B-036, in K.A. Fields and G.B. Wickramanayake (Chairs), *Remediation of Chlorinated and Recalcitrant Compounds—2010.* Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2010). ISBN 978-0-9819730-2-9, Battelle Memorial Institute, Columbus, OH, **www.battelle.org/chlorcon**.

DNAPL Source Excavation with Electron Donor Injection for Chlorinated Hydrocarbon Remediation

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ABSTRACT: Launch Complex (LC) 39A is a National Historic Site located within Kennedy Space Center, on the east coast of Florida. During Resource Conservation and Recovery Act (RCRA) investigations, trichloroethene (TCE), cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC) concentrations were discovered in groundwater at levels exceeding the Florida Department of Environmental Protection (FDEP) Groundwater Cleanup Target Levels (GCTLs) in the liquid oxygen tank (LOX) area of LC 39A. Subsequent site investigations indicated the impacted area was beneath and downgradient from the discharge point of the LOX pipes.

LC 39A is an active launch facility used for NASA's Space Transport System (STS) operations. Selection of a remedial technology involved consideration of restrictions not typical to many RCRA sites. In particular, access to the site is limited for security and safety reasons, resulting in very short windows of opportunity for remedy implementation in between STS launches. Based upon the access constraints and limited "hot spot" identified at the discharge point of the LOX pipes, electron donor injection was initially selected as an applicable remedial technology, and in September 2005 Hydrogen Release Compound (HRC®) was injected into 25 borings near and downgradient from the LOX pipes. The initial results indicated that the electron donor was successful in reducing the chlorinated volatile organic compound (CVOC) concentrations. Additionally, increases in the Dehalococcoides population were observed. However, after one year the CVOC concentrations rebounded indicating that the source of the CVOC contamination may not have been fully characterized at the presumed source. Additional site investigations determined that an upgradient dense non-aqueous phase liquid (DNAPL) source zone existed in saturated soils beneath the base of an adjacent ditch.

The decision was made to aggressively remove the DNAPL source area through excavation, with the subsequent injection of HRC® to address residual dissolved phase CVOCs. The entire remedy implementation was completed in a two-week period, with activities starting less than 12 hours after the launch of STS-119, which had been delayed by several days, and ending one day prior to the roll-out of STS-125. During this period, site clearing, monitoring well abandonment and replacement, LOX pipe removal and replacement, drainage ditch dewatering and water treatment, soil removal (516 cubic yards), backfill, HRC® injections (2,400 pounds at 40 locations, 5 to 20 feet bgs), and site restoration were completed. Groundwater samples collected from the source area 3 months and 9 months after remedial actions indicate TCE concentrations are near GCTLs. Monitoring will continue quarterly for one year to document CVOC concentrations and natural attenuation parameters.

INTRODUCTION

The development of an accurate conceptual site model (CSM) is a key component to the successful remediation of any Resource Conservation and Recovery Act (RCRA) site. The initial remediation efforts at Kennedy Space Center's Launch Complex 39A appeared successful following the first post-remedial sampling event, six months after electron donor injection. However, chlorinated volatile organic compounds (CVOCs) concentrations in groundwater rebounded to levels above the initial concentrations within one year. By revisiting the CSM and completing a second site investigation, a dense nonaqueous-phase liquid (DNAPL) source was discovered in an area that had not been considered during the development of the first CSM. Using the new assessment results and the revised CSM, the second remedial action was implemented. This study focuses on the development of the revised CSM and the implementation of the second remedial action.

Site Description. Launch Complex 39A (LC39A) is a National Historic Site located within Kennedy Space Center (KSC), situated on the northern portion of Merritt Island, at the northern terminus of Cape Canaveral between the Indian and Banana Rivers. This National Aeronautics and Space Administration (NASA) facility encompasses an area of approximately 160 acres, and is the southernmost of KSC's two space shuttle launch sites situated along the eastern boundary of NASA property (Figure 1).

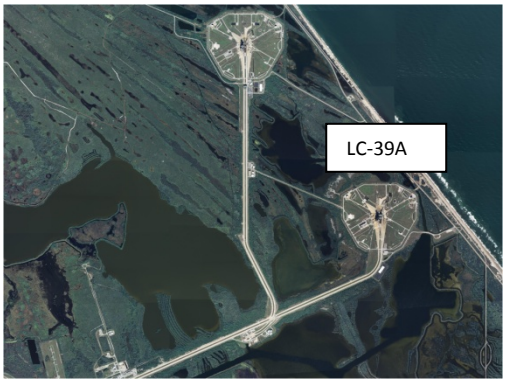

FIGURE 1. Launch Complex 39A.

Land currently occupied by the LC39A facility was undeveloped prior to the mid-1960s, when launch operations associated with the Apollo Space Program commenced. Prior to construction, sections of the site were wetlands associated with the Banana River and Mosquito Lagoon. The pad was retrofitted to support Space Transportation System (STS) operations in 1975. STS launches are ongoing, occurring several times a year.

MATERIALS AND METHODS

Resource Conservation and Recovery Act Facility Investigation (RFI) activities were performed at LC39A from early 1998 through mid-2000 to characterize the nature and extent of contamination at the site. Launch Complex 39A has nine support areas, each of which were designated as Potential Release Locations (PRLs), and investigated accordingly. One of the nine PRLs included the Liquid Oxygen Tank (LOX) Area.

Pertinent findings of these assessments and investigations indicated that groundwater flow radiates from the LC39A pad at the center of the site towards the lower elevation site perimeter. In the area of the site located adjacent and to the east of the LOX Area, groundwater impacts due to CVOCs, including trichloroethene (TCE), *trans*-1,2-dichloroethene (tDCE), *cis*-1,2-DCE (cDCE), and vinyl chloride (VC) were observed to be limited to the upper 40 feet of the aquifer and were remote from the perimeter fence.

Supplemental RFI activities were performed at LC39A from mid-2000 through early 2003 to further evaluate the presence and extent of contamination at four specific areas of the site, including the LOX Area. The supplemental RFI field activities revealed that elevated concentrations of CVOCs identified in groundwater in October 2001 decreased rapidly and significantly over time and with distance away from the LOX Area discharge pipe outfall (the conceptualized source area). TCE did not exceed the surface water cleanup target level (SWCTL) in any of the monitoring wells. Low levels of cDCE, tDCE, and VC were detected in several wells.

Based on the data evaluated during the LC39A RFI, the impacted media was identified to be groundwater. A CVOC plume was identified in groundwater downgradient of the LOX Area discharge pipe outfall at LC39A. The CSM developed for the site was based upon a historic release of TCE from the LOX pipe outfall, which created the low-concentration dissolved groundwater plume. At the time of the RFI Addendum, the plume consisted primarily of cDCE and VC.

Based upon the CSM findings which documented a limited footprint and a degrading CVOC plume with a limited and reasonable source area, an interim measure (IM) was considered a viable approach for transitioning the site into a Long Term Monitoring strategy. The IM was performed to target the source area conceptualized in the RFI Addendum associated with the drainage pipe outfall from the LOX Area. The selected IM involved injection of an electron donor, Regenesis' Hydrogen Releasing Compound (HRC®), to stimulate enhanced reductive dechlorination (ERD). The purpose was to reduce CVOC concentrations to less than Natural Attenuation Default Criteria (NADCs), thereby enabling long-term monitoring of the groundwater.

Following baseline sampling in December 2004, HRC® injection was completed in January 2005. HRC® was injected at 25 locations using direct push technology (DPT) from 25 to 35 ft BLS, with a spacing of approximately 10 ft in the vicinity of the discharge pipes from the LOX area. An HRC® dose of 4.5 pounds per foot (lb/ft) was applied under pressure, resulting in a total of 2,280 lbs of HRC® being injected at the site.

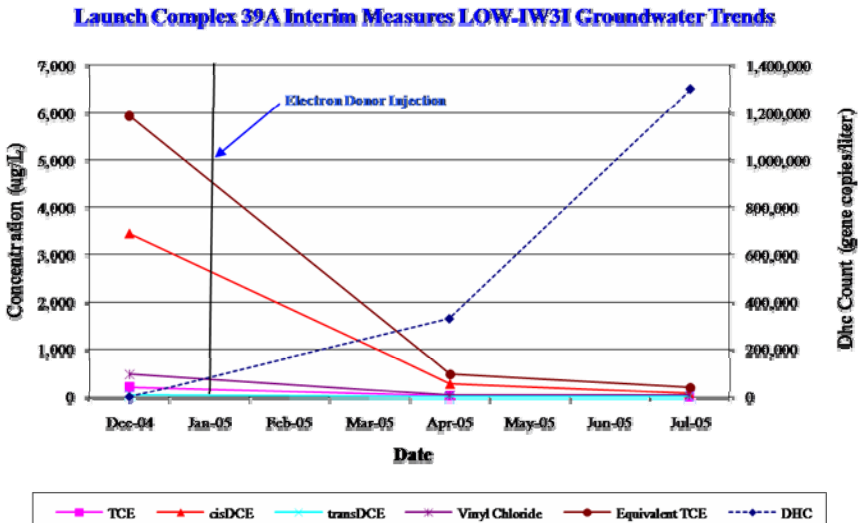

FIGURE 2. CVOC concentrations in groundwater, 6 months.

During the July 2005 groundwater sampling event, the source area wells achieved the IM objectives; CVOC concentrations were reported to be below NADCs. Source well LOX-IW3I exhibited a significant reduction in CVOC concentrations: the TCE concentration decreased from 206 micrograms per liter (µg/L) to 3.5 µg/L, cDCE decreased from 3,440 µg/L to 75.3 µg/L, and VC decreased from 481 µg/L to 45 µg/L (Figure 2). Concurrently, increases in the *Dehalococcoides* population were reported and the reductive dechlorination end-product, ethene, was detected. Analytical results suggested that reductive dechlorination was actively taking place with the assistance of the HRC®.

Although ERD documented initial success, within one year CVOC concentrations rebounded (Figure 3). Rather than injecting additional electron donor, the project team elected to evaluate the CSM and determine if an upgradient source was present.

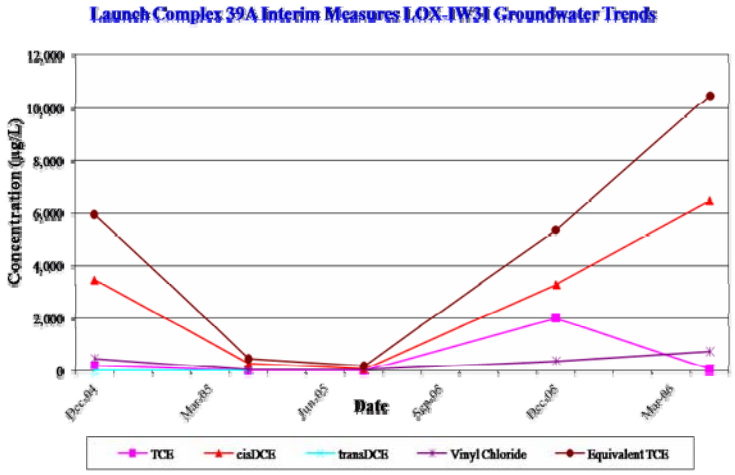

FIGURE 3. CVOC concentrations in groundwater, 15 months.

Supplemental Site Assessment. A supplemental assessment was initiated to evaluate if an upgradient source area was present at the LOX Area. The goals of the assessment were to identify and delineate the potential source area contributing to CVOC concentration increases post HRC® injection, further refine the delineation of TCE, cDCE and VC dissolved groundwater plumes, and modify the CSM and path forward based upon the additional collected data.

Between September 2006 and January 2007, 102 groundwater samples were collected by direct push technology (DPT) at 22 locations (primarily within a saturated ditch system immediately upgradient from the LOX discharge pipe). An additional 120 groundwater samples were collected from 15 DPT locations (13 new locations and two existing) and 25 monitoring wells (18 existing and seven newly installed) in April and May 2007. In addition, saturated zone soil borings were advanced to a maximum of 25 ft below the base of the ditch (~30 ft BLS) at 12 locations. Discrete intervals of soil were screened with a Photoionization Detector (PID) and saturated zone soil samples were collected based on the PID response. Fifty-six soil samples were analyzed for TCE, cDCE and VC by a mobile laboratory.

The saturated zone soil results revealed a well-defined source area below the base of the ditch, with TCE concentration up to 27,500 milligrams per kilogram (mk/kg), and indicative of DNAPL rather than in the vicinity of the present-day termination point of the LOX discharge pipes, as earlier conceptualized (the LOX pipes had been historically

lengthened). The revised CSM and recommendations from the supplemental assessment investigations presented at the June 2007 Remediation Team Meeting included the preparation of an IM Work Plan to address the aggressive excavation of the identified source area.

Soil Excavation. The goal of the IM was to mitigate human health and ecological risks associated with a TCE DNAPL source area within the LOX Tank Area located along the northwestern perimeter of LC39A. The intent of the IM was to remove a CVOC source area of approximately 575 cubic yards (yd^3) as defined by TCE concentrations in saturated zone soils exceeding 1.4 mg/kg.

Completion of the IM within a very short time frame presented a challenge. The project was scheduled to begin on March 16, 2009. NASA was originally to launch STS-119 (Space Shuttle Discovery) on March 11 and the roll out of STS-125 (Space Shuttle Atlantis) was to begin March 31. After several delays, the shuttle Discovery finally launched the evening of March 15th, approximately 12 hours prior to the start of the IM activities. To accommodate the rollout of STS-125, the IM team was required to complete the project no later than March 30.

Prior to project initiation, all health and safety, permitting, utility clearance, and endangered species survey requirements were completed. Mobilization included surveying, clearing vegetation as necessary to perform the IM, abandonment of monitoring wells within the IM area, installation of erosion and sedimentation (E&S) controls, construction of a water treatment system and soil staging area, removal of LOX pipes and support structures, installation of ditch blocks to restrict water migration into the excavation area, and implementation of security and access controls.

The excavation area was prepared for dewatering on March 18, 2009, by excavating a shallow channel to direct flow from the northern end of the excavation to the southern end where a sump was installed. The suction pipe of a 4-inch pump was placed in the sump and started on March 19, 2009, just prior to beginning excavation. The water was transferred to a weir tank to allow settling of sediments. The pump was turned on and off periodically during excavation to remove groundwater as it infiltrated into the excavation from the sides and bottom.

All groundwater removed from the excavation area was treated to remove CVOCs prior to discharge. The treatment system consisted of a bag filter unit, air stripper unit, and granular activated carbon (GAC) units (Figure 4). The air stripper unit was powered by an onboard generator and had the capacity to treat up to 100 gallons per minute (gpm).

FIGURE 4. Groundwater treatment.

The GAC units were each 2,000-pound units, placed in line prior to and following the air stripper unit, to initially reduce CVOCs entering the air stripper unit and then to remove any CVOCs not removed by the air stripper unit. The treated water was stored in tanks until confirmation sample results indicated adequate treatment, at which time the water was discharged to the perimeter ditch system.

During operation of the groundwater treatment system, one influent and two effluent samples were collected. Samples were analyzed for CVOCs and compared to FDEP GCTLs to verify discharge requirements. CVOCs were not detected in the two effluent samples. Approximately 17,400 gallons of treated water were rerun through the treatment system prior to discharge to the ditch in the area between the two downstream ditch blocks.

Excavation commenced on March 19, 2009 and included two areas from which a total approximately 516 yd^3 (723 tons) of impacted soil were excavated. Excavation began at the northern end of Area #1 (Figure 5). Excavated soil was loaded into articulated trucks for transfer to the soil stockpile area constructed along the Pad 39A emergency access road. The excavation depths were verified using a pre-measured point on the excavator bucket and a laser level. Excavation proceeded to a depth of approximately 6 feet in Area #1 with 2:1 side slopes.

FIGURE 5. Excavation areas.

Upon completion of Area #1, excavation proceeded in the northern end of Area #2 to a depth of approximately 6 feet (Area 2a, Figure 5). Excavation was then completed to the south to the area between SB01 and SB05 (Area 2b, Figure 5) to a depth of 9 to 10 feet in this area. Excavation to a depth of 5 feet continued to the south from SB05 to SB06 (Area 2c, Figure 5). Clay and organic layers encountered within the excavation areas were completely removed, which was accomplished within the planned excavation depths (i.e., no additional excavation was required). No confirmation sampling was required from the bottoms or sidewalls of the excavations because the excavation limits were determined by previous sampling efforts.

As soil excavation depths were verified, the excavation was backfilled. The stockpiled backfill, placed adjacent to the excavation areas during site preparation, was pushed into the excavation area by a bulldozer. The excavation was dewatered as necessary to facilitate placement of the backfill. The soil was spread, compacted, and graded with a bulldozer to reflect pre-excavation grades and to provide positive drainage. Compaction to reference standards (i.e., standard or modified Proctor maximum dry density) was not required based on the end use of the property.

The stockpiled soil was reloaded into dump trucks for transport to the J.E.D. Solid Waste Management Facility (OMNI Landfill) in St. Cloud, Florida. Each truck was appropriately manifested and was loaded with soil to the sidewall height of the truck bed.

Prior to leaving the site, each truck was inspected to ensure that the tailgate was latched, automatic tarps were in place, and no residual soils were on the side rails or the tailgate. The transportation vehicles destined for OMNI Landfill were weighed both loaded and empty at the disposal facility to quantify disposal weights.

The contents of the weir tank including sediments and residual water with a high of level suspended solids were removed by F.E.C.C. and disposed at Aquaclean, located in Lakeland, Florida.

HRC® Injections. Based upon the findings from the initial HRC® injection activities, which documented the effectiveness of ERD in providing treatment to the dissolved groundwater impacts, ERD was utilized as a polishing step following source excavation. From March 20 through 22, 2009, following completion of backfill and grading activities, HRC® was injected into the groundwater in the excavation to enhance the anaerobic degradation of residual CVOCs in groundwater. A total of 40 delivery points were installed via DPT in a grid pattern over the excavated areas. The grid was established based on a spacing of 7.5 feet between injection points. The HRC® slurry was injected starting at a depth of 20 feet below land surface (bls) and continuing to a depth 5 feet bls. The HRC® loading rate was 4.0 pounds per foot, or 60 pounds per point. A total of two 30-pound buckets of HRC® were injected per point.

Restoration. Following completion of HRC® injection activities, the LOX pipe support structures were replaced from March 24 through 26, 2009, in accordance with as-built documents provided by NASA. Source area monitoring wells MW0005S and MW0006I were replaced following completion of HRC® injection activities in close proximity to the original locations, located by survey coordinates, and to approximately the same specifications as the original wells. Replacement monitoring wells were installed as micro-wells with 10-foot screens and were developed and purged in accordance with the NASA Sampling and Analysis Plan (2006). The locations and top of casing elevations of the replacement monitoring wells were surveyed. On March 26 and 27, 2009, sod was placed in the disturbed areas after they were backfilled and graded (Figure 6). Following completion of IM activities, demobilization occurred. Demobilization included removal of all equipment, tanks, and temporary facilities and was completed on March 30, 2009. The roll out of STS-125 began as scheduled on March 31st.

FIGURE 6. Site restoration.

RESULTS AND DISCUSSION

Monitoring Wells MW0005 and MW0006 are located in the center of Area 2 and provide groundwater quality data for two separate depths within the water table. MW0005 is screened from 5 to 15 feet below land surface (BLS), and MW0006 is screened from 20 to 30 feet BLS. Groundwater samples were collected from these wells in April 2009 (pre-remediation), and after remediation in June and December, 2009. As indicated in Table 1, the concentration of TCE in both wells has decreased significantly.

TABLE 1. CVOC concentrations in source area wells.

Well ID	Sample Date	Trichloroethene (µg/L)	Cis-1,2-Dichloroethene (µg/L)	Trans-1,2-Dichloroethene (µg/L)	Vinyl Chloride (µg/L)
	FDEP GCTL	3	70	100	1
	FDEP NADC	300	700	1,000	100
MW0005	04/27/09	**16,200**	**18,000**	100U	**4,000**
	06/03/09	**66**	**5,800**	**120**	**6,900**
	12/02/09	11.2I	**1,460**	58.1	**1,520**
MW0006	04/27/09	**710**	**930**	40U	**360**
	06/03/09	**4**	**10,800**	**460**	**1,600**
	12/02/09	19.9I	**3,190**	31.8I	**1,180**

µg/L – micrograms per liter
I – Result is greater than or equal to method detection limit, but less than method reporting limit
U – Result is less than method quantitation limit
Bold values indicate exceedances of FDEP GCTLs

Following source removal and HRC® injection, the trichloroethene concentration in both wells decreased significantly, while the concentrations of daughter products cDCE, tDCE and VC first increased and then decreased. The reduction of TCE concentrations and fluctuation of daughter product concentrations is a strong indicator of the anaerobic degradation of CVOCs as a result of remedial actions. Additional evidence of anaerobic degradation includes elevated Methane concentrations of 1,470 µg/L in MW0005, and 960 µg/L in MW0006. Ethene concentrations are also elevated in MW0005 (221 µg/L) and MW0006 (102 µg/L). Sulfate (196 µg/L to 1,950 µg/L) and Sulfide (8.5 µg/L to 85 µg/L) are also present in the two source wells as well as the surrounding monitoring locations, suggesting attenuation under reducing conditions.

CONCLUSIONS

Although the initial ERD IM appeared successful, it was followed by a rebound in CVOC concentrations within one year. The project Team elected to question the CSM rather than continuing the ERD program. Further evaluation of the CSM and performance of a supplemental assessment revealed significant changes to the specific location and distribution of TCE mass perpetuating a dissolved CVOC plume. While the initial CSM source location hypothesis was appropriate at the time of the original investigation, changes in the site structures resulted in the initial investigations missing the source area by approximately 20 feet. Using the new CSM, the project team implemented a fast-track source removal program which was complimented with ERD as a polishing step. The project demonstrated the importance of constantly reviewing and questioning site data, redefining the CSM, optimizing strategies to effectively meet project objectives, and the importance of supplemental assessment as an effective tool for redefining site conditions.

REFERENCES

Geosyntec Consultants. 2008. "Launch Complex 39A Liquid Oxygen Tank Storage Area SWMU No. 008 Supplemental Site Assessment and Interim Measures Work Plan." Kennedy Space Center, Florida.

Tetra Tech NUS. 2009. "Interim Measure Report for the LC 39A Liquid Oxygen Tank Storage Area SWMU No. 008." Kennedy Space Center, Florida.

TETRA TECH

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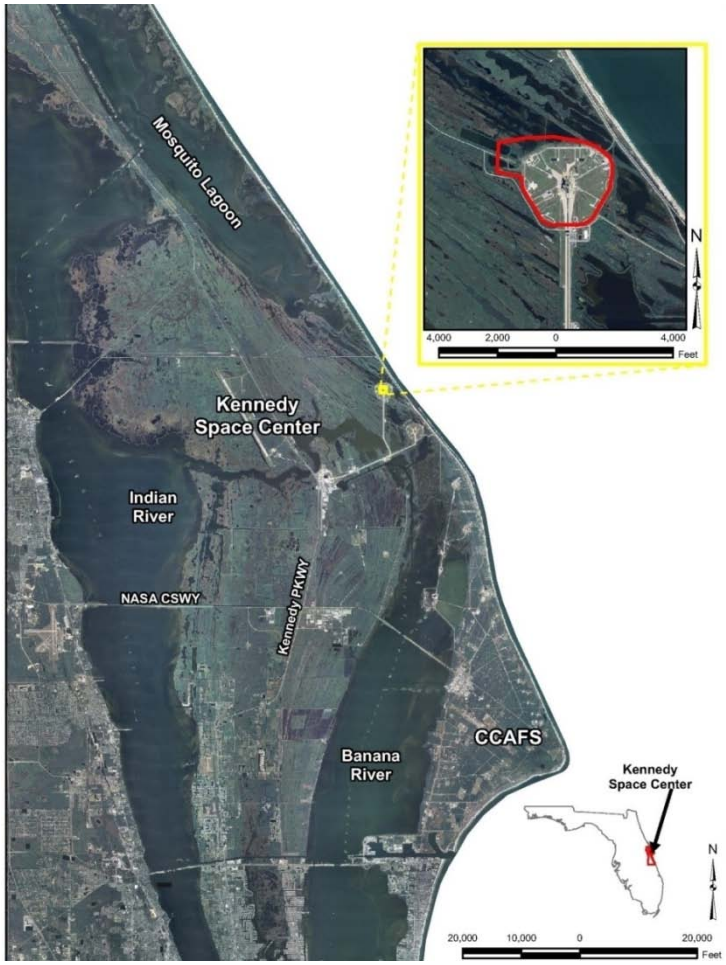
Kennedy Space Center, Florida
Launch Complex 39A

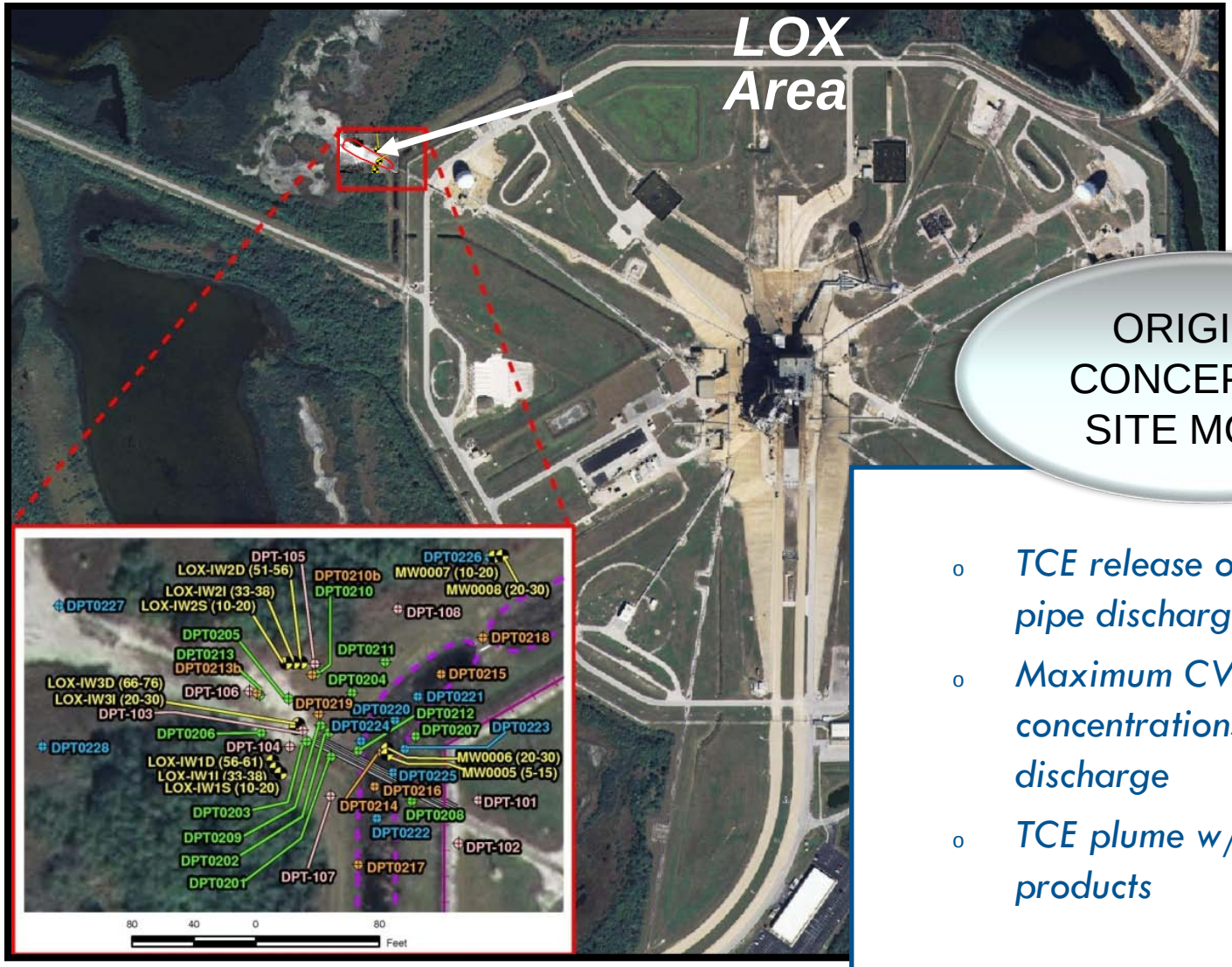
Site Background and History

- LC 39A is a 170 acre portion of the NASA Kennedy Space Center facility
- TCE, cDCE and VC identified in groundwater at concentrations exceeding FDEP groundwater concentration target levels (GCTLs)
- Liquid Oxygen (LOX) tank area
  - Discharge pipes extend from LOX tank beyond perimeter ditch
  - Perimeter ditch discharges to the adjacent surface water bodies (Outstanding Florida Waters)



TETRA TECH

Overall LC39A Site



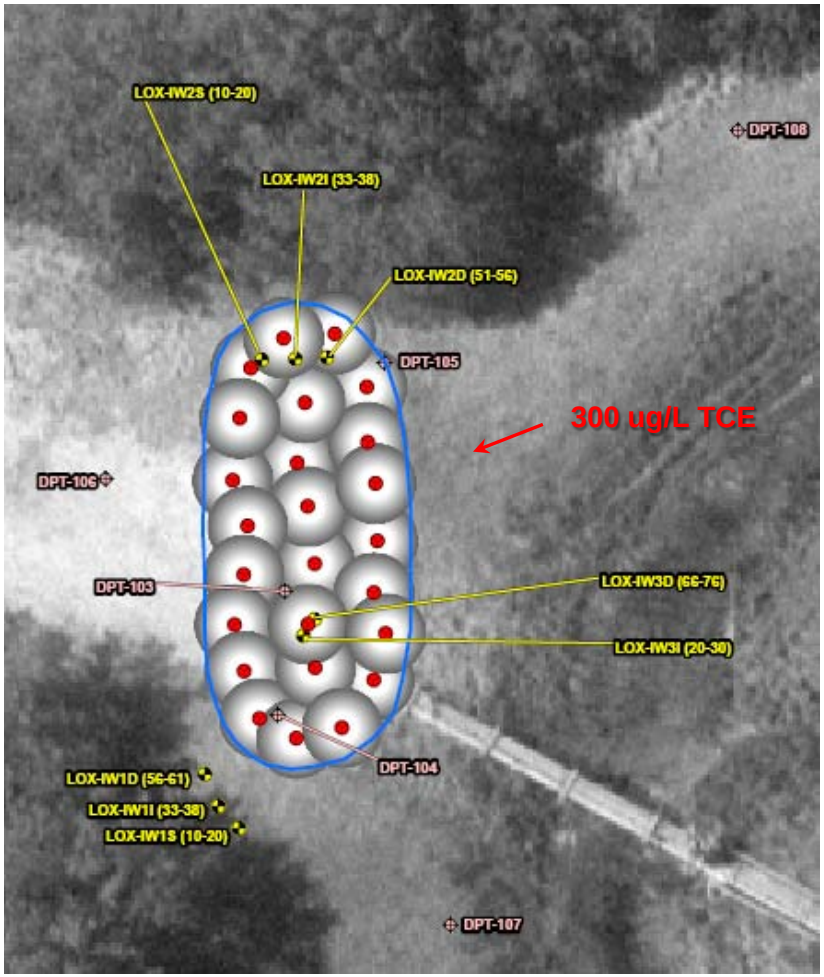
ORIGINAL CONCEPTUAL SITE MODEL

- *TCE release occurred at LOX pipe discharges*
- *Maximum CVOC concentrations at LOX pipe discharge*
- *TCE plume w/ daughter products*

TETRA TECH

LC-39A Interim Measures

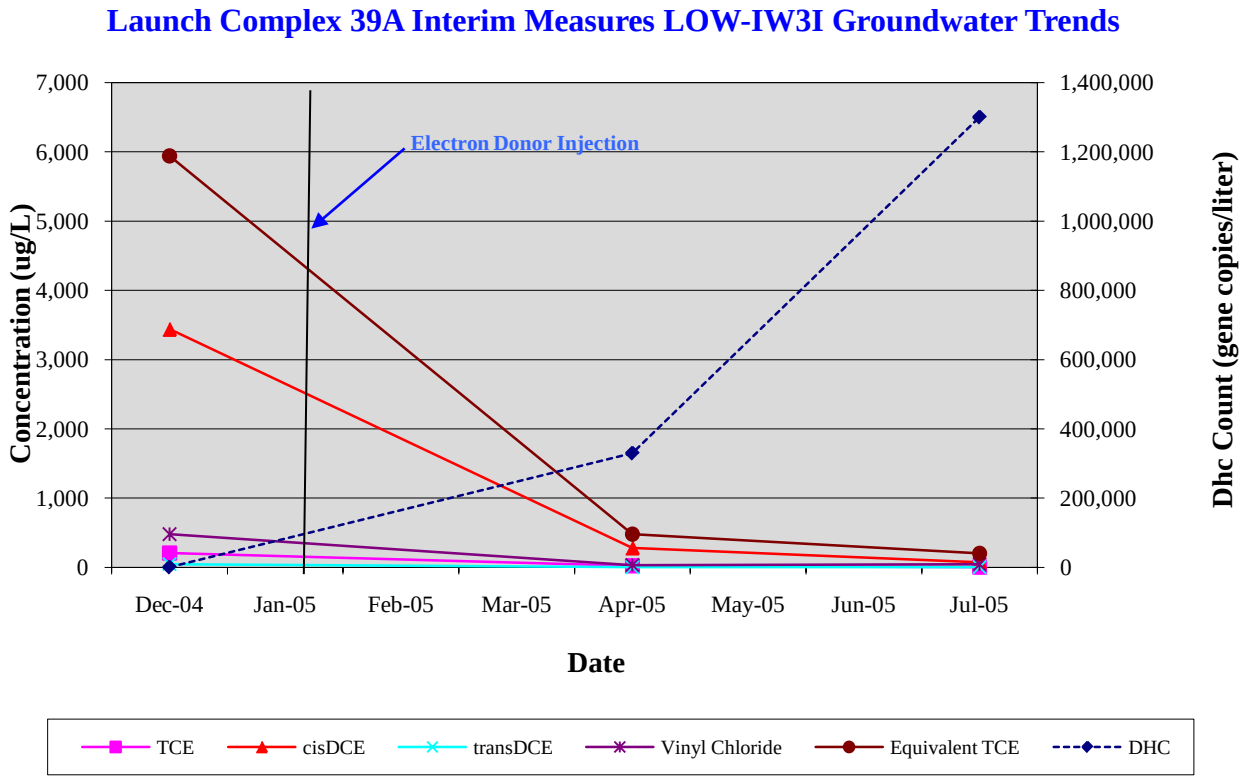
- Based upon assessment results IM Work Plan (October 2004) prepared to:
  - Reduce CVOC concentrations to less than NADCs
  - Facilitate Long Term Monitoring
- Slow release electron donor injected in January 2005 to stimulate microbial reductive dechlorination
  - 25 injection locations
  - 25 to 35 feet below land surface (ft BLS)
  - Total of 2,280 pounds injected



TETRA TECH

LC-39A IM – 6 Months Post Injection

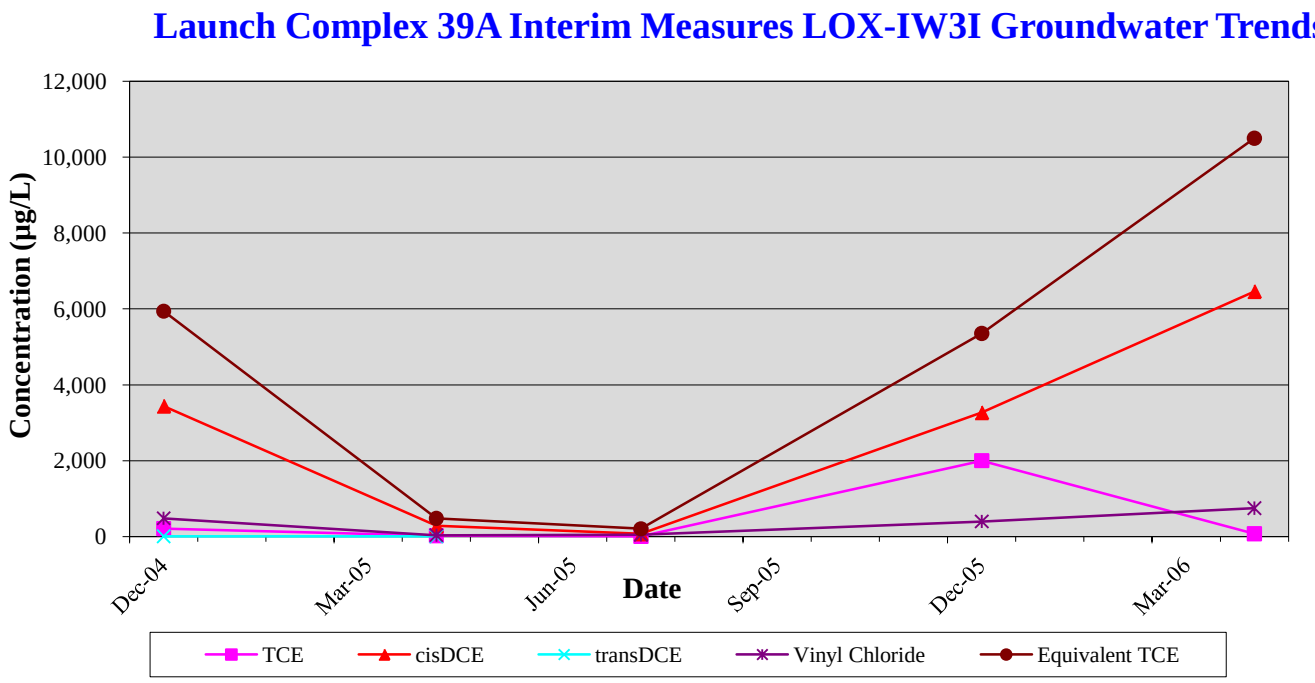
- 98.3% TCE, 97.9% cDCE, and 90.6% reduction in VC
- Dehalococcoides increase (3 orders of magnitude)
- Ethene production (711 µg/L)



TETRA TECH

LC39A IM – 24 Months Post Injection

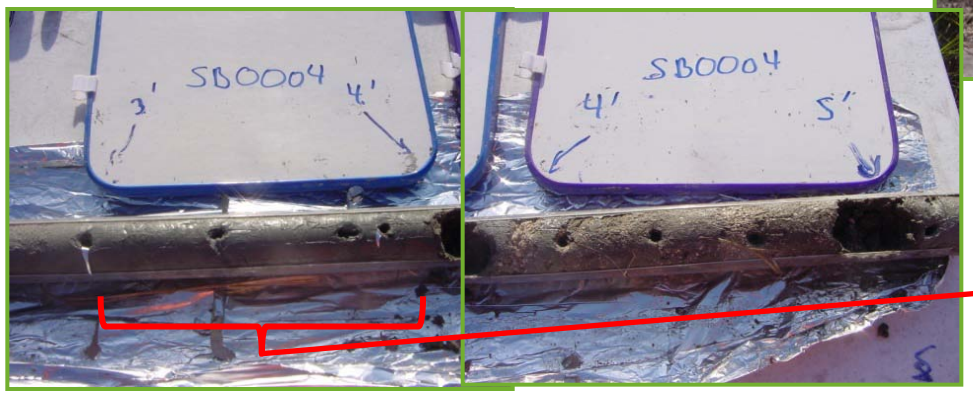
- Traditional Approach
  - Continue Remedial Action
  - Inject more electron donor
  - Continue Monitoring



TETRA TECH

CSM Refinement Assessment

- DPT investigation
  - Soil borings w/ PID screening and saturated zone soil sampling October 2007
    - 21 boring locations
    - 38 saturated zone soil samples
  - Groundwater sampling
    - >200 DPT samples at 37 locations
    - Dynamic location selection



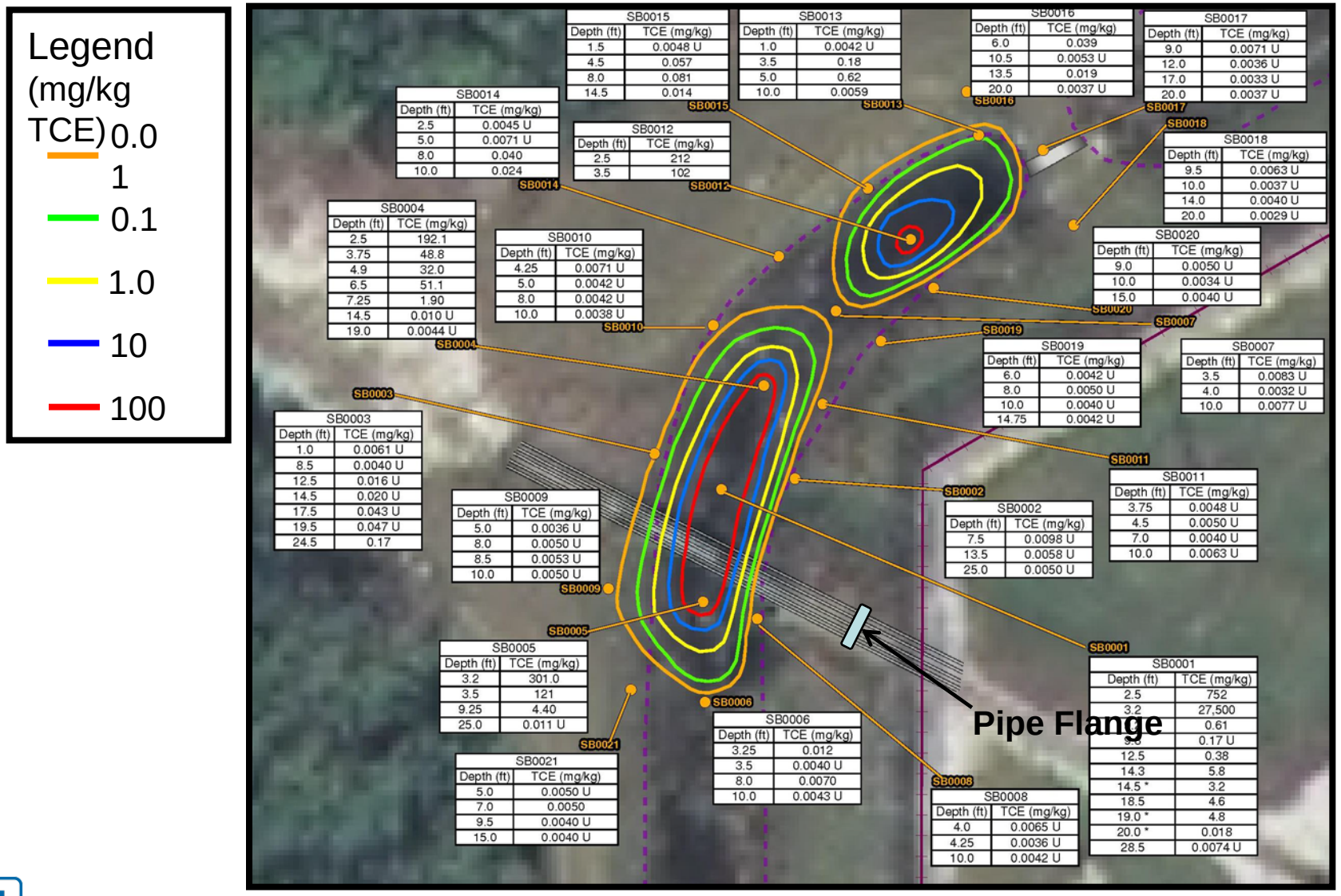
Sandy CLAY ditch lining

TETRA TECH

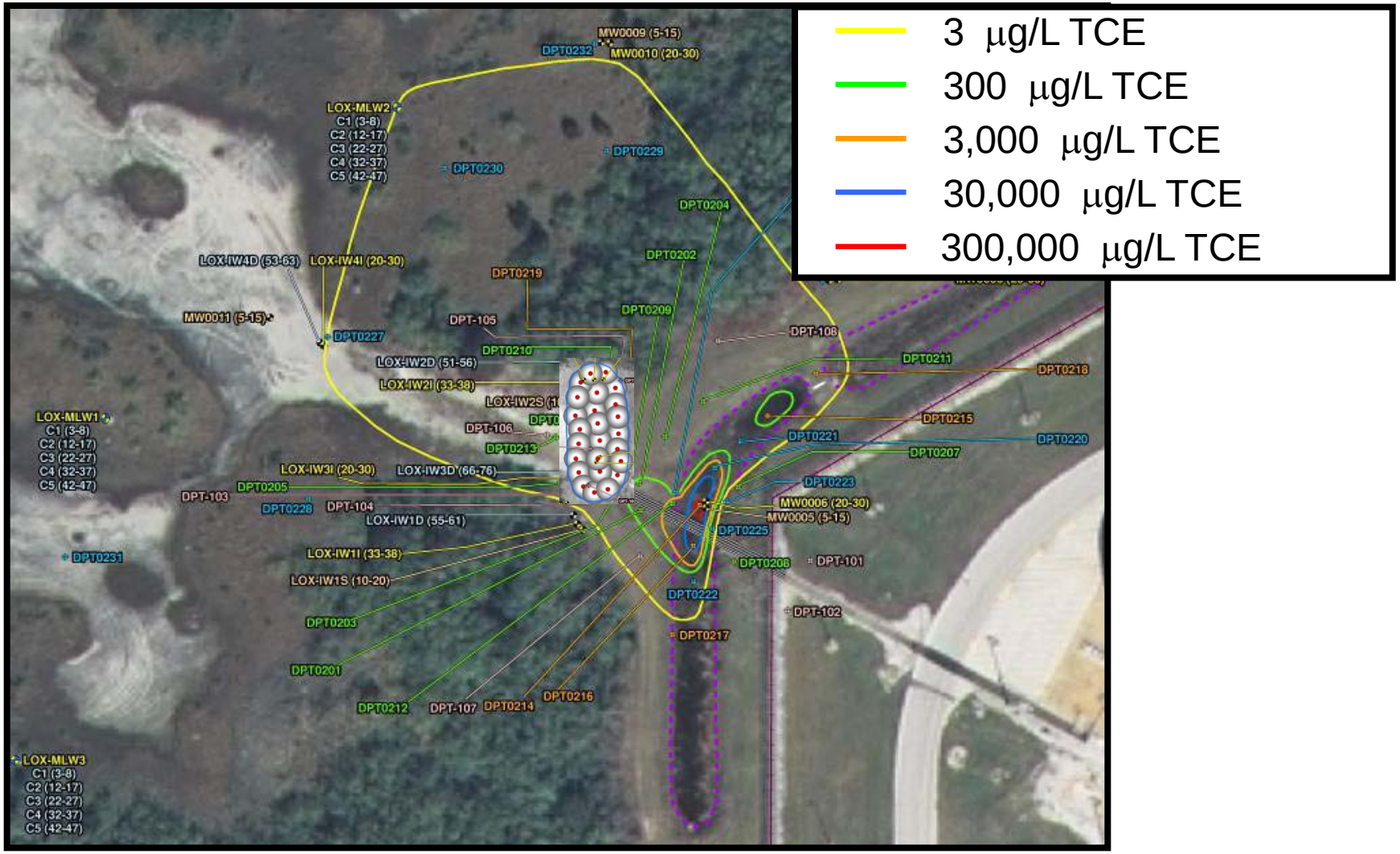
Refinement Assessment Results

- Soil core PID responses up to >9,999 ppm
- Maximum saturated zone soil concentrations
  - TCE = 27,500 mg/kg
  - cDCE = 82.5 mg/kg
- Maximum groundwater TCE = 499,000 ug/L
- Mass focused from 1 to 5 ft below base of ditch
  - ~200 pounds of TCE present
  - clay ditch lining
- Maximum soil concentrations indicative of TCE DNAPL

Saturated Zone Soil Sampling Results



Dissolved TCE Plume Less than 20 ft BLS

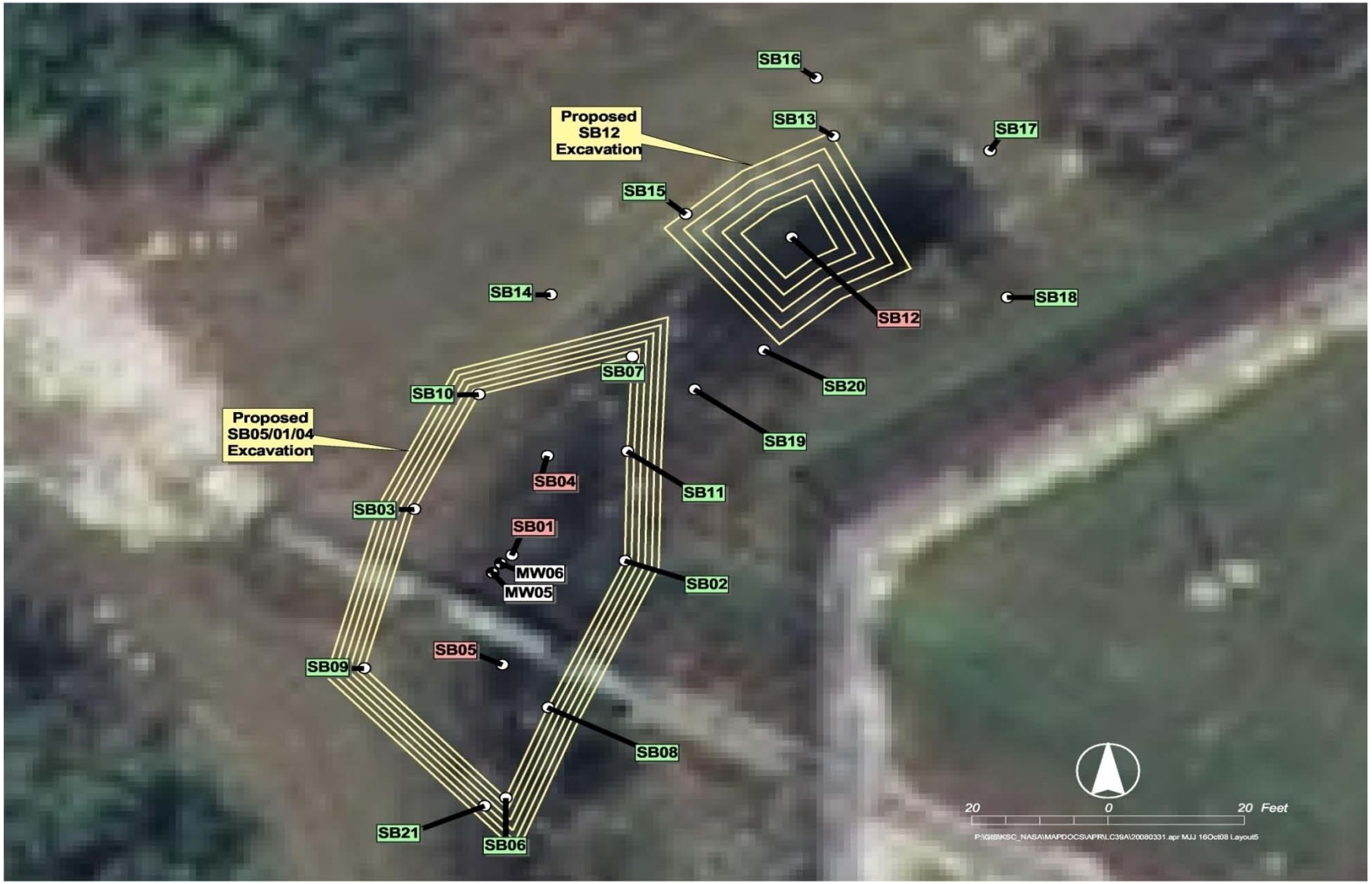


TETRA TECH

CSM Refinement Conclusions

- Missed the source area by <20 ft
  - LOX pipes were extended in early1970's ~25 ft
  - LOX pipe outfall historically was the ditch
- Clay ditch lining provided mechanism for significant mass diffusion
- Source is shallow – excavate source and enhance bioremediation in dissolved plume

Excavation



TETRA TECH

Construction Activities

- Schedule
  - Contingent upon STS-119 launch
  - Approved window between:
    - 16-Mar-09, following STS-119 launch, and
    - 30-Mar-09, prior to STS-125 rollout
  - Mobilization commenced on 15-Mar-09
  - STS-119 launched 15-March-09
  - Site Preparation began 12 hours later

Site Preparation

- Constructed
  - Soil Stockpile Area
  - Decon Pad
- Sump Installation
- Remove LOX Pipes/Supports
- Mobilize and Connect Water Treatment System (Air Stripper, Carbon Vessels, Frac-Tanks)

TETRA TECH

Interim Measures Excavation

- IM implemented in March 2009
  - 750 tons of soil excavated and disposed
  - Maximum depth of 9 ft below base of ditch
- Electron donor injection performed after excavation activities
  - 40 locations within the excavation area
  - 2,400 lbs of electron donor injected
  - Injected from 5 to 20 ft BLS

TETRA TECH

Excavation

TETRA TECH

Water Treatment

TETRA TECH

Backfill

TETRA TECH

Transportation and Disposal

- T&D
  - Transported and Disposed at NASA - Approved Landfill
  - 27 Loads

TETRA TECH

Electron Donor Injection and Restoration

- Electron Donor Injection
  - HRC® Injection
  - 40 Locations
  - 5 to 20 ft bls
  - 2,400 pounds

- Restoration
  - LOX Re-construction
  - Sod placement

TETRA TECH

Restoration

TETRA TECH

STS-125 Rollout

- Project Completion 03/29/09
- Demobilization of Equipment 03/30/09
- STS-125 Roll Out 03/31/09

Post - Restoration

TETRA TECH

Monitoring Well Sampling

	MW0005 (5 to 15 ft BLS)				MW0006 (20 to 30 ft BLS)			
	April 2007	June 2009	Dec 2009	Feb 2010	April 2007	June 2009	Dec 2009	Feb 2010
TCE	**16,200**	66	11.2I	1.2U	**710**	**4**	19.9I	21.4I
cDCE	**18,000**	**5,800**	**1,460**	**190**	**930**	**10,800**	**3,190**	**3,120**
VC	**4,000**	**6,900**	**1,520**	**451**	**360**	**1,600**	**1,180**	**2900**

I – Result greater than detection limit but less than reporting limit
U – Not detected at quantitation limit
Bold text indicates values exceeding the FDEP NADC (TCE = 300 ug/L, cDCE = 700 ug/L, VC = 100 ug/L

TETRA TECH

LC39A Summary

- Following initial electron donor injection, CVOC concentrations rebounded within one year.
- The CSM was re-evaluated rather than continuing the Electron Donor injections.
- Supplemental assessment results revealed a TCE source 20 feet from the original investigation area.
- Using the new CSM, the project team implemented a fast-track source removal program which was complimented with electron donor injection as a polishing step.
- TCE concentrations in the excavated source area and electron donor treatment zones remain below FDEP NADCs. cDCE and VC concentrations continue to decrease within the electron donor treatment zone.