
Overview of the Rocky Flats Site Annual Report of Site Surveillance and Maintenance Activities Calendar Year 2009

Rocky Flats Stewardship Council
June 7, 2010



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Surface Water Monitoring and Operations



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Pond Operations – Calendar Year 2009

- Terminal Pond Discharges:
 - Pond B-5
 - May 19 through June 6, 2009 (12.63 MG)
 - Pond A-4
 - May 23 through June 5, 2009 (9.1 MG)
 - December 12 through December 21, 2009 (7.17 MG)
 - Pond C-2
 - May 26 through June 4, 2009 (4.84 MG)
- Transfers:
 - Pond A-3 to A-4
 - Four periods (24.62 MG total)
- Pond Levels:
 - As of January 1, 2010, Ponds A-3, A-4, B-5, and C-2 and the Landfill Pond were holding approximately 15.4 MG (15.6 percent of capacity)



Recent Pond Levels (May 12, 2010):

- Landfill (22 percent)
- A-3 (33 percent)
- A-4 (28 percent)
- B-5 (14 percent)
- C-2 (35 percent)



Dam Breach Project

- Breach of Dams A-1, A-2, B-1, B-2, B-3, and B-4 completed in March 2009



Dam A-1: Notch and Stoplog Structure
April 23, 2009



Dam A-1:
October 8, 2008



Dam A-1:
January 8, 2009

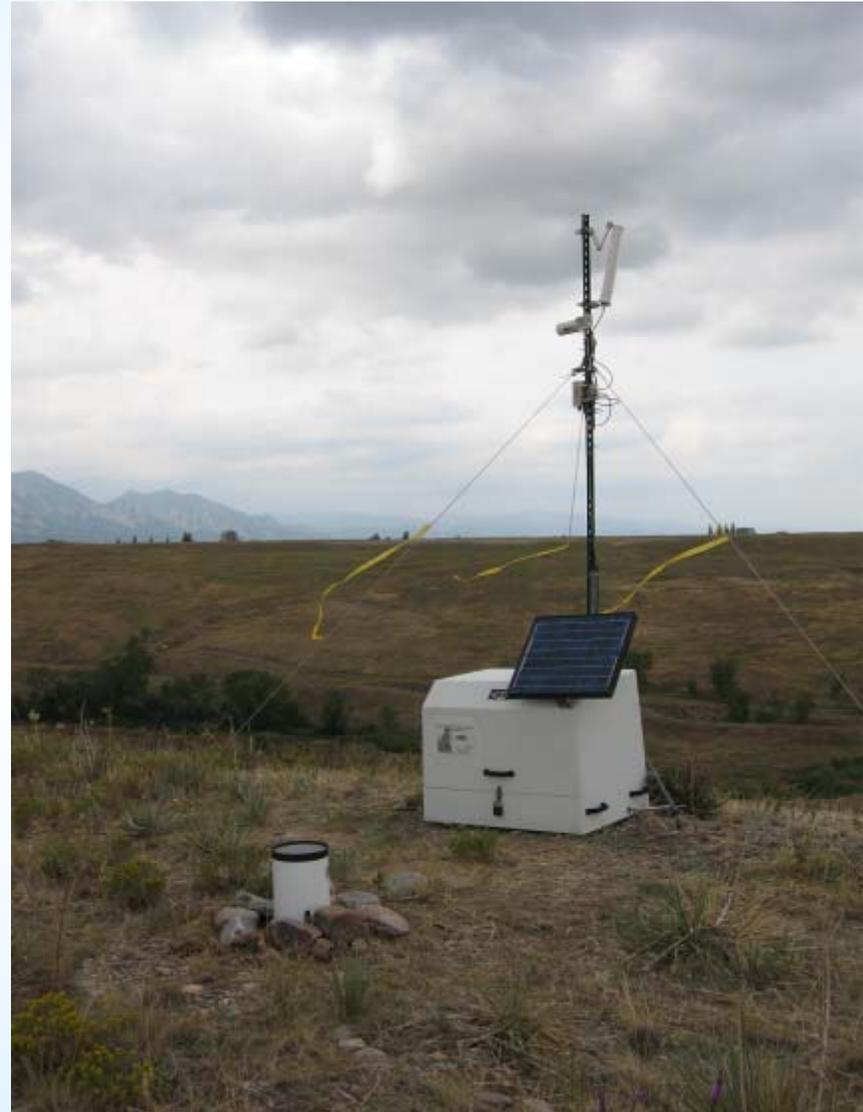


U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

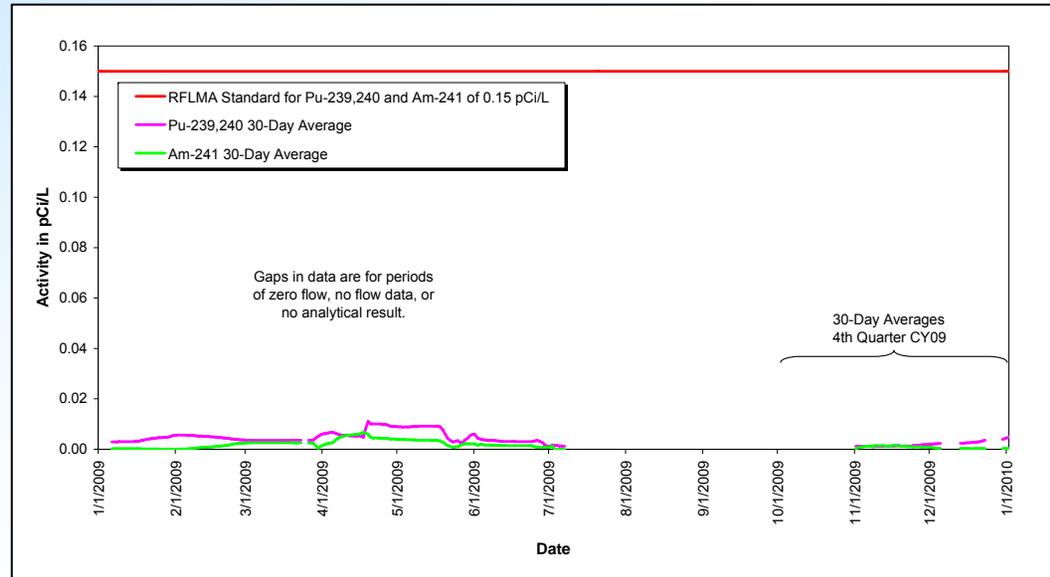
Hydrologic Data – Calendar Year 2009

- Precipitation:
 - 13.1 inches total precipitation
 - 107 percent of average CY 1993–2008
- Flow rates (percentage of CY 1997–2008 average):
 - GS01 (88 percent)
 - GS03 (37 percent)
 - GS10 (58 percent)
 - SW027 (26 percent)
 - SW093 (70 percent)

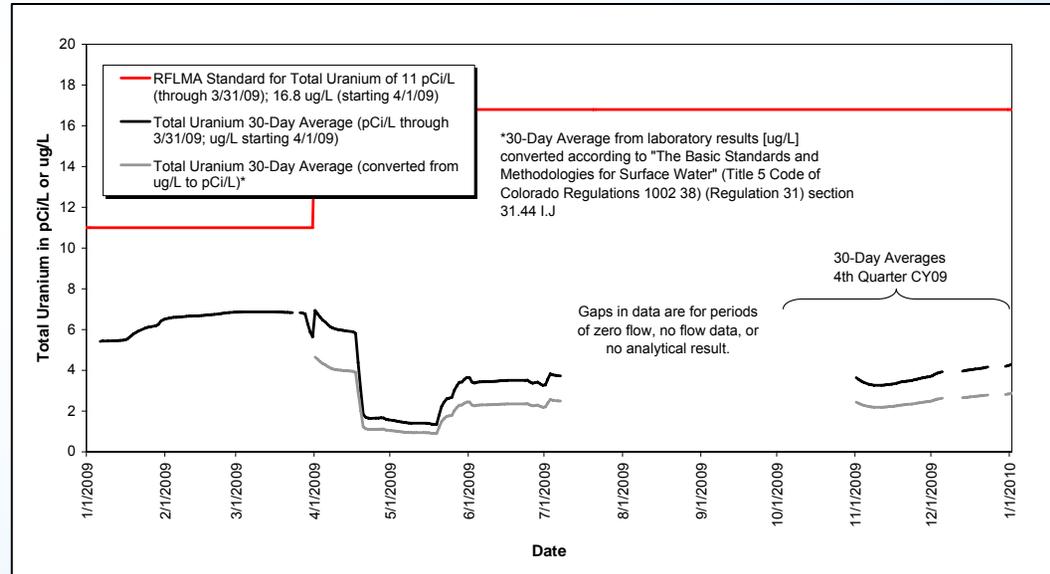


POC GS01

- Plutonium and Americium

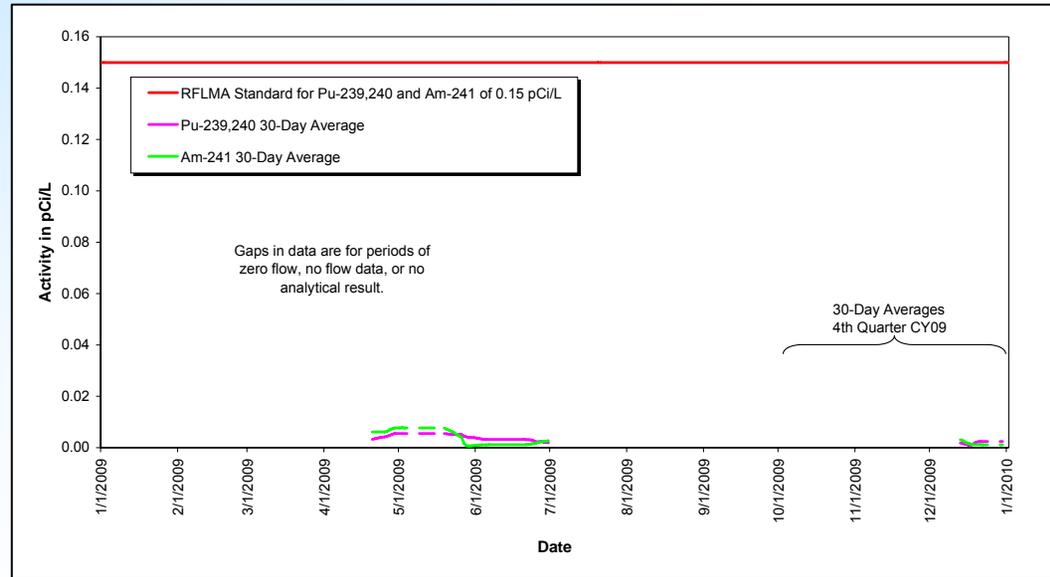


- Total Uranium

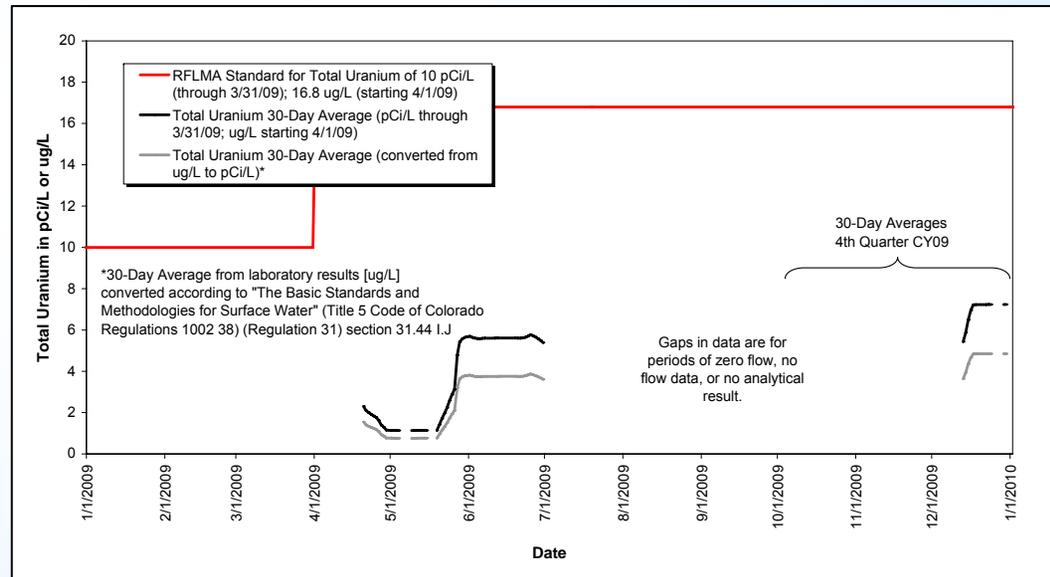


POC GS03

- Plutonium and Americium

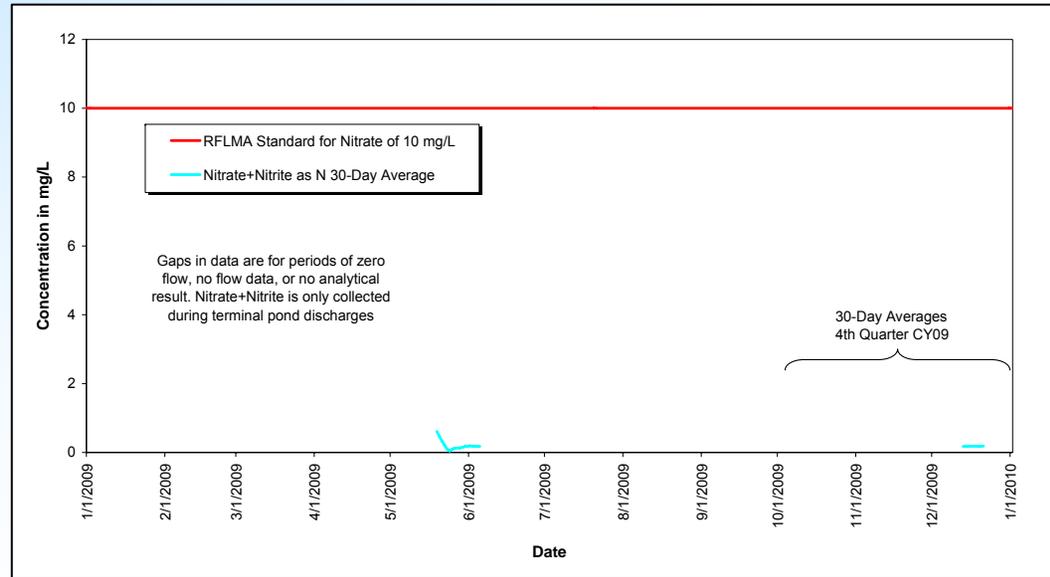


- Total Uranium



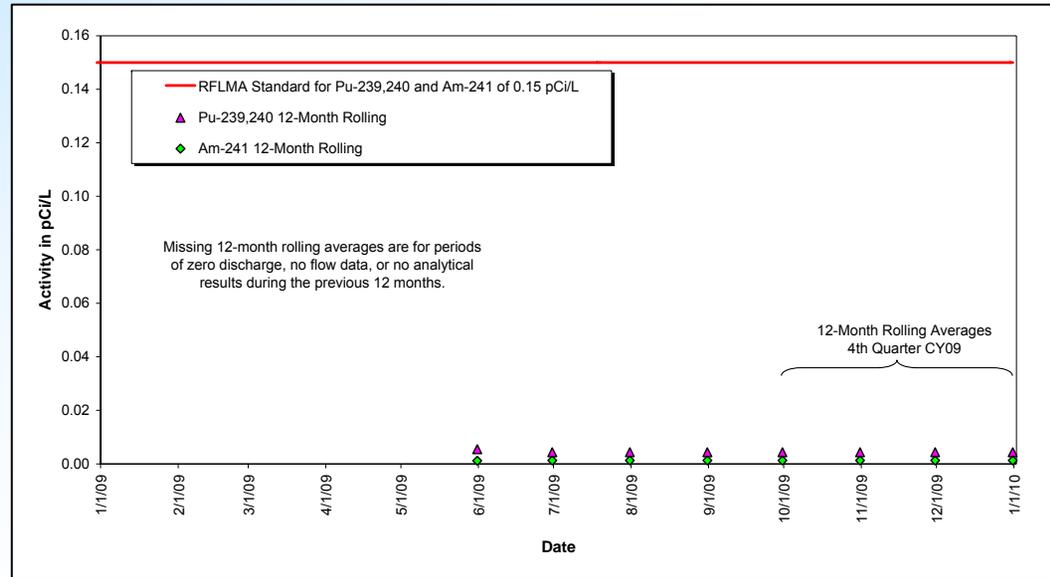
POC GS03

- Nitrate + Nitrite as Nitrogen

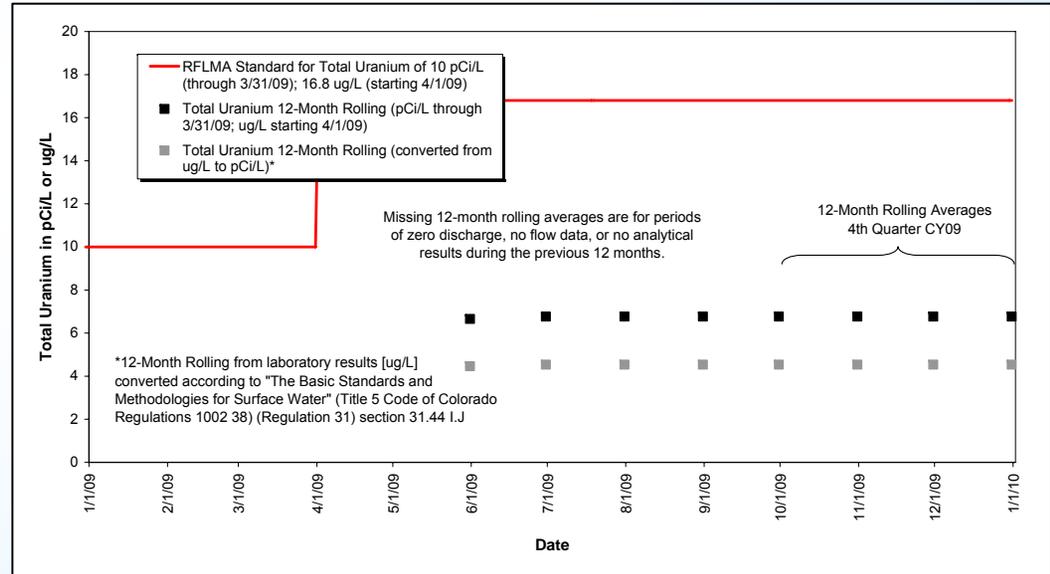


POC GS08

- Plutonium and Americium

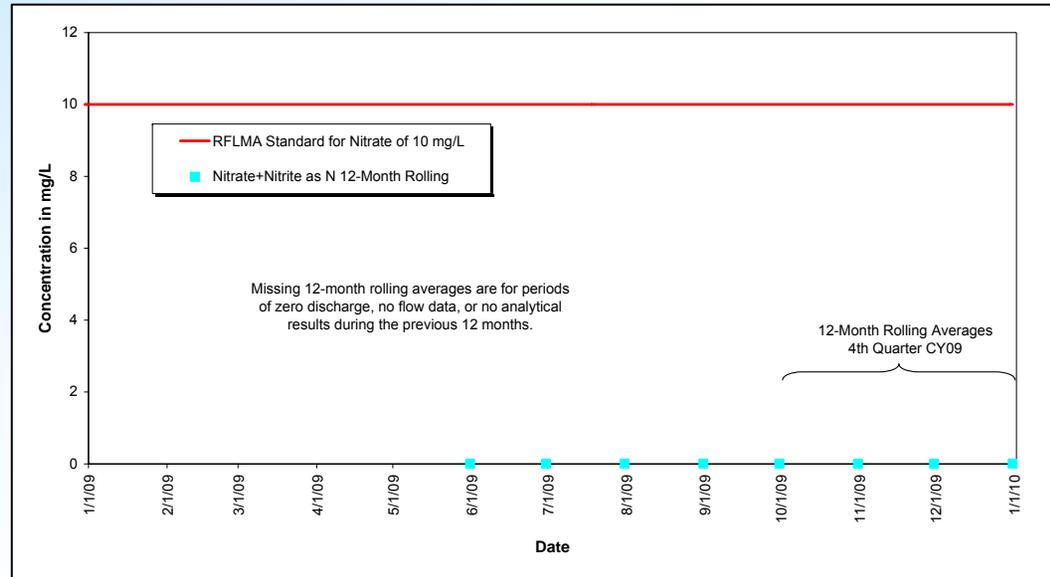


- Total Uranium



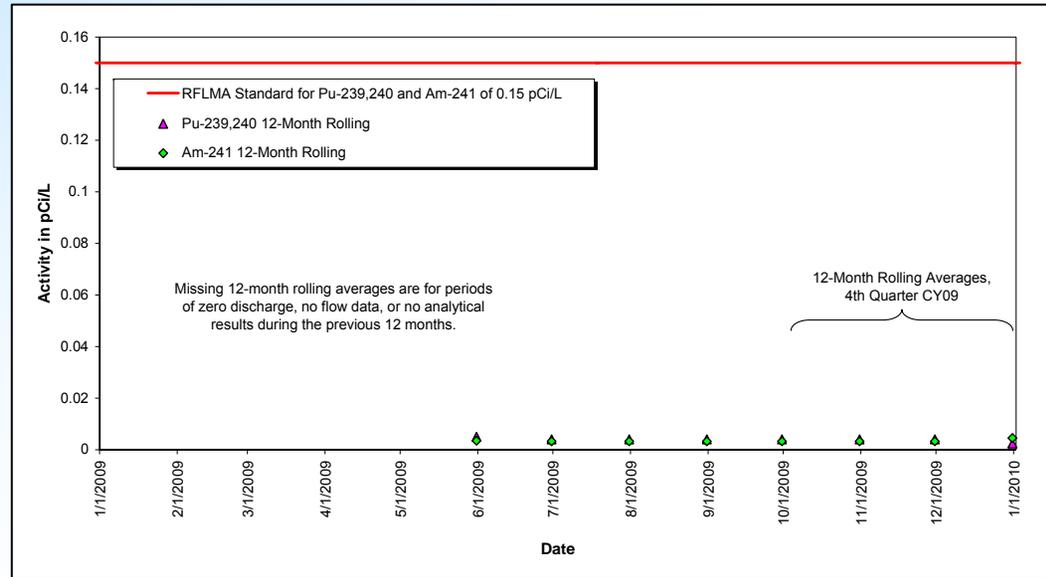
POC GS08

- Nitrate + Nitrite as Nitrogen

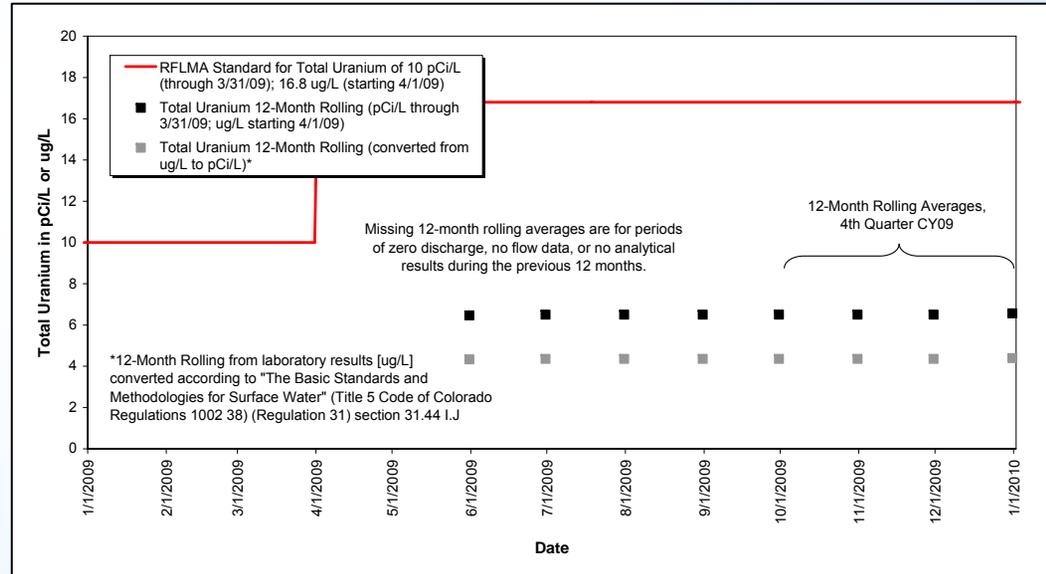


POC GS11

- Plutonium and Americium

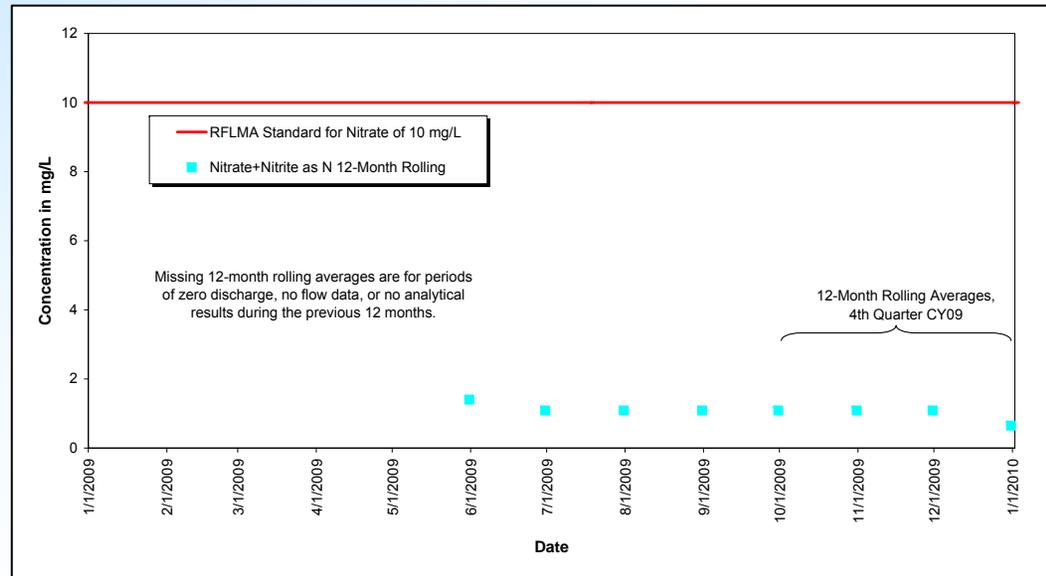


- Total Uranium



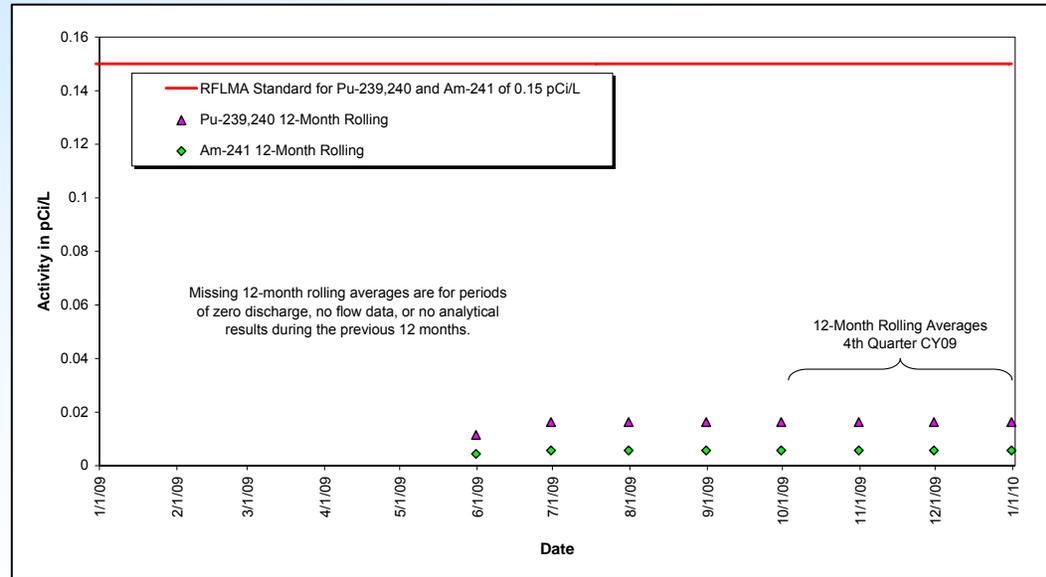
POC GS11

- Nitrate + Nitrite as Nitrogen

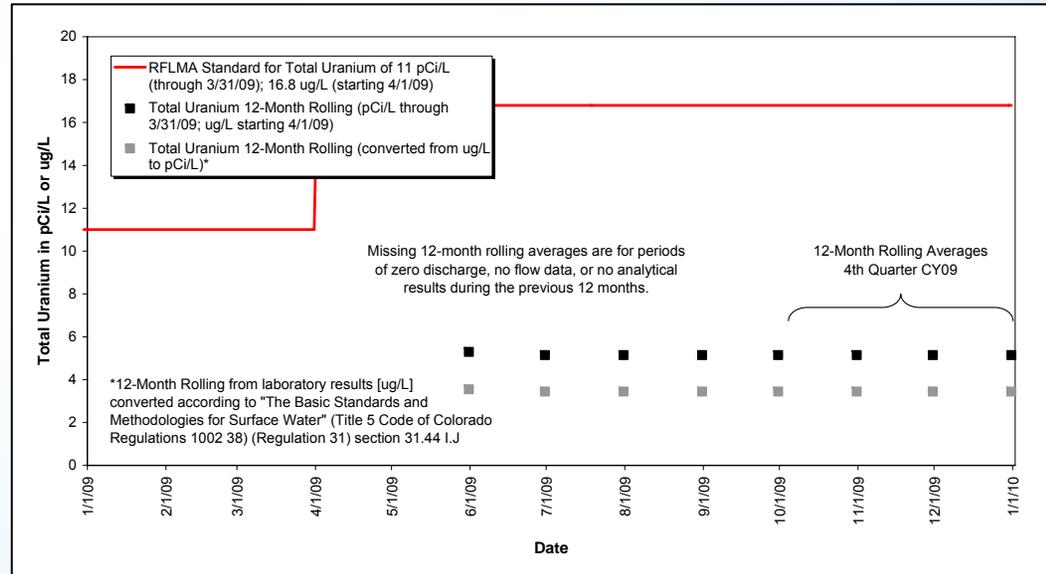


POC GS31

- Plutonium and Americium



- Total Uranium



Point of Evaluation Monitoring – Calendar Year 2009

- Water quality at all points of evaluation, except GS10, was below applicable standards
 - Reportable values for total uranium at GS10 continued to be observed through March 31, 2009; total uranium was not reportable starting on April 30, 2009. Concentrations are likely caused by groundwater contributions of naturally occurring uranium to South Walnut Creek.



Performance Monitoring – Calendar Year 2009

Original and Present Landfills

- Original Landfill: surface water quality results during CY 2009 triggered monthly sampling for dissolved silver
 - Dissolved silver was not detected in three consecutive monthly samples; monthly sampling was discontinued
- Present Landfill: surface water quality results triggered monthly sampling for selenium, dissolved silver, and vinyl chloride
 - No analytes were detected in three consecutive monthly samples; monthly sampling was discontinued



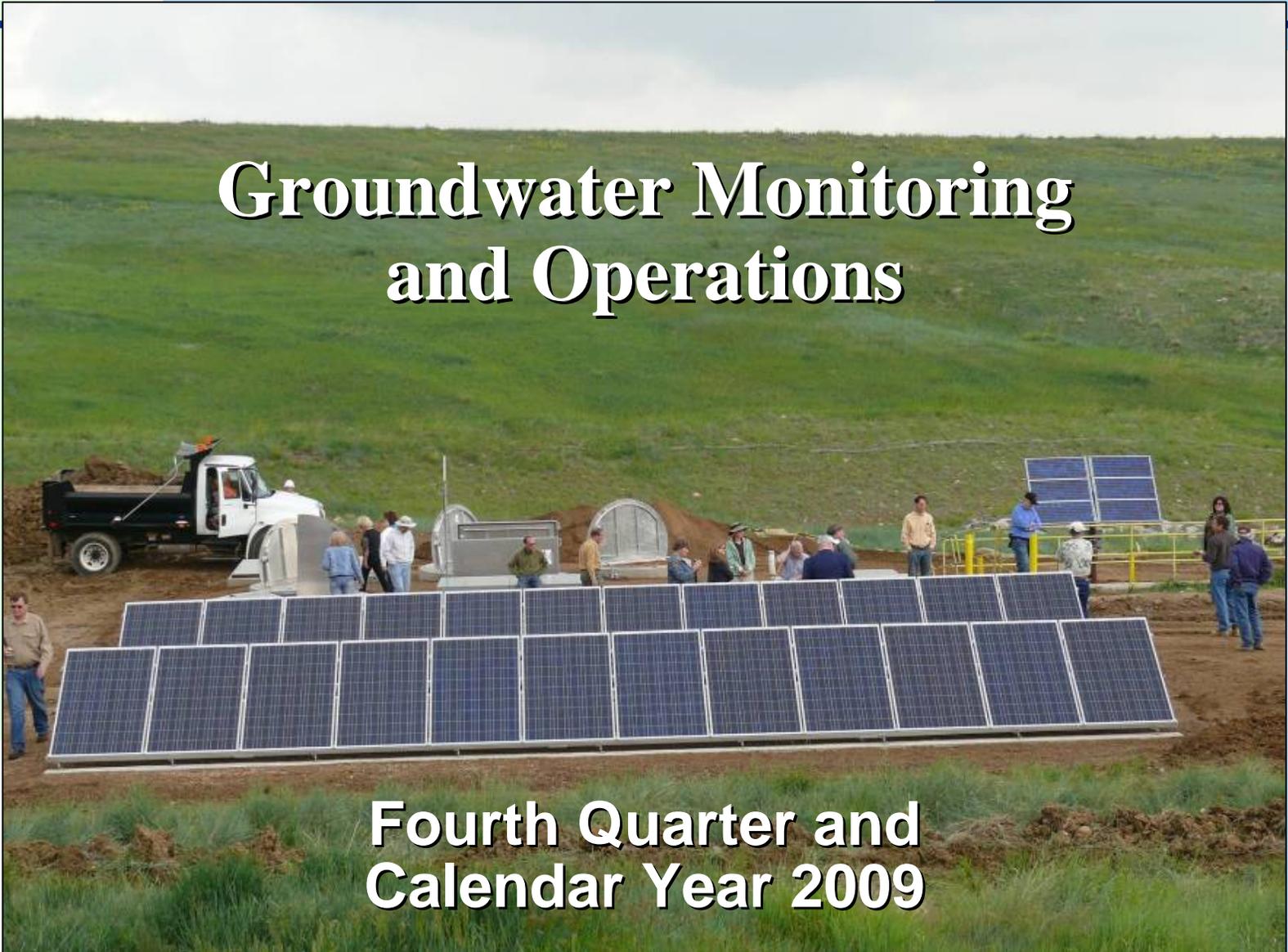
Questions?



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Groundwater Monitoring and Operations



Fourth Quarter and
Calendar Year 2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Groundwater Monitoring, Fourth Quarter 2009

■ RFLMA monitoring

- All AOC, Sentinel, and RCRA wells were monitored
- Treatment system locations were monitored
- Results are included and evaluated in the 2009 Annual Report

■ Non-RFLMA monitoring

- Additional samples were collected at and around the SPPTS
 - Support optimization of the Phase II (uranium) and Phase III (nitrate) upgrades



Summary Highlights From 2009

- All RFLMA-required monitoring was performed
- Dry conditions affected a few locations, but reduced compared to pre-closure (better wells, direct recharge)
- Groundwater treatment systems continue to remove contaminants from the groundwater
- SPPTS Phase II (uranium), III (nitrate) upgrades installed
- ETPTS media replaced, plumbing upgraded
- Data from AOC wells and surface water performance locations indicate the remedy continues to function as intended



Statistics Performed for 2009 Annual

- Statistical analyses of groundwater quality data performed per RFLMA
 - Analysis of variance (ANOVA): RCRA wells
 - Downgradient PLF versus upgradient PLF
 - Downgradient OLF versus upgradient OLF
 - Seasonal-Kendall (S-K) trending: Sentinel wells, RCRA wells
- Additional, non-RFLMA analyses
 - S-K for selected AOC wells, analytes
- See Annual Report text, tables, figures, and Appendix B for well- and chemical-specific details



Statistical Analysis: PLF Groundwater

- Summary: ANOVA results for 2009 same as for 2008
 - Downgradient groundwater concentrations of several metals are higher than upgradient concentrations
 - As in 2008, only selenium (Se) exceeds applicable RFLMA level
- With addition of 2009 data, Seasonal Kendall trending calculations can now be completed
 - Boron (B) concentrations in samples from well 73105 are on increasing trend with 95 percent statistical significance, but are well below RFLMA standard
- See Contact Record 2010-05



Statistical Analysis: OLF Groundwater

- Summary: ANOVA results for 2009 same as for 2007, 2008
 - Downgradient groundwater concentrations of two metals higher than upgradient concentrations
 - One result for uranium (U) exceeded threshold –130 µg/L, first quarter
 - Uranium confirmed 100 percent natural in previous high-resolution analysis (2007)
- With addition of 2009 data, Seasonal Kendall trending calculations can now be completed; 95 percent statistical significance confirmed for
 - Boron (B) decreasing in samples from well 80005
 - Selenium (Se) increasing in samples from well 80205, but every single result is qualified (nondetect, estimated, or present in blank); trend may not be valid
- See Contact Record 2010-05



Selected Highlights From 2009: MSPTS

- Mound/Oil Burn Pit (OPB) #2 Plume
 - Source areas not sampled in 2009
 - Downgradient Sentinel wells (15699, 91299) and MSPTS influent report some lower concentrations of parent compounds, higher concentrations of degradation byproducts
- MSPTS characteristics
 - Contaminant concentrations in system influent continue to reflect presence of OPB #2-impacted groundwater
 - Effluent water quality generally consistent with previous years
 - Results from surface water performance location GS10 indicate MSPTS is functioning as intended



Selected Highlights From 2009: MSPTS (continued)

- MSPTS treated approximately 287,000 gallons
 - Continues trend of higher volumes observed since 2005

Calendar Year	Annual Estimates of Volume Treated (gallons)	Estimated Cumulative Volume Treated (gallons)
2000	258,000	660,000
2001	119,000	780,300
2002	53,000	833,000
2003	82,000	915,000
2004	86,000	1,001,000
2005	506,000	1,507,000
2006	430,000	1,937,000
2007	326,000	2,263,000
2008	358,000	2,621,000
2009	287,000	2,908,000



Selected Highlights From 2009: ETPTS

■ East Trenches Plume

- Source area not sampled in 2009
- Sentinel, AOC well water quality generally consistent with previous samples
- Downgradient well 23296, next to South Walnut Creek, shows increasing degradation byproducts, decreasing parent compounds, rising water levels (dam breach)

■ ETPTS characteristics

- Contaminant concentrations in system influent are generally consistent with previous years
- Effluent water quality showed increasing concentrations of some contaminants (particularly TCE) in first part of 2009
- Results from surface water performance location POM2 indicate ETPTS is functioning as intended



Selected Highlights From 2009: ETPTS (continued)

- ETPTS treated approximately 406,000 gallons
 - Continues trend of decreasing volumes observed since 2006

Calendar Year	Annual Estimates of Volume Treated (gallons)	Estimated Cumulative Volume Treated (gallons)
2000	1,633,000	2,800,000
2001	1,900,000	4,700,000
2002	≤1,000,000	5,700,000
2003	2,100,000	7,800,000
2004	1,500,000	9,300,000
2005	1,800,000	11,100,000
2006	675,000	11,775,000
2007	951,000	12,726,000
2008	629,000	13,355,000
2009	406,000	13,761,000

- Media replaced September through November 2009 due to effluent quality, media clogging
- Plumbing upgrades also installed, as reported in previous meeting



Selected Highlights From 2009: SPPTS

■ Solar Ponds Plume

- Source area not sampled in 2009
- Increasing trends in nitrate and uranium in downgradient Sentinel well P210089 (nearest the source area)
- Other wells, including AOC well 10594, consistent with previous samples

■ SPPTS characteristics

- Influent concentrations, flow significantly higher than previous years
- First full year of contributions from Phase I upgrades (October 2008)
- Effluent water quality worse at start of year, improved as optimization of Phases II (uranium), III (nitrate) upgrades (May 2009) proceeded
- Results from surface water performance location GS13 indicate overall effectiveness of SPPTS is improving



Selected Highlights From 2009: SPPTS (continued)

- SPPTS treated approximately 524,000 gallons
 - Significantly higher than all previous years, due to Phase I

Calendar Year	Annual Estimates of Volume Treated (gallons)	Estimated Cumulative Volume Treated (gallons)
2000	64,000	64,000
2001	424,000	452,700
2002	5,600	458,000
2003	340,000	797,000
2004	230,000	1,027,000
2005	140,000	1,167,000
2006	251,000	1,418,000
2007	244,000	1,662,000
2008	280,000	1,942,000
2009	524,000	2,466,000

- Optimization of Phases II (uranium treatment cell) and III (pilot-scale nitrate cells) continues, will inform Phase IV (full-scale nitrate cell)



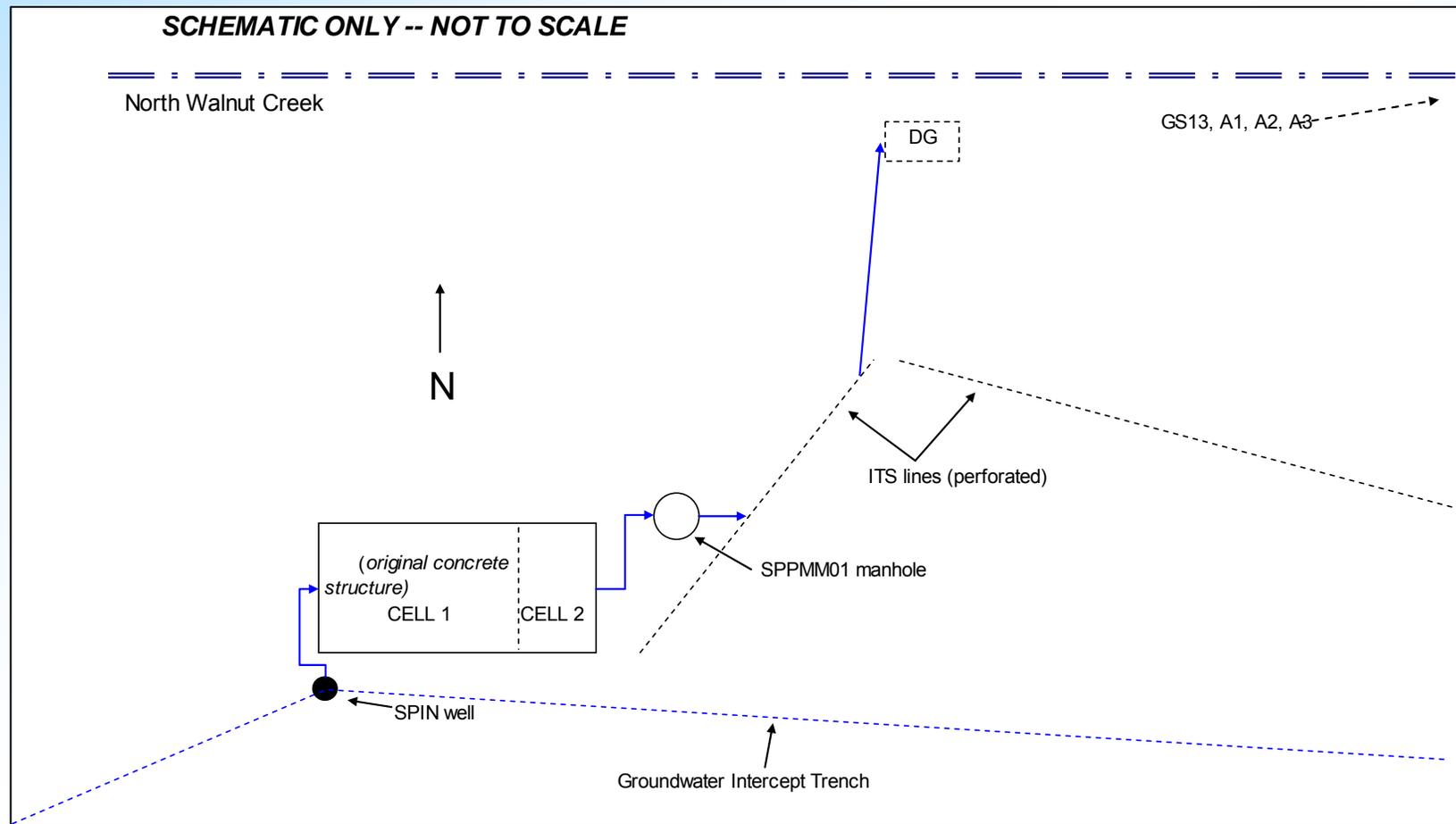
Selected Highlights From 2009: SPPTS (continued)

- Main groundwater focal point in 2009: SPPTS upgrades
 - Phase I (October 2008) collects more contaminated groundwater and routes to treatment cells, effluent discharged via new, non-perforated line
 - Phase II (May 2009) moves uranium treatment to first step in new, easily accessible cell
 - Phase III (May 2009) evaluates pilot-scale nitrate treatment
 - Repairs to Phases II, III (summer 2009)
 - Optimization activities continued through 2009 and into 2010
 - Phase IV scheduled for next year, full-scale nitrate treatment cell informed by previous phases
 - Additional detail presented in previous meetings and Annual Report



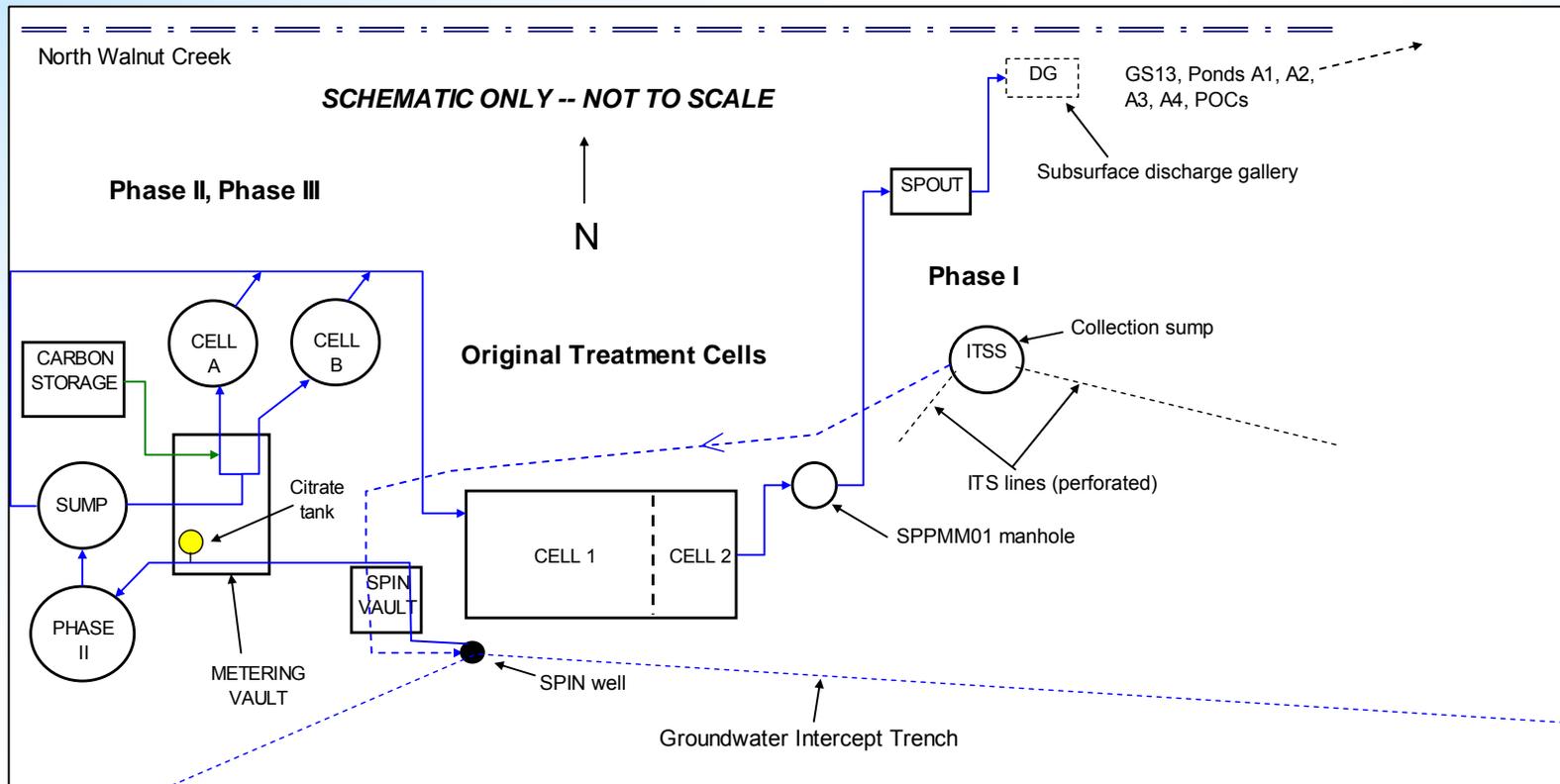
Selected Highlights From 2009: SPPTS (continued)

■ SPPTS at site closure



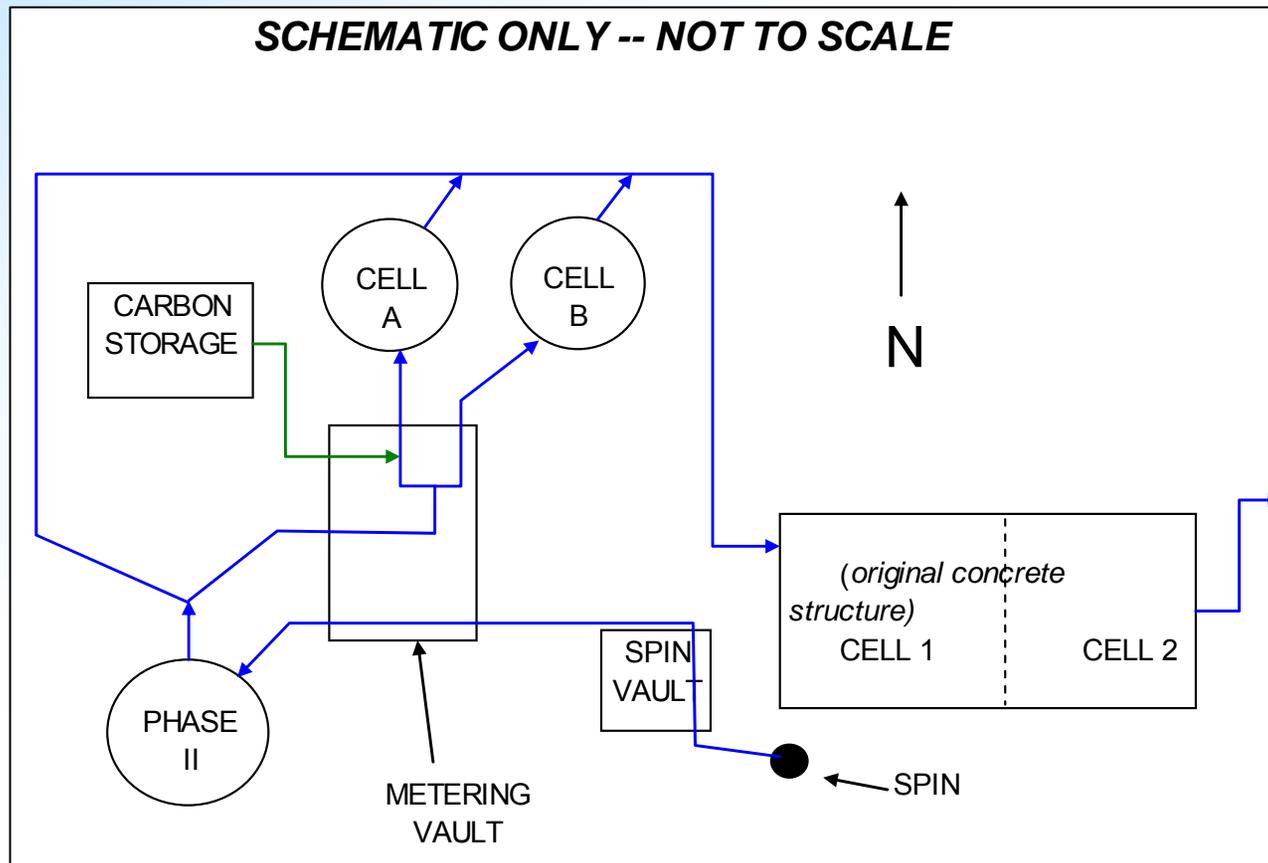
Selected Highlights From 2009: SPPTS (continued)

- SPPTS with completed Phase I, II, and III upgrades (Phase II and III as originally constructed)



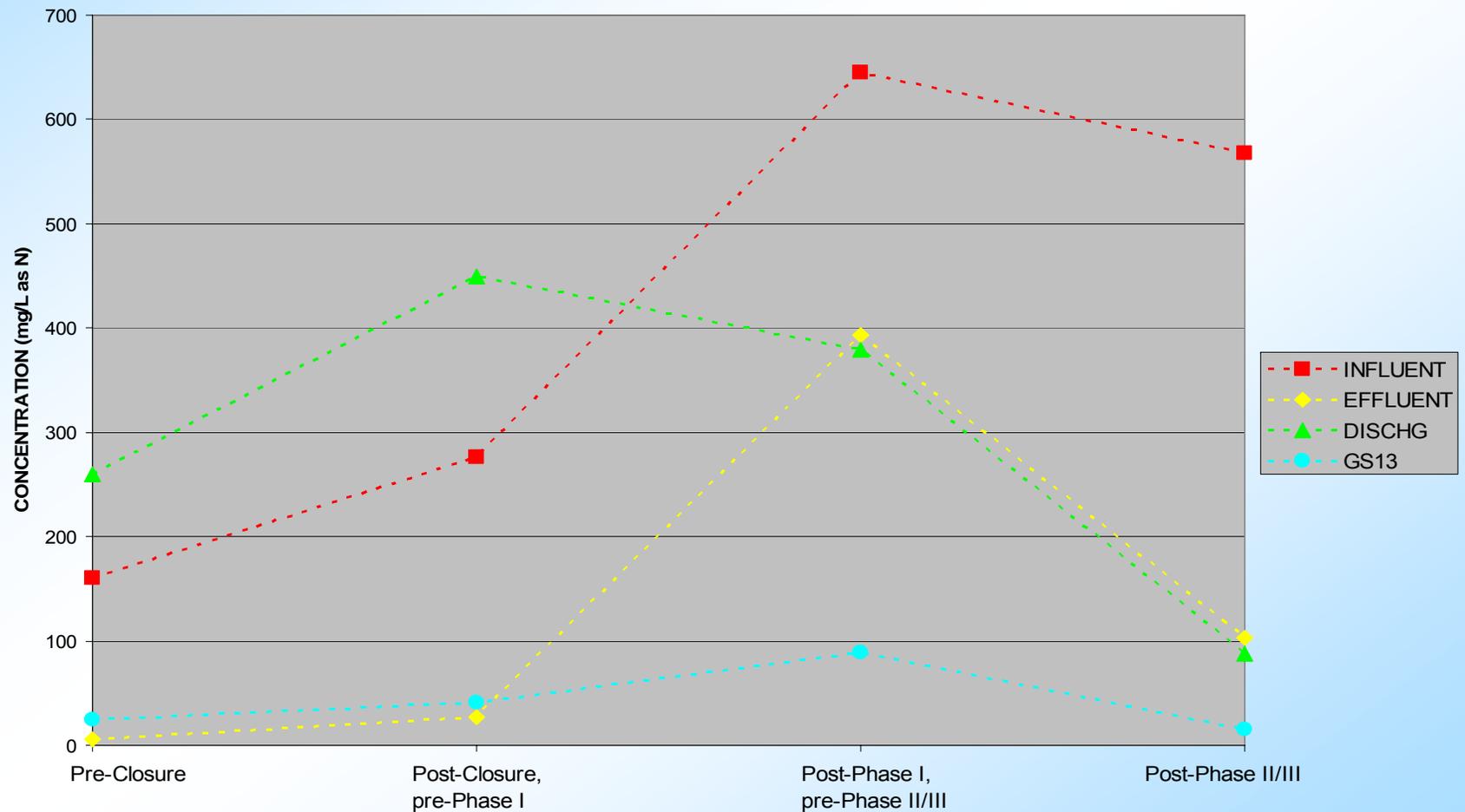
Selected Highlights From 2009: SPPTS (continued)

- Phases II and III following repairs; through end 2009



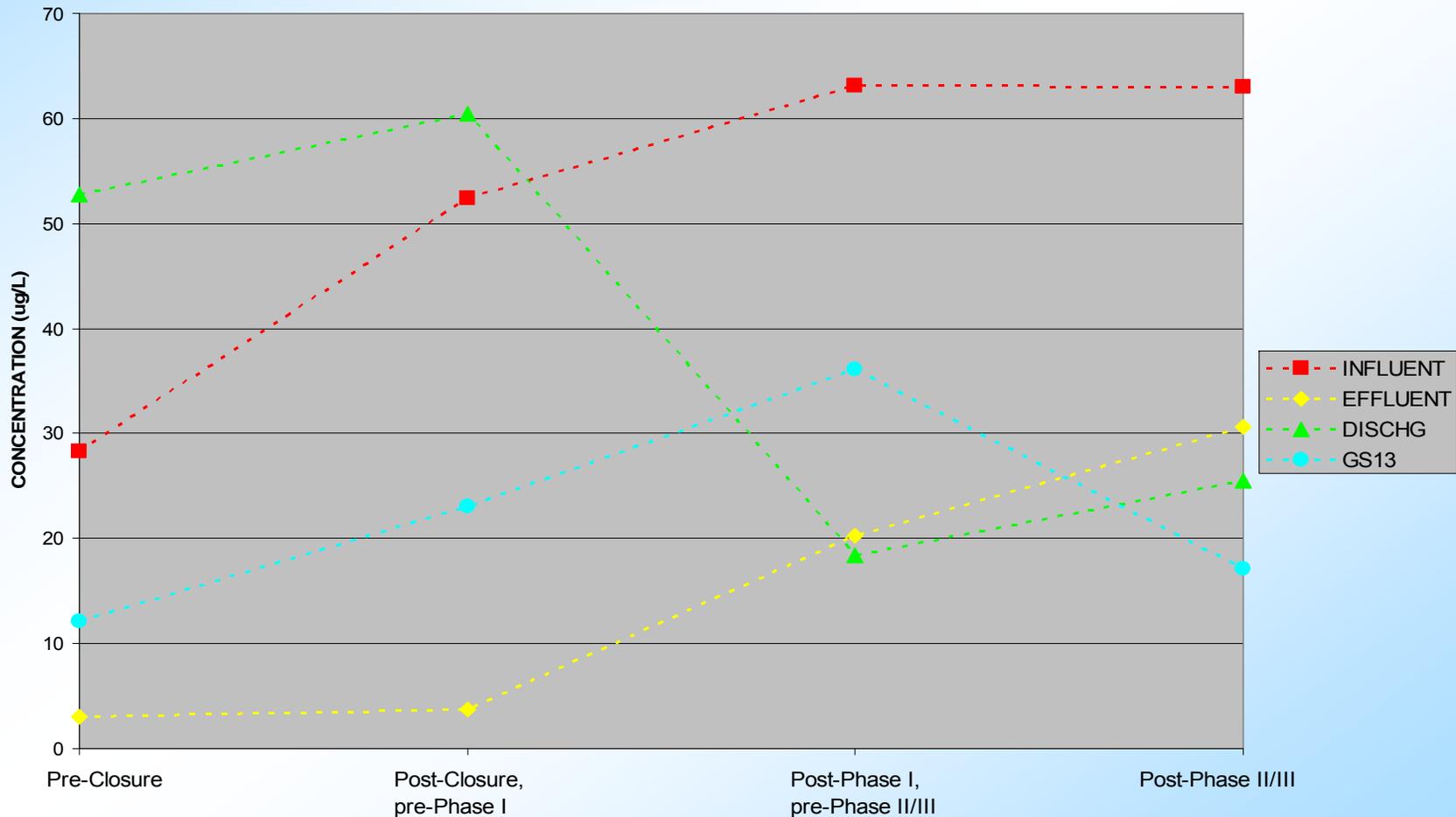
Selected Highlights From 2009: SPPTS (continued)

AVERAGE NITRATE CONCENTRATIONS (with unvalidated ESL data)



Selected Highlights From 2009: SPPTS (continued)

AVERAGE URANIUM CONCENTRATIONS (with unvalidated ESL data)



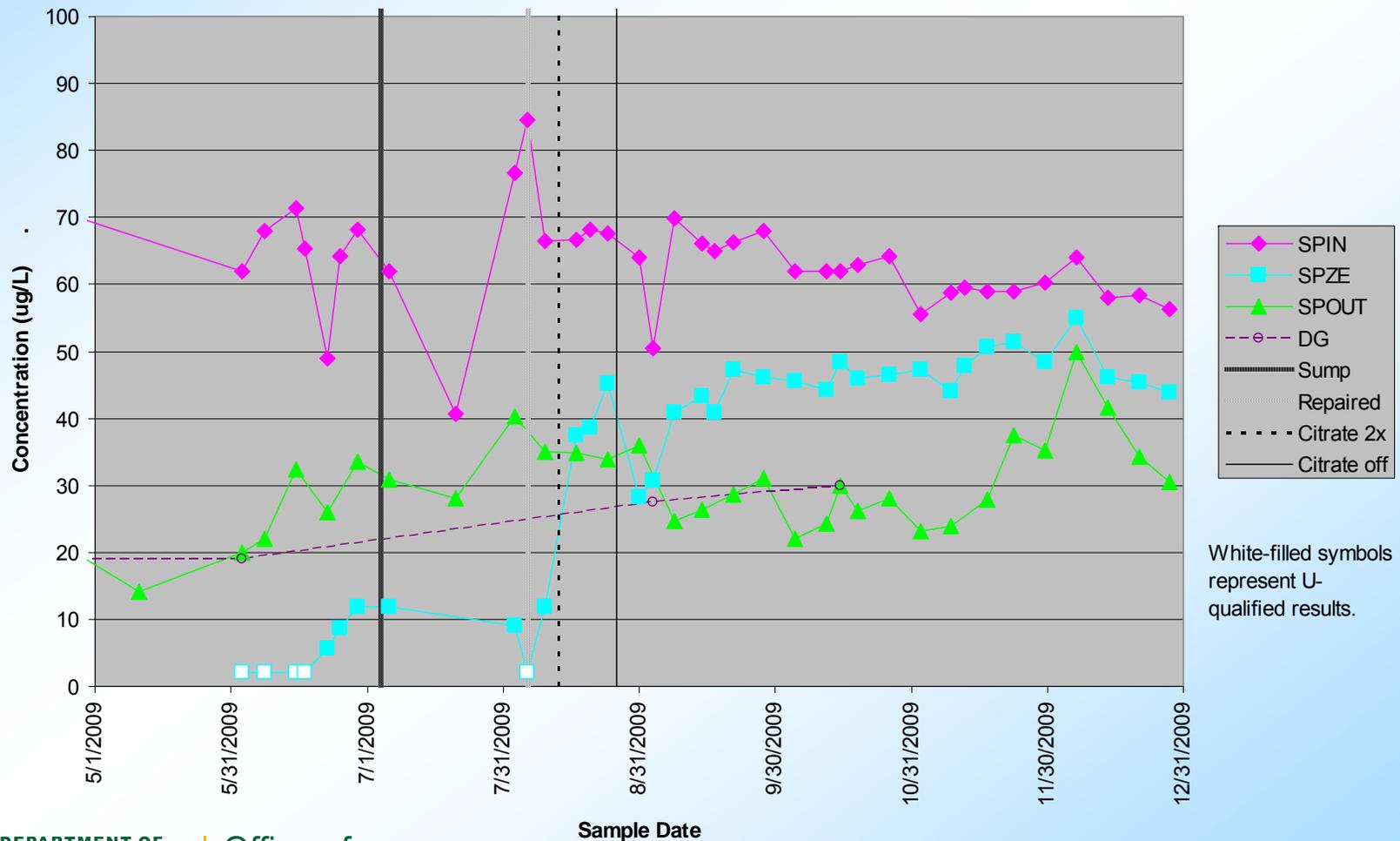
Selected Highlights From 2009: SPPTS (continued)

- Phase II uranium treatment cell utilized new technology to extend life of treatment media
 - Citrate added to influent to chelate precipitate-forming cations, delay media clogging, reduce downstream scale buildup
 - Based on laboratory testing, showing excellent results
 - Implementation in Phase II did not replicate lab results
 - Uranium breakthrough within weeks of installation
 - Treatment is slowly improving, but still not achieving targets
 - Tracer tests (1 in 2009, 1 in 2010) did not show preferential flow through media to be the cause
 - Treatment media samples analyzed (in 2010) appeared normal
 - Working on path forward for possible causes for and solutions to reduced treatment effectiveness



Selected Highlights From 2009: SPPTS (continued)

PHASE II CELL PERFORMANCE



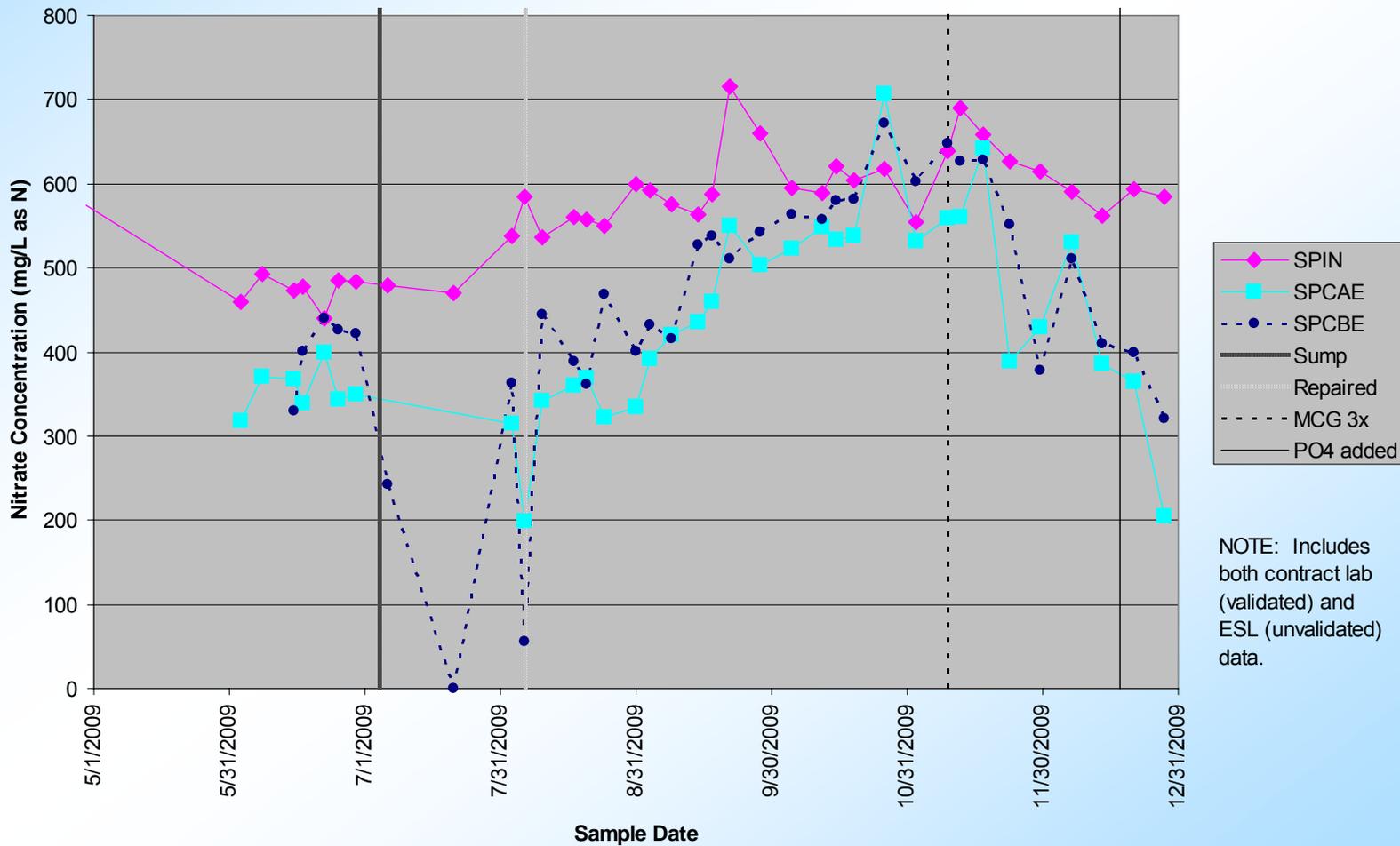
Selected Highlights From 2009: SPPTS (continued)

- Phase III includes two pilot-scale nitrate treatment cells
 - **Cell A**: inert media, influent dosed with liquid carbon nutrient, water recirculated through the cell
 - Maintained relatively uniform flow rate through 2009 (approximately 1/4 gpm)
 - Treatment effectiveness improved toward end of 2009 as dose rates increased, heat losses decreased
 - **Cell B**: organic media, passive flow-through
 - Flow rate reduced in late 2009 (from approximately 1/4 gpm to approximately 0.01 gpm, then to approximately 0.005 gpm)
 - Treatment effectiveness static or decreasing (heat loss) by end of 2009



Selected Highlights From 2009: SPPTS (continued)

CELL A, B PERFORMANCE



NOTE: Includes both contract lab (validated) and ESL (unvalidated) data.



Selected Highlights From 2009: SPPTS (continued)

- Current (spring 2010) status
 - Cell A (inert media, liquid carbon source)
 - Influent is typically 400 to 600 mg/L as nitrogen
 - Effluent typically below 30 mg/L as nitrogen
 - Often less than 10 mg/L as nitrogen
 - Cell B (corn stover)
 - Influent is typically 400 to 600 mg/L as nitrogen
 - Effluent typically over 400 mg/L as nitrogen
 - Corn stover media does not appear to be viable option for Phase IV
 - Phase II (uranium) cell
 - Influent is typically 55 to 75 µg/L
 - Effluent typically 30 to 45 µg/L (improved over 2009)
 - SPOUT/DG: nitrate averaging approximately 30s mg/L as nitrogen (to less than 1); uranium averaging approximately 20s µg/L



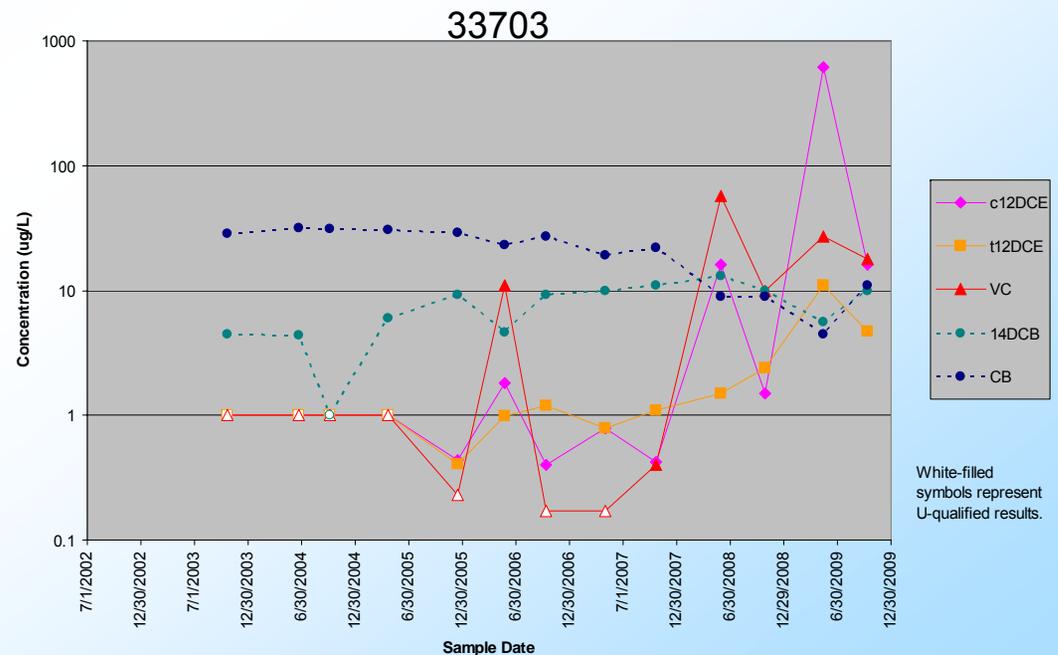
Selected Highlights From 2009: Other Plumes

- Groundwater contaminant plumes
 - Evaluation wells (monitor source areas) not scheduled for RFLMA sampling in 2009
 - Non-RFLMA samples collected from several to obtain additional data
 - Data from other wells (especially Sentinel) provide indication of conditions along plume margins
 - Data from AOC wells provide indication of impact of groundwater on surface water



Selected Highlights From 2009: Other Plumes

- Groundwater contaminant plumes (continued)
 - Vinyl Chloride Plume
 - Source area groundwater quality generally consistent with previous years
 - Plume is expanding to nearby downgradient Sentinel well 33703
 - Result of post-closure hydrologic regime: impervious surfaces were removed, allowing direct groundwater recharge

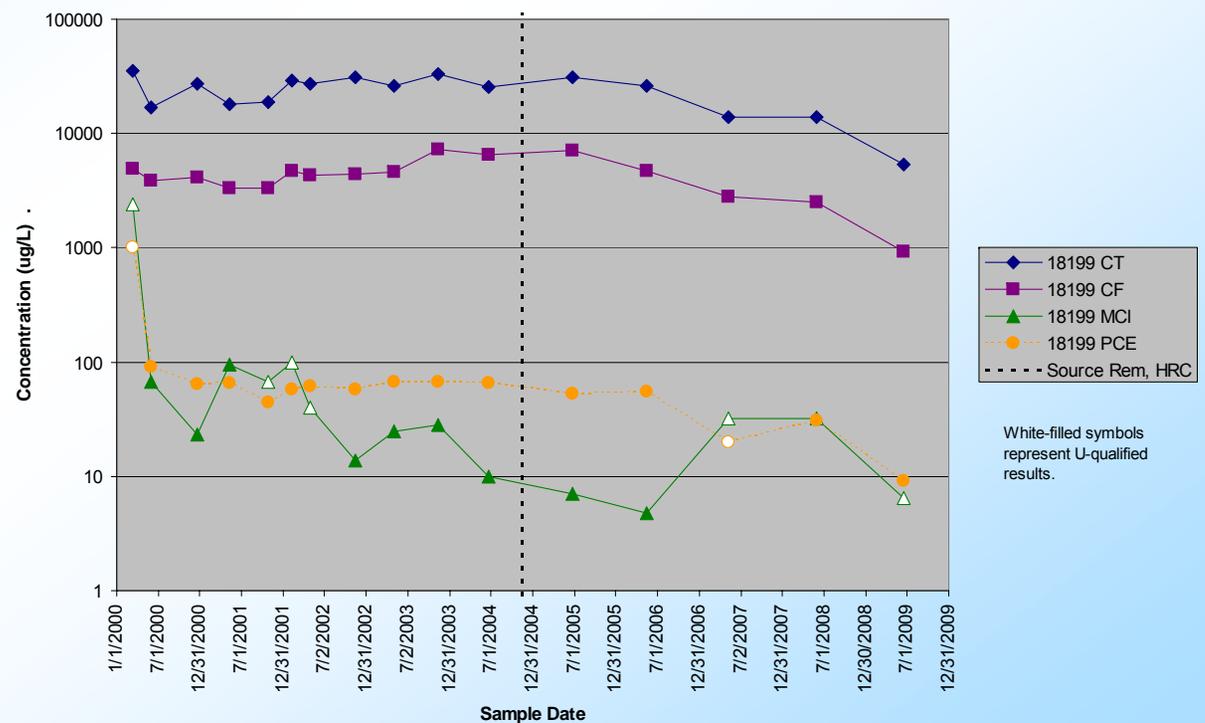


Selected Highlights From 2009: Other Plumes

■ Groundwater contaminant plumes (continued)

• IHSS 118.1 (Carbon Tetrachloride) Plume

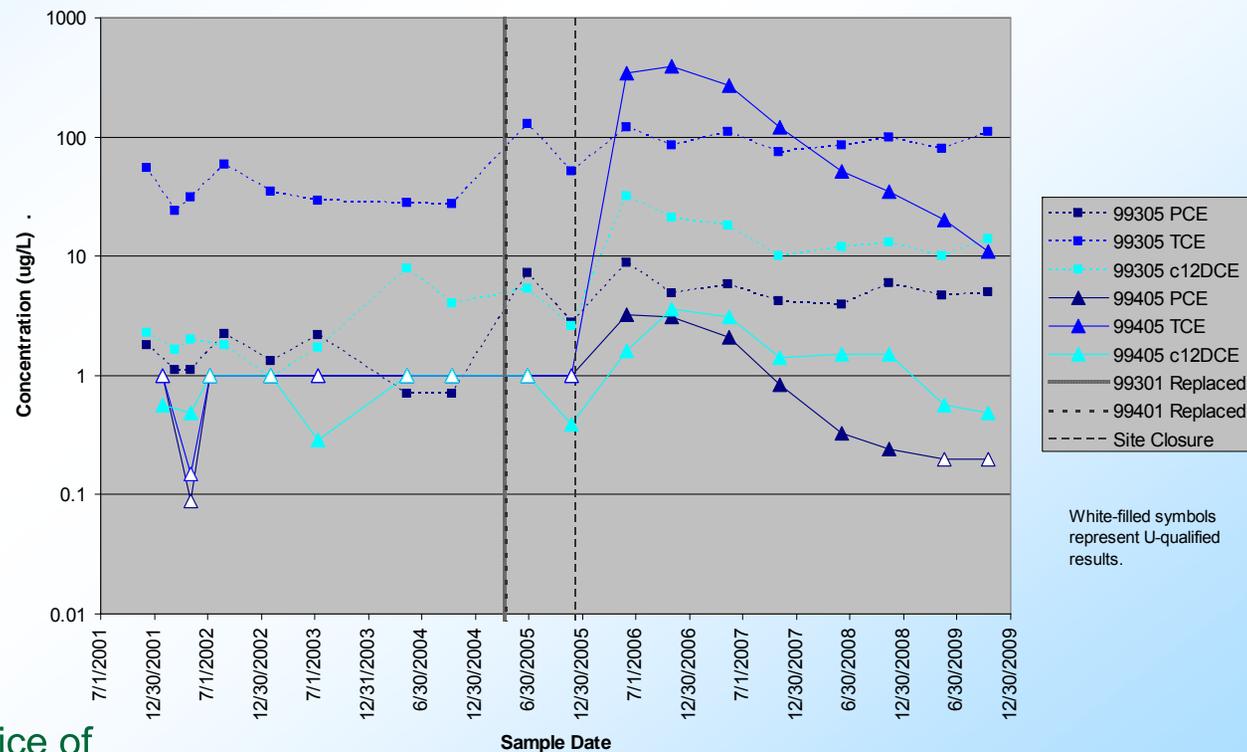
- Source-area groundwater quality shows carbon tetrachloride and chloroform (main contaminants) decreasing
- Degradation products are not increasing



Selected Highlights From 2009: Other Areas of Interest

■ B991

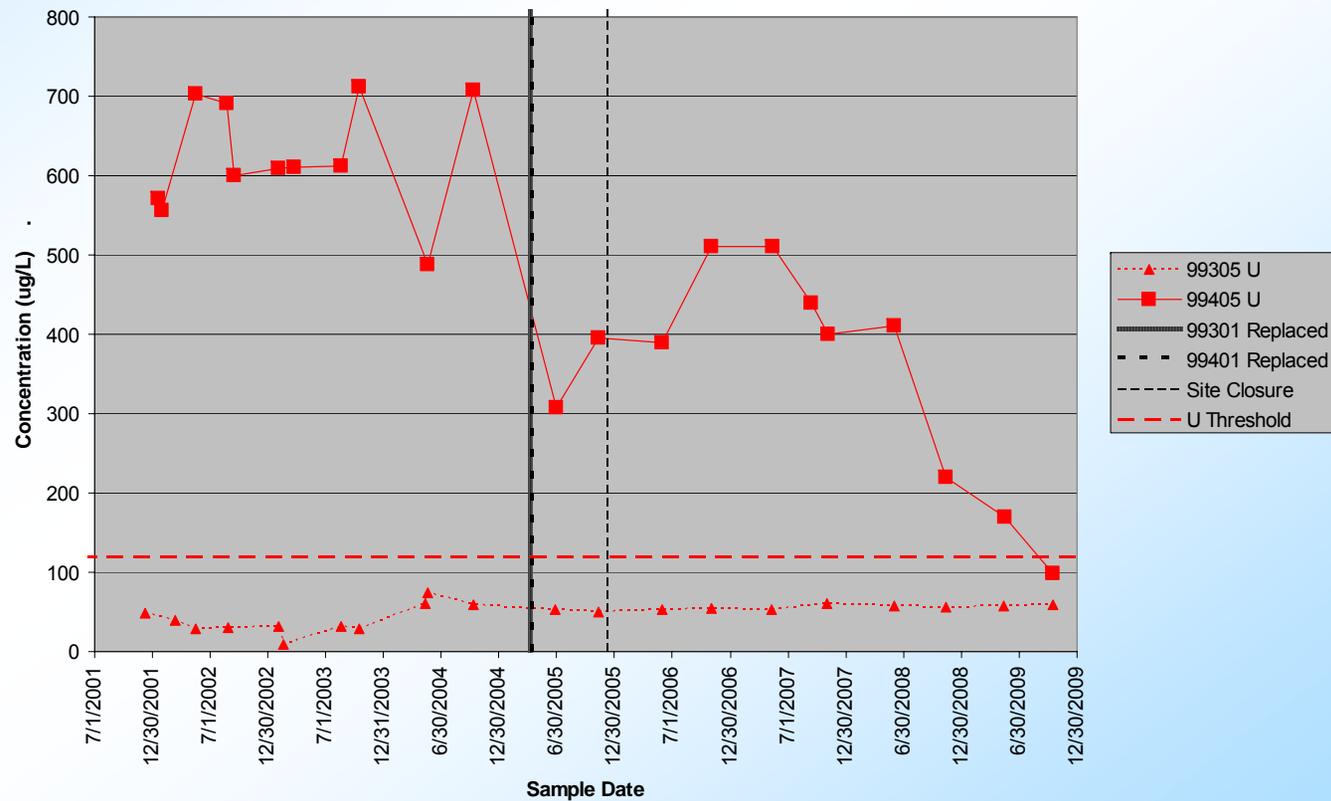
- VOCs in the well in former loading dock area (Sentinel well 99405) are decreasing
- VOCs in the well higher on hillside (Sentinel well 99305) have stabilized



Selected Highlights From 2009: Other Areas of Interest

■ B991 (continued)

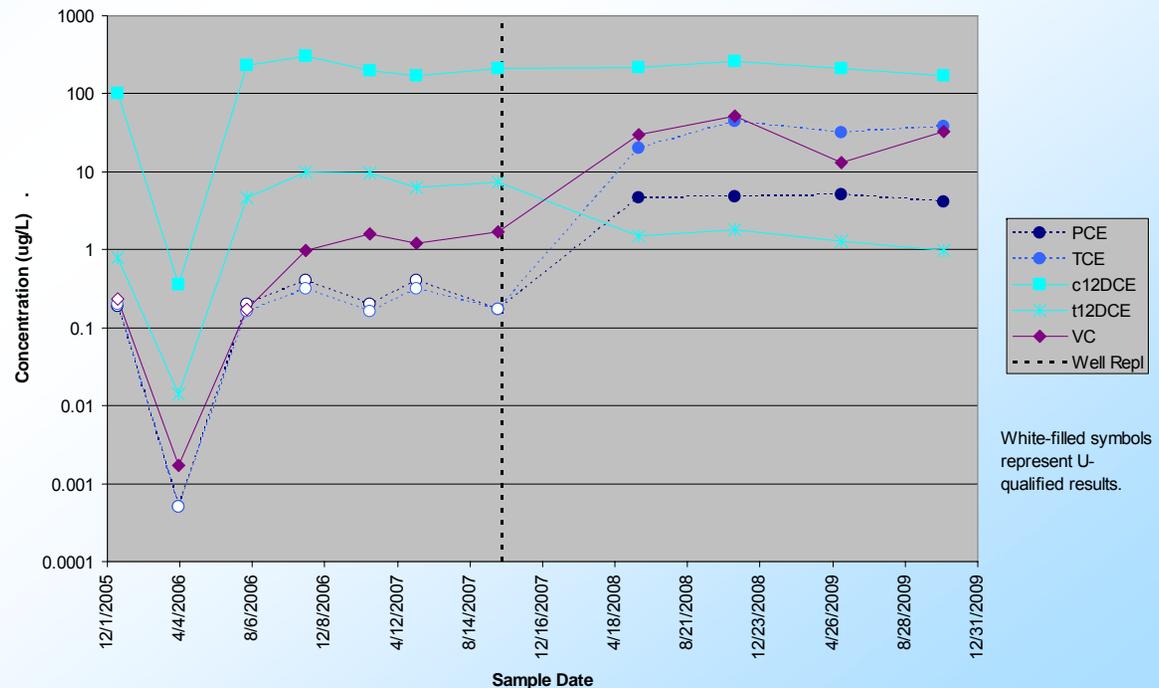
- Uranium in well 99405 is decreasing



Selected Highlights From 2009: Other Areas of Interest (continued)

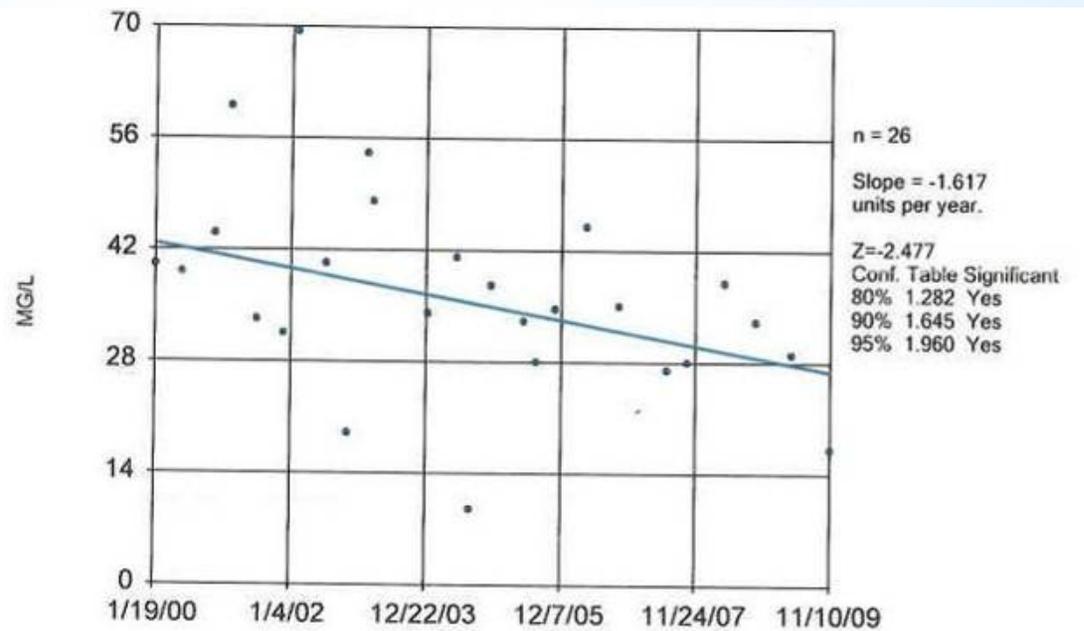
■ Hillside south of B991

- Concentrations of parent compounds initially increased, have since stabilized
- Changes coincide with well replacement following slump regrade
- Concentrations consistent with now-removed French drain outfall (well 45608 monitors groundwater collected by remnants of drain)



Selected Highlights From 2009 (continued)

- AOC well B206989 (east of Landfill Pond dam)
 - Entered reportable condition for nitrate in 2007
 - Incorporating 2009 data indicates decreasing trend, 95 percent significance
 - Monitoring continues



Questions?



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Annual Site (Central OU) Inspection

March 25, 2009

- Inspection and monitoring for evidence of significant erosion
 - Conduct visual observation for precursors of significant erosion
 - Evaluate proximity of any significant erosion to subsurface features
- Inspect effectiveness of institutional controls (ICs)
 - Determine effectiveness by any evidence of violation of ICs and determine whether required signs are in place
 - Verify that Environmental Covenant is in Administrative Record and on file with Jefferson County (verified March 31, 2009)
- Evidence of any adverse biological conditions observed during inspection



Annual Site Inspection (continued)

- Central OU divided into five areas:
 - A – Former 300 and 400 Areas
 - B – Former 700 and 991 Areas
 - C – Former 800 Area
 - D – Former 903 Pad and East Trenches Area
 - E – Former Ash Pits Area
- Landfills, treatment systems, and water monitoring stations inspected during the year on a routine basis
- Team walked down surface of each area (A–E) to observe conditions



Annual Site Inspection (continued)

- No significant erosion noted – minor holes, small animal evidence, and depressions identified
 - Very limited aerial extent – filled in
 - Debris and trash collected or flagged for pick up
- No adverse biological conditions noted
- No evidence of IC violations
- Signs in place



Update on WQCC Rulemaking

- Petition to adopt the statewide basic uranium standard (MCL 30 $\mu\text{g/L}$ [approximately 20 pCi/L]).
Hearing: January 12, 2009
 - WQCC recognized that changed conditions warranted revision
 - WQCD said that a mistake was made in promulgating uranium's statewide standard in 2005:
 - The range should be from 16.8 to 30 $\mu\text{g/L}$ (“hyphenated standard”)
 - The higher number applies as the end-of-pipe limit for discharge permits
 - The lower number is a health-based goal value derived using WQCC methodology per Policy 96-2
 - 10-6 incremental lifetime cancer risk
 - 2 liters drunk per day over a lifetime
 - Hyphenated standard is proposed by WQCD for adoption in 2010
Statewide Basic Standards triennial review



Update on WQCC Rulemaking (continued)

- WQCC revised the site-specific uranium standard to the 16.8 $\mu\text{g/L}$ (approximately 11.5 pCi/L) health-based standard
- A higher ambient-based standard may be addressed in the future, based on data and what is practical
- Gross alpha and gross beta standards were removed; specific radionuclides (uranium, plutonium, and americium) are being monitored



Update on WQCC Rulemaking (continued)

- Triennial review South Platte River Basin: hearing June 8, 2009
 - WQCC revised current arsenic standard (50 µg/L) to conform with new statewide water supply standard, effective January 1, 2010
 - New standard 0.02 to 10 µg/L (WQCC risk-based water consumption – EPA’s maximum contaminant level [MCL] for drinking water supply)
 - Water below MCL (based on 85th percentile of data) is considered in attainment with standard
 - Water at Rocky Flats is in attainment with new standard

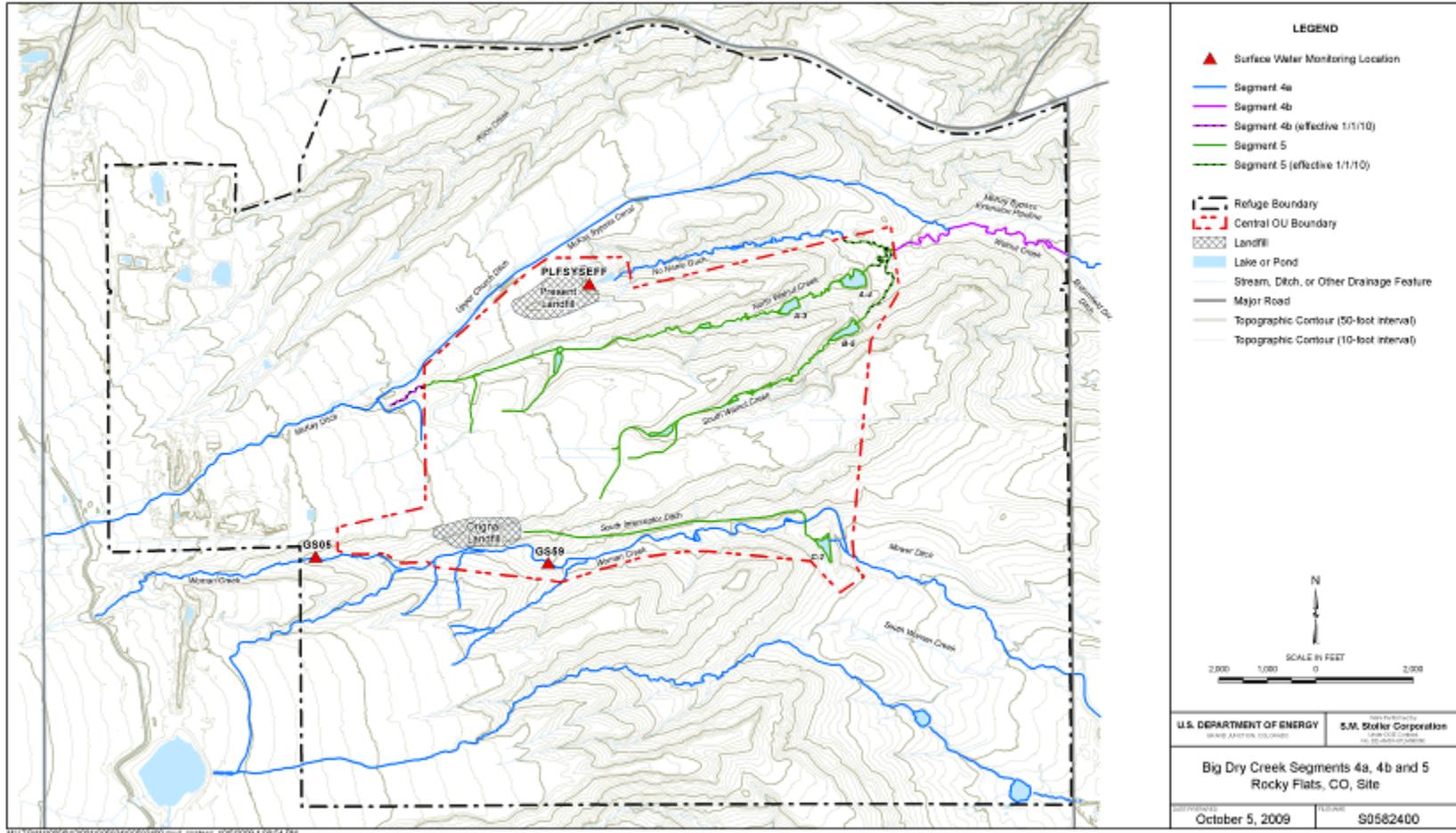


Update on WQCC Rulemaking

- Triennial review South Platte River Basin: hearing June 8, 2009 (continued)
 - WQCC changed segment 4b recreation use classification from N (no recreation use) to P (potential recreation use) based on establishment of refuge outside of Central Operable Unit (COU), effective January 1, 2010
 - *E. coli* standard changed from 630/100 mL to 205/100 mL
 - Segment 5 retains N classification
 - Portion of segment 4b now inside COU (from A-4 and B-5 terminal ponds to COU west boundary) will become segment 5
 - Portion of segment 5 outside COU (North Walnut Creek west of COU boundary) will become segment 4b



Stream Segment Changes



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Update on WQCC Rulemaking (continued)

■ Other Key Issues

- Temporary modifications for segment 5 expired December 31, 2009
 - Six VOCs – underlying standards (or PQLs if higher than standard) met at SW performance monitoring points
 - Nitrate in North Walnut Creek – underlying standard (10 mg/L) currently not met at GS13
 - SPPTS phase III upgrade (pilot scale) will provide data for phase IV, with goal to meet 10 mg/L
- Rocky Flats did not request any change to the temporary modification (TM) expiration date



2009 Ecological Monitoring Summary



2005

2010



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Project Assistance

- Project support for ecological issues was provided for the:
 - OLF projects
 - 2009 roads projects
 - East Trenches project
 - Annual Dam Mowing and Riprap Spraying project
 - Solar Ponds Plume Treatment System projects
 - Annual weed control efforts

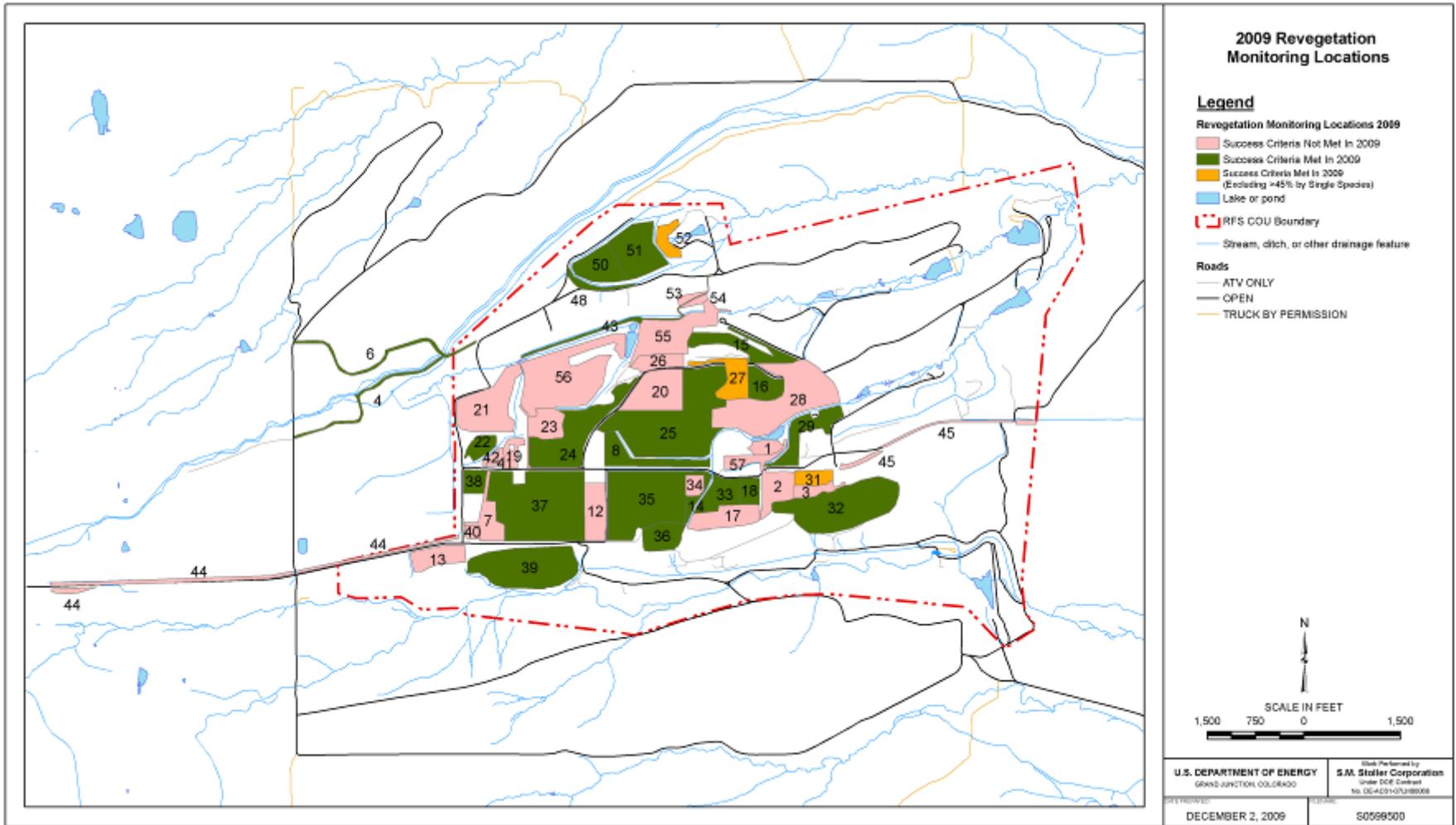


Ecological Monitoring

- OLF and PLF vegetation surveys
- Monthly weed surveys in the mitigation wetlands
- Revegetation monitoring
- Weed monitoring/mapping
- Preble's mouse mitigation monitoring
- Wetland mitigation monitoring
- Bluebird box monitoring



Revegetation Activities



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management



2004



2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

2003



2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

2004



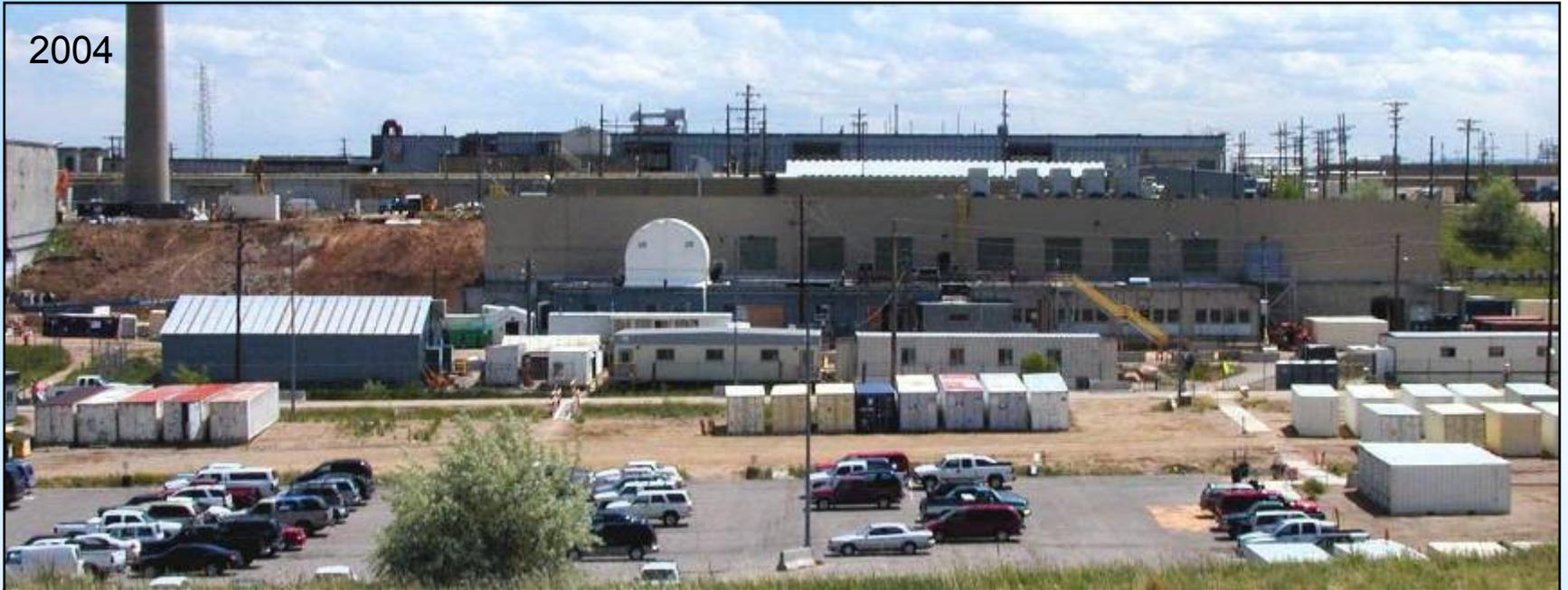
2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

2004



2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

2005



2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management



Bluebird Nest Boxes

9 nest boxes were built and installed in 2009

- 1 box with a tree swallow nest in 2009
- Several filled with twigs (probably house wrens)





Site Operations – Calendar Year 2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Site Operations

Original Landfill – Inspections

- 12 monthly inspections were performed in 2009
- Fourth-quarter inspections were completed on October 27, November 30, and December 30, 2009
- Settlement Monuments surveyed in March, June, September, and December; data are within the expected range per Monitoring and Maintenance Plan, which is between 1.34 and 2.86 feet depending on the location
- Surface cracking continuing in vicinity of Berm 1, indicating localized instability



Site Operations (continued)

OLF Seep #7 Drain Adjustments

- New surface expression of Seep #7 area located approximately 10 feet southwest of inclinometer 82608 documented in November. Observation of area is ongoing. Adjustment to drain may be needed to carry additional water observed after heavy precipitation.



OLF Settlement Monuments and Inclinometers

- Inclinometers were measured on October 27, November 25, and December 29, 2009
- Very little inclinometer deflection was noted during fourth quarter
- Review by geotechnical engineer – consistent with 2008 Geotechnical Report findings
 - Localized slumping occurs as groundwater levels saturate organic layer near bedrock
 - Continue monitoring and implementing maintenance to fill/grade surface cracking



OLF Observed Crack Location



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

Site Operations (continued)

Present Landfill – Inspections and Surveys

- Four quarterly inspections were completed in 2009
- The fourth-quarter inspection was completed on November 30; the vegetation inspection was completed on December 1
- The settlement monument surveys were completed in January and December 2009



Questions?



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management