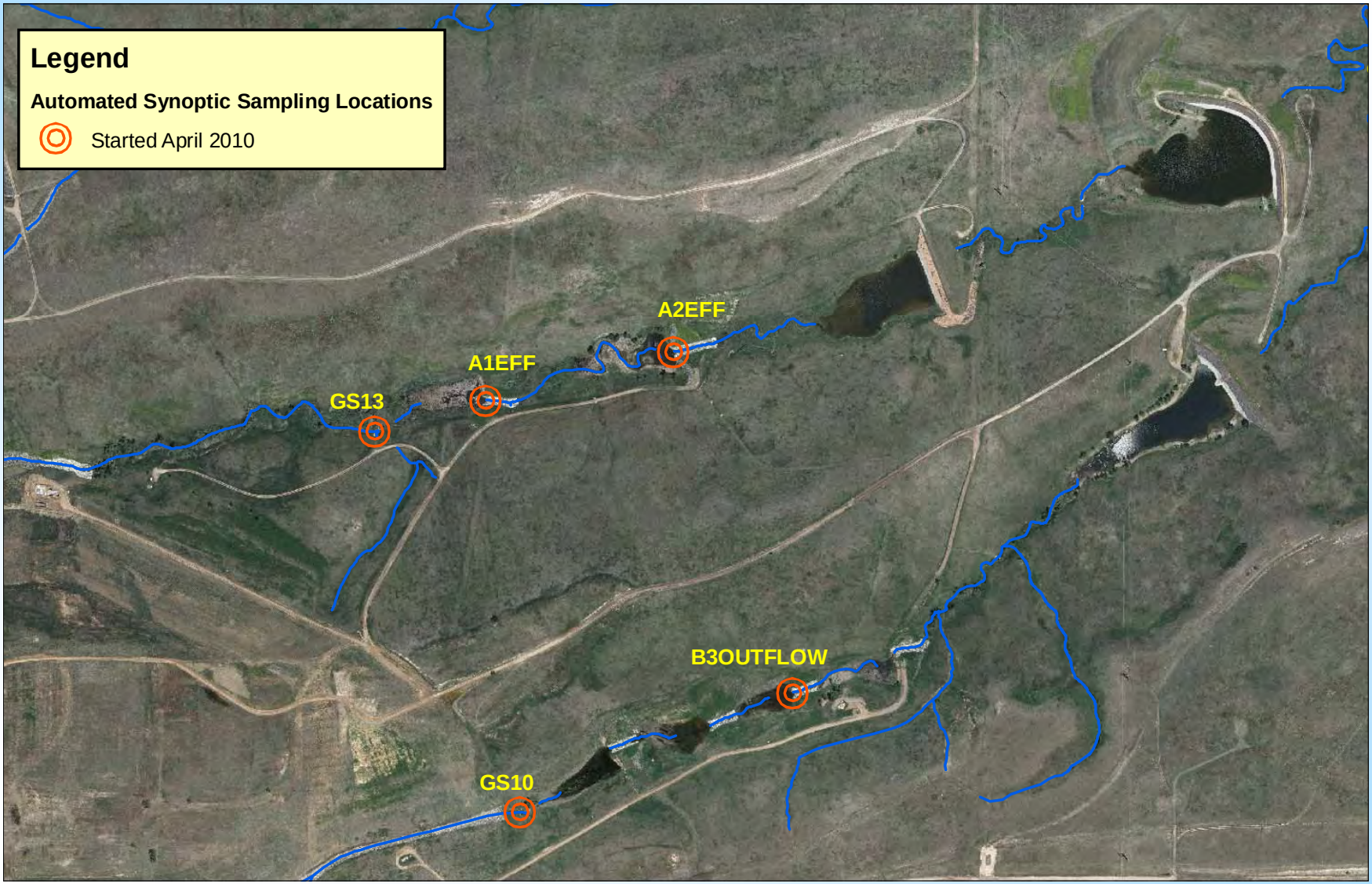
April 22, 2010 Event	Location Code	Location Description	Pu-239,240 (pCi/L)	Am-241 (pCi/L)	Uranium (ug/L)	TSS (mg/L)
Upstream	GS13	Influent to Pond A-1	0.006 ± 0.007	0.01 ± 0.007	10.50	62.0
⬇	A1EFF	Effluent from Pond A-1 / Influent to Pond A-2	0.004 ± 0.006	0 ± 0.004	13.30	0.6
Downstream	A2EFF	Effluent from Pond A-2	0.007 ± 0.006	0 ± 0.012	14.10	0.6

July 4, 2010 Event	Location Code	Location Description	Pu-239,240 (pCi/L)	Am-241 (pCi/L)	Uranium (ug/L)	TSS (mg/L)
Upstream	GS13	Influent to Pond A-1	0.011 ± 0.01	0.006 ± 0.005	9.17	2.4
⬇	A1EFF	Effluent from Pond A-1 / Influent to Pond A-2	0.007 ± 0.008	0.003 ± 0.005	6.24	2.5
Downstream	A2EFF	Effluent from Pond A-2	0.004 ± 0.006	0.002 ± 0.003	8.62	7.2

South Walnut Creek

April 22, 2010 Event	Location Code	Location Description	Pu-239,240 (pCi/L)	Am-241 (pCi/L)	Uranium (ug/L)	TSS (mg/L)
Upstream	GS10	Influent to Pond B-1	0.015 ± 0.008	0.01 ± 0.006	17.30	33.0
Downstream	B3OUTFLOW	Effluent from Pond B-3	0 ± 0.005	0.01 ± 0.013	18.20	0.6

Synoptic Storm-Event Sampling



Questions?

Groundwater Monitoring and Operations

Third Quarter 2010

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RFLMA Monitoring

- Third quarter is light sampling quarter
  - All RCRA wells (10)
- Results reviewed in accordance with the RFLMA Attachment 2 decision flowchart
- Results will be evaluated in the 2010 annual report

Additional (Non-RFLMA) Monitoring

- Several locations associated with MSPTS, ETPTS
  - As reported in previous quarterly meeting
  - Samples support consultation and evaluation of system performance
  - System effluent contained some constituents above RFLMA Table 1 levels
    - Treatment is most effective at low flow rates (high residence time), less effective at high flow rates (low residence time)
    - Second-quarter flows represented relatively higher flow rates
    - Flows decreased into third quarter, and concentrations in system effluent similarly decreased
  - Evaluation will be included in 2010 annual report

Additional (Non-RFLMA) Monitoring

- Numerous locations associated with SPPTS
  - Support optimization of upgrades, pilot studies
  - Support evaluation of media replacement in Phase II cell
- Two off-site wells
  - Scheduled for abandonment
  - Collected splits of samples City of Broomfield wished to collect
  - Analyzed for VOCs, nitrate analysis
  - No VOCs detected, nitrate concentrations very low

SPPTS Activities in Third Quarter

- Main item: Changed media in Phase II cell
  - Cell was filled with ZVI/gravel mix
  - Early reduction in performance not fully understood
    - Most likely due to passivation of the ZVI – the iron grains become coated and no longer “available” for treatment
    - Hypotheses on cause included citrate dosing performed in first weeks of cell’s operation; accelerated weathering of granitic pea gravel; interferences from high nitrate, dissolved oxygen, calcium, and/or carbonate in the groundwater
  - New media incorporates a different pea gravel (quartzite), no citrate dosing, and slightly more ZVI in the mix
  - Current data indicate the citrate and gravel may have contributed to, but were not the cause for, the decreased treatment effectiveness
- Continued to collect samples at least weekly
  - Locations support evaluation of Phase II, III, and entire system
  - Most analyzed by ESL; not validated
  - Splits collected periodically for contract lab analysis

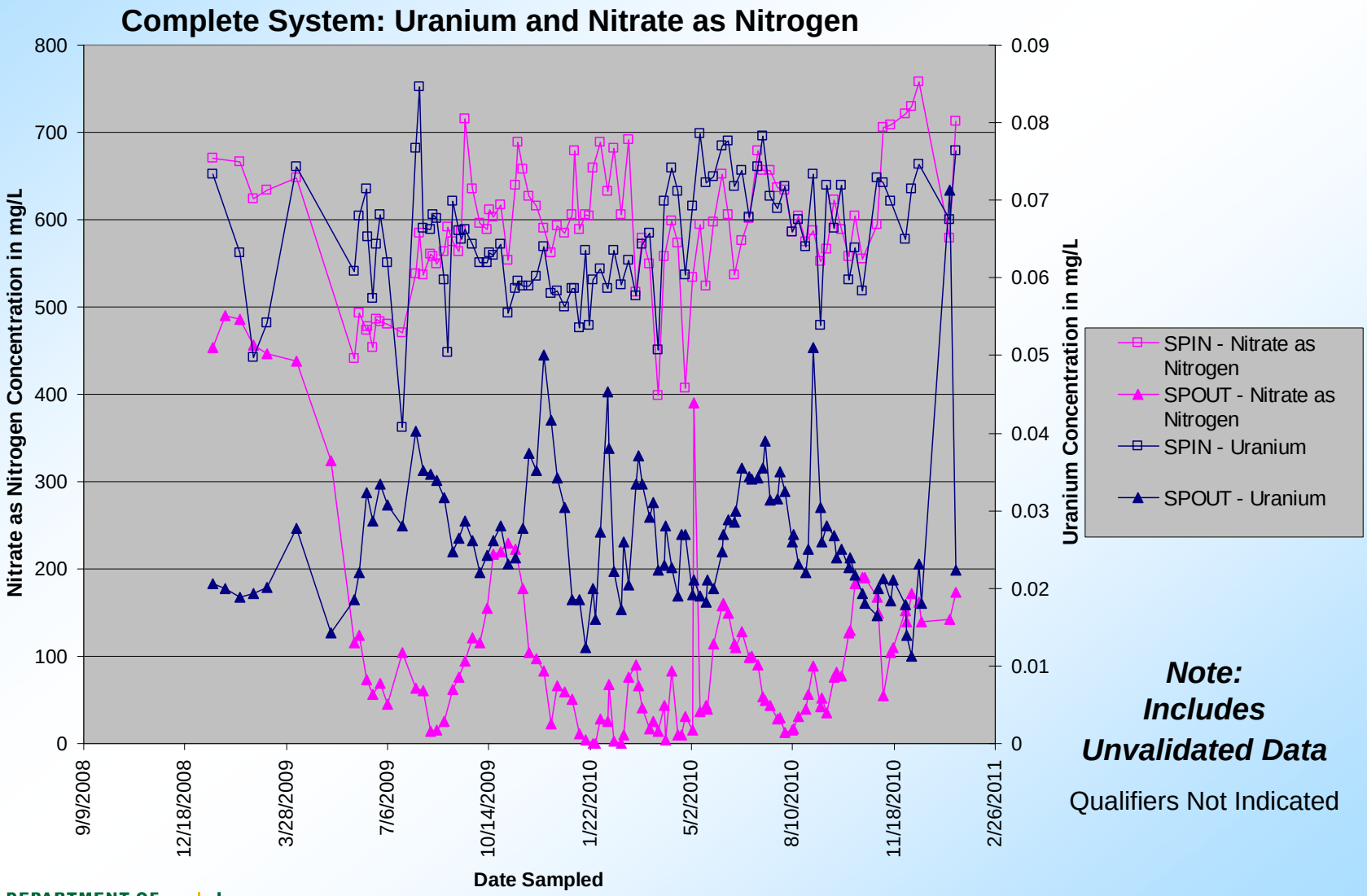
SPPTS Activities in Third Quarter

- Optimization of Phases II, III
  - Transitioned to dosing Cell A with preblended mixture of carbon and phosphorus
  - Evaluated effects of recirculation in Cell A
  - Increased flow to Cell B [from approximately 0.005 to 0.25 gallons per minute (gpm)]
  - Stopped regularly sampling Cell B (no longer a Phase IV candidate)
- Attempted to improve flow conditions in original cells
  - Installed auxiliary distribution gallery in Cell 1; clogged quickly and repeatedly (biological, some mineral precipitates)

SPPTS Update: Current

- Working on Phase IV design
- Incorporates a Phase III, Cell A approach to treatment (inert media dosed with liquid carbon source)

SPPTS Update: Current



Note: Includes Unvalidated Data

Qualifiers Not Indicated

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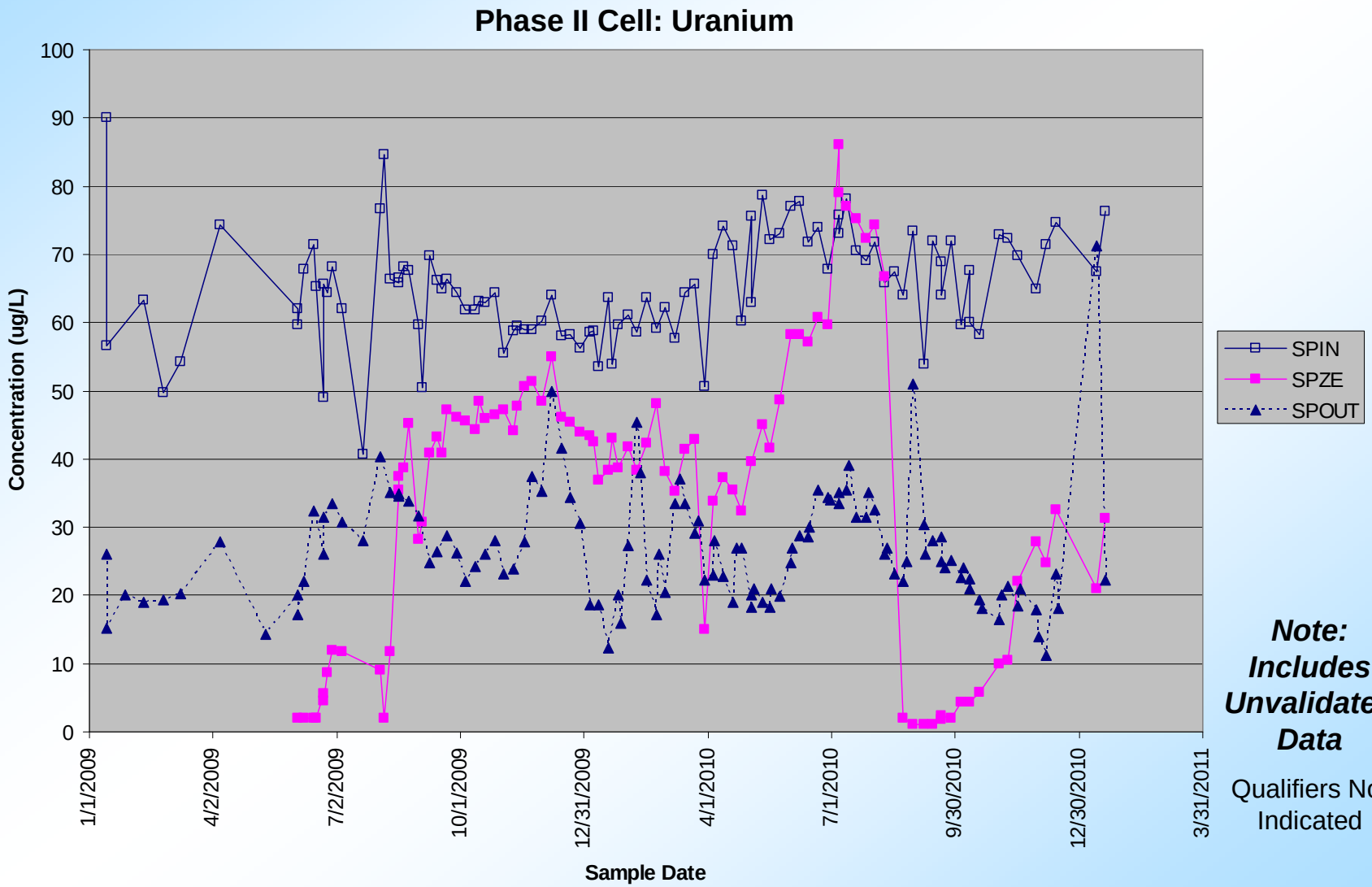
SPPTS Update: Current



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Qualifiers Not Indicated

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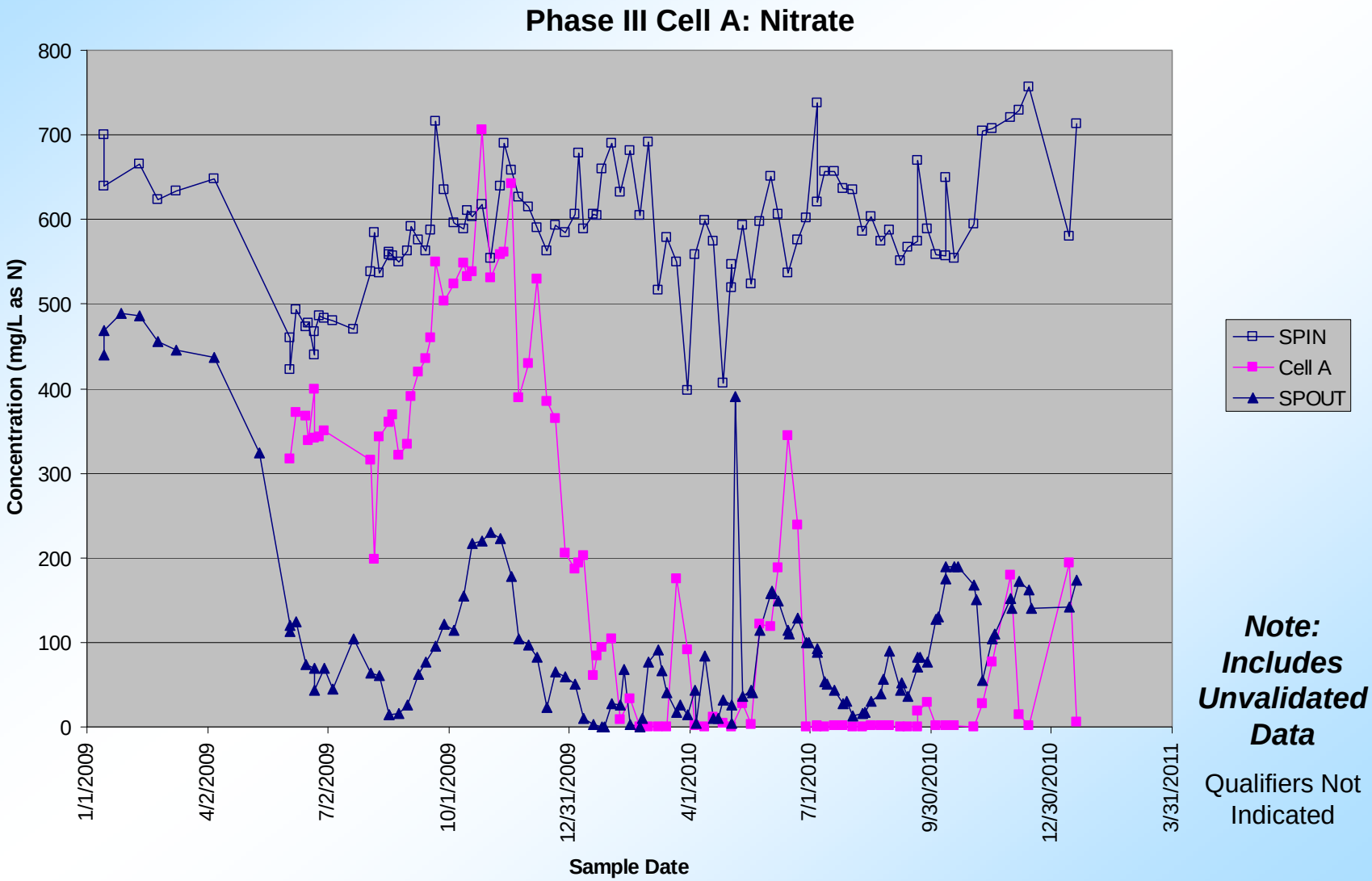
SPPTS Update: Current



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Qualifiers Not Indicated

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Ongoing Activities

- MSPTS
  - Preparing for media replacement project
  - Designing effluent polishing component
    - Tested small-scale version in January
    - Based on principal of air stripping

Questions?

Site Operations

Third Quarter 2010

OLF Inspections

- Monthly inspections at the OLF were completed on July 19, August 31, and September 23, 2010

OLF Features

OLF Seeps

- Seep 1 was dry throughout the third quarter
- Seep 2 and 3 area saturated in third quarter – showed some surface expression but no surface flow
  - Supported small stands of wetland vegetation
- Seep 4 and 5 area saturated in second quarter – showed surface expression, but drained via Berm 3 drain as designed
  - Thriving wetland vegetation in Seep 4 and 5 area
- Seep 6 area dry most of third quarter
  - Supported small stand of wetland vegetation

OLF Seeps

- Seep 7 surface expression stopped in third quarter
  - Wetland vegetation areas mostly dried up
  - About half of the wetland vegetation died
- Seep 8 flowed at approximately 2 to 5 gpm throughout the third quarter
- In second quarter seep flows were noted to have saturated base of Berm 7
- Geotechnical engineering evaluation of Berm 7 stability conducted in third quarter due to continued saturation
  - Design criteria met in saturated condition
  - Geotechnical report to be included in 2010 annual report

OLF Settlement Monuments

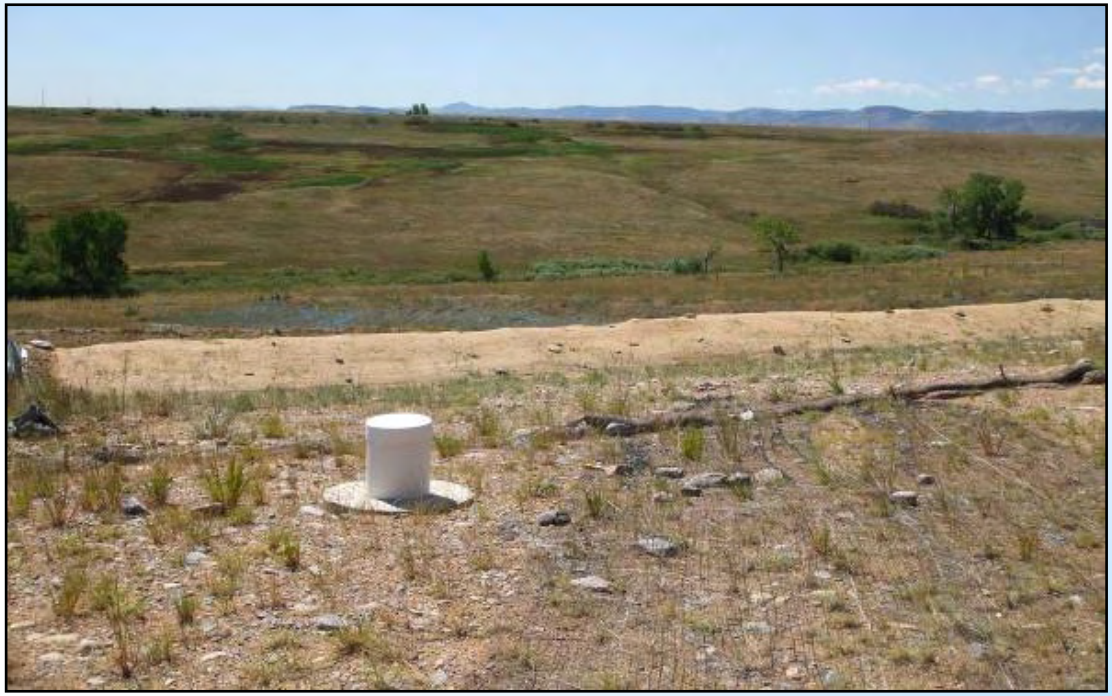
- Settlement monuments were surveyed on September 23; data are within the expected range per the *Original Landfill Monitoring and Maintenance Plan*

OLF Inclinometers

- Inclinometers were measured July 28, August 30, September 9, and September 30
  - Inclinometers 5, 6, and 7 measured September 9
  - September 30 measurements invalidated – instrument orientation error
  - Subsequent readings taken in fourth quarter showed very little deflection

OLF Slumps

- Berm 1 crack filled and compacted in second quarter; no new cracking appeared in third quarter
- End of Berm 7 at East Perimeter Channel repaired in second quarter; no problems noted in third quarter



PLF Inspections and Surveys

- The quarterly inspection was completed on August 31
- No areas of concern were observed

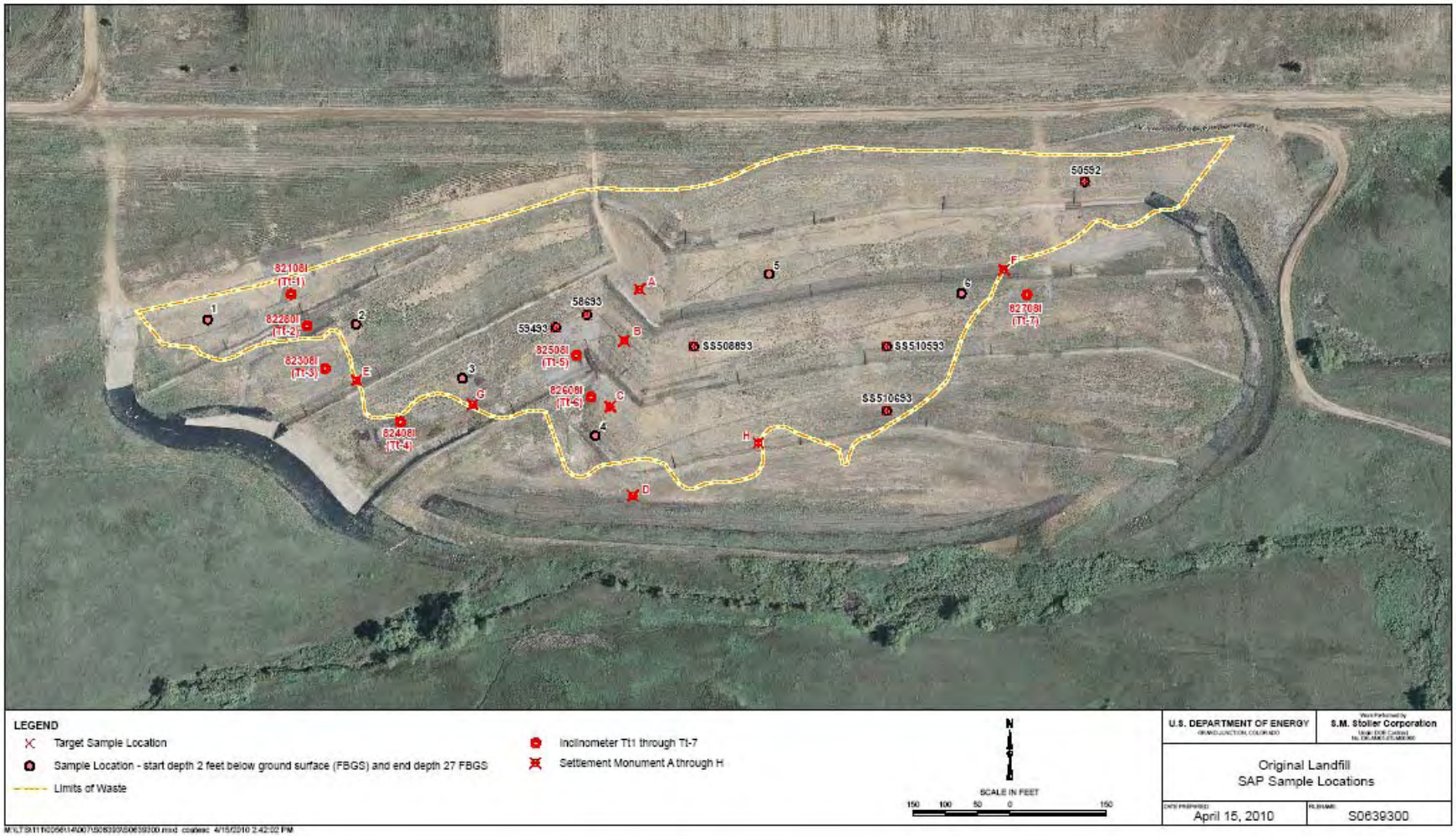
OLF Soil Sampling Project

- Preliminary evaluation of residual contamination levels in relation to CDPHE's August 2008 policy, *End of Post-Closure Care*
  - Project covered by CR 2010-01
  - Pre-closure residual soil contamination data are between 15 and 19 years old
  - Provide data for comparison to risk-based levels
- Does not necessarily mean that post-closure controls for the OLF would end
  - Some M&M requirements possibly may be reduced
  - Remains subject to land-use restrictions under Environmental Covenant

OLF Soil Sampling Project

- CDPHE approved the OLF SAP on June 9, 2010
  - Goal – twelve 25-foot boreholes, below 2-foot cover soil
  - Sample 5-foot core intervals
- Six OLF IM/IRA targeted locations
  - Three from the surface soil data set, and three from subsurface soil data set
- Six additional locations to provide subsurface data from the east and west side
- Analyze for VOCs; SVOCs; pesticides and PCBs; metals; and plutonium, americium, and uranium

OLF Soil Sampling Project



OLF Soil Sampling Project

- Sampling June 29 to July 8, 2010
- 228 samples collected
- Data evaluation and summary reporting completed in the fourth quarter and will be included in 2010 annual report

OLF Soil Sampling Project DQOs

- Evaluate whether any analyte concentrations are above CDPHE CSEVs or WRW PRGs
- 2010 data are generally similar to OLF IM/IRA data
  - Arsenic (100 percent of samples) and SVOC and PCB samples (6 to 44 percent of samples) greater than CSEVs or WRW PRGs
  - Several analytes above screening levels in OLF IM/IRA data were below CSEVs or WRW PRGs in the 2010 samples
    - Antimony
    - Copper
    - Tetrachloroethene
    - Trichloroethene
    - Iron less than WRW PRG
    - Chrysene less than WRW PRG
    - PCB Aroclor 1260 <WRW PRG

OLF Soil Sampling Project DQOs

- Evaluate whether residual contamination levels are stable or have decreased
- The 2010 data showed decreases in concentrations for some analytes, compared to OLF IM/IRA data
  - Might have been caused by the mixing of some soils from the cutting, filling, and contouring work in closing the OLF
- 2010 SVOC and PCB results greater than CDPHE CSEVs or WRW PRGs are from samples deeper than 7 feet below ground surface
- Targeted surface soil sample location SS510593 at 7 to 12 feet below ground surface — SVOCs about an order of magnitude higher than the OLF IM/IRA data maximum

OLF Soil Sampling Project DQOs

- Evaluate risk if subsurface soils become exposed to the surface
- Based on comparison to surface soil WRW PRGs, risk from residual contaminants is within the normally acceptable remedy risk range of 10^{-6} to 10^{-4}
- Other than arsenic, only one sample in OLF localized instability area exceeded WRW PRG
  - Aroclor 1254 at OLFS-02 in 2 to 7 feet below ground surface (1,930 µg/kg vs. 1,349 µg/kg)

Questions?

Ecological Monitoring Third Quarter 2010

- Preble's meadow jumping mouse (PMJM) mitigation monitoring
  - Results presented in annual PMJM report to USFWS
- Wetland mitigation monitoring
  - Results presented in annual wetland mitigation report to EPA
- Revegetation monitoring
  - Both DOE and EPA monitoring efforts
    - Results presented in annual RFS report
- Photopoint monitoring
  - Results presented in reports listed above