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JUN 22 2015

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PPPO-02-2923210-15C

Ms. April Webb
Acting Interim Federal Facility Agreement Manager
Division of Waste Management
Kentucky Department for Environmental Protection
200 Fair Oaks Lane, 2nd Floor
Frankfort, Kentucky 40601

Dear Ms. Corkran and Ms. Webb:

**TRANSMITTAL OF THE DOCUMENT CONCERNING TRICHLOROETHENE AND
TECHNETIUM-99 GROUNDWATER CONTAMINATION IN THE REGIONAL
GRAVEL AQUIFER FOR CALENDAR YEAR 2014 AT THE PADUCAH GASEOUS
DIFFUSION PLANT PADUCAH, KENTUCKY (PAD-ENR-0146)**

Please find enclosed for your information the subject document, *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2014 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD-ENR-0146.

If you have any questions or require additional information, please contact David Dollins at (270) 441-6819.

Sincerely,

A handwritten signature in cursive script that reads "Jennifer Woodard".
Jennifer Woodard
Paducah Site Lead
Portsmouth/Paducah Project Office

Enclosure:

TCE and Tech-99 Groundwater Contamination in the Regional Gravel Aquifer for CY 2014

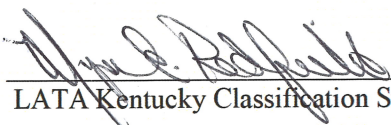
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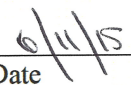
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**Trichloroethene and Technetium-99 Groundwater
Contamination in the Regional Gravel Aquifer for
Calendar Year 2014 at the
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**



This document is approved for public release per review by:


LATA Kentucky Classification Support


Date

**Trichloroethene and Technetium-99 Groundwater
Contamination in the Regional Gravel Aquifer for
Calendar Year 2014 at the
Paducah Gaseous Diffusion Plant,
Paducah, Kentucky**

Date Issued—June 2015

Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
LATA Environmental Services of Kentucky, LLC
managing the
Environmental Remediation Activities at the
Paducah Gaseous Diffusion Plant
under contract DE-AC30-10CC40020

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ACRONYMS

LATA Kentucky	LATA Environmental Services of Kentucky, LLC
MCL	maximum contaminant level
MW	monitoring well
OREIS	Oak Ridge Environmental Information System
PGDP	Paducah Gaseous Diffusion Plant
RGA	Regional Gravel Aquifer

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1. INTRODUCTION

LATA Environmental Services of Kentucky, LLC, (LATA Kentucky) has evaluated groundwater analytical data as of the end of calendar year 2014 to produce revised groundwater plume maps for both trichloroethene (TCE) and technetium-99 (Tc-99) within the Regional Gravel Aquifer (RGA), associated with the U.S. Department of Energy's Paducah Gaseous Diffusion Plant (PGDP) in Paducah, Kentucky. The two primary groundwater plume constituents are TCE and Tc-99. This report presents the analytical data sets taken from the Paducah Oak Ridge Environmental Information System (OREIS) data system, methods used to develop these maps, and changes to the contaminant plumes over time. These plume maps are intended to show the most recent sample result from each location as of the end of calendar year 2014. For wells that were not sampled in 2014, the most recent data from 2013 have been used. These plume maps are based on the most recent values for 2014 or 2013; thus, they may not reflect the maximum or minimum value observed during the reporting period for all locations.

The plume maps depict the general footprint of the TCE and Tc-99 contamination in the RGA and convey the general magnitude and distribution of contamination within the plumes. The PGDP groundwater plume maps are revised every two years to provide a basis for timely incorporation of routine groundwater monitoring and characterization data, demonstrate the progress of groundwater cleanup to date, and facilitate planning to optimize the site groundwater cleanup. The plume maps also compliment reporting of results of environmental monitoring programs and activities in the PGDP Annual Site Environmental Report. These plume maps are used, along with additional information, to further evaluate specific areas of groundwater contamination at PGDP in more detail for decision-making purposes based on individual project needs. More specific project evaluations are discussed in applicable documents, which are available through the U.S. Department of Energy's Environmental Information Center (www.paducaheic.com).

The maps and data tables (including charts of TCE and Tc-99 sampling results collected for the last 10 years) used to generate maps referenced in this document are included in the Appendices. Appendix A contains tables and charts of TCE and Tc-99 sampling results collected for the last 10 years, which includes the minimum and the maximum values observed during 2014. Appendix B contains the most recent 2014 and 2013 values from PGDP RGA monitoring wells (MWs) used to develop the plume maps. Appendix C provides large-scale maps of PGDP's entire well network for the RGA and the interpretation of the 2014 plume maps.

The isoconcentration contours of contaminant levels that appear on the maps have been depicted based on the most recently observed distribution of contaminant concentrations and knowledge of the site conceptual model. The magnitude and distribution of contamination within the plumes will vary slightly from year to year based on contaminant trends and variations in hydrologic influences.

2. BASIS OF ANALYSIS

All data used in these maps were extracted from the Paducah OREIS database. Paducah OREIS is the centralized, standardized, quality assured, and configuration-controlled data management system that is the long-term repository of environmental data (measurements and geographic) for Paducah projects. (See Table B.1 in Appendix B for the 2014 TCE and Tc-99 results in RGA wells and the data used to create the 2014 TCE and Tc-99 plume maps.) The maps for calendar year 2014 are based on analytical results from the most recent sampling event (primarily January–December 2014). Where co-located monitoring wells

(i.e., clustered wells or multiport wells) provide analytical results for the calendar year from screened intervals at multiple elevations within the RGA (e.g., upper, middle, and/or lower RGA), the maps use the value from the interval that has the highest concentration. Data from sampling in 2013 have been used, as necessary, to supplement the 2014 information and aid in plume delineation.

Mapping involved first plotting the selected data on Geographic Information System-generated maps and then comparing those data to the contouring performed for the 2012 TCE and Tc-99 plume maps. Plume contours were adjusted to accommodate more recent data. On the 2014 plume maps shown in Appendix C, dashed lines are used for the contours to indicate that maps represent interpolation and extrapolation of spatially limited TCE and Tc-99 data. On the 2014 plume maps shown in the main text, dashed lines show the contour lines from the 2012 plume maps for comparison.

For TCE, the Safe Drinking Water Act maximum contaminant level (MCL) of 5 µg/L is the isoconcentration contour that defines the limit of the plume. Subsequent isoconcentration contours of 100 µg/L, 1,000 µg/L, 10,000 µg/L, and 100,000 µg/L are provided based on concentration data for the period. For Tc-99, 900 pCi/L defines the plume limit.¹

3. 2014 PLUME MAPS

Figure C.1 of Appendix C is a map of PGDP’s entire well network for the RGA. According to the “Well Program Inventory” in the Environmental Monitoring Plan, there are 244 active MWs, plus piezometers and extraction wells, and 6 residential wells that can be used to monitor the RGA (LATA Kentucky 2013). The PGDP environmental remediation prime contractor monitored a subset of this well network in 2014, as discussed below, in accordance with the environmental monitoring program.

Figures C.2 and C.3 of Appendix C provide the interpretation of the 2014 plume maps. Table 1 presents a summary of these plumes. Because these plumes are based on interpretation, off-site² plume length and areas are approximated.

Table 1. PGDP Groundwater Plumes, CY 2014

Plume	Approximate Maximum Off-Site ^a Contaminant Levels	Off-Site ^a Plume Length	Approximate Total Area of Minimum Contour ^b
<i>Trichloroethene</i>			
Northwest	300 µg/L	2.9 miles	808 acres
C-746-S&T Area	20 µg/L	0.62 miles	76 acres
Northeast	240 µg/L	2.3 miles	950 acres
Southwest	10 µg/L	0.04 miles	95 acres
<i>Technetium-99</i>			
Northwest	N/A	N/A	19 acres

^a Off-site indicates plume outside Limited Area (i.e., PGDP boundary shown on maps).

^b Total area indicates plume both inside and outside the Limited Area (i.e., PGDP boundary shown on maps).

¹ EPA derived the 900 pCi/L value from the 4 mrem/yr MCL for Tc-99, a beta emitter in 1976, but has never promulgated 900 pCi/L of Tc-99 as an MCL (EPA 570/9-76-003, Appendix B).

² For purposes of this report, off-site indicates area outside the Limited Area or the PGDP boundary shown on maps.

3.1 TRICHLOROETHENE

During 2014, 150 RGA MWs and 4 residential wells were monitored for TCE. The sample collection was based on the Environmental Monitoring Program, which plans and schedules the compliance sampling and sampling by other regulatory programs being conducted at the site (LATA Kentucky 2013). These results are supplemented by 68 RGA MWs and 1 residential well monitored in 2013. A summary of maximum off-site levels of TCE in RGA wells is shown in Table 1.

Figure C.2 of Appendix C provides the interpretation of the 2014 TCE isoconcentration map (plume map). The plume interpretation is based on the following:

- A total of 409 groundwater samples was collected and analyzed for TCE from 154 wells in 2014.
- The data for 2014, along with the date sampled, are posted adjacent to the well label. The basis for data posting is as follows:
 - If the well was sampled only once in 2014, the resulting analysis is posted.
 - If the well was sampled multiple times, the most recent result was posted. If the most recent data are from duplicate samples, the higher concentration value of the two was posted.
 - For well clusters with completions screened in the upper, middle, and lower horizons of the RGA, each value is posted where feasible.
- Groundwater extraction well locations are labeled on the map, but the concentrations from the wells are neither posted nor used in contouring.
- Posted data are rounded to the nearest whole number for presentation purposes.
- For some wells that were not sampled in 2014, but sampled in 2013, the most recent result was posted following the basis described above.
- The contour intervals selected were 5 µg/L, 100 µg/L, 1,000 µg/L, 10,000 µg/L, and 100,000 µg/L. This order of magnitude interval approach for contour interval selection is consistent with the contour interval selection used in the prior mapping for the site.
- Contouring was produced by hand, using interpolation between observed concentrations. The contouring also incorporated historical source information and previous plume interpretations.

Exceptions to this basis are discussed in Section 4.

3.2 TECHNETIUM-99

During 2014, 147 RGA MWs and 4 residential wells were monitored for Tc-99. The sample collection was based on the Environmental Monitoring Program, which plans and schedules the compliance sampling and sampling by other regulatory programs being conducted at the site (LATA Kentucky 2013). These results are supplemented by 70 RGA MWs and 1 residential well monitored in 2013. Sampling during 2013 and 2014 did not show Tc-99 above 900 pCi/L in off-site RGA wells.

Figure C.3 of Appendix C provides the interpretation of the extent of the Tc-99 plume in 2014.

- A total of 408 groundwater samples was collected and analyzed for Tc-99, from 151 wells in 2014.
- The observed data for 2014, along with the date sampled, are posted adjacent to the well. The logic for data posting was the same as described for TCE in Section 3.1.
- The posted data are rounded to the nearest whole number for presentation purposes.
- For some wells that were not sampled in 2014, but sampled in 2013, the most recent result was posted following the basis described above.
- The contour intervals selected were 900 pCi/L and 3,790 pCi/L. The interval selection is based on EPA's 1976 derived MCL of 900 pCi/L; the higher interval represents a risk-based alternative criterion.³

4. CHANGES FROM 2012 PLUME MAPS

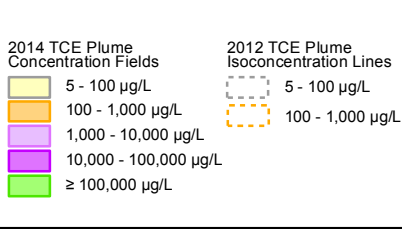
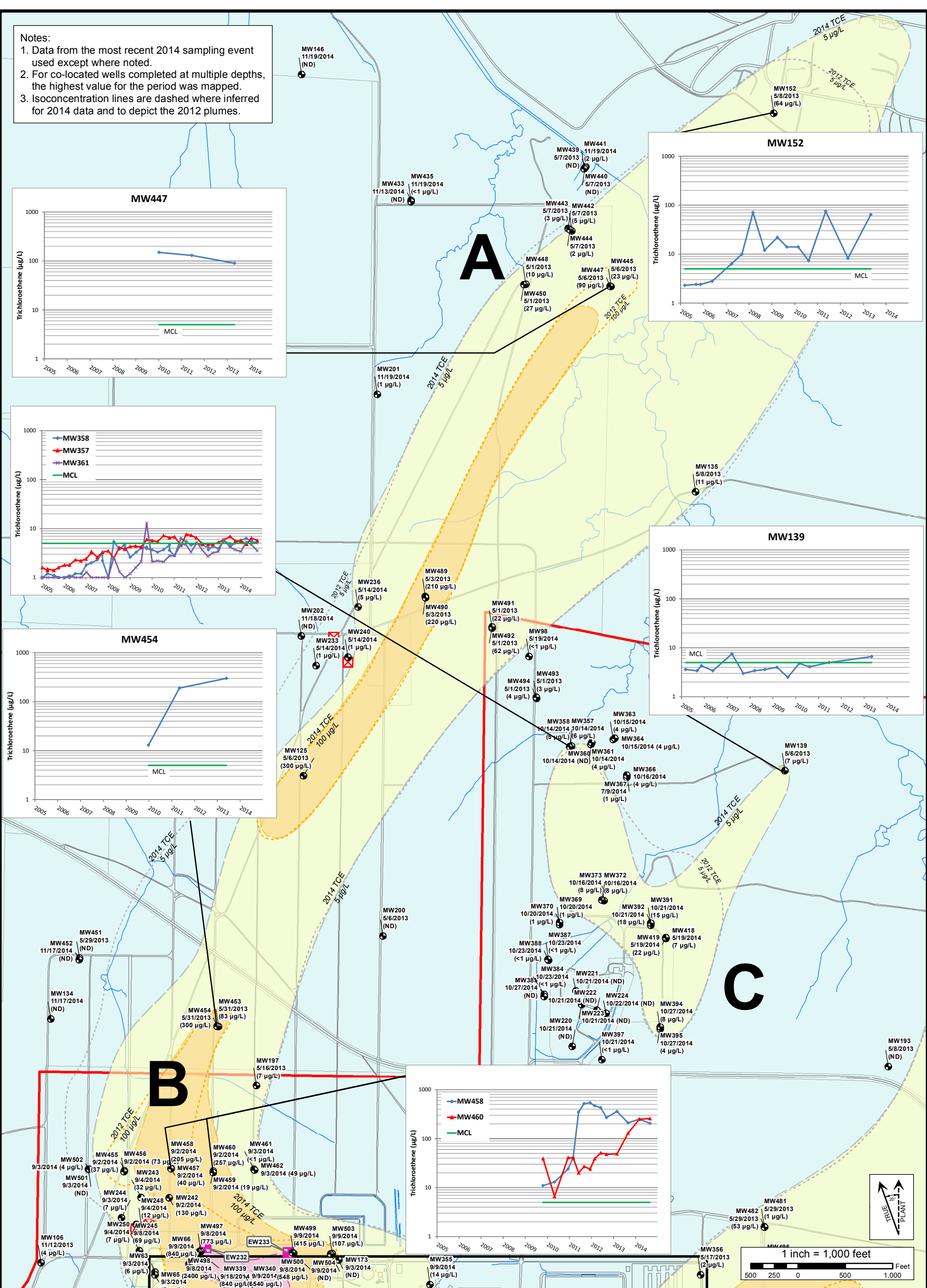
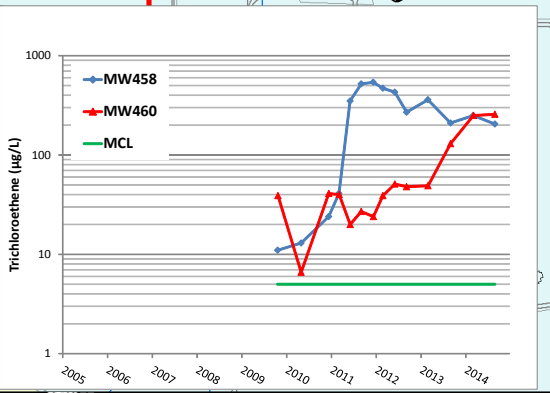
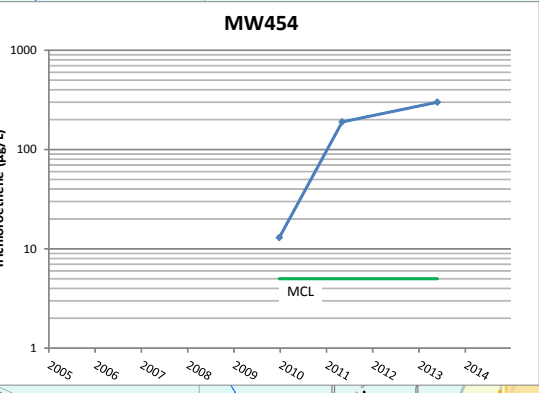
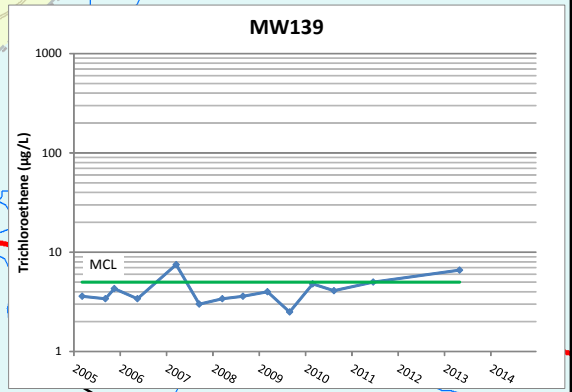
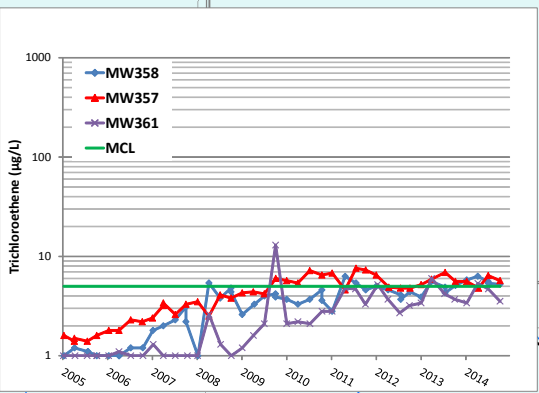
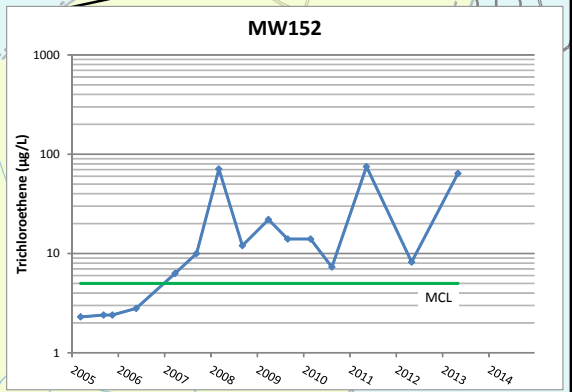
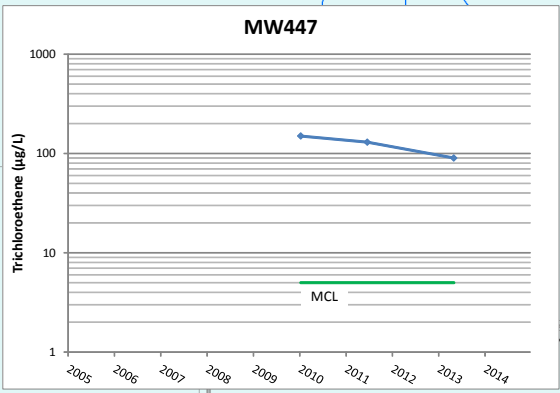
The latest previous plume maps were published in 2012 (LATA Kentucky 2014). In an effort to understand the efficacy of groundwater cleanup at PGDP, LATA Kentucky compared the 2014 maps with the 2012 plume maps for both TCE and Tc-99. For discussion purposes, the plumes have been divided into Northwest, Northeast, and Central portions. Figures in this section show the 2014 TCE plume overlaid with the 2012 plume isoconcentration lines. A comparison of isoconcentration contours for the 2012 and 2014 plumes indicates that the footprints for each plume are similar with some notable differences. Similarly, the last figure in this section shows the 2014 Tc-99 plume overlaid with the 900 pCi/L and 3,790 pCi/L contours from the 2012 plume map. The Tc-99 plume, as defined by the 900 pCi/L activity level, is limited to the central part of the site and is discussed in that subsection.

4.1 NORTHWEST PLUME

Figure 1 provides an enlargement of the north portion of the Northwest Plume. Three areas are described in this subsection: (A) the northern distal margin, (B) the area in the vicinity of southern extraction wells of the Northwest Plume Pump-and-Treat System, and (C) the vicinity of the C-746-S&T Landfills. In addition, Figure 1 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

³ The contour value of 3,790 pCi/L is used for consistency with historical plume maps. It (3,790 pCi/L) was derived as the equivalent of 4 mrem/yr by EPA and was proposed, but not promulgated, as the MCL for Tc-99 in 1991 (56 *Fed. Reg.* 33121). In 2011, DOE published "DOE Standard: Derived Concentration Technical Standard (DOE-STD-1196-2011, which provides concentration standards for public consumption of drinking water that equate to an effective dose of 100 mrem/yr. The 2011 standards are based on guidance found in International Committee on Radiation Protection Publication 72 (ICRP 1995), Publication 89 (ICRP 2002), and Publication 107 (ICRP 2008). The published, derived concentration standard for Tc-99 in drinking water is 44,000 pCi/L, at an effective dose of 100 mrem/yr from the ingestion of drinking water. The value to yield an effective dose of 4 mrem/yr is 1,760 pCi/L.

Notes:
 1. Data from the most recent 2014 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2014 data and to depict the 2012 plumes.



LEGEND

MW103 8/17/2014 (ND) - Monitoring Well Identification, Date of Sample & Sample Value

EW234 - Extraction Well

EW233 - Former Extraction Well

A - Area A

B - Area B

C - Area C

- Water Policy Area

- DOE Property Boundary

- Roadways

- Streams

- PGDP Boundary

LATA Environmental Services
 of Kentucky, LLC

U.S. DEPARTMENT OF ENERGY
 PORTSMOUTH / PADUCAH PROJECT OFFICE
 PADUCAH GASEOUS DIFFUSION PLANT

Figure 1. 2014 Northwest Portion of the TCE Plume Regional Gravel Aquifer

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Area A

- The northern extent of the 5 µg/L TCE isoconcentration contour continues to be defined by MW433, MW435, MW439, MW440, and MW441, in which TCE was not detected above 5 µg/L. The leading edge, however, has been moved farther north because two of the latest three TCE analyses for MW152 have exceeded 60 µg/L (64 µg/L in the most recent sampling event, which was May 2013, and 75 µg/L in the May 2011 sampling event).
- The leading edge of the 100 µg/L TCE contour previously extended beyond MW447; however, the most recent MW447 sampling has shown TCE at 90 µg/L. Thus, the leading edge of the 100 µg/L TCE contour has been moved south of MW447.
- The western boundary of the Northwest Plume was adjusted in the vicinity of the former northern extraction well field pump-and-treat system based on sub-MCL results for MW233 and MW240 and results equal to MCL for MW236. MW125 is used to help define the southern extent of the 100 µg/L TCE isoconcentration, its TCE concentration was 300 µg/L in May 2013.

Area B

Area B coincides with recent extraction system optimization for the south wellfield. In August 2010, extraction wells EW232 and EW233 began operations. Because the EW232 and EW233 are located slightly upgradient and crossgradient of the former extraction wells, some changes in TCE concentrations at some downgradient locations reflect trends associated with changes in pumping stress in the new area. Observations related to changes in dissolved-phase TCE distribution within the plume and plume configuration for this area are as follows:

- MW455 through MW462, MW501, and MW502 were installed and sampling began in 2009. These wells form a transect perpendicular to the longitudinal axis of the plume (the direction of flow), downgradient of the current extraction well field for the Northwest Plume Pump-and-Treat System, and provide a monitoring network to evaluate the efficacy of the pump-and-treat system. TCE was detected at concentrations varying from < 1 to 257 µg/L. Detections of TCE above 100 µg/L in this network shifted from wells MW456 and MW458 in 2013 to wells MW458 and MW460 in 2014, resulting from changes in plume trajectory due to extraction at EW232 and EW233.
- Additionally, MW454 (located approximately 2,400 ft downgradient of EW232) and MW242 (located approximately 1,400 ft downgradient of EW232) also detected TCE above 100 µg/L.
- TCE concentrations in MW503 were above 100 µg/L immediately upon startup of the new well field in October 2010 and rose to a high of 670 µg/L in September 2011. TCE concentrations at MW503 declined after 2011 to its current concentration near 100 µg/L. The declining trend likely reflects capture of the TCE plume mass to the east of EW233.

Area C

Area C is located in the vicinity of the C-746-S&T and C-746-U Landfills. These locations are monitored frequently to support the solid waste permit for the C-746-S, -T, and -U Landfills.

- The 2014 TCE footprint is greater than that interpreted in 2012. Based on continued trends at MW357 and MW358, and now including MW361, TCE concentrations are observed to approximate the MCL with some values slightly over or slightly lower than the MCL (Figure 1). Consequently, the 5 µg/L contour was extended in this area to include these wells.

- TCE levels at MW139 have fluctuated near the 5 µg/L level (see Figure 1). Previously, because TCE is variable at this location and did not consistently exceed the MCL, the location was not included in the depiction of the plume footprint. The TCE level in 2013 was 7 µg/L, which followed a 2011 TCE detection of 5 µg/L; therefore, MW139 has been included in the plume footprint.

4.2 NORTHEAST PLUME

Figure 2 provides an enlargement of the northeast portion of the plume. Three areas are described in this subsection: (D) the northern distal margin; (E) the area in the vicinity of the Northeast Plume Pump-and-Treat extraction wells; and (F) the vicinity of the industrial site. Figure 2 also includes temporal TCE concentration plots for selected wells to illustrate the observations made in this subsection.

Area D

- Some changes were made to the northern extent of the 5 µg/L TCE isoconcentration contour from 2012. Wells MW463 through MW476 provide definition of the plume. The interpreted distal extent is between well clusters MW463 through MW468 and clusters MW473 through MW476. Additionally, well clusters MW469/MW470 and MW471/MW472, with groundwater TCE concentrations below the laboratory detection limit, define the eastern edge of the plume.
- The well samples for 2014 document that TCE concentrations increased near the distal end of the Northeast Plume to 100 µg/L in the upper RGA (MW463) and to 62 µg/L in the lower RGA (MW464). This trend suggests that a discrete concentration field has migrated northward within the Northeast Plume.

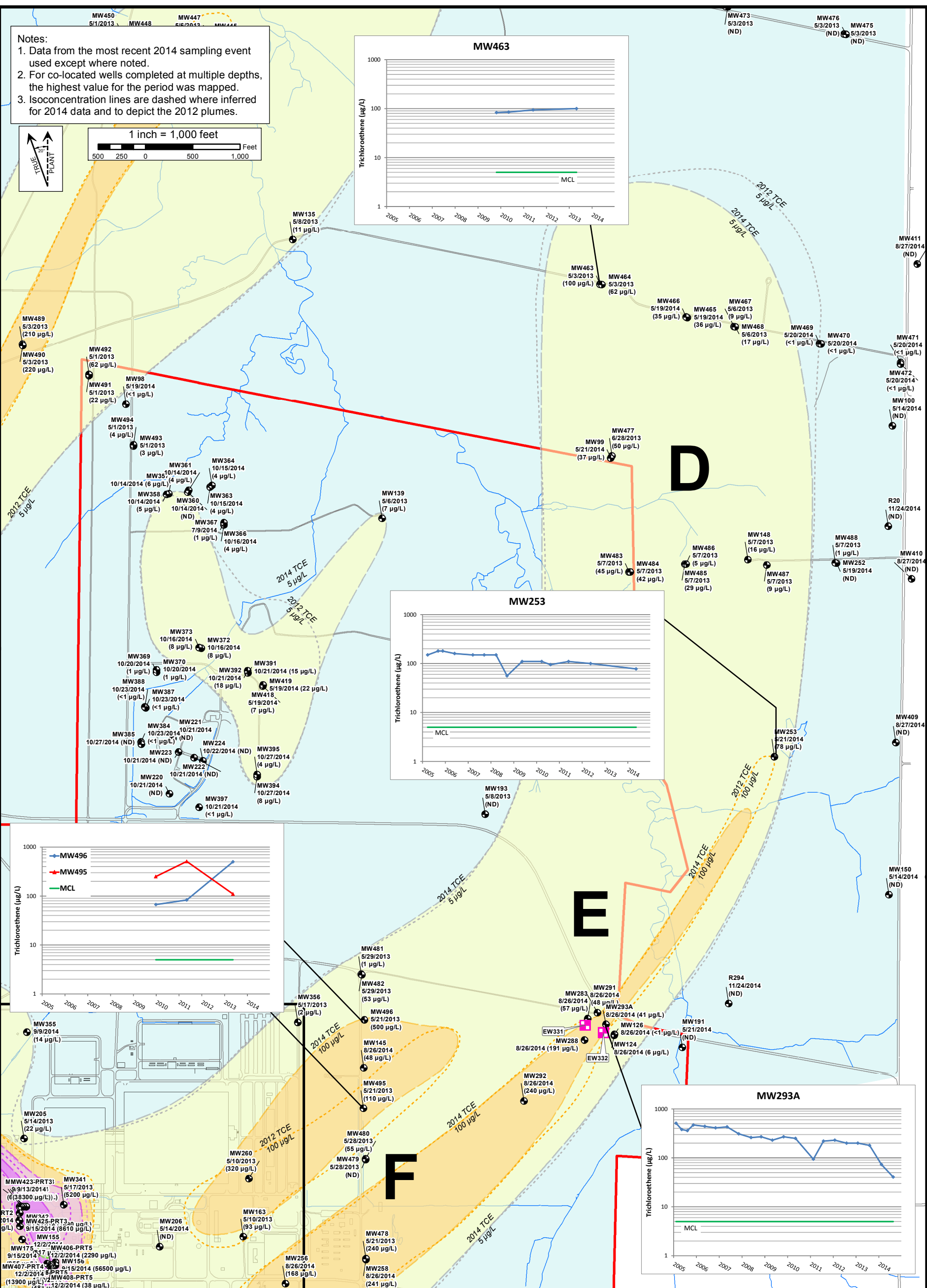
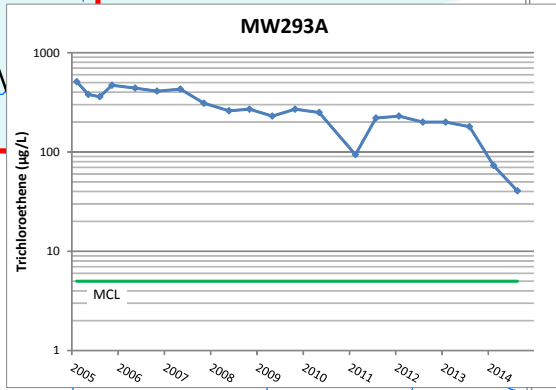
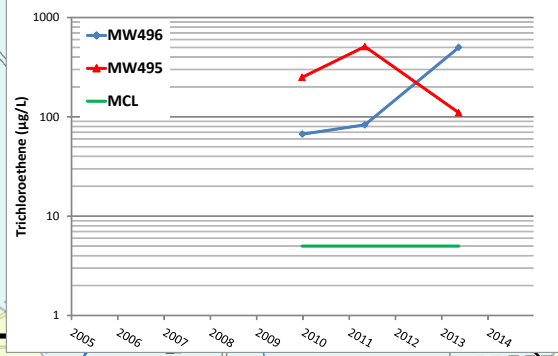
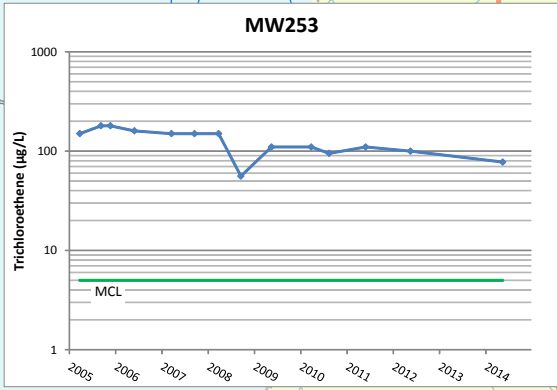
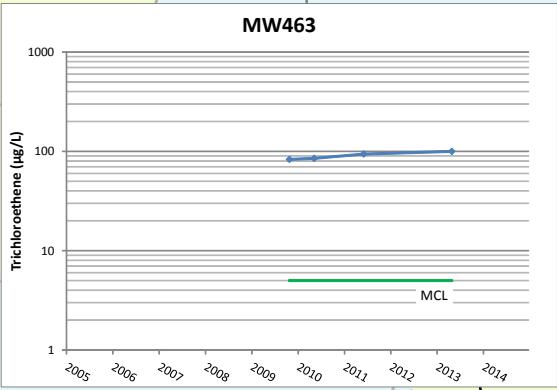
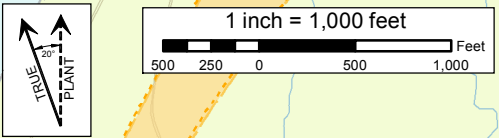
Area E

- The TCE footprint in the central part of the Northeast Plume is similar in 2012 and 2014, with a few exceptions. The 100 µg/L TCE contour no longer extends as far north as MW253. Analyses for 2014, show the TCE concentration at MW253 to be less than 100 µg/L.
- Near the site of the extraction wells, the 100 µg/L contour has narrowed, based on decreasing trends at MW293A.

Area F

- The 100–1,000 µg/L boundary in this area has expanded slightly from the 2012 interpretation, but the overall > 5 µg/L concentration field has not changed. TCE concentrations in MW496 indicate TCE is greater than 100 µg/L and rising. TCE concentrations in MW495 are near 100 µg/L, but a clear trend cannot be established. TCE analyses of samples collected from MW145 remain less than 100 µg/L, but this well is screened in the upper RGA, while MW495 and MW496 are screened lower in the RGA (i.e., there are no current data for the lower RGA at the MW145 location).

Notes:
 1. Data from the most recent 2014 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2014 data and to depict the 2012 plumes.



2014 TCE Plume Concentration Fields		2012 TCE Plume Isoconcentration Lines		LEGEND	
5 - 100 µg/L	Lightest yellow	5 - 100 µg/L	Dashed line	MW103 (8/17/2014 ND)	Monitoring Well Identification, Date of Sample & Sample Value
100 - 1,000 µg/L	Light yellow	5 - 100 µg/L	Dashed line	●	RGA Well
1,000 - 10,000 µg/L	Yellow	100 - 1,000 µg/L	Dashed line	□	Extraction Well
10,000 - 100,000 µg/L	Orange	100 - 1,000 µg/L	Dashed line	⊗	Former Extraction Well
≥ 100,000 µg/L	Dark orange			D	- Area D
				E	- Area E
				F	- Area F
				—	- Water Policy Area
				—	- DOE Property Boundary
				—	- Roadways
				—	- Streams
				—	- PGDP Boundary

LATA Environmental Services
of Kentucky, LLC

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PORTSMOUTH / PADUCAH PROJECT OFFICE
PADUCAH GASEOUS DIFFUSION PLANT

Figure 2. 2014 Northeast Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME: Fig_02_2012_2014PlumesTCE_NER1	PROJECT #: EM	SCALE: AS NOTED	DATE: 6/4/2015
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4.3 CENTRAL SITE AREA INCLUDING SOUTHWEST PLUME

TCE

The TCE plume in the approximately 650-acre industrialized section of the PGDP site is presented in Figure 3. The overall footprint in 2014 is similar to previous years; differences are noted below. In addition, Figure 3 includes temporal TCE concentration plots for selected wells illustrating the observations made in this subsection.

- The western part of the area commonly referred to as the Southwest Plume area (designated as G on Figure 3) is similar to the extent mapped in 2012. The extent of the source area to the Southwest Plume north of SWMU 4 is expanded slightly. The 1,000 µg/L contour now includes MW87, MW93, and MW95A.
- The second area (designated as H on Figure 3) is on the northern margin of the industrial footprint. The highest concentrations of TCE extend from C-400 Building toward the Northwest Plume groundwater extraction wells. The interpretation for 2014 shows a significant reduction in extent by removing MW340 from within the 10,000 µg/L isoconcentration. The area impacted by 1,000 µg/L increased slightly, as TCE concentrations in MW498 rose to 2,400 µg/L.
- The C-400 Building source area shows a significant reduction in higher concentrations. The > 100,000 µg/L contour has been decreased and moved to the north, though none of the current MWs detected TCE in this range in 2014. MW156 has been mapped with a concentration of 56,500 µg/L even though it is not the most recent value; concentrations in the well vary, and the most recent value (925 µg/L, December 2014) does not appear to be representative. Further, MW408-PRT5 and MW405-PRT5 have shown significant declines in TCE concentration, from highs of 1,400,000 µg/L in September 2012 (MW408-PRT5) and 97,000 µg/L in June 2012 (MW405-PRT5), to most recent 2014 values of 37.6 and 481 µg/L, respectively. Additional changes in concentrations similar to those seen in the 2014 map are expected to be seen in the future as the source remediation continues.

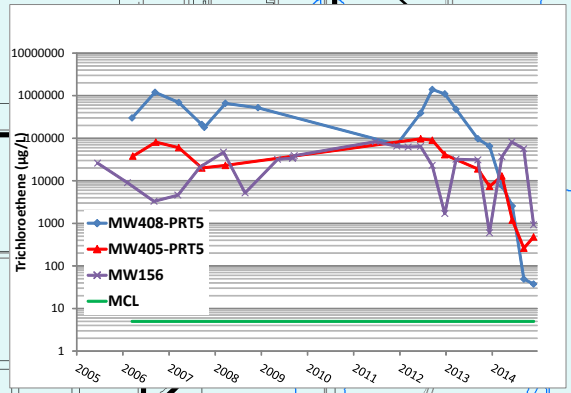
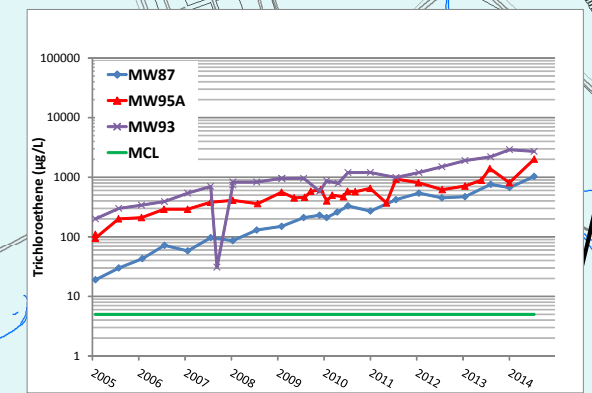
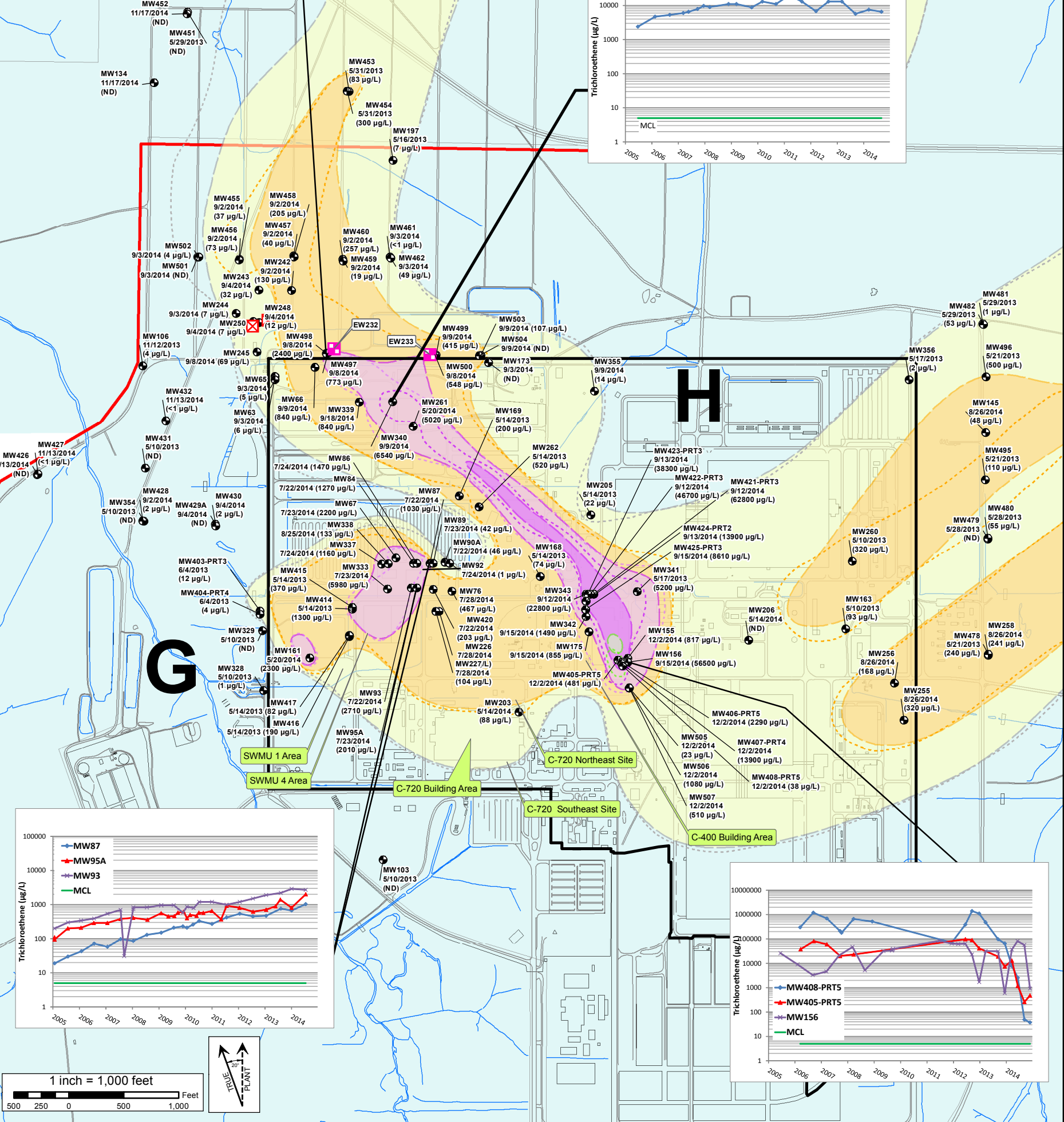
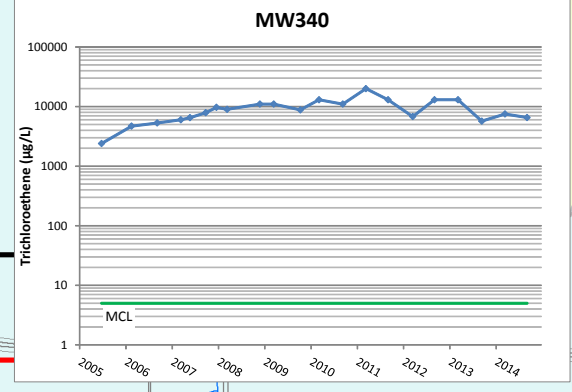
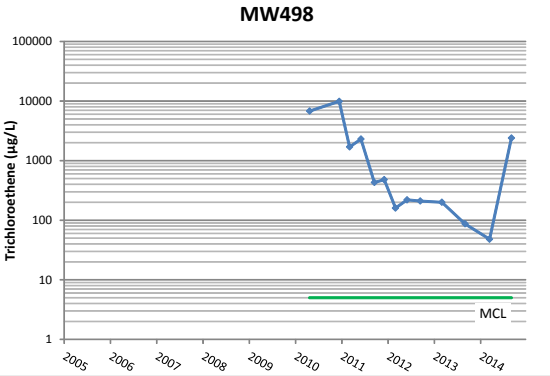
Tc-99

There were 408 analyses for Tc-99 in RGA groundwater at PGDP in 2014, with only 26 results above 900 pCi/L. Figure 4 presents the results of Tc-99 analyses near the central area of the plant, where the groundwater samples collected in 2014 contained Tc-99 at activities greater than 900 pCi/L, and temporal concentration plots for selected wells illustrating the observations made in this subsection. The area exceeding 900 pCi/L for Tc-99 is similar to the high-concentration TCE footprint on Figure 3 (i.e., the area encompassed by the 1,000–10,000 µg/L isocontour) with a few exceptions. The highest level of Tc-99 occurs in the area of MW422 through MW425. This is consistent with the location of the former Tc-99 storage tank, located near the northwestern portion of C-400 Building, which is near the expected source area of the Tc-99 plume.

The footprint for Tc-99 in 2014 has been reduced slightly along the longitudinal axis based on reduced Tc-99 activities in MW261, MW339, and MW340. The revised activities were expected as a response to extraction at EW233 for the Northwest Plume optimization. Additionally, near the source area, MW342 continued to decline in Tc-99 activities; it no longer shows Tc-99 above 900 pCi/L (activities in 2014 ranged from 287 to 303 pCi/L—303 pCi/L being the most recent). The 3,790 pCi/L isoconcentration contour continues to be reduced due to the lower activities in the source area.

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Notes:
 1. Data from the most recent 2014 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2014 data and to depict the 2012 plumes.



2014 TCE Plume Concentration Fields		2012 TCE Plume Isoconcentration Lines		LEGEND	
5 - 100 µg/L	5 - 100 µg/L	MW103 8/17/2014 (ND)	Monitoring Well Identification, Date of Sample & Sample Value	Water Policy Area	- Water Policy Area
100 - 1,000 µg/L	100 - 1,000 µg/L	Extraction Well	- Extraction Well	DOE Property Boundary	- DOE Property Boundary
1,000 - 10,000 µg/L	1,000 - 10,000 µg/L	Former Extraction Well	- Former Extraction Well	Roadways	- Roadways
10,000 - 100,000 µg/L	10,000 - 100,000 µg/L	Area G	- Area G	Streams	- Streams
≥ 100,000 µg/L	≥ 100,000 µg/L	Area H	- Area H	PGDP Boundary	- PGDP Boundary

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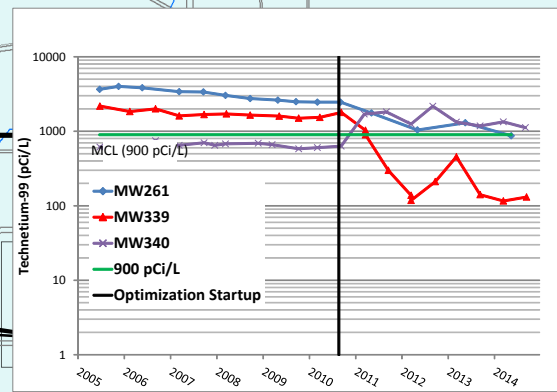
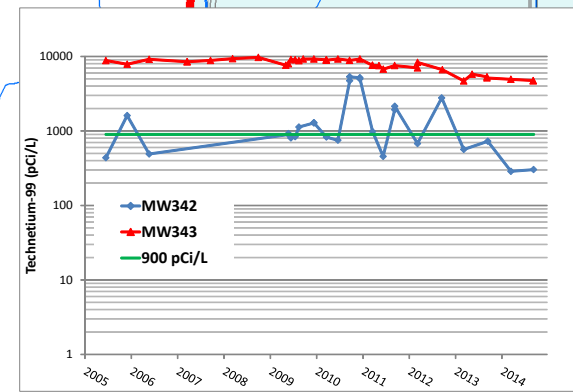
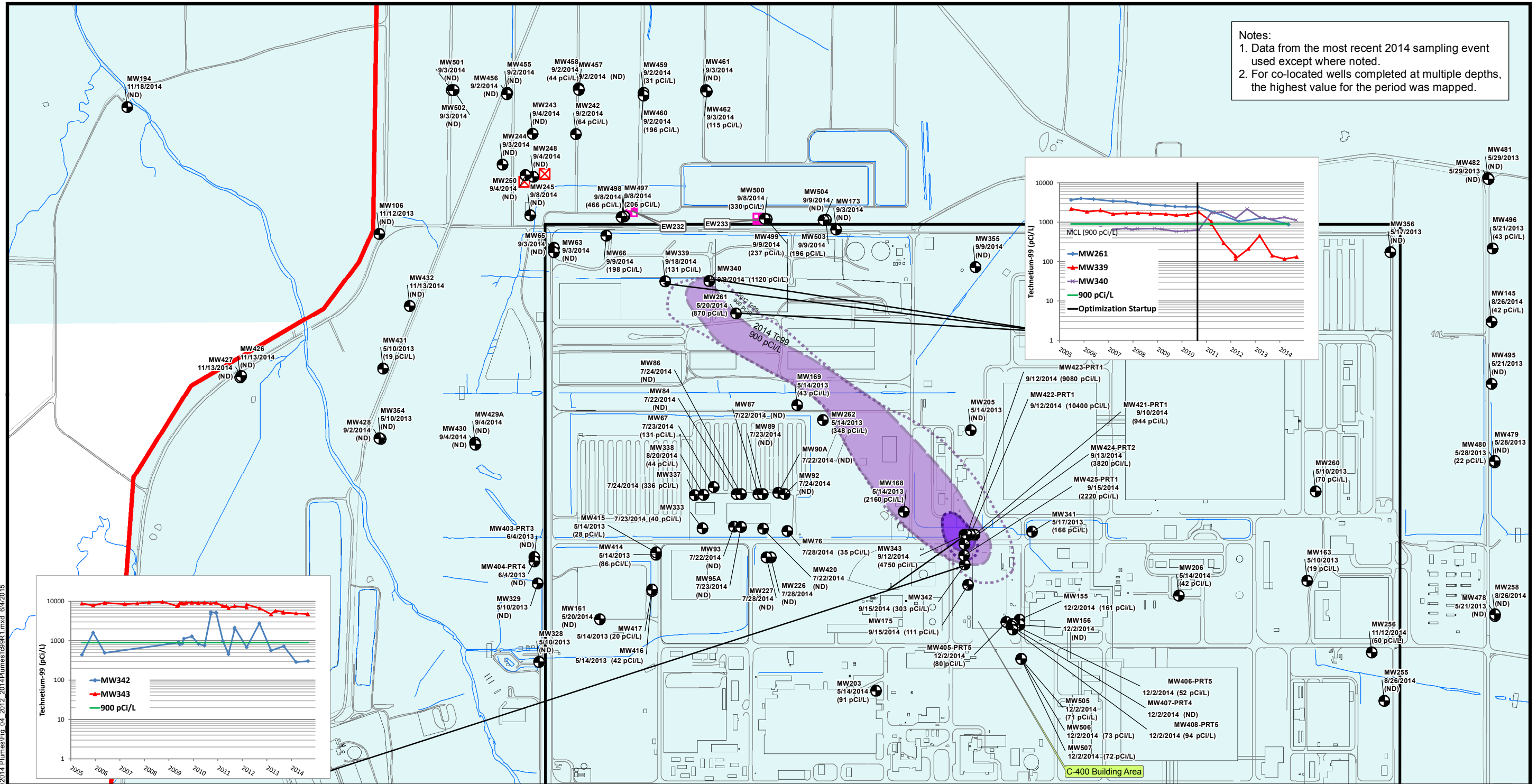
U.S. DEPARTMENT OF ENERGY
 PORTSMOUTH / PADUCAH PROJECT OFFICE
 PADUCAH GASEOUS DIFFUSION PLANT

Figure 3. 2014 Central Portion of the TCE Plume Regional Gravel Aquifer

FILE NAME: Fig_03_2012-2014PlumesTCE_CentralR1 PROJECT #: EM SCALE: AS NOTED DATE: 6/4/2015

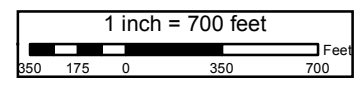
G:\GIS\ARCVIEW\PROJECTS\PLUMES\2014 Plumes\Fig_03_2012-2014PlumesTCE_CentralR1.mxd 6/4/2015

Notes:
 1. Data from the most recent 2014 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.



LEGEND

- 2014 Tc-99 Plume Concentration Fields
 - 900 - 3,790 pCi/L
 - ≥ 3,790 pCi/L
- 2012 Tc-99 Plume Isoconcentration Lines
 - 900 - 3,790 pCi/L
 - ≥ 3,790 pCi/L
- MW163 8/17/2014 (ND) Monitoring Well Identification, Date of Sample & Sample Value
 ND - Result Less than MDA
- RG Well
- Extraction Well
- Former Extraction Well
- Water Policy Area
- DOE Property Boundary
- Roadways
- Streams
- PGDP Boundary



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Figure 4. 2014 Tc-99 Plume - Regional Gravel Aquifer

FILE NAME Fig_04_2012_2014PlumesTc99R1	PROJECT # EM	SCALE AS NOTED	DATE 6/4/2015
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5. INTERNAL REVIEW PROCESS

Several steps were used during preparation of these maps to ensure quality. The steps followed are described below:

- The data sets were compared to the Environmental Monitoring Plan for Fiscal Year 2014 to ensure completeness of the data set for calendar year 2014 in the query of Paducah OREIS (LATA Kentucky 2013).
- The resulting data set then was further reduced by the selection criteria described in Sections 3.1 and 3.2.
- The data sets then were posted to the maps electronically.
- The map contours generated for 2012 were adjusted based upon the posted data (LATA Kentucky 2014). An independent review of the constructed maps then was conducted by hydrogeologists familiar with the site.

6. REFERENCES

- EPA (U.S. Environmental Protection Agency) 2002. "EPA Facts About Technetium-99," July, accessed at <http://www.epa.gov/superfund/health/contaminants/radiation/pdfs/technetium.pdf>, U.S. Environmental Protection Agency, Washington, DC.
- ICRP (International Commission on Radiological Protection) 1995. "Age-dependent Doses to the Members of the Public from Intake of Radionuclides - Part 5 Compilation of Ingestion and Inhalation Coefficients," ICRP Publication 72, Ann. ICRP 26 (1), International Commission on Radiological Protection Ottawa, Ontario, Canada.
- ICRP 2002. "Basic Anatomical and Physiological Data for Use in Radiological Protection Reference Values," ICRP Publication 89, Ann. ICRP 32 (3-4), International Commission on Radiological Protection Ottawa, Ontario, Canada.
- ICRP 2008. "Nuclear Decay Data for Dosimetric Calculations," ICRP Publication 107, Ann. ICRP 38 (3), International Commission on Radiological Protection Ottawa, Ontario, Canada.
- LATA Kentucky (LATA Environmental Services of Kentucky, LLC) 2013. *Environmental Monitoring Plan Fiscal Year 2014 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD-ENM-0055/R3, LATA Environmental Services of Kentucky, LLC, Kevil, KY, November.
- LATA Kentucky 2014. *Trichloroethene and Technetium-99 Groundwater Contamination in the Regional Gravel Aquifer for Calendar Year 2012 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, PAD/ENR/0136, LATA Environmental Services of Kentucky, Kevil, KY, January.

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APPENDIX A
ELECTRONIC COPIES TABLES (CD)

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APPENDIX A
ELECTRONIC COPIES OF TABLES (CD)

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APPENDIX B
TABLE OF DATA USED TO PREPARE
THE 2014 PLUME MAPS

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Table B.1. 2013 and 2014 TCE and Tc-99 Data Used to Create Plume Map

Station	Well Screen Depth (ft bgs)	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW100	77-87	5/14/2014	1	5/14/2014	4.75	
MW103	79.5-89.5	5/10/2013	1	5/10/2013	-1.09	
MW106	62-72	11/12/2013	4.3	11/12/2013	0.83	
MW124	83-93	8/26/2014	6.18	8/26/2014	-6.23	
MW125	78-88	5/6/2013	300	5/6/2013	112	
MW126	55-65	8/26/2014	0.71	8/26/2014	-2.86	
MW134	85-95	11/17/2014	1	11/17/2014	2.39	
MW135	41-51	5/8/2013	11	5/8/2013	64.5	
MW139	57-67	5/6/2013	6.6	5/6/2013	5.71	
MW145	85-95	8/26/2014	48	8/26/2014	42.4	
MW146	57-67	11/19/2014	1	11/19/2014	3.72	
MW148	60-90	5/7/2013	16	5/7/2013	-4.03	
MW150	65-95	5/14/2014	1	5/14/2014	-5.81	
MW152	45-75	5/8/2013	64	5/8/2013	121	
MW155	87-92	12/2/2014	817	12/2/2014	161	
MW156	63-70	9/15/2014	56500	12/2/2014	9.1	TCE mapped is not most recent, but is most representative. See charts.
MW161	78-83	5/20/2014	2300	5/20/2014	9.67	
MW163	94-99	5/10/2013	93	5/10/2013	18.8	
MW168	63-68	5/14/2013	74	5/14/2013	2160	
MW169	65-70	5/14/2013	200	5/14/2013	42.7	
MW173	53-58	9/3/2014	1	9/3/2014	-12.2	
MW175	75-80	9/15/2014	855	9/15/2014	111	
MW191	55-60	5/21/2014	1	5/21/2014	-9.03	
MW193	58-63	5/8/2013	1	5/8/2013	4.76	
MW194	46.9-51.9	11/18/2014	1	11/18/2014	-3.64	
MW197	58-63	5/16/2013	7.2	5/16/2013	20.2	
MW199	57-62	11/18/2014	1	11/18/2014	-1.74	
MW200	74-79	5/6/2013	1	5/6/2013	10.4	
MW201	62.5-67.5	11/19/2014	1.01	11/19/2014	0.67	
MW202	77-83	11/18/2014	1	11/18/2014	0.243	
MW203	71-76	5/14/2014	88.3	5/14/2014	91	
MW205	65-70	5/14/2013	22	5/14/2013	6.81	
MW206	67-77	5/14/2014	1	5/14/2014	42.3	
MW220	59-69	10/21/2014	1	10/21/2014	35	
MW221	74-84	10/21/2014	1	10/21/2014	4.53	
MW222	68.3-78.3	10/21/2014	1	10/21/2014	2.22	
MW223	72.4-82.4	10/21/2014	1	10/21/2014	10.6	
MW224	72-82	10/22/2014	1	10/22/2014	11.9	
MW226	78.9-88.9	7/28/2014	350	7/28/2014	7.97	
MW227	64.5-74.5	7/28/2014	104	7/28/2014	-4.4	
MW233	69.22-79.22	5/14/2014	1.35	5/14/2014	16.2	
MW236	69.5-79.5	5/14/2014	5.35	5/14/2014	-4.62	
MW240	69.66-79.66	5/14/2014	1.28	5/14/2014	4.88	
MW242	65.1-75.1	9/2/2014	130	9/2/2014	63.6	
MW243	65.13-75.13	9/4/2014	32.2	9/4/2014	8.54	
MW244	64.3-74.3	9/3/2014	6.51	9/3/2014	-11.8	
MW245	64.58-74.58	9/8/2014	69.1	9/8/2014	6.33	

Table B.1. 2013 and 2014 TCE and Tc-99 Data Used to Create Plume Map (Continued)

Station	Well Screen Depth (ft bgs)	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW248	65.81-75.81	9/4/2014	11.9	9/4/2014	9.25	
MW250	63.77-73.77	9/4/2014	7.09	9/4/2014	-13.1	
MW252	84.2-88.9	5/19/2014	1	5/19/2014	-12.1	
MW253	91.2-95.9	5/21/2014	77.6	5/21/2014	-13.1	
MW255	91-95.7	8/26/2014	320	8/26/2014	-0.985	
MW256	100.2-104.9	8/26/2014	168	11/12/2014	50.2	
MW258	89.2-93.9	8/26/2014	241	8/26/2014	5.78	
MW260	93.2-97.9	5/10/2013	320	5/10/2013	69.6	
MW261	90-94.7	5/20/2014	5020	5/20/2014	870	
MW262	90.2-94.9	5/14/2013	520	5/14/2013	348	
MW283	69-79	8/26/2014	56.8	8/26/2014	13.4	
MW288	78-88	8/26/2014	191	11/12/2014	35.2	
MW291	70-80	8/26/2014	48	8/26/2014	5.41	
MW292	87-97	8/26/2014	240	11/12/2014	42.1	
MW293A	80.5-90.5	8/26/2014	40.6	8/26/2014	-3.21	
MW328	60.75-65.75	5/10/2013	1.3	5/10/2013	5.62	
MW329	65.5-70.5	5/10/2013	1	5/10/2013	5.51	
MW333	69.25-79	7/23/2014	5980	7/23/2014	40.1	
MW337	64.58-74.33	7/24/2014	1160	7/24/2014	336	
MW338	64.58-74.33	8/25/2014	133	8/20/2014	44.4	
MW339	85.3-95	9/18/2014	840	9/18/2014	131	
MW340	85.63-95.3	9/9/2014	6540	9/9/2014	1120	
MW341	75.5-85.5	5/17/2013	5200	5/17/2013	166	
MW342	75.4-85.1	9/15/2014	1490	9/15/2014	303	
MW343	75.4-85.1	9/12/2014	22800	9/12/2014	4750	
MW354	65-70	5/10/2013	1	5/10/2013	7.66	
MW355	85-90	9/9/2014	13.7	9/9/2014	16.8	
MW356	118-123	5/17/2013	2	5/17/2013	8.84	
MW357	52.7-62.7	10/14/2014	5.71	10/14/2014	38.9	
MW358	71.5-81.5	10/14/2014	5.24	10/14/2014	41.9	
MW360	40-50	10/14/2014	1	10/14/2014	-3.63	
MW361	55-65	10/14/2014	3.54	10/14/2014	41.9	
MW363	55-65	10/15/2014	4.27	10/15/2014	5.23	
MW364	73-83	10/15/2014	3.86	10/15/2014	39.6	
MW366	53-63	10/16/2014	3.59	10/16/2014	64.4	
MW367	73-83	7/9/2014	1.13	10/15/2014	-3.34	TCE mapped is not most recent; most recent was not detected at a concentration of 1 µg/L.
MW369	41.5-51.5	10/20/2014	1.27	10/20/2014	43.3	
MW370	61-71	10/20/2014	1.11	10/20/2014	22.5	
MW372	46.5-56.5	10/16/2014	7.79	10/16/2014	107	
MW373	60-70	10/16/2014	7.67	10/16/2014	38	
MW384	50-60	10/23/2014	0.34	10/23/2014	144	
MW385	66.2-76.2	10/27/2014	1	10/27/2014	106	
MW387	47.4-57.4	10/23/2014	0.84	10/23/2014	245	
MW388	60.2-70.2	10/23/2014	0.75	10/23/2014	79	
MW391	57.2-67.2	10/21/2014	14.5	10/21/2014	10.7	
MW392	81.2-91.2	10/21/2014	18.2	10/21/2014	4.39	
MW394	65-75	10/27/2014	7.64	10/27/2014	17.2	

Station	Well Screen Depth (ft bgs)	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW395	73-83	10/27/2014	4.12	10/27/2014	14.4	
MW397	85-95	10/21/2014	0.33	10/21/2014	14.7	
MW403-PRT3	84-85	6/4/2013	12	6/4/2013	4.77	
MW404-PRT4	95-96	6/4/2013	3.6	6/4/2013	8.36	
MW405-PRT5	80-82	12/2/2014	481	12/2/2014	79.8	
MW406-PRT5	80-82	12/2/2014	2290	12/2/2014	52	
MW407-PRT4	72-74	12/2/2014	13900	12/2/2014	2.74	
MW408-PRT5	78-80	12/2/2014	37.6	12/2/2014	93.7	
MW409	83.2-93.2	8/27/2014	1	11/14/2013	-2.05	
MW410	85-95	8/27/2014	1	11/14/2013	6.25	
MW411	62.2-72.2	8/27/2014	1			Tc-99 was not sampled in 2013 or 2014; 2012 value was nondetect at a minimum detectable activity of 15.8 pCi/L.
MW414	63.85-73.85	5/14/2013	1300	5/14/2013	86.2	
MW415	88.03-98.03	5/14/2013	370	5/14/2013	27.9	
MW416	64.92-74.92	5/14/2013	190	5/14/2013	42.1	
MW417	92.2-102.2	5/14/2013	82	5/14/2013	19.8	
MW418	58.4-68.4	5/19/2014	6.97	5/19/2014	-10.7	
MW419	73.27-83.27	5/19/2014	22.2	5/19/2014	-5.25	
MW420	67-77	7/22/2014	203	7/22/2014	6.67	
MW421-PRT1	70.9-72.9	9/10/2014	26000	9/10/2014	944	
MW421-PRT2	78.9-80.9	9/12/2014	58600	9/12/2014	255	
MW421-PRT3	82.9-84.9	9/12/2014	62800	9/12/2014	181	
MW422-PRT1	71.2-73.2	9/12/2014	10800	9/12/2014	10400	
MW422-PRT2	79.2-81.2	9/12/2014	41800	9/12/2014	514	
MW422-PRT3	83.2-85.2	9/12/2014	46700	9/12/2014	496	
MW423-PRT1	70.6-72.6	9/12/2014	8980	9/12/2014	9080	
MW423-PRT2	78.6-80.6	9/12/2014	38100	9/12/2014	1550	
MW423-PRT3	82.6-84.6	9/13/2014	38300	9/13/2014	1500	
MW424-PRT1	71.5-73.5	9/13/2014	2630	9/13/2014	3070	
MW424-PRT2	79.5-81.5	9/13/2014	13900	9/13/2014	3820	
MW424-PRT3	83.5-85.5	9/13/2014	11100	9/13/2014	2600	
MW425-PRT1	70.9-72.9	9/15/2014	2260	9/15/2014	2220	
MW425-PRT2	78.9-80.9	9/15/2014	4080	9/15/2014	1860	
MW425-PRT3	82.9-84.9	9/15/2014	8610	9/15/2014	1950	
MW426	44-54	11/13/2014	1	11/13/2014	0.0887	
MW427	74-84	11/13/2014	0.4	11/13/2014	-3.95	
MW428	84-94	9/2/2014	1.88	9/2/2014	-9.07	
MW429A	61.3-71.3	9/4/2014	1	9/4/2014	-11.9	
MW430	80.5-90.5	9/4/2014	1.97	9/4/2014	-10.6	
MW431	76.9-86.9	5/10/2013	1	5/10/2013	19.2	
MW432	68-78	11/13/2014	0.35	11/13/2014	-2.89	
MW433	52.5-55	11/13/2014	1	11/13/2014	-1.97	
MW435	74-84	11/19/2014	0.65	11/19/2014	1.64	
MW439	30.3-32.8	5/7/2013	1	5/7/2013	5.08	
MW440	38-40.5	5/7/2013	1	5/7/2013	1.49	
MW441	48.5-51	11/19/2014	1.93	11/19/2014	-2.98	
MW442	63-65.5	5/7/2013	4.9	5/7/2013	-1.74	
MW443	76.75-79.25	5/7/2013	2.6	5/7/2013	4.77	
MW444	89.65-94.65	5/7/2013	2.4	5/7/2013	7.95	

Station	Well Screen Depth (ft bgs)	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW445	54.9-57.4	5/6/2013	23	5/6/2013	10.9	
MW447	88.7-93.7	5/6/2013	90	5/6/2013	9.52	
MW448	48-50	5/1/2013	9.8	5/1/2013	9.58	
MW450	66-76	5/1/2013	27	5/1/2013	18.8	
MW451	50.4-60.4	5/29/2013	1	5/29/2013	-0.886	
MW452	74.8-84.8	11/17/2014	1	11/17/2014	3.7	
MW453	50-60	5/31/2013	83	5/31/2013	41.2	
MW454	72-82	5/31/2013	300	5/31/2013	90.4	
MW455	58.3-68.3	9/2/2014	36.7	9/2/2014	13.5	
MW456	79.8-89.8	9/2/2014	72.7	9/2/2014	20.3	
MW457	52.8-62.8	9/2/2014	40.3	9/2/2014	-2.6	
MW458	76.8-86.8	9/2/2014	205	9/2/2014	43.6	
MW459	51-61	9/2/2014	18.5	9/2/2014	30.7	
MW460	77.8-87.8	9/2/2014	257	9/2/2014	196	
MW461	51-61	9/3/2014	0.77	9/3/2014	4.66	
MW462	70.9-80.9	9/3/2014	49.3	9/3/2014	115	
MW463	58-68	5/3/2013	100	5/3/2013	5.59	
MW464	89-99	5/3/2013	62	5/3/2013	7.02	
MW465	61.5-66.5	5/19/2014	35.8	5/19/2014	-3.27	
MW466	69-74	5/19/2014	34.9	5/19/2014	2.33	
MW467	57-67	5/6/2013	8.6	5/6/2013	-2.08	
MW468	68-73	5/6/2013	17	5/6/2013	-2.32	
MW469	62.3-72.3	5/20/2014	0.38	5/20/2014	-10.9	
MW470	73.1-78.1	5/20/2014	0.47	5/20/2014	-5.72	
MW471	65.8-5.8	5/20/2014	0.4	5/20/2014	-9.59	
MW472	76.9-81.9	5/20/2014	0.85	5/20/2014	-4.18	
MW473	65.6-75.6	5/3/2013	1	5/3/2013	4.23	
MW474	79.86-89.8	5/3/2013	1	5/3/2013	8.81	
MW475	60.3-70.3	5/3/2013	1	5/3/2013	-2.26	
MW476	86.4-96.4	5/3/2013	1	5/3/2013	7.74	
MW477	75-85	6/28/2013	50	6/28/2013	7.24	
MW478	77-87	5/21/2013	240	5/21/2013	2.27	
MW479	69.8-79.8	5/28/2013	1	5/28/2013	-2.12	
MW480	87.9-97.9	5/28/2013	55	5/28/2013	21.6	
MW481	68.8-78.8	5/29/2013	1	5/29/2013	0.941	
MW482	97.9-107.9	5/29/2013	53	5/29/2013	9.74	
MW483	63.8-73.8	5/7/2013	45	5/7/2013	0	
MW484	80.9-90.9	5/7/2013	42	5/7/2013	-0.999	
MW485	65-75	5/7/2013	29	5/7/2013	2.42	
MW486	94-104	5/7/2013	4.5	5/7/2013	1.42	
MW487	80.5-90.5	5/7/2013	8.5	5/7/2013	3.21	
MW488	63-73	5/7/2013	1.3	5/7/2013	-0.769	
MW489	58-68	5/3/2013	210	5/3/2013	78.2	
MW490	68-78	5/3/2013	220	5/3/2013	74.3	
MW491	55-65	5/1/2013	22	5/1/2013	81.1	
MW492	69.8-79.8	5/1/2013	62	5/1/2013	88.4	
MW493	55.9-65.9	5/1/2013	3.2	5/1/2013	39.4	
MW494	67.9-77.9	5/1/2013	3.6	5/1/2013	41.7	
MW495	101.4-111.4	5/21/2013	110	5/21/2013	1.11	
MW496	101.4-111.4	5/21/2013	500	5/21/2013	43.1	
MW497	59.6-69.6	9/8/2014	773	9/8/2014	206	

Station	Well Screen Depth (ft bgs)	Date TCE Sample Collected	TCE (µg/L)	Date Tc-99 Sample Collected	Tc-99 (pCi/L)	Notes
MW498	83.9-93.9	9/8/2014	2400	9/8/2014	466	
MW499	63.5-73.5	9/9/2014	415	9/9/2014	237	
MW500	82.6-92.6	9/8/2014	548	9/8/2014	330	
MW501	59.4-69.4	9/3/2014	1	9/3/2014	5.23	
MW502	76.1-86.1	9/3/2014	4.42	9/3/2014	-0.792	
MW503	83.6-88.6	9/9/2014	107	9/9/2014	196	
MW504	50.9-55.9	9/9/2014	1	9/9/2014	14.9	
MW505	65-70	12/2/2014	22.8	12/2/2014	71.4	
MW506	77-82	12/2/2014	1080	12/2/2014	72.7	
MW507	90-95	12/2/2014	510	12/2/2014	71.7	
MW63	58.5-63.5	9/3/2014	5.86	9/3/2014	11.9	
MW65	86.2-91.2	9/3/2014	5.09	9/3/2014	12.6	
MW66	55.2-60.2	9/9/2014	840	9/9/2014	198	
MW67	65.3-70.3	7/23/2014	2200	7/23/2014	131	
MW76	68.6-79	7/28/2014	467	7/28/2014	35	
MW84	65.47-75.87	7/22/2014	1270	7/22/2014	13.5	
MW86	75.17-85.57	7/24/2014	1470	7/24/2014	-6.8	
MW87	63.88-74.28	7/22/2014	1030	7/22/2014	0.314	
MW89	77.75-88.15	7/23/2014	41.6	7/23/2014	1.95	
MW90A	62-72	7/22/2014	46.2	7/22/2014	9.16	
MW92	78.88-89.28	7/24/2014	1.34	7/24/2014	-4.86	
MW93	69.5-79.9	7/22/2014	2710	7/22/2014	4.72	
MW95A	78-88	7/23/2014	2010	7/23/2014	9.75	
MW98	64.5-74.5	5/19/2014	0.43	5/19/2014	40.1	
MW99	62-72	5/21/2014	37.1	5/21/2014	-13.4	
R20		11/24/2014	1	11/24/2014	-7.06	
R294		11/24/2014	1	11/24/2014	-1.36	
R302		11/24/2014	1	11/24/2014	2.51	
R384		11/21/2013	1	11/21/2013	2.35	
R387		11/20/2014	1	11/20/2014	-6.52	

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APPENDIX C

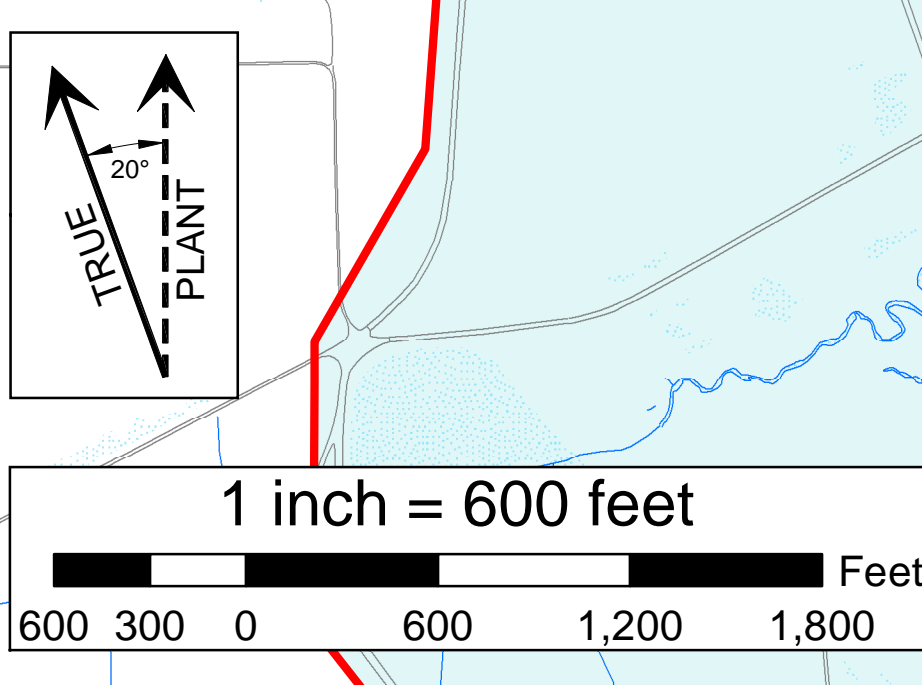
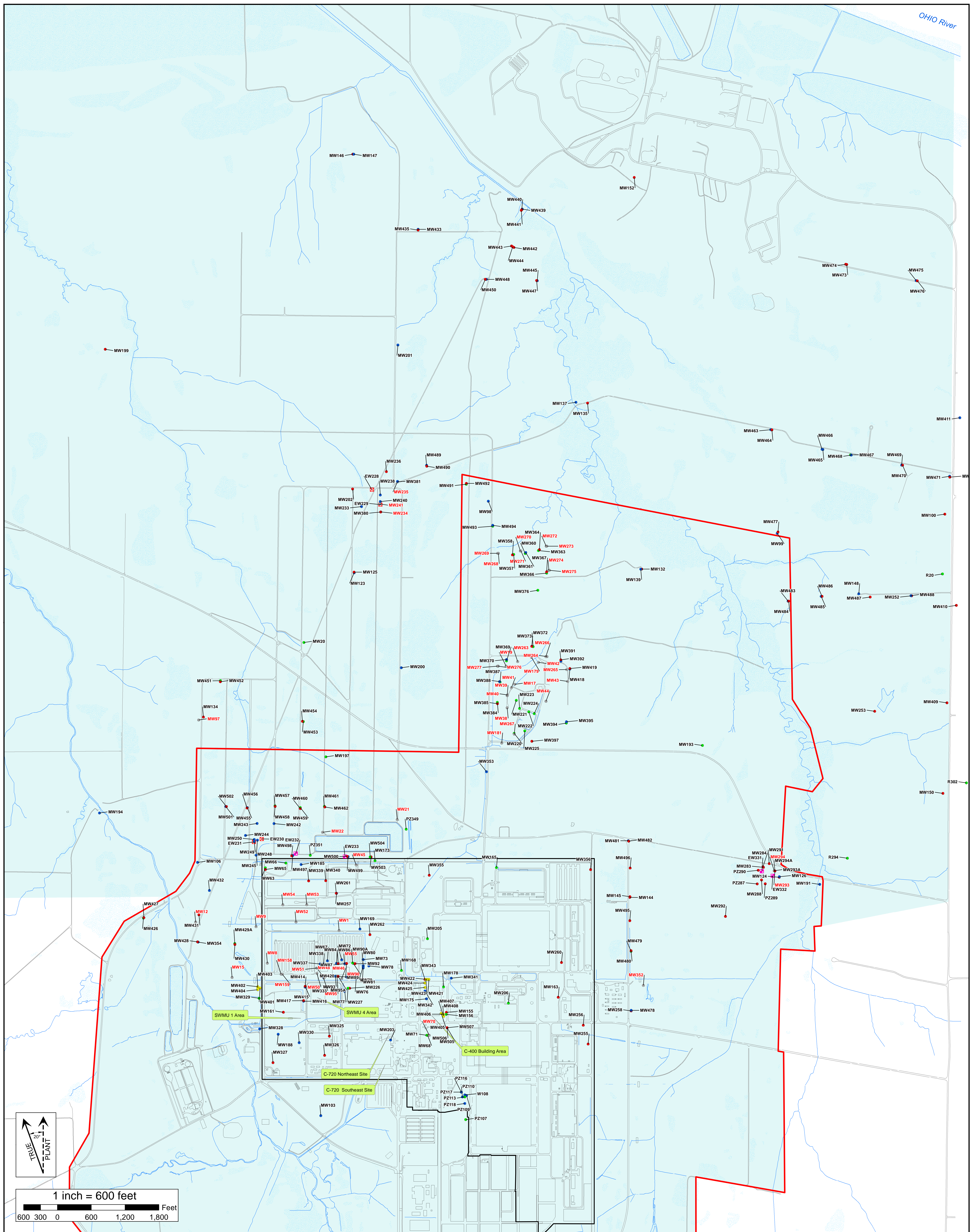
**PGDP WELL NETWORK FOR THE REGIONAL GRAVEL
AQUIFER AND 2014 PLUME MAPS**

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FIGURES

C.1. Locations of Regional Gravel Aquifer Monitoring Wells at Paducah Gaseous Diffusion Plant	C-5
C.2. 2014 TCE Plume—Regional Gravel Aquifer	C-7
C.3. 2014 Tc-99 Plume—Regional Gravel Aquifer	C-9

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|--|---|---|
| <p>Monitoring Well Information</p> <p>Screened Horizons -</p> <ul style="list-style-type: none"> ● Regional Gravel Aquifer (multi-screened) ● Upper Regional Gravel Aquifer¹ ● Middle Regional Gravel Aquifer ● Lower Regional Gravel Aquifer ● Abandoned RGA Well | <ul style="list-style-type: none"> ■ - Water Policy Area MW103 - Active Monitoring Well MW294 - Abandoned Monitoring Well R20 - Residential Well EW - Extraction Well X - Inactive Extraction Well | <ul style="list-style-type: none"> - DOE Property Boundary - Roadways - Streams - PGDP Boundary |
|--|---|---|

¹(Residential wells are assumed to be completed in the Upper Regional Gravel Aquifer)

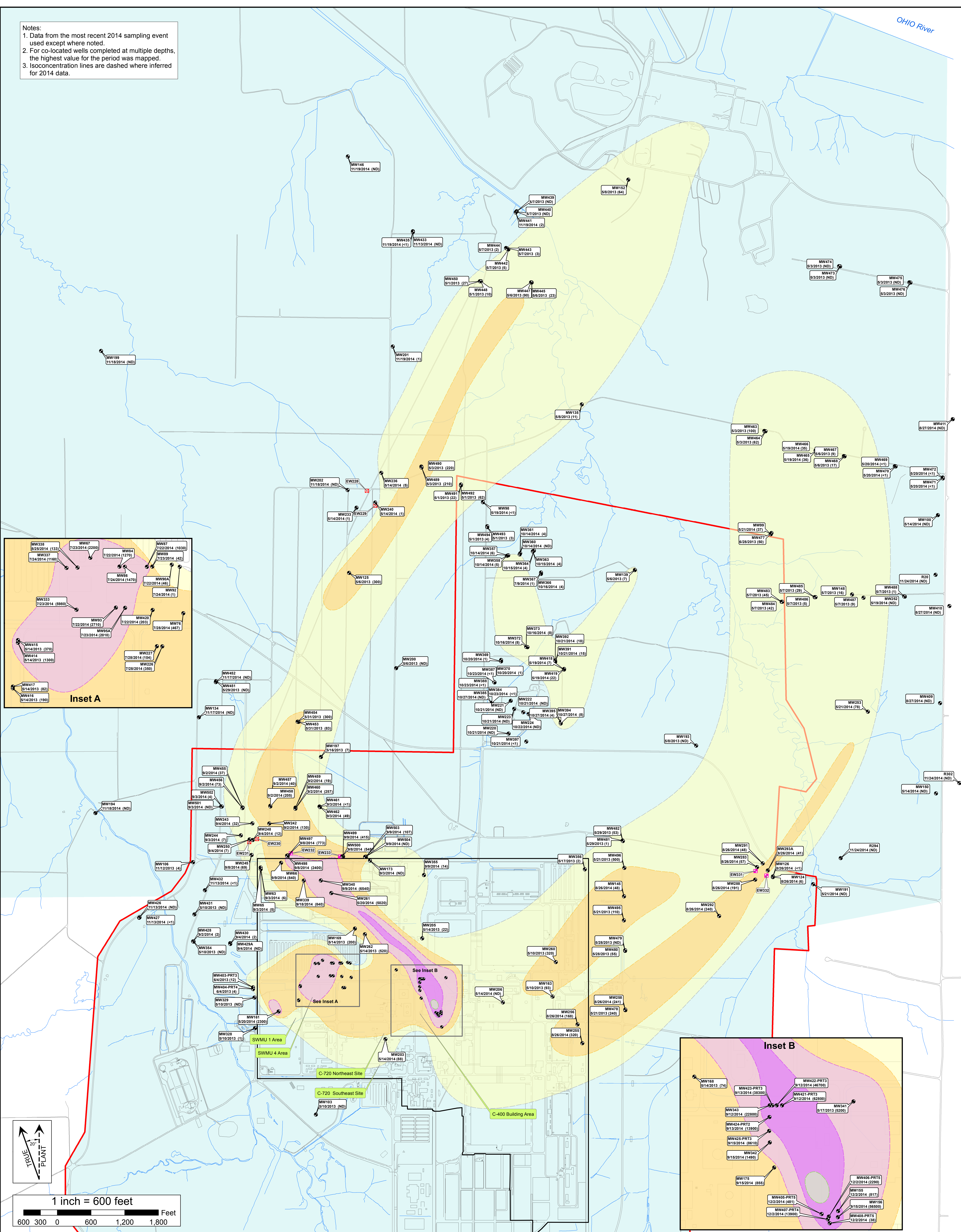


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PADUCAH GASEOUS DIFFUSION PLANT

Figure C.1. Locations of Regional Gravel Aquifer Monitoring Wells at Paducah Gaseous Diffusion Plant

FILE NAME: Fig_C01_2014PlumesR1	PROJECT #: EM	SCALE: AS NOTED	DATE: 6/4/2015
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Notes:
 1. Data from the most recent 2014 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.
 3. Isoconcentration lines are dashed where inferred for 2014 data.



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<p>2014 TCE Plume Concentration Fields</p> <ul style="list-style-type: none"> 5 - 100 µg/L 100 - 1,000 µg/L 1,000 - 10,000 µg/L 10,000 - 100,000 µg/L ≥ 100,000 µg/L 	<ul style="list-style-type: none"> - Water Policy Area MW103 (11/18/2014 (ND)) - Monitoring Well Identification, Date of Sample, and Sample Value - RGA Well - Extraction Well - Inactive Extraction Well 	<ul style="list-style-type: none"> - DOE Property Boundary - Roadways - Streams - PGDP Boundary
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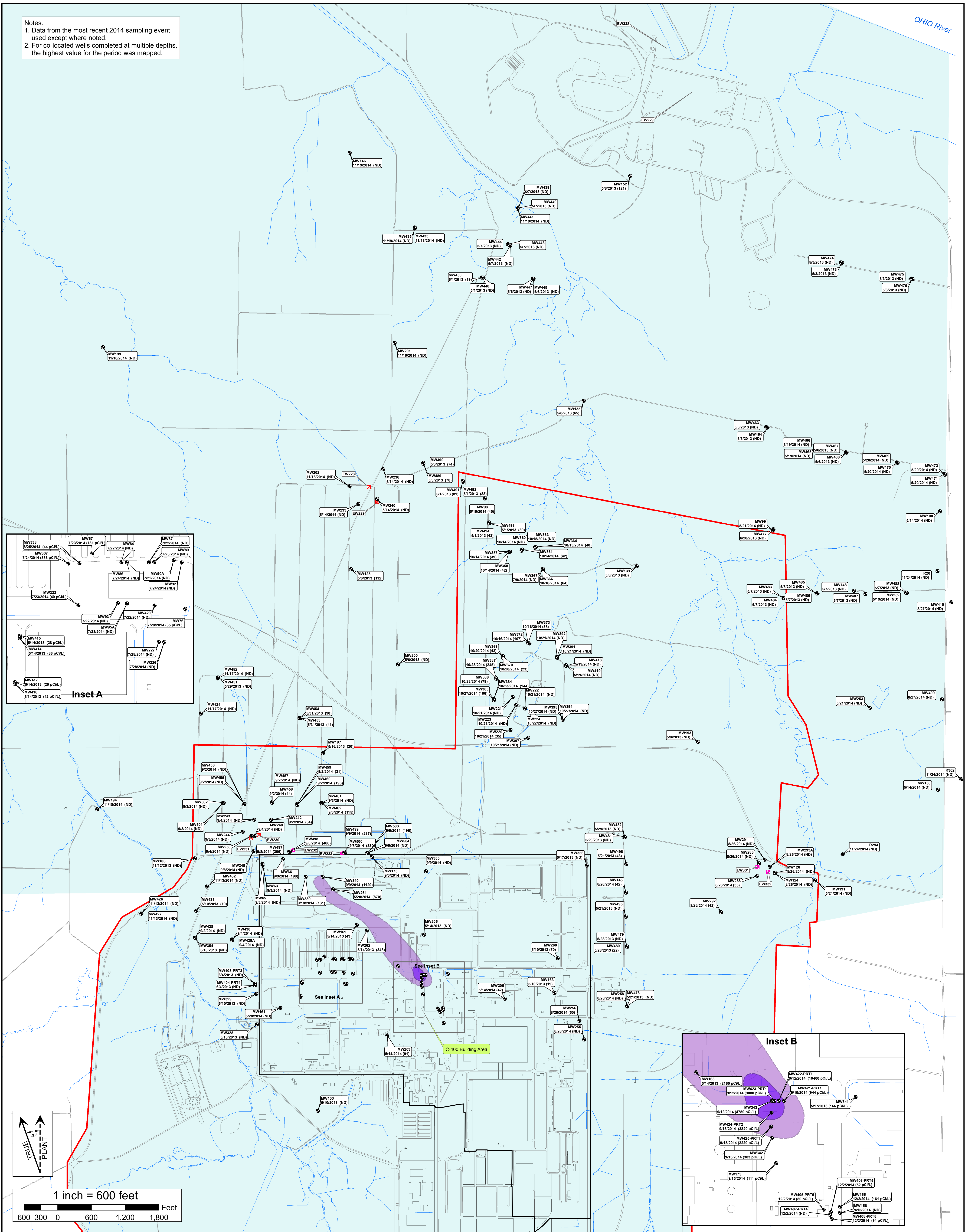


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Figure C.2. 2014 TCE Plume—Regional Gravel Aquifer

FILE NAME: Fig_C02_2014PlumesTCER1	PROJECT #: EM	SCALE: AS NOTED	DATE: 6/8/2015
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Notes:
 1. Data from the most recent 2014 sampling event used except where noted.
 2. For co-located wells completed at multiple depths, the highest value for the period was mapped.



LEGEND

2014 Tc-99 Plume Concentration Fields
 900 - 3,790 pCi/L
 ≥ 3,790 pCi/L

- Water Policy Area
- MW103
5/17/2014 (ND) - Monitoring Well Identification, Date of Sample, and Sample Value
- RGA Well
- Extraction Well
- Inactive Extraction Well

- DOE Property Boundary
- Roadways
- Streams
- PGDP Boundary



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Figure C.3. 2014 Tc-99 Plume—Regional Gravel Aquifer