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Resource Conservation and Recovery Act Groundwater Monitoring Summary

January through March 2010

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

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Resource Conservation and Recovery Act Groundwater Monitoring Summary

January through March 2010

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CH2M HILL Plateau Remediation Company

Date Published
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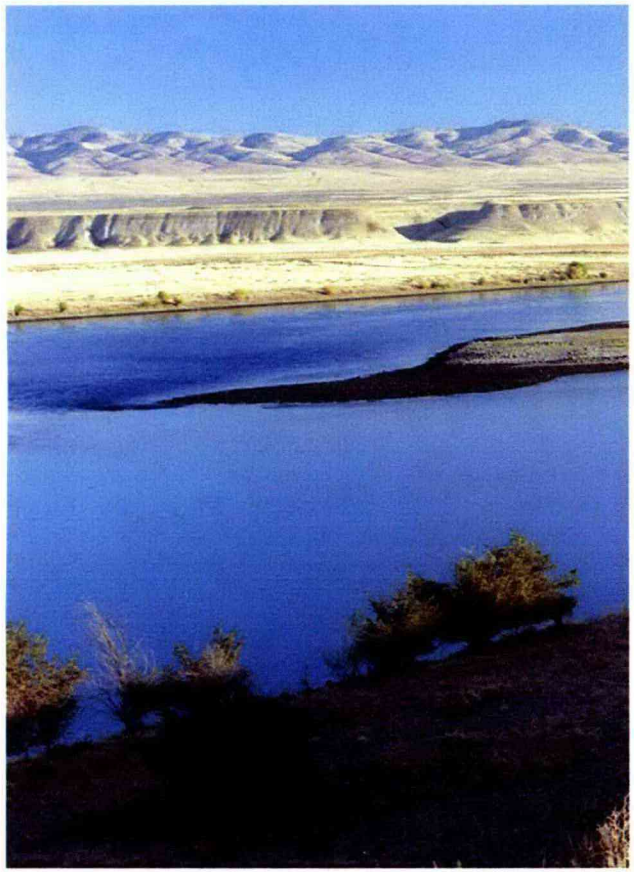

Resource Conservation and Recovery Act Groundwater Monitoring Summary – January through March 2010

Presented to: Washington State Department of Ecology

Presented by: Stuart P. Luttrell, John P. McDonald, and Jon W. Lindberg

One Team. One Culture.

CHPRC1008-38

Purpose

- Summarize status of Resource Conservation and Recovery Act (RCRA) sampling and analysis
- Report results of statistical analyses required by RCRA
- Present additional results of low-gradient evaluation in 200-East Area in relation to monitoring system adequacy
- Provide groundwater quality assessment results for Single-Shell Tank (SST) Waste Management Area (WMA) A-AX
- Summarize groundwater quality assessment and uranium results at WMA B-BX-BY

Sampling and Analysis Status

- **Five wells listed below were not sampled**

Well	Site	Scheduled	Comments
199-N-57	1301-N	3/10	Pump problem, not repaired in time
199-N-32	1325-N	3/10	Required different pump, not replaced in time
299-E33-9	SST B-BX-BY	2/10	No access, schedule reduced to semiannual
299-W11-12	SST T	1/10	Pump removed, bailer sample not collected
299-W19-44	SST U	2/10	Pump problem, not repaired in time

SST is Single Shell Tank

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Sampling and Analysis Status

- **Eleven wells were sampled after the end of the quarter**

Well	Site	Scheduled	Sample Date
299-E27-14	SST C	3/10	4/16/10
299-E27-155	SST C	3/10	5/13/10
299-E27-4	SST C	3/10	5/24/10
299-E27-23	SST C	3/10	5/25/10
299-W22-26	SST S-SX	3/10	4/18/10
299-W22-50	SST S-SX	3/10	4/05/10
299-W22-83	SST S-SX	3/10	4/05/10
299-W22-84	SST S-SX	3/10	4/18/10
299-W23-15	SST S-SX	3/10	4/05/10
299-W23-19	SST S-SX	3/10	4/23/10
699-25-34D	NRDWL	1/10	4/06/10

SST is Single Shell Tank; NRDWL is Nonradioactive Waste Landfill

Interim-Status Compliance Evaluation

- **Twelve sites are in an indicator evaluation program**

Site	Exceed Criteria?	Comments
1301-N Liquid Waste Disposal Facility (LWDF)	No	--
1324-N/NA Facilities	Yes	Specific conductance; ongoing trend
1325-N LWDF	Yes	Specific conductance; ongoing trend
216-A-29 Ditch	Not Sampled	--
216-B-3 Pond	No	--
216-B-63 Trench	Not Sampled	--
216-S-10 Pond and Ditch	No	--
LLWMA-1	Yes	Specific conductance; upgradient source
LLWMA-2	Not Sampled	--
LLWMA-3	NA	No upgradient wells for evaluation
LLWMA-4	Yes	TOX; trend from upgradient source
NRDWL	No	--

Note: TOC - total organic carbon; LLWMA - Low-Level Waste Management Area; TOX - total organic halides

Interim-Status Compliance Evaluation

- Eight sites are in a groundwater quality assessment program

Site	Sampled?
PUREX Cribs (216-A-10, 216-A-36B, 216-A-37-1)	Yes
SST A-AX Farms	Yes
SST B-BX-BY Farms	Yes
SST C Farm	Yes
SST S-SX Farms	Yes
SST T Farm	Yes
SST TX-TY Farms	Yes
SST U Farm	Yes

SST is Single Shell Tank

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Final-Status Compliance Evaluation

- Four sites in the Hanford Permit are monitored per WAC 173-303-645
- 100-N Area Cribs are in the Permit but evaluated under interim status

Sites in 173-303-645 Program	Sampled?	Comments
Liquid Effluent Retention Facility	Yes	No statistical evaluations
Integrated Disposal Facility	Yes	No waste in place
300 Area Process Trenches	Yes	Corrective action
183-H solar basins	No	Corrective Action

Indicator Parameter Exceedances

- 1324-N/NA Liquid Waste Disposal Facilities
  - Specific conductance continues above the critical mean
  - Caused by non-dangerous constituents
- 1325-N Crib
  - Specific conductance continues above the critical mean
  - Caused by non-dangerous constituents
- LLWMA-1
  - Specific conductance continues above the critical mean
  - Caused by upgradient sources
- LLWMA-4
  - TOX continues above the critical mean
  - Caused by regional carbon tetrachloride plume

200-East Area Groundwater Flow

- Systematic evaluation of water-level measurements continued
  - LLWMA-1, IDF/PUREX, and LLWMA-2/B-63/LERF
- LLWMA-1 recent results indicate overall north-northwest flow
  - No evidence of a flow reversal from late 2009 to early 2010, but flow may have been stagnant from September 2009 to May 2010

Date	Gradient Magnitude (m/m)	Gradient Direction (azimuth)	P-Value	Statistically Significant?
9/21/09	3.7E-06	008	0.573	No
10/27/09	6.0E-06	100	0.578	No
11/12/09	3.5E-06	259	0.893	No
1/21/10	1.1E-05	243	0.675	No
5/23/10	6.3E-06	358	0.502	No
6/30/10	1.8E-05	353	0.021	Yes

200-East Area Groundwater Flow

- **IDF/PUREX recent results are consistent with earlier results**
  - Flow direction is to the east-northeast
  - Long-term average flow direction (15 data sets): 079 degrees +/- 18 degrees (061 to 097)
  - Long-term average gradient magnitude: 2.1E-05 m/m +/- 0.24E-05 (1.9E-05 to 2.4E-05)

Date	Gradient Magnitude (m/m)	Gradient Direction (azimuth)	P-Value	Statistically Significant?	Number of Wells
12/30/09	2.8E-05	084	0.004	Yes	9
3/16/10	2.2E-05	041	0.007	Yes	8
6/30/10	1.3E-05	103	0.019	Yes	8

200-East Area Groundwater Flow

- LLWMA-2/B-63 Trench results appear inconclusive
  - Fifteen data sets (approximately monthly) using 8 wells
  - Results from nine data sets were significant
    - Most were between 20 to 32 degrees azimuth (north-northeast)
    - This flow toward the basalt subcrop is not reasonable
    - Gradient ranged from 4.4E-5 to 8.1E-6 m/m, and averaged 2.6E-5 m/m
    - Results are provided on the table on the next page
  - Initial conclusion is that the hydraulic gradient is currently too low to measure using water level measurements
  - Other possible techniques may need to be evaluated

200-East Area Groundwater Flow

- **LLWMA-2/B-63 Trench results**

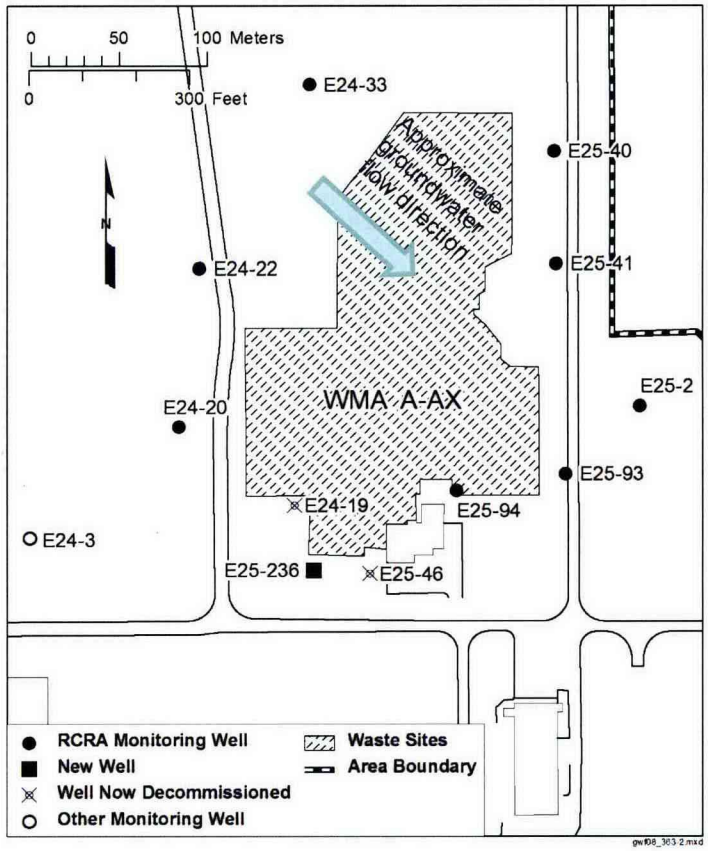
Date	Gradient Magnitude (m/m)	Gradient Direction (azimuth)	p-Value	Statistically Significant?	Number of Wells
3/24/09	2.4E-05	032	0.015	Yes	5
4/30/09	2.3E-05	021	0.220	No	4
5/28/09	1.9E-05	021	0.029	Yes	5
6/29/09	3.5E-05	028	0.021	Yes	6
7/27/09	3.7E-05	024	0.012	Yes	7
8/06/09	2.1E-05	028	0.073	No	4
9/22/09	2.0E-05	029	0.014	Yes	6
10/29/09	1.1E-05	028	0.125	No	4
11/12/09	1.2E-05	029	0.014	Yes	5
1/04/10	8.1E-06	314	0.022	Yes	7
1/20/10	3.4E-05	224	0.012	Yes	5
2/18/10	2.2E-05	023	0.076	No	4
3/10/10	3.2E-05	029	0.234	No	4
5/23/10	1.5E-04	192	0.126	No	4
6/30/10	4.4E-05	020	0.011	Yes	7

200-East Area Groundwater Flow

- LERF results
  - Eight data sets were measured between February 2009 and June 2010, using a three-well network
  - Directions range from 132 to 254 degrees azimuth, with a mean of 184 degrees +/- 20 degrees (164 to 204)
  - Transducers were installed in two wells
  - Continue to measure and evaluate water level data

SST A-AX Groundwater Assessment Results

- Groundwater assessment (PNNL-15315) began in 2006 under a "first determination"
  - Well 299-E25-236 was installed in 2008 to complete the well network
  - Sampling and analysis results were also compared with analyte lists in the Tank Closure DQO
  - Dangerous constituents barium and nickel were detected



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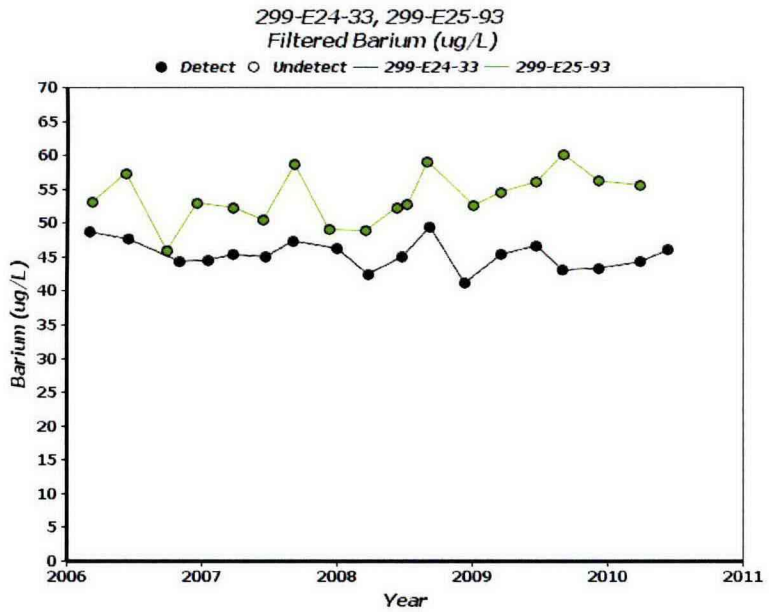
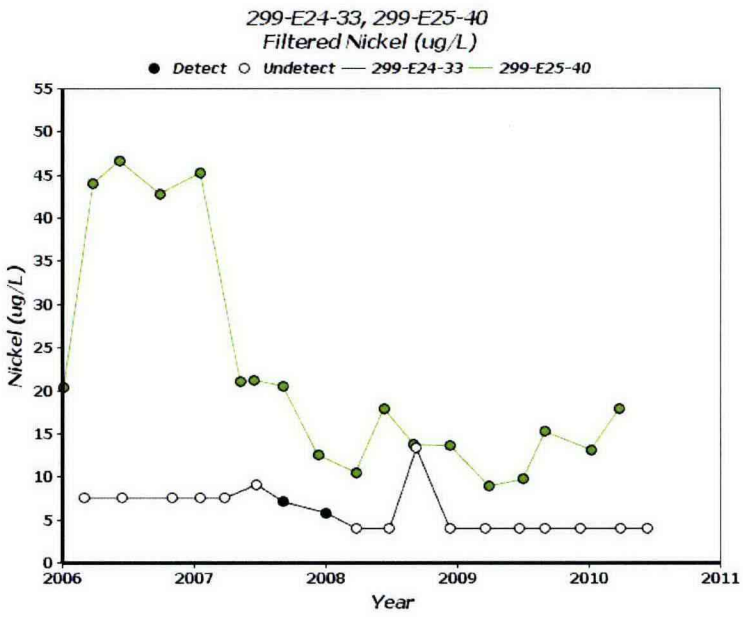
SST A-AX Groundwater Assessment Results

- Barium and nickel levels observed in downgradient wells were statistically significant relative to levels in upgradient wells
- Barium is below the site background of 105 ug/L (90% confidence)
- Nickel is above the site background of 1.56 ug/L (90% confidence)





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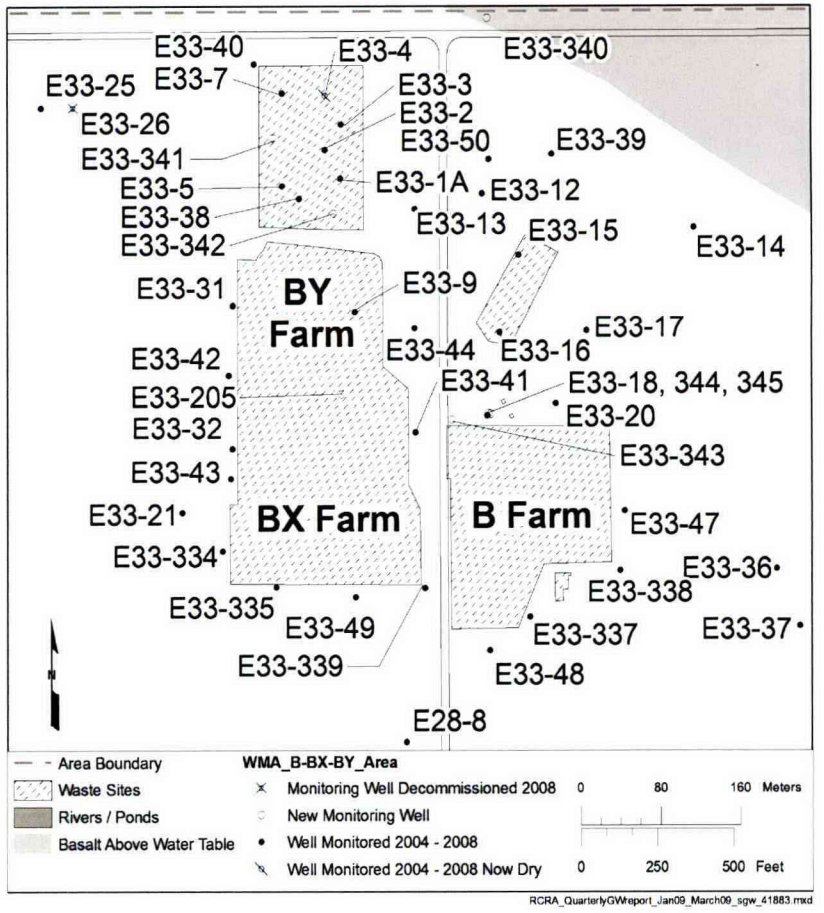
SST A-AX Groundwater Assessment Results

- SST A-AX groundwater quality assessment plan will be revised
  - Similar to other single shell tank monitoring plans
    - Quarterly sampling and analysis for selected dangerous constituents and geochemical parameters
    - Sampling and analysis once for the overlapping list of Tank Closure DQO constituents with Appendix V (Ecology publication 97-407) constituents
    - Radionuclides will be analyzed under the 200-PO-1 requirements
  - Plan to submit Draft A to Ecology by 9/30/2010

Groundwater Quality Assessments

- **SST B-BX-BY**
  - Contaminant plumes of cyanide, nitrate, Tc-99, and uranium extend to the northwest at least 1,500 m
  - BY Cribs are the main source of cyanide, nitrate, and Tc-99
  - The 241-BX-102 overfill is the main source of uranium contamination



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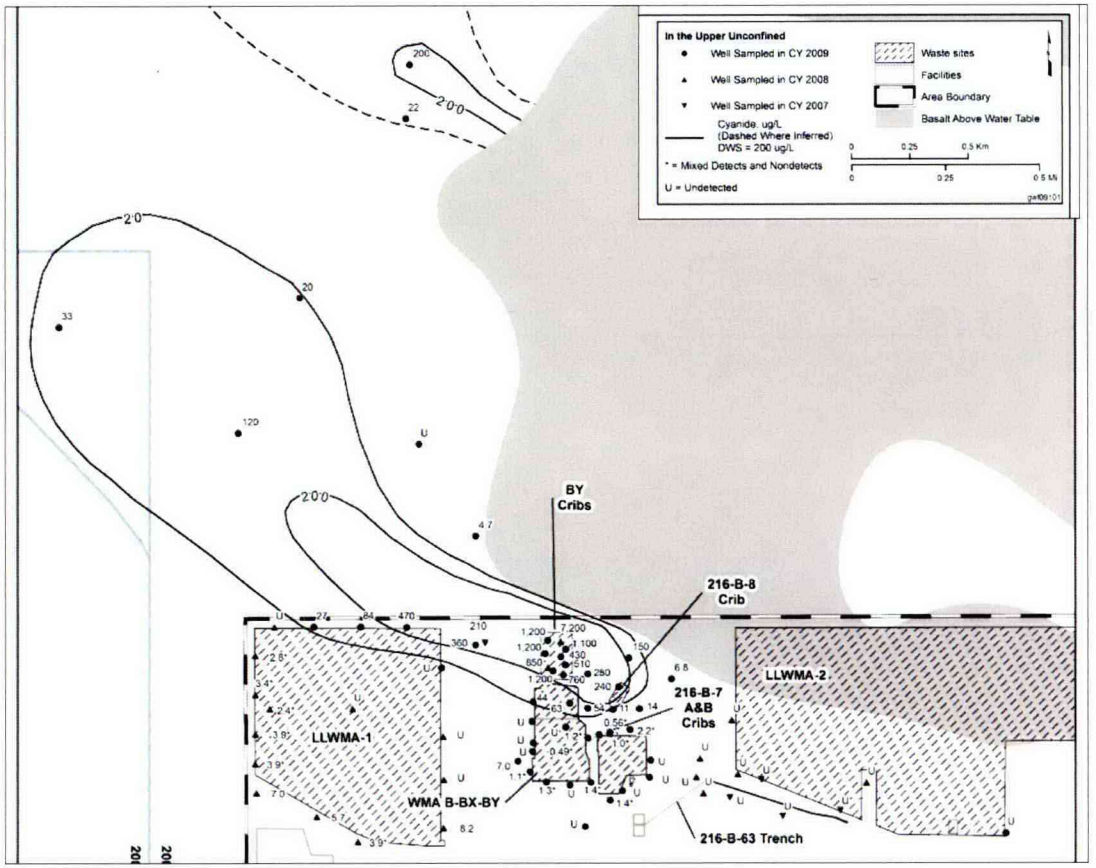
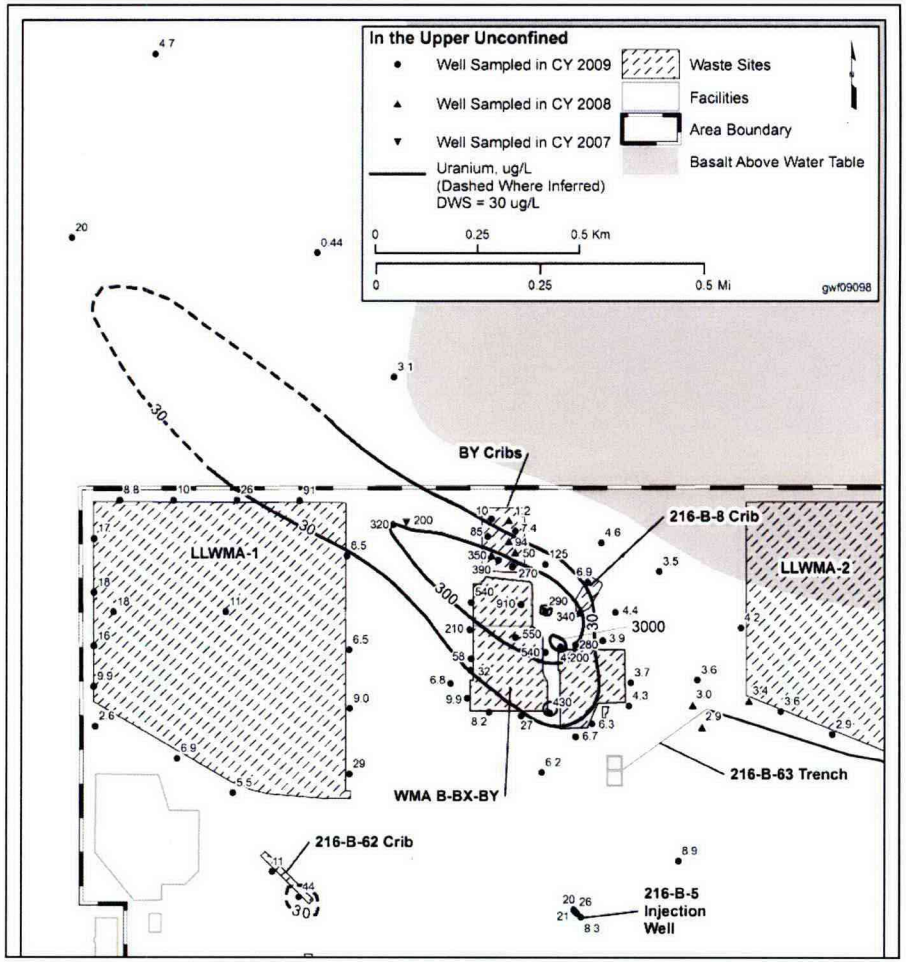
Groundwater Quality Assessments

- **SST B-BX-BY (cont)**
  - Cyanide is a dangerous constituent (plume from 2009 shown)
  - Levels increased to 1,590 µg/L in well 299-E33-7
  - Primary source is the BY Cribs



Groundwater Quality Assessments

- SST B-BX-BY radionuclides
  - Uranium and Tc-99 not regulated under RCRA
  - May results: uranium was 3,610 ug/L in groundwater and 1,660 ug/L in the perched water table (2009 plume shown)
  - T-99 continues to rise in most wells



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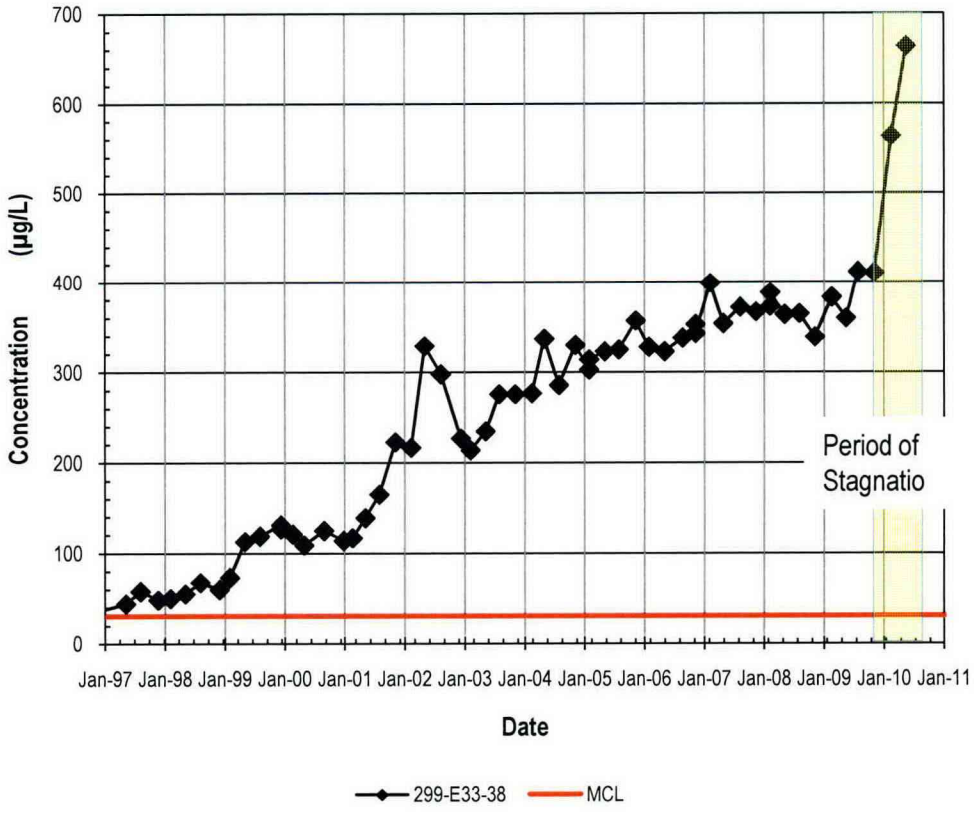
Groundwater Quality Assessments

- SST B-BX-BY radionuclides
  - Uranium increased 27% in well 299-E33-38 (figure) and 34% in well 299-E33-31 (not shown) from the previous quarter
  - Increase may be due to spreading of the plume from groundwater stagnation between October and May



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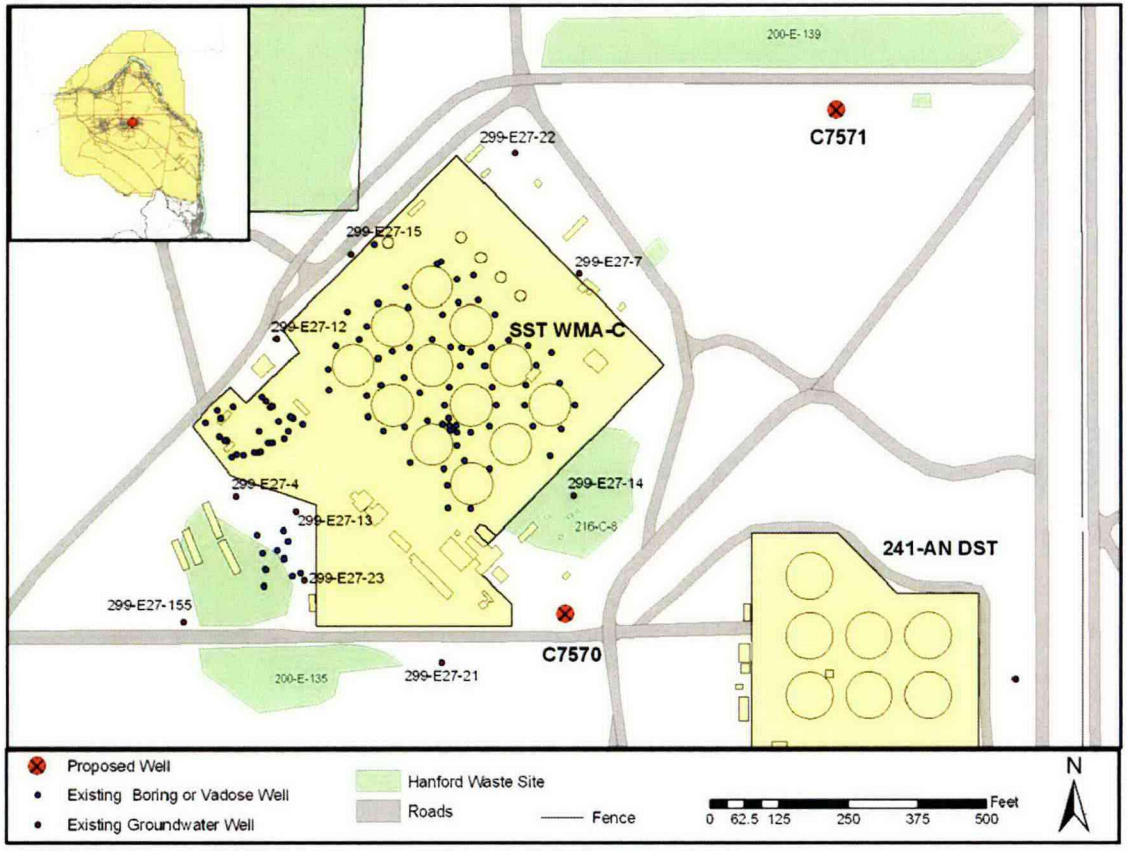
Groundwater Quality Assessments

- **SST C**
  - Cyanide is a dangerous constituent in groundwater
  - Organic constituents were not detected
  - Construction began on two new wells (awaiting pumps)



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Groundwater Quality Assessments

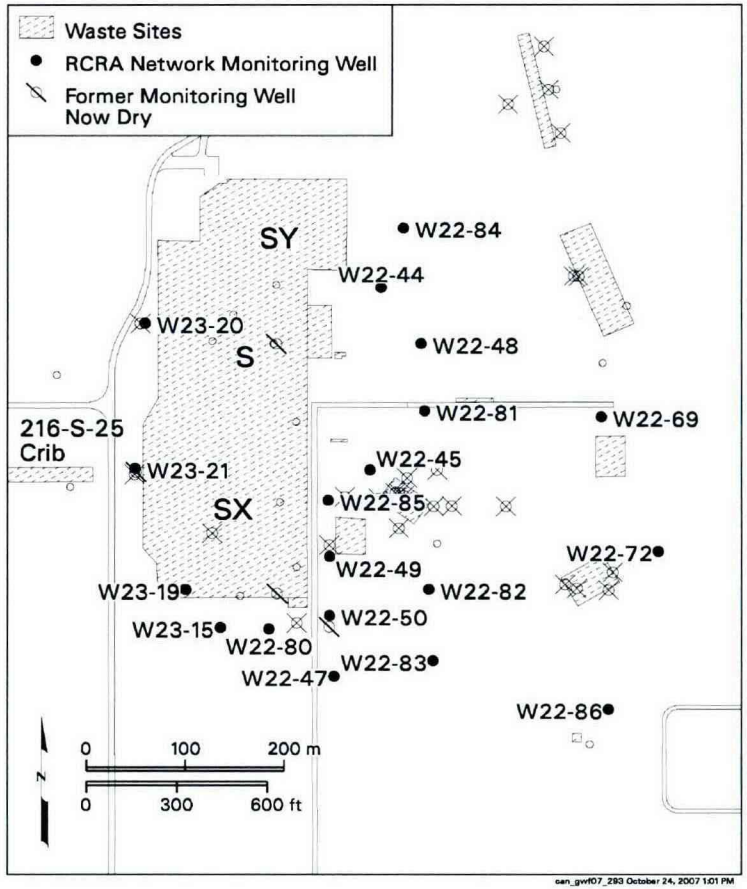
- SST C (continued)
  - Contaminants include nitrate, sulfate, cyanide, Tc-99, and iodine-129
  - Cyanide was detected in five wells in March – May samples
    - 17.5 ug/L in 299-E27-7
    - 17.5 ug/L in 299-E27-14
    - 4.01 ug/L in 299-E27-4
    - 4.41 and <4.0 (duplicate) ug/L in 299-E27-23
    - 5.2 ug/L in 299-E27-155

Groundwater Quality Assessments

- SST C (continued)
  - Depth-discrete samples were collected from wells 299-E27-7, 299-E27-21, and 299-E27-23 as part of the 200-BP-5 RI
    - Nitrate and sulfate were slightly elevated with depth
    - Tc-99 was up to an order of magnitude higher in the deep vs shallow sample intervals – may indicate dangerous constituents at depth
  - Volatile, semi-volatile, and pesticide analyses will not be analyzed in future samples (except in new wells) – this is in accordance with the plan (DOE/RL-2009-77, Rev 0)
  - Recent geochemical and contaminant evaluation suggests groundwater flow is trending to the southeast

Groundwater Quality Assessments

- **SST S-SX**
  - Major plumes of chromium, nitrate, and Tc-99 continue migrating to the east
  - One new well is being installed south of 299-W22-47 to bound the south edge of the SX plume



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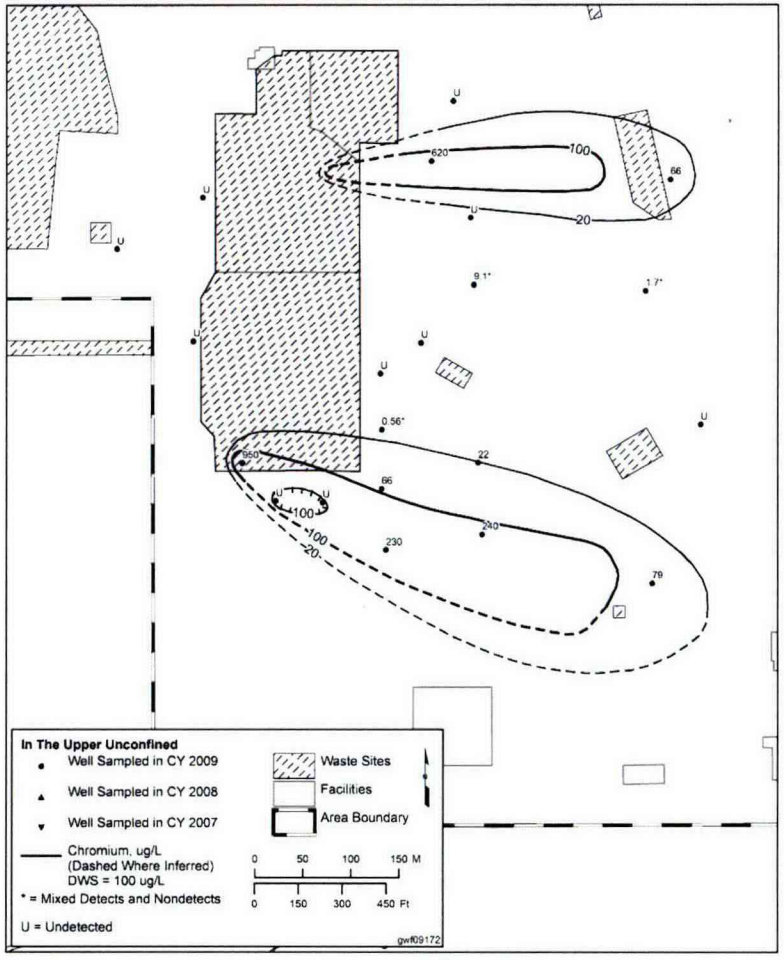
Groundwater Quality Assessments

- **SST S-SX (cont)**
  - The S Farm chromium plume extends east at least to 299-W22-26
  - The SX Farm chromium plume extends east at least to 299-W22-86
  - Chromium 2009 plumes are shown to the right



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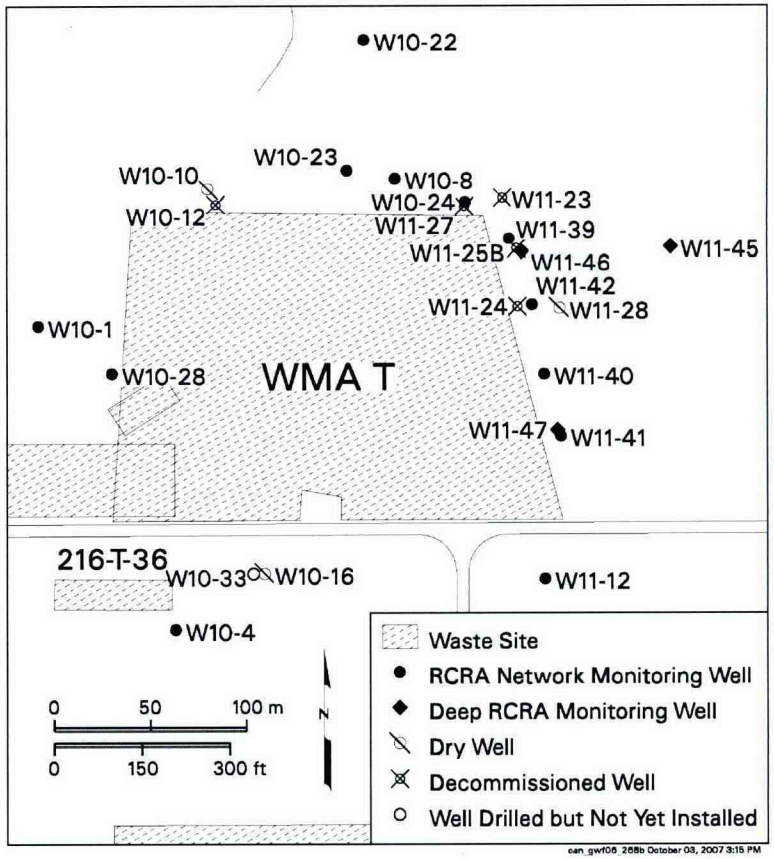
Groundwater Quality Assessments

- **SST T**
  - Plumes of chromium, nitrate, and Tc-99 underlie and extend east of the WMA
  - Chromium is a dangerous constituent
  - Chromium extends ~100 m east to well 299-W11-45, where it was 133 ug/L (unfiltered); well is screened 5.5 to 10 m below the water table



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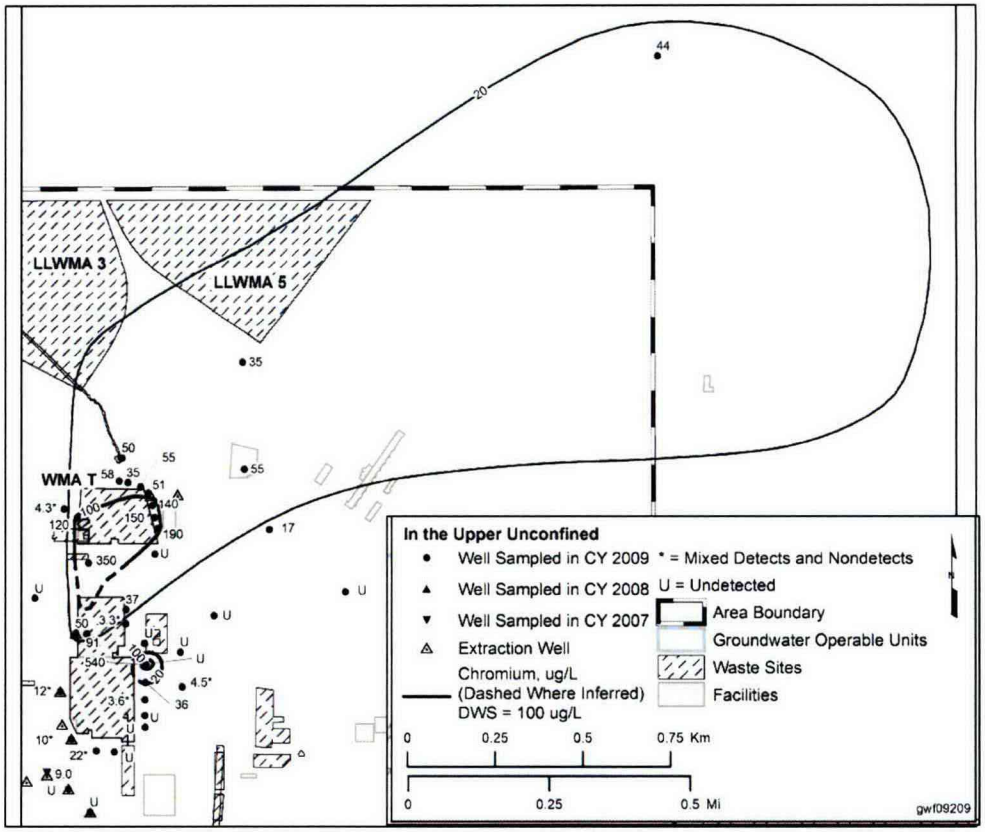
Groundwater Quality Assessments

- **SST T (cont)**
  - Chromium (figure) extends past the northeast edge of 200-West Area
  - Chromium is also found in deeper wells
    - 168 ug/L in 299-W11-47 (deeper) and 156 ug/L in 299-W11-41
    - 114 ug/L in 299-W11-46 (deeper) and 48.5 ug/L in 299-W11-39



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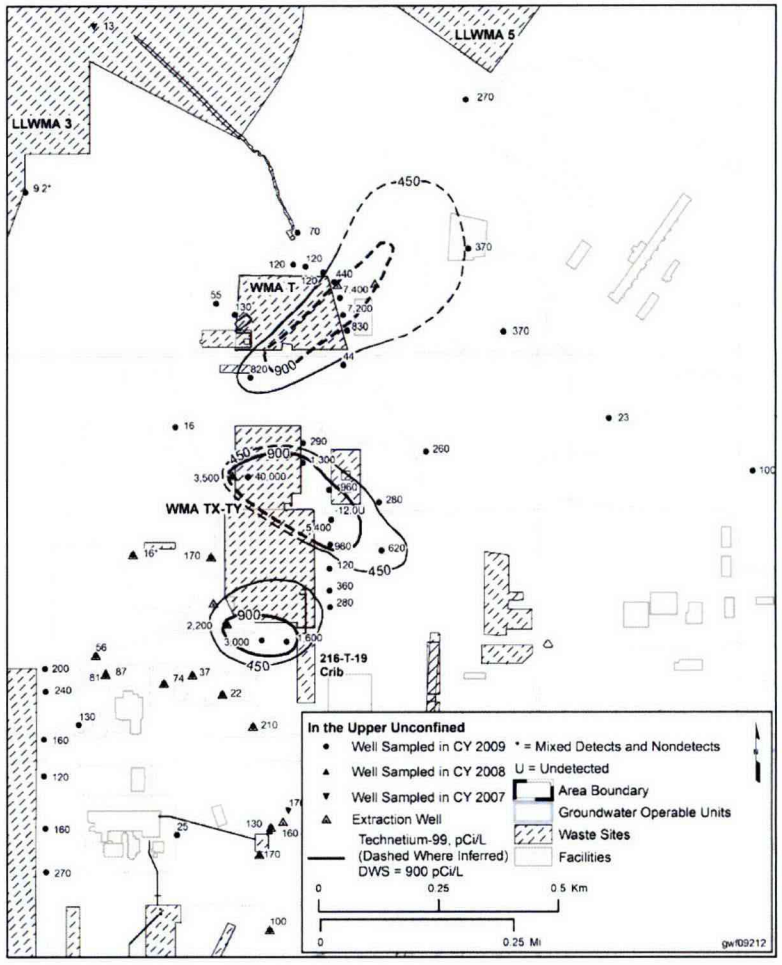
Groundwater Quality Assessments

- **SST T (continued)**
  - **Tc-99 is not regulated under RCRA**
  - **Maximum level for Tc-99 was 9,900 pCi/L in well 299-W11-40**
  - **Tc-99 plume also extends beyond the northeast edge of 200-West Area (240 pCi/L in 699-48-71 is not shown on the figure)**



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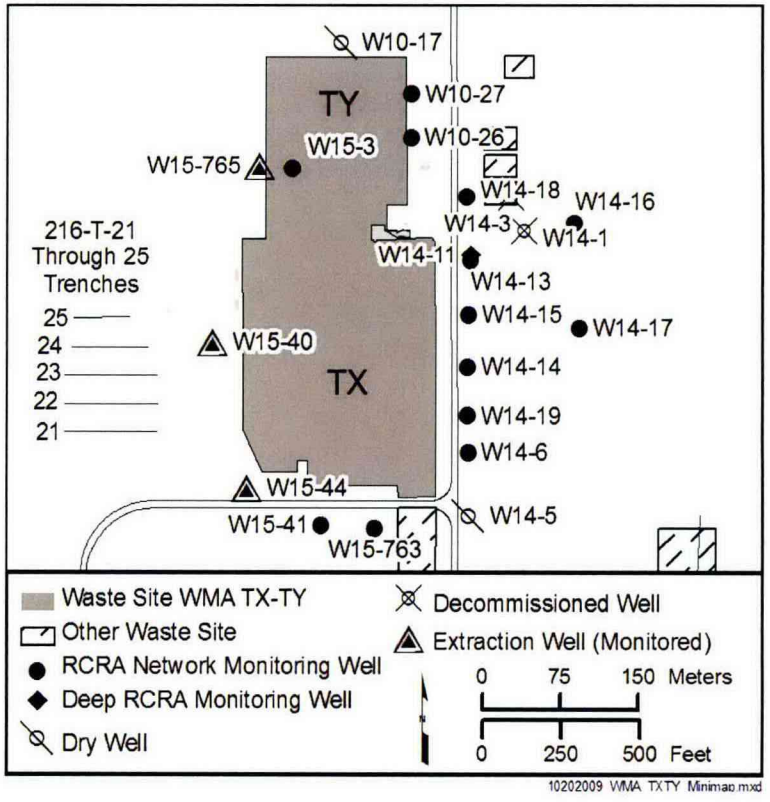
Groundwater Quality Assessments

- **SST TX-TY**
  - Plumes of chromium, nitrate, Tc-99, tritium, and I-129 underlie the WMA (see maps on earlier slides)
  - Contamination sources include the tank farm, the 242-T evaporator and nearby cribs
  - Tc-99 continues to be elevated in 299-W14-17 (840 pCi/L in March) indicating migration eastward



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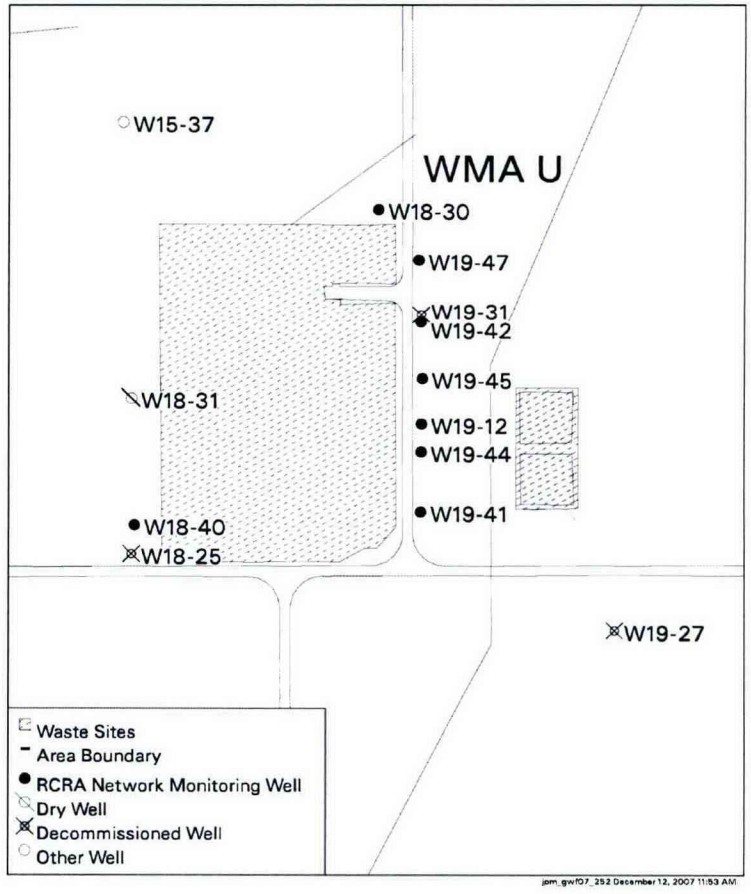
Groundwater Quality Assessments

- SST TX-TY (continued)
  - Maximum contaminant levels in respective wells are as follows:
    - Chromium was 731 ug/L (unfiltered), in 299-W14-13
    - Nitrate was 460 mg/L in 299-W10-27
    - Tc-99 was 6,900 pCi/L in 299-W14-13
    - Tritium was 1.6 million pCi/L in 299-W14-13
    - Iodine-129 was 34.5 pCi/L, also in 299-W14-13

Groundwater Quality Assessments

- **SST U**
  - Plumes of nitrate and Tc-99 lie beneath the SST U Farm; the contamination source is the tank farm
  - There are no dangerous constituents in groundwater directly related to the tank farm



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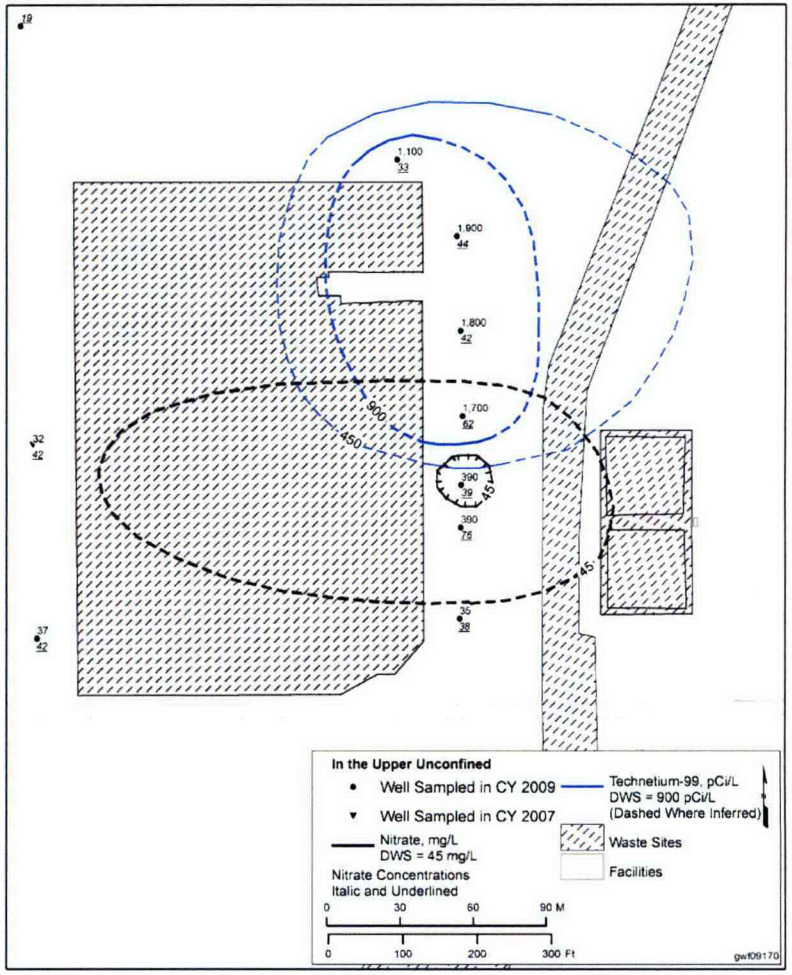
Groundwater Quality Assessments

- **SST U**
  - **Plumes of nitrate and Tc-99 for 2009 are shown (figure)**
  - **January – March 2010 results:**
    - **Four wells exceeded Tc-99 DWS: maximum of 2,200 pCi/L**
    - **Three wells exceeded nitrate DWS: maximum of 67 mg/L**



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Groundwater Quality Assessments

- PUREX Cribs (216-A-10, 216-A-36B, 216-A-37-1)
  - The 216-A-10 Crib is no longer a TSD
  - The groundwater monitoring plan will be revised and will consist of two separate plans for the remaining two cribs
  - Groundwater monitoring may return to indicator evaluation monitoring
  - Revised groundwater monitoring plans for 216-A-36B and 216-A-37-1 scheduled for release by 9/30/2010