Role of Modeling in the Remediation of the WP14/LF15 Chlorinated Solvent Plume at Dover Air Force Base, Delaware

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Role of Modeling in the Remediation of the WP14/LF15 Chlorinated Solvent Plume at Dover Air Force Base, Delaware

- Introduction
- Location and Background
- Fate and Transport Modeling
- Source Delineation and Treatment
- Summary and Path Forward

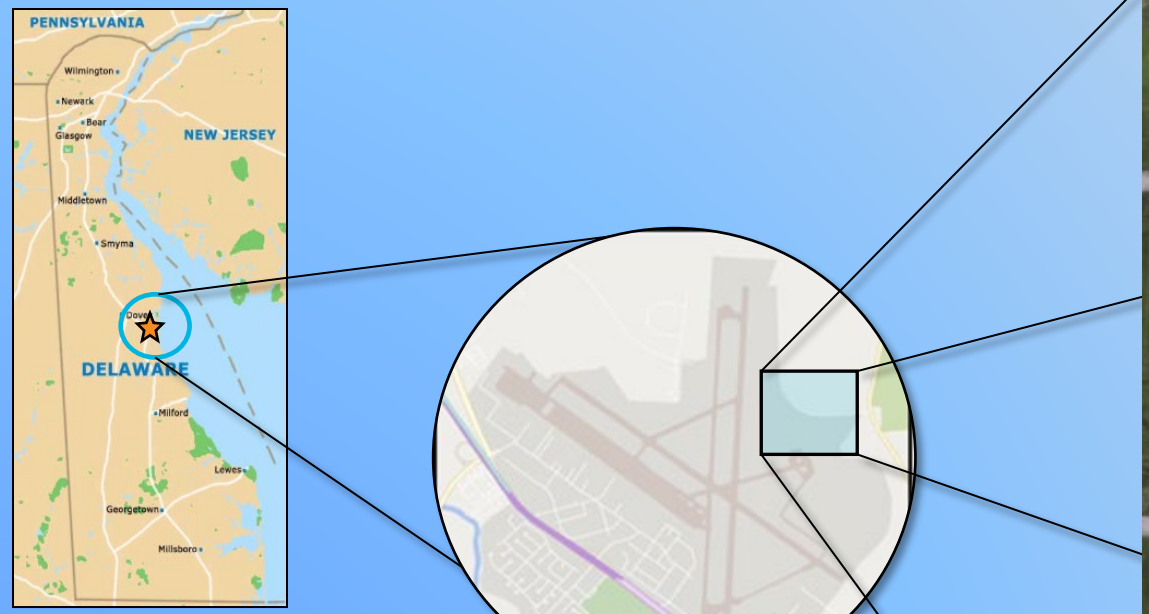
Introduction

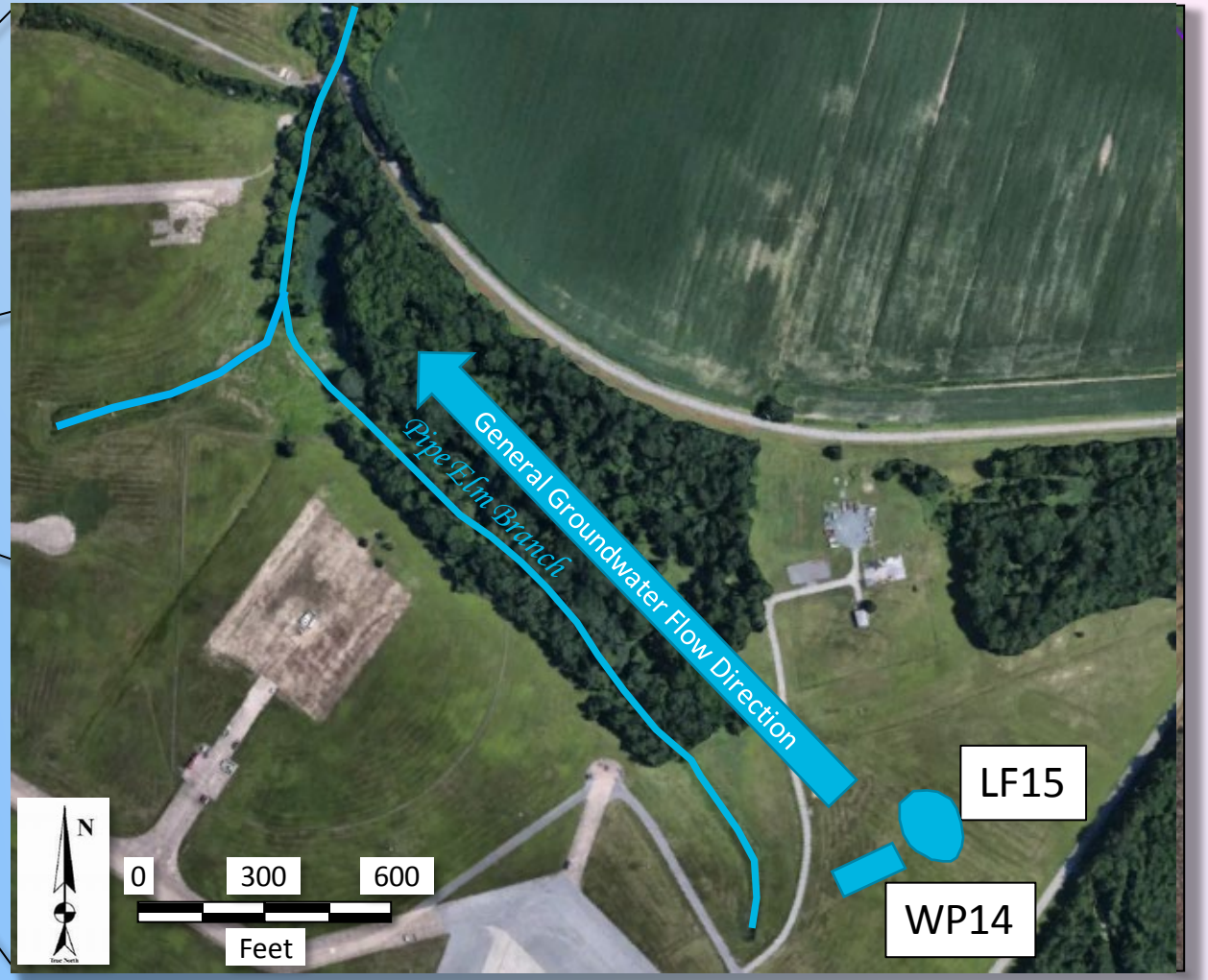
This is a case study of the use of various modeling and data evaluation tools to manage and investigate environmentally impacted sites.

Two locations at Dover Air Force Base, WP14/LF15 were selected as our case study to show how multiple modeling tools were employed at various points during a nearly 30-year long project.

Models developed across the base and refined to address issues specifically at WP14/LF15 provided greater assurance for implemented and augmented remedial technologies to reach Remedial Action Objectives.

Location of WP14 and LF15





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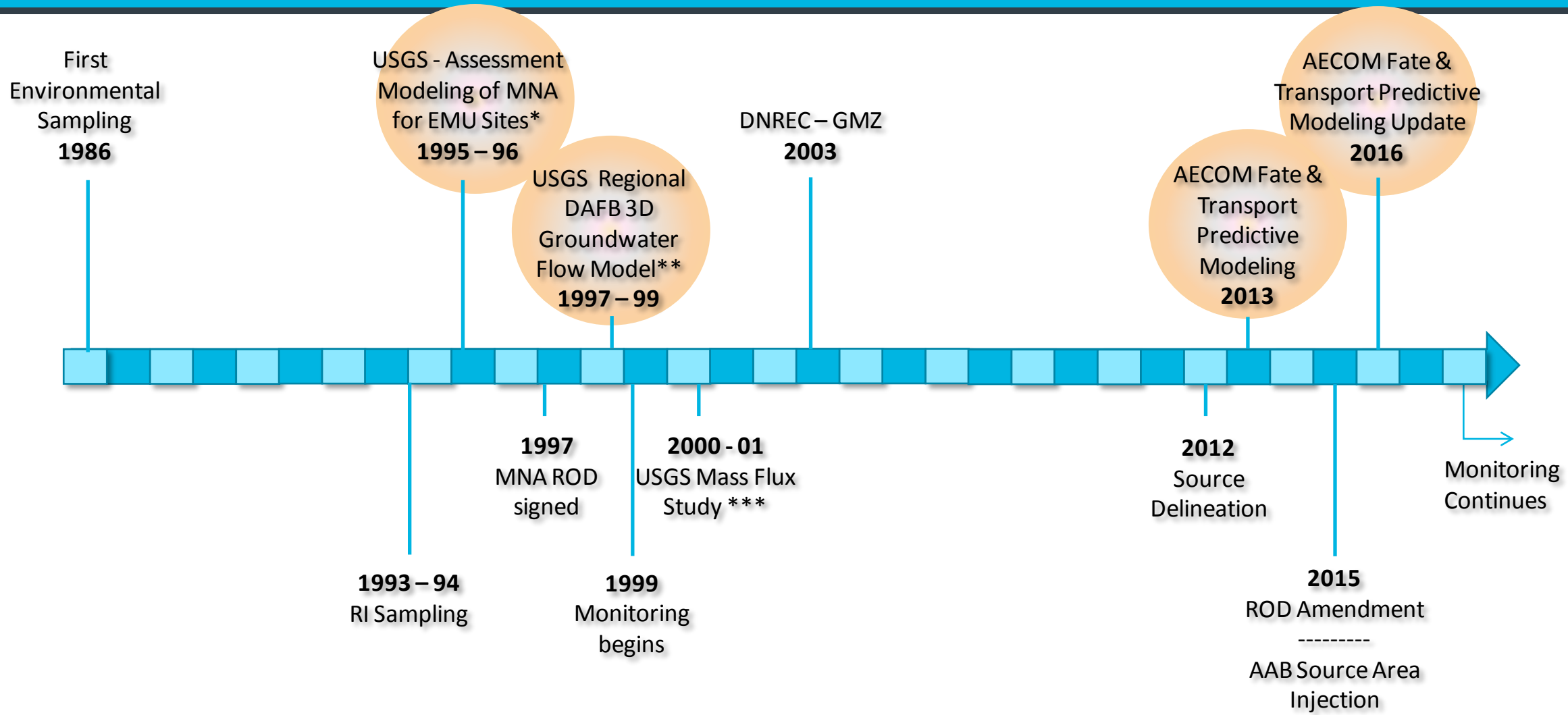
Background of WP14 and LF15

- WP14 – Liquid Waste Disposal Pit
  - Active in late 1950s to early 1960s
  - Disposed of liquid shop wastes including oils and solvents
- LF15 – Landfill
  - Active during the 1960s
  - Used for solid waste and small quantities of shop wastes
- Early 1960s (precise time frame unknown), sites were covered with soil and grass. No active remediation was conducted.
- Environmental investigations revealed a groundwater contamination plume, primarily PCE and TCE and their breakdown products.
- Monitored natural attenuation was implemented per 1997 Record of Decision.

Environmental Restoration Time-Line



* Published in 1998
** Published in 2000
*** Published in 2001

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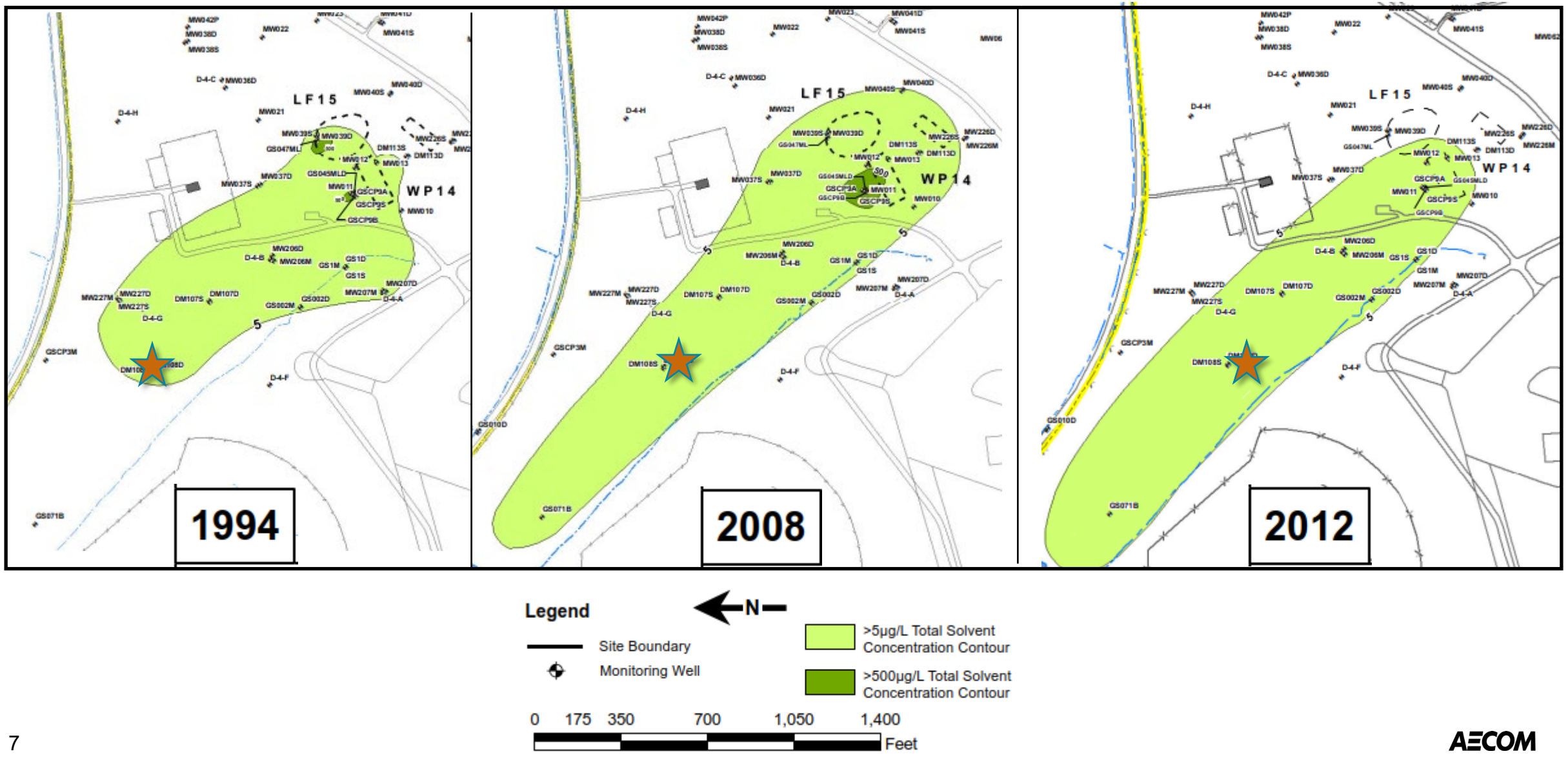
Plume over Time



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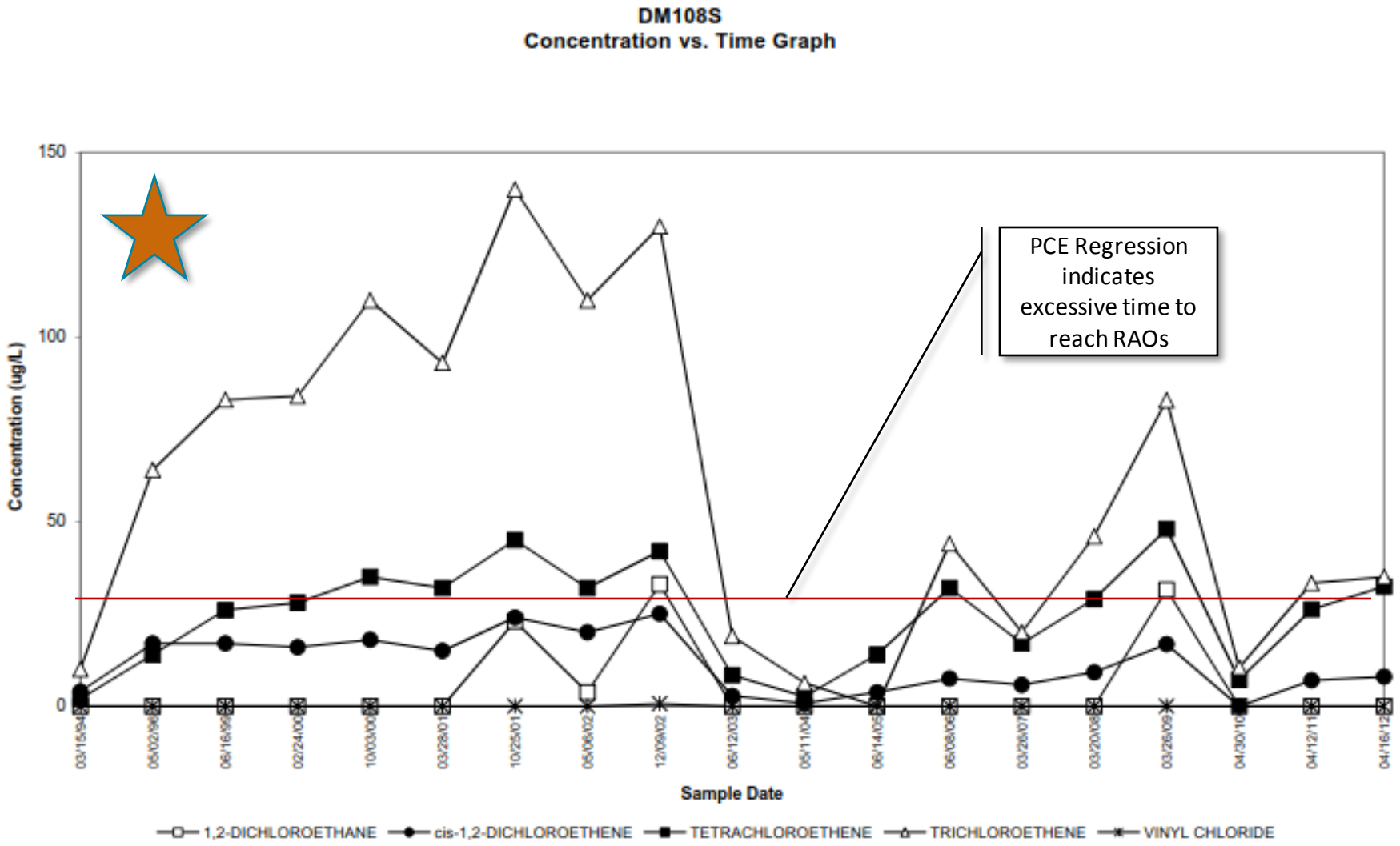
Trend Evaluation of MNA for meeting RAOs



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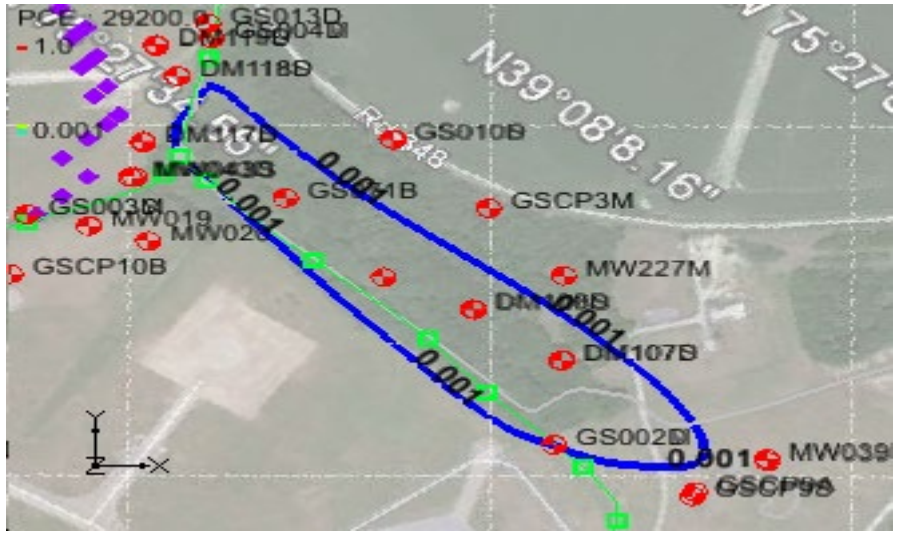
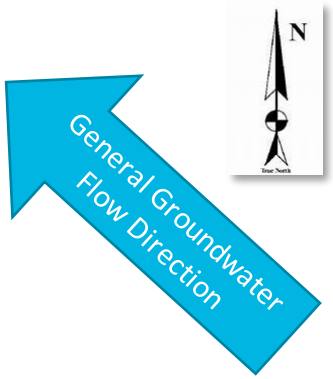
Simulated PCE Plume Assuming no Source Area

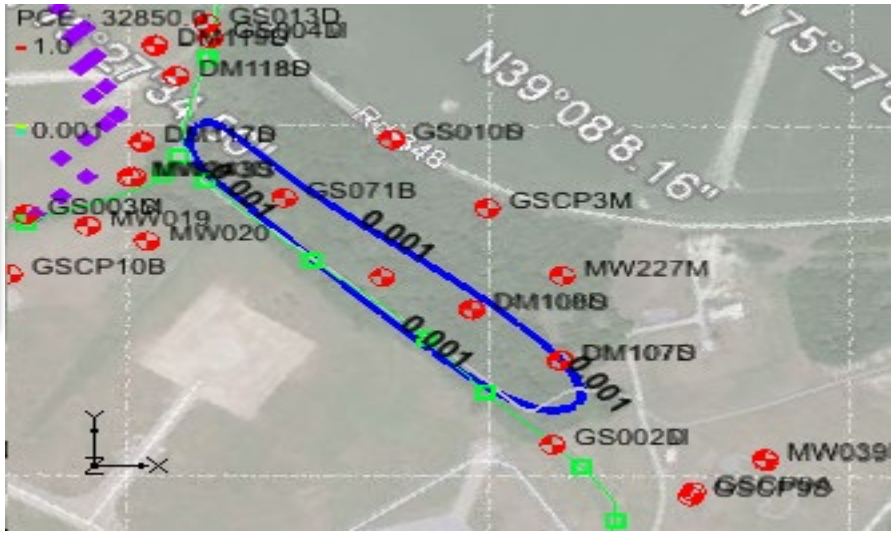
T = Present (1994), source removed

T = Source removed + 10 years



T = Source removed + 20 years





T = Source removed + 30 years

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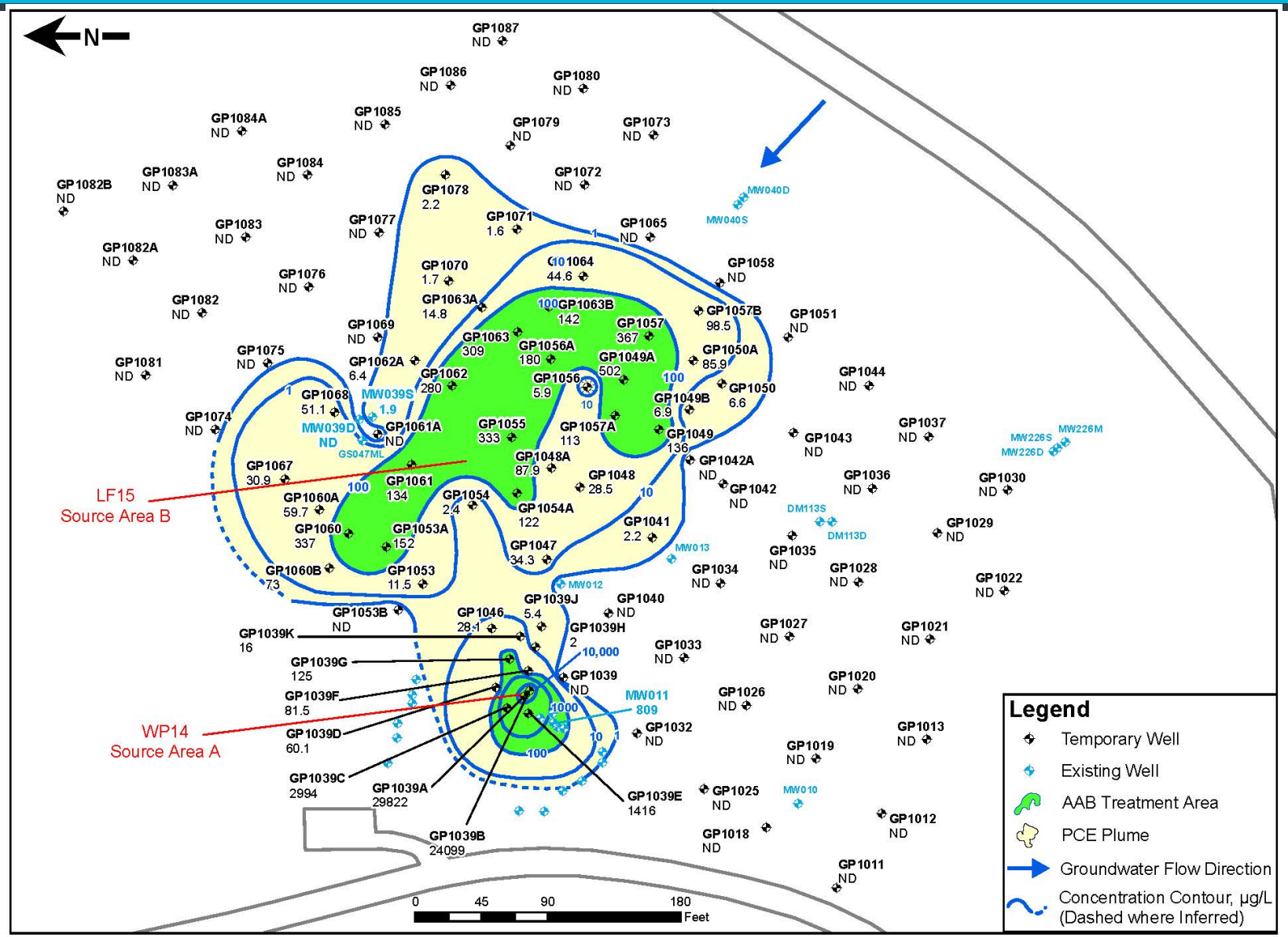
Fate and Transport Modeling

- Graphical trend analysis has been used for plume monitoring since 2003.
- More robust numerical modeling was performed, starting in 2013, to provide information on the fate and transport of COCs and time to reach RAOs.
- Site data were used to calculate site-specific degradation rates. Degradation rates were refined through iterative model runs to best fit observed constituent distributions using both reactive (RT3D) and non-reactive (MT3DMS) model codes.
- At WP14/LF15, graphs of COC trends in source area wells were used to predict when source area concentrations would fall below RAOs.
- Model runs with calibrated parameters and assuming no continuing source were used to estimate when the dissolved plume areas would fall below RAOs.
- Modeling indicated that total time to reach RAOs 40+ years.

Source Delineation and Treatment

- 77 locations across WP14 and LF15
- Evidence of previously unknown source material
- Highest PCE Concentration = 29,822 µg/L
- Carbon injections in AAB treatment area in 2015



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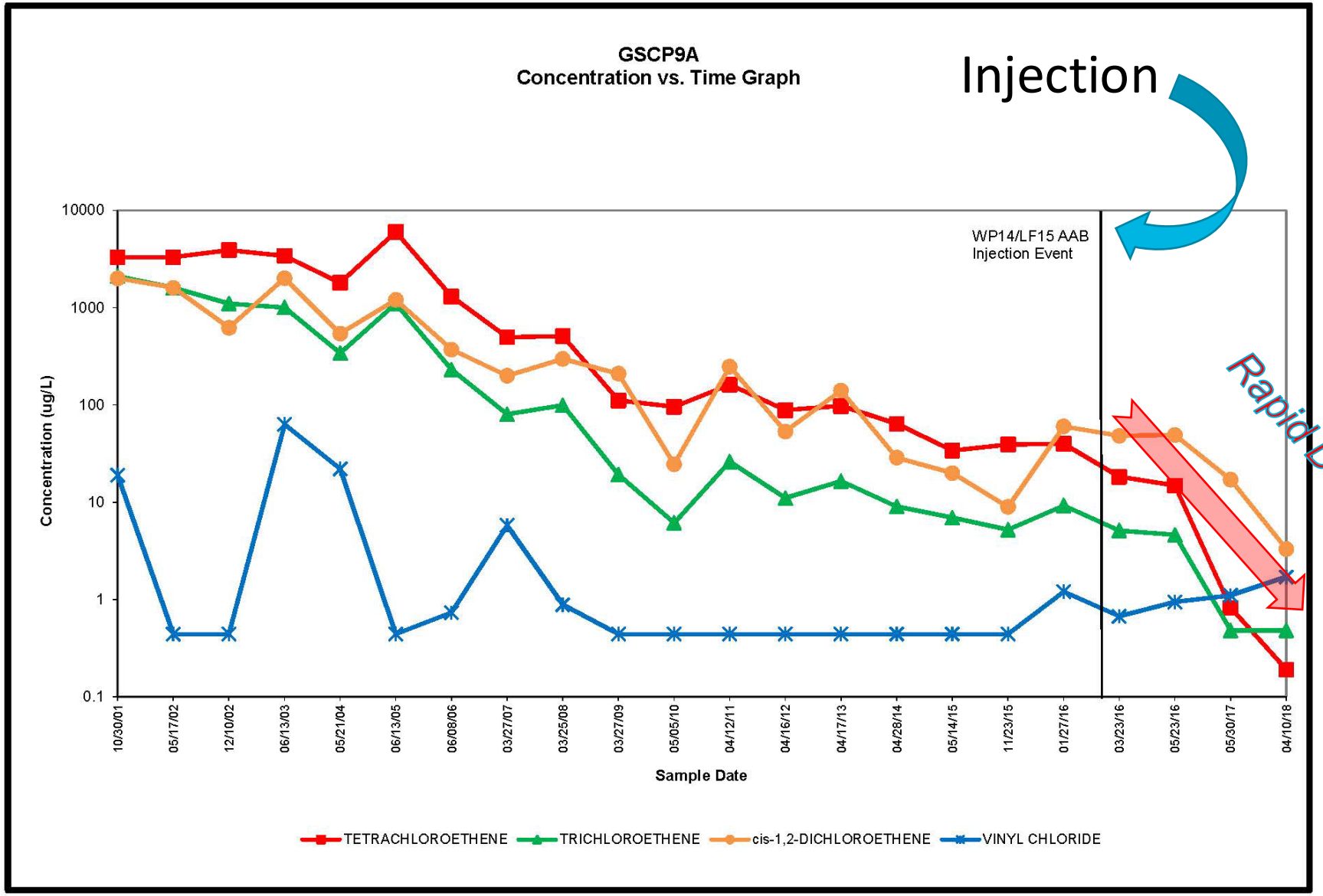
Source Area Well Trend Graph



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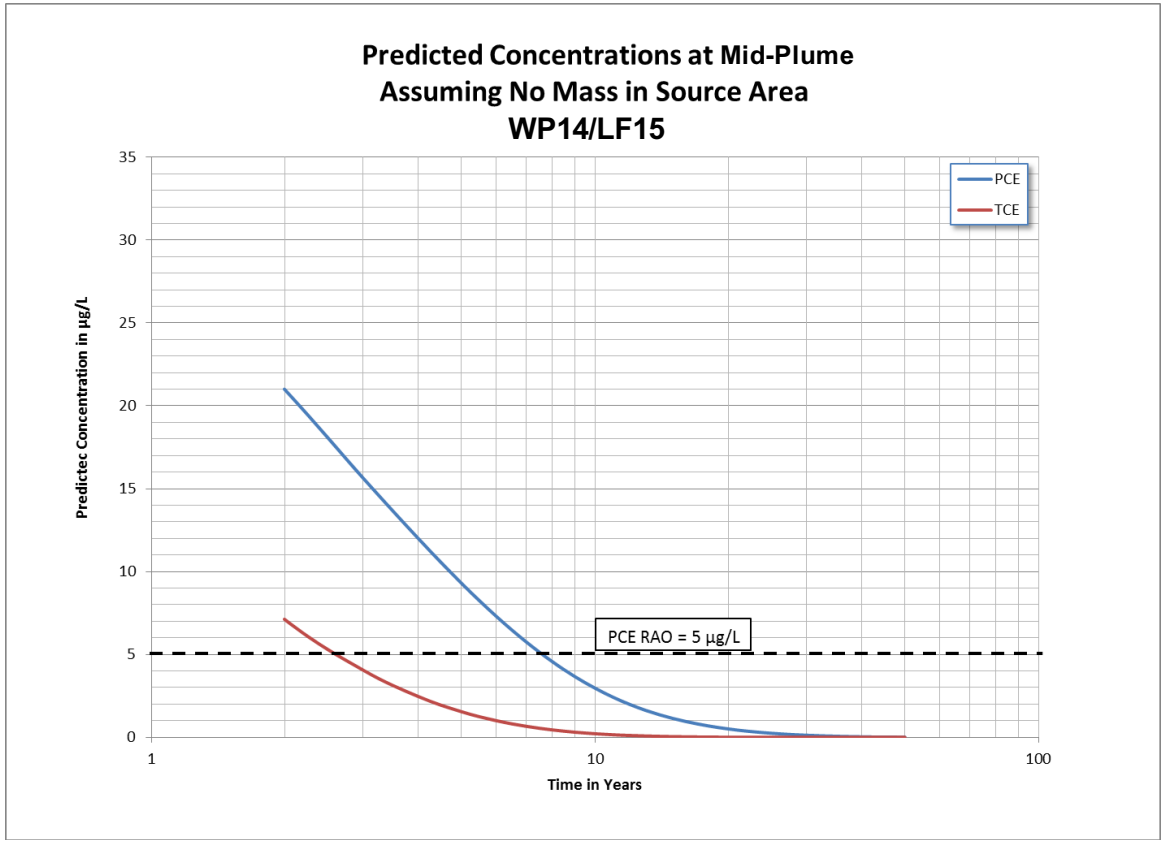
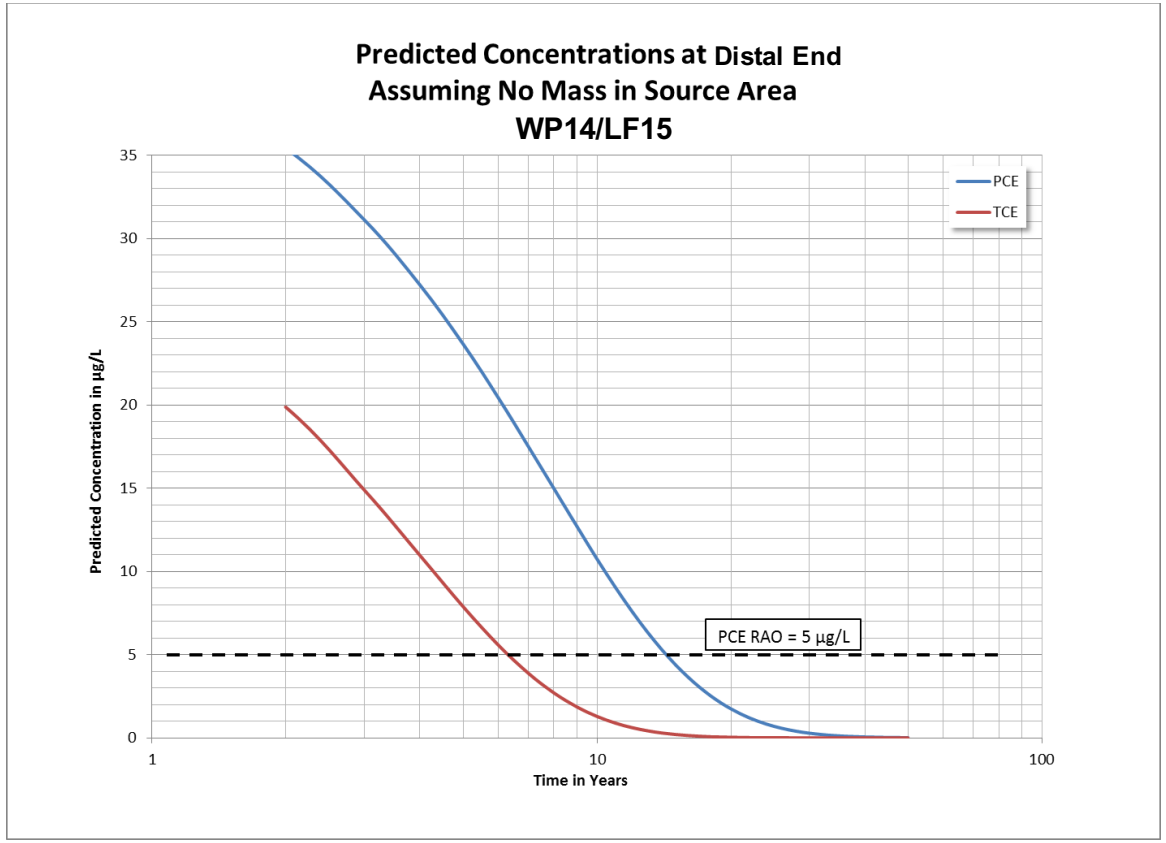
Updated Simulated Concentrations over Time





Simulated concentrations drop below RAOs in approximately 20 to 25 years

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Summary

- WP14/LF15 was selected as our case study to show how multiple modeling tools were employed at various points during a nearly 30-year long project.
  - Early on, USGS models provided foundational understanding of F&T and support of remedy selection.
- Previous modeling exercises at modeling studies at DAFB indicated the importance of understanding source area conditions for overall plume persistence.
- Concentration trends inconsistent with model results raised concerns that RAOs would not be met in reasonable time frame and that source area conditions may be different than expected at WP14/LF15.
- Subsequent source area investigation identified mass remaining in source area which was treated using
- Refined 3D Fate and Transport modeling and Trend analysis supported a change to the existing remedy.

Path Forward

- Continue annual plume monitoring and evaluation of concentration trends as compared to predicted changes.
- Enhance the Conceptual Site Model through Environmental Sequence Stratigraphy (ESS)
- When RAOs are reached, use statistical analysis or modeling to demonstrate sustainable achievement of RAOs

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Thank You!

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