A Phased Remedial Approach with "Soft" and "Hard" Transition Triggers for a Chlorinated Solvent Plume at Kennedy Space Center

Presented to:

NASA

By:

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Background

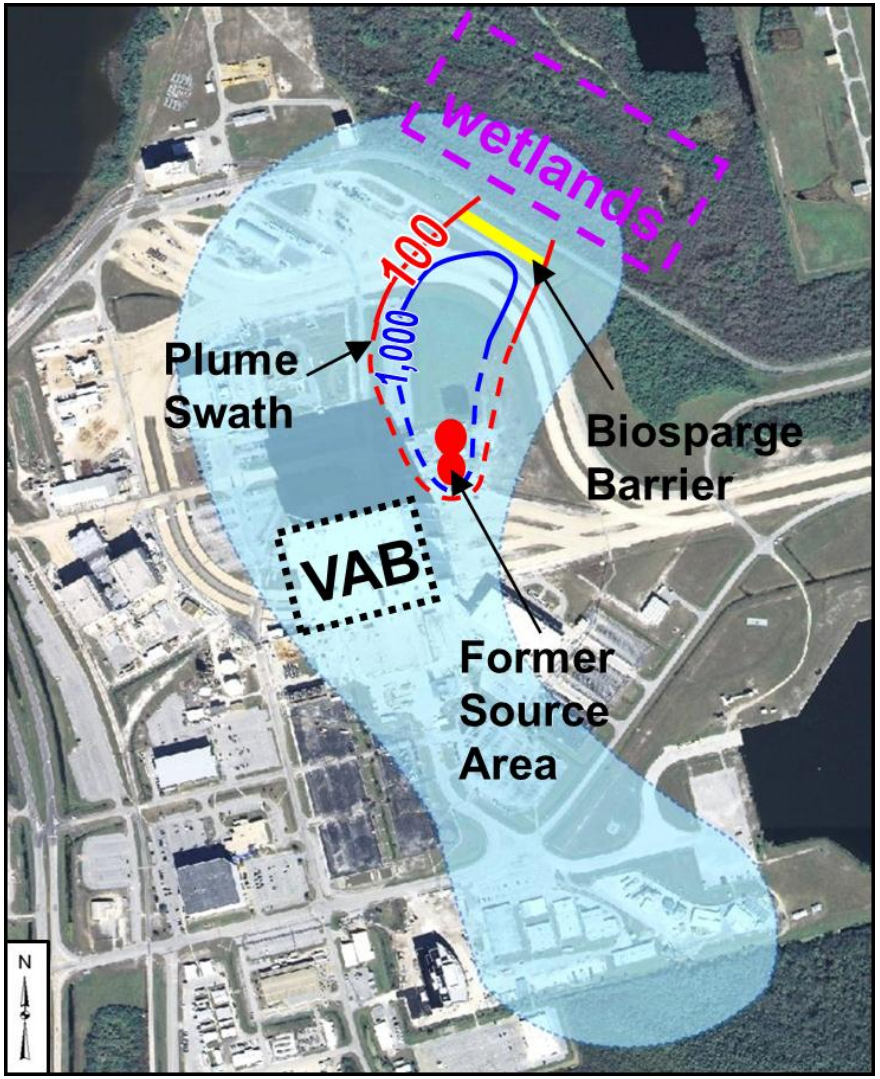
Site Information

- National Aeronautics and Space Administration's (NASA's) Vehicle Assembly Building (VAB) area at the Kennedy Space Center in east-central Florida.
- Groundwater Chlorinated Volatile Organic Compound (CVOC) plume
- Trichloroethene source area = 0.5 acres
- Dissolved plume area (primarily Vinyl Chloride) = +100 acres

NASA VAB area circa 1966

Long Term Management Plan

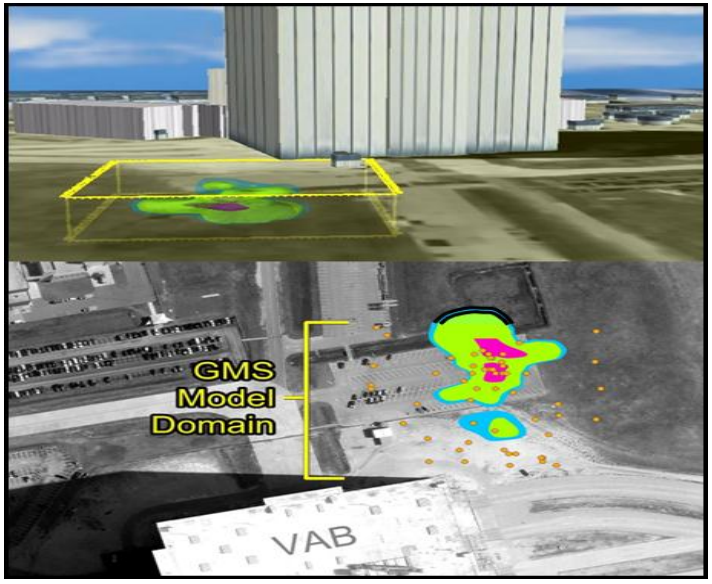
- RCRA site regulated by FDEP
- Worked with FDEP to create phased remedial approach
- Created triggers to determine when to transition between active and passive remediation
  - Hard Trigger = Quantitative
  - Soft Trigger = Qualitative
- Enhanced bioremediation in source area
- Biosparge barrier to mitigate potential discharge to adjacent surface water
- LTM for remaining dissolved VC plume (area in light blue)

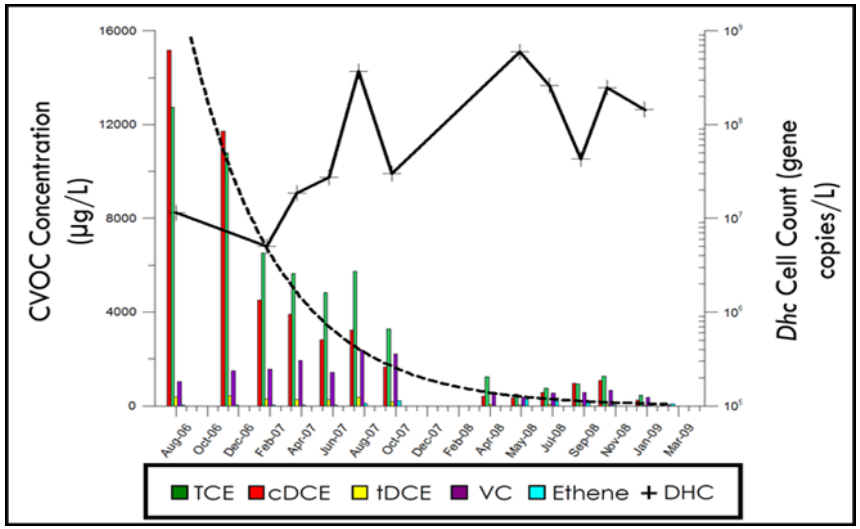


Phase One – Source Zone Bioremediation and Biosparge Barrier

Source Zone Bioremediation

- Biostimulation with ethyl lactate injections over two years in SZ
- **Hard trigger** for SZ transition
  - CVOC concentrations reduced below the FDEP Natural Attenuation Default Concentrations (NADCs; ~ 100 x MCLs)
- Concentrations of all CVOCs reduced well below NADCs (exceeded goals) and transitioned to LTM



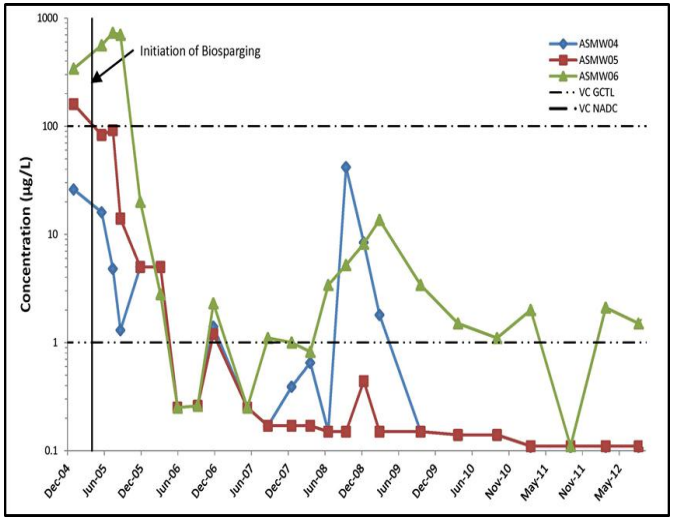


Source Zone Sampling Results

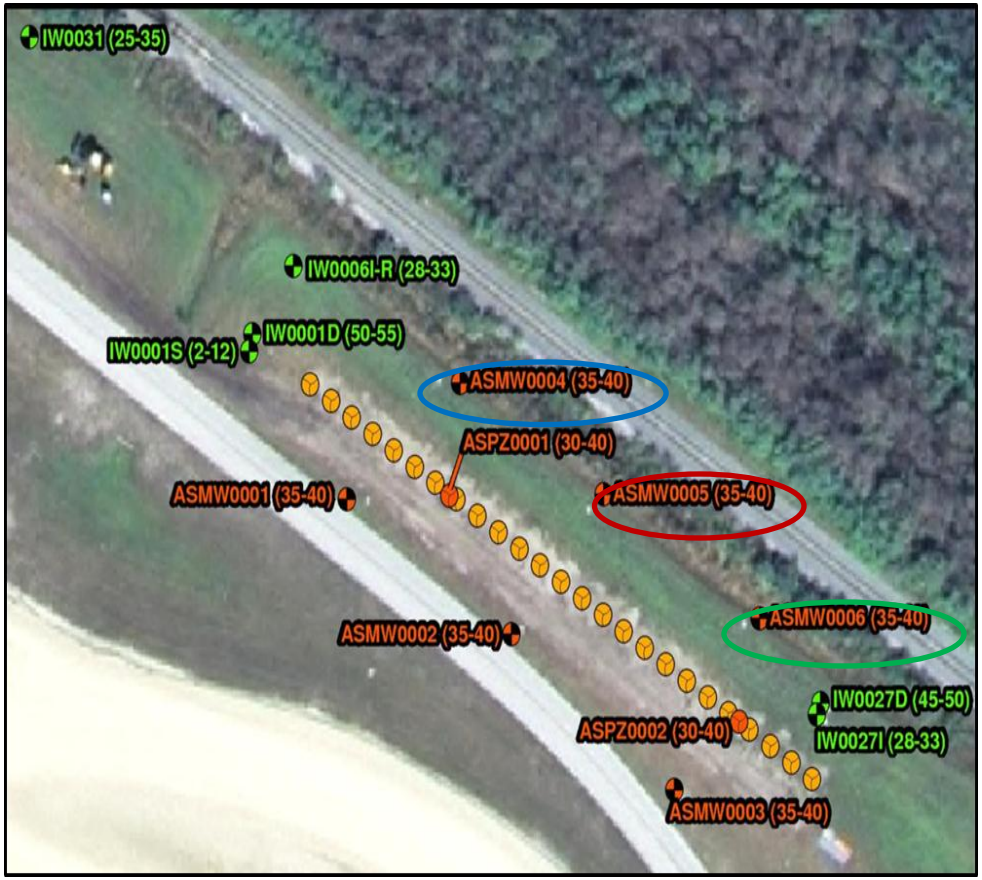
Phase One – Source Zone Bioremediation and Biosparge Barrier

Biosparge Barrier

- 25 biosparge wells covering a length of approximately 360 feet designed to treat area where VC > 100 µg/L
- **Soft trigger** for biosparge barrier transition - collapse of dissolved plume



Biosparge Wall Downgradient VC Sample Results

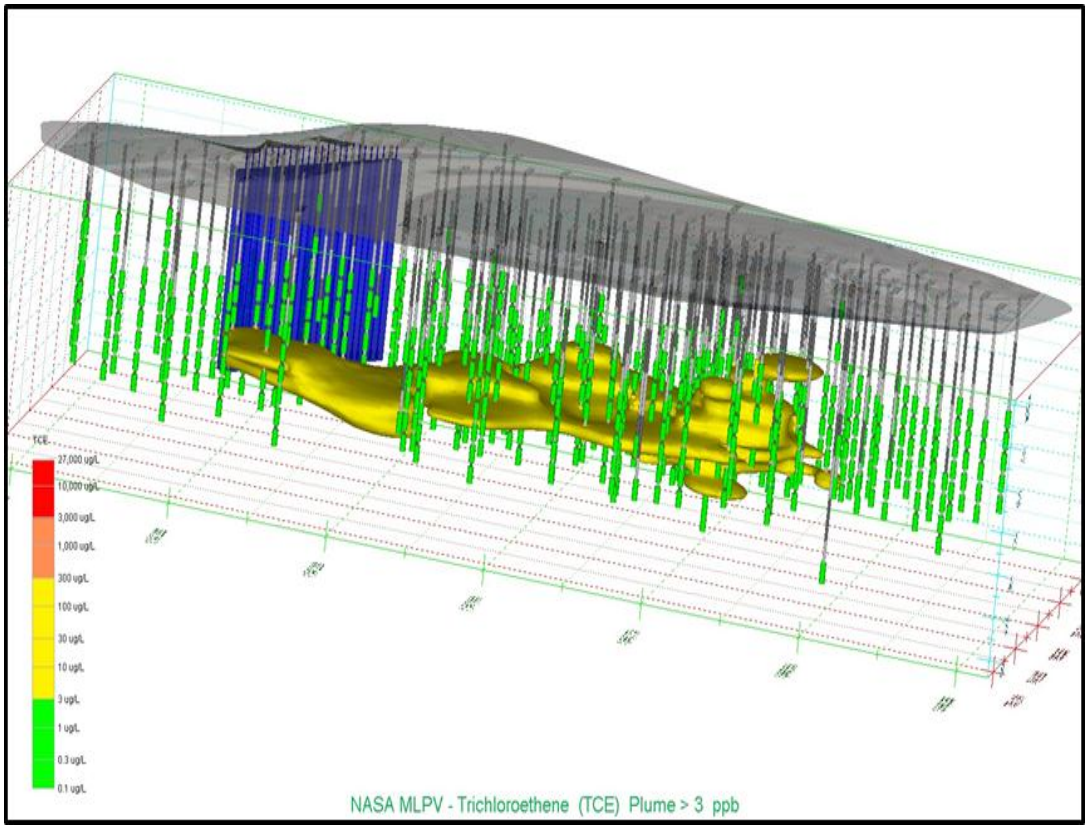


Biosparge Wall Layout

Phase Two – Supplemental Assessment and Air Sparging

Supplemental Assessment

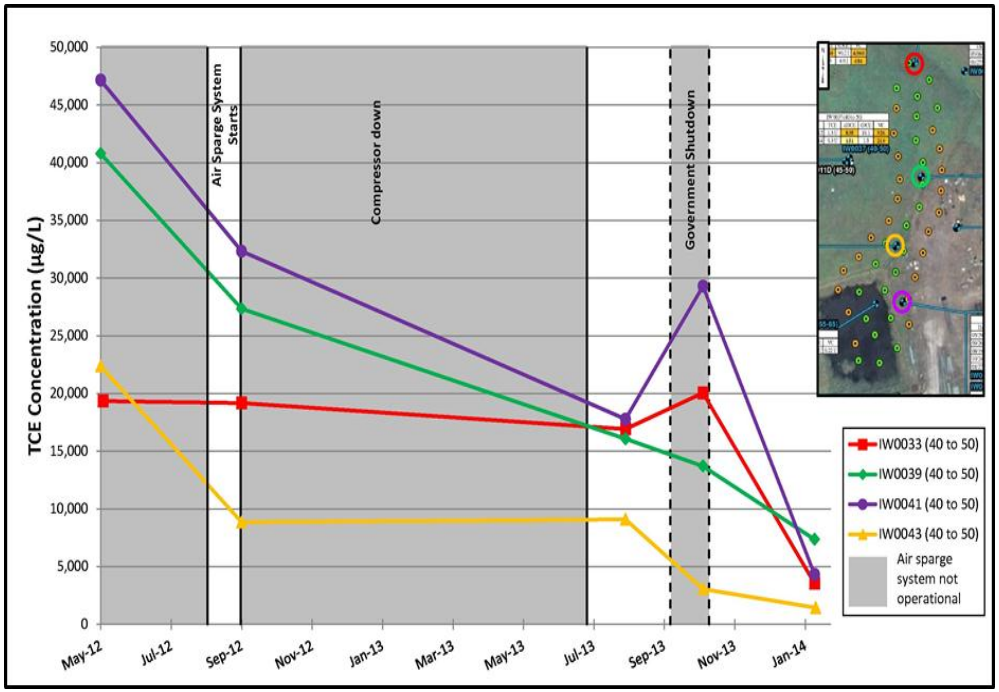
- Once SZ transitioned to LTM, supplemental assessment of plume swath between source area and biosparge wall initiated
- Conducted Direct Push Technology groundwater sampling
- Utilized results to refine CSM



Phase Two – Supplemental Assessment and Air Sparging

Air Sparge Implementation

- Install air sparge system in portion of plume swath where TCE > 300 µg/L and *cis*-dichloroethene > 7,000 µg/L (high concentration plume)
- **Hard trigger** in place for air sparge operation
  - Transition when CVOC concentrations are below NADCs
- Cost effectively utilizes mechanical equipment shared with the biosparge barrier
- Currently operational and providing rapid concentration reductions



Results and Conclusions of Long Term Management Plan

- The source area bioremediation achieved transition trigger and transitioned into LTM in less than 2 ½ years (greater than 99% CVOC mass removed).
- The biosparge barrier has met the objective of mitigating the potential discharge of the dissolved vinyl chloride plume to the wetlands and surface water.
- The updated CSM led to the design and installation of an air sparge system (operations initiated in 2013), which is providing for rapid reductions of CVOCs within the primary dissolved plume swath
- Anticipated operation of air sparge system will facilitate transition into LTM.
- Implementation of remedial alternatives in a phased approach and establishment of transition triggers has allowed NASA to work within the regulatory framework to move the site toward closure.