Use of the Triad and Performance-Based Contracting to Accelerate Site Closure at Seymour Johnson AFB, NC

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Regulatory Framework

- Regulatory oversight performed through three NCDENR regulatory programs:
  - Underground Storage Tank (UST) Program
    - 7 Sites
  - Inactive Hazardous Sites Branch (IHSB) Program:
    - 5 Sites
  - RCRA Program (Landfill) Sites:
    - 4 Sites
Exit/Closure Strategy

Exit/Closure Strategy Based on a Marriage of:

- Future Property Use
- Triad
- Innovative Technologies
- Remedial Process Optimization
- Decision-Based Partnering
The Triad

- Uncertainty Management through the Triad:
  - Systematic Project Planning
  - Dynamic Work Strategies
  - Real Time Measurement Technologies
OT-29: Former Radar Tower Site

- **Overview**
  - Pending Construction of mission-critical fuel hydrant system
  - Mixed plume of petroleum hydrocarbons and chlorinated hydrocarbons
  - Legacy system installed as Interim Remedial Action in 1998

- **Legacy System**
  - Biosparge/biovent wells & groundwater extraction trench
  - Projected cleanup >20 yrs
OT-29 Site Boundary and Proposed Hydrant System Construction Area
OT-29: Exit Strategy

- Site characterization utilizing the Triad
- Removal of residual LNAPL using surfactant flush and recovery
- Excavation of contaminated soils
- Groundwater treatment through chemical oxidation events
OT-29: Dynamic Work Strategies

Delineation Decision Tree
OT-29: Characterization Actions

- Membrane Interface Probe Characterization
  - 55 points analyzed
  - MIP enabled determination of source area and extents

- Rapid Analysis
  - Soil and groundwater samples used to correlate data with MIP
  - PID headspace analysis performed on potentially contaminated soil
OT-29: Surfactant Injection

Field Activities:

- Installed temporary injection points within targeted LNAPL area based on Triad results
- Injected 10,000 gal of 1.6% non-ionic surfactant (1,250 gal/well)
- Used MMPE to recover surfactant and >700 gal of petroleum product
- Work completed in 2 weeks
OT-29: “Hot Spot” Excavation

- Source removal of 3,400 tons of impacted soil
- Excavation extents based on Triad delineation results – soil removed from 3 areas

TCE Source Removal
Adjacent to Radar Tower
OT-29: Biopile Construction

- Actions Completed:
  - Constructed biopile to treat petroleum/VOC-impacted soil on-site
  - Biopile actively vented and moisture content managed
  - Highly-impacted soil amended w/~1,000 gal hydrogen peroxide (12 wt %) & tilled
  - Beneficial reuse of cover material for local landfill following treatment

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OT-29: In Situ Chemical Oxidation

- Actions Completed:
  - ISCO Bench Scale Tests (modified Fenton’s)
  - Three ISCO events w/287 injection points and ~75,000 gal oxidizer/ catalyst over 50,000 ft² area
OT-29: In Situ Chemical Oxidation

ISCO #1 Locations

ISCO #2 Locations

ISCO #3 Locations
OT-29: In Situ Chemical Oxidation

- Apr. 05: cis-DCE Pre-ISCO #1
- Dec. 05: cis-DCE Post-ISCO #1
- Feb. 06: cis-DCE Post-ISCO #2
- May. 06: cis-DCE Post-ISCO #3

cis-DCE Concentration (ug/L)

MW-14
MW-15
MW-17
OT-29: Current Status

- Site remediation activities completed with no impact to the mission-critical fuel hydrant system construction
- Received NCDENR concurrence on No Further Active Remediation status
- Cleanup timeframe reduced from 20+ years to 4 years
- Projected Savings to Government in excess of $1.5M
Bulk Fuel Storage Area (BFSA)

- Setting:
  - 400,000-gal jet fuel (JP-4) release (>50,000 gal in subsurface requiring cleanup)
  - Estimated 29,000 ft² LNAPL plume
  - Estimated 395,000 ft² dissolved plume
  - Legacy treatment system installed in 1998
BFSA Cleanup Strategy

- Optimize legacy treatment system to maximize performance prior to design and installation of updated recovery system
- Perform Triad-based characterization to expedite plume definition
- Design, install, and operate enhanced recovery system
BFSA: Triad LIF/CPT ROST Investigation

- Rapid Optical Screening Tool (ROST) used for simultaneous collection of LIF and CPT data
- Data collection provided integrated 3D investigation and mapping of LNAPL and smear-zone vadose soils
- 9-day field effort with collection of 98 borings with minimal disturbance to AF mission
- Decision Tree utilized to direct field activities
BFSA: Real Time Data Collection
BFSA: Data Rendering

Fluorescence Response Thickness Between B-6 and B-7

ROST Data

CPT & LIF Data
BFSA: Updating the Conceptual Site Model
BFSA: Treatment System Expansion

- Installation of 65 MPE wells in target areas identified during the Triad investigation
- Horizontal drilling and installation of system piping (~3,000 linear ft) to minimize impact to high-traffic, mission critical site area
- Installation/Integration of 650-cfm extraction skid to increase recovery volume as estimated from the 3D site models
BFSA: System Enhancement

- **ROST Point**: Used to locate contamination and evaluate soil characteristics.
- **Extraction well point**: Installed based on ROST data.
- **Bottom of smear zone** based on ROST data.

**Labels**:
- Static WT
- Post-MPE WT

**Diagram**:
- Diagram illustrating BFSA system enhancement with various components labeled accordingly.
BFSA: Treatment Zone Configuration

Trailer Manifold Piping
BFSA: MPE Trailer System
BFSA: Current Status

- Targeting of Triad-defined LNAPL removed ~50,000 gal of LNAPL in 12-month period
- Achieved NFA in November 2010
- Cleanup timeframe reduced from an estimated 10+ yrs to 4 yrs
Summary

- Triad reduced:
  - Number of mobilizations & fixed-base lab costs
  - Field and reporting efforts
  - Time to design and implement remedial action enhancements

- Provided data to revise CSM reflecting:
  - More accurate LNAPL distribution (vertical and horizontal)
  - Soil impacts below regulatory criteria
  - Role of stratigraphy in contaminant transport/recovery

- Resulted in a design targeting source and “hot-spot” areas, reducing cleanup time
Thank you! Questions?

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