

Norwalk Tank Farm Update

Presented to the Norwalk Tank Farm
Restoration Advisory Board

On behalf of KMEP

February 27, 2014

Presentation Overview

- KMEP Update
 - Remediation Operations Update
 - Pipeline Integrity Testing
 - August 2013 Soil Vapor Monitoring
 - Air Sparge Well Abandonment
 - Conceptual Site Model and Alternate Interim Remedy
 - Five-year Action Plan Progress Report
 - Planned Activities

Remediation Operations Update

- Objectives
 - Contaminant Mass Containment
 - Contaminant Mass Removal
- South-Central and Southeast Areas
 - Soil Vapor Extraction (SVE) System
 - Groundwater Extraction (GWE) System
 - Total Fluids Extraction (TFE) System
 - Free product
 - Groundwater
- West Side Barrier
 - Groundwater Extraction
 - Discontinued August 2008
 - Shut-down based on low concentrations of MTBE and 1,2-DCA
 - Currently monitoring TBA and other constituents

Remediation Systems

- South-Central Area
 - 18 TFE wells (product and groundwater)
 - 24 onsite and 6 off-site SVE wells (most collocated with TFE wells)
 - 2 GWE Wells
- Southeastern Area (24-inch Block Valve Area)
 - 3 TFE wells (GMW-O-15, GMW-O-18, GMW-36)
 - 3 SVE wells (both collocated with TFE wells)
 - 2 GWE Wells (GMW-SF-9, GMW-SF-10)
- Treatment and Discharge
 - SVE Vapors
 - Treatment – Thermal catalytic oxidizer (catox)
 - Discharge – Atmosphere under SCAQMD Permit
 - TFE Liquids
 - Oil/Water Separator – Free product recycled offsite
 - Groundwater Treatment – Liquid-phase GAC, Fluidized Bed Bioreactors (FBBRs) for fuel oxygenates (MTBE, TBA, etc.)
 - Groundwater Discharge – Coyote Creek under NPDES permit

Remediation Systems

- Operations & Maintenance Activities
 - Weekly Inspection and Maintenance of SVE, TFE, and TBA treatment systems
 - Weekly Data Collection
 - Vapor flow rate, vacuum, groundwater extraction rates, hours of operations, and other system parameters
 - Monthly Pump Inspections, Well Re-development
 - Measurement of Individual Well Vapor Concentrations
 - Collection and Analysis of System Influent and Effluent Vapor and Groundwater Samples
 - Gauging of Select Remediation Wells

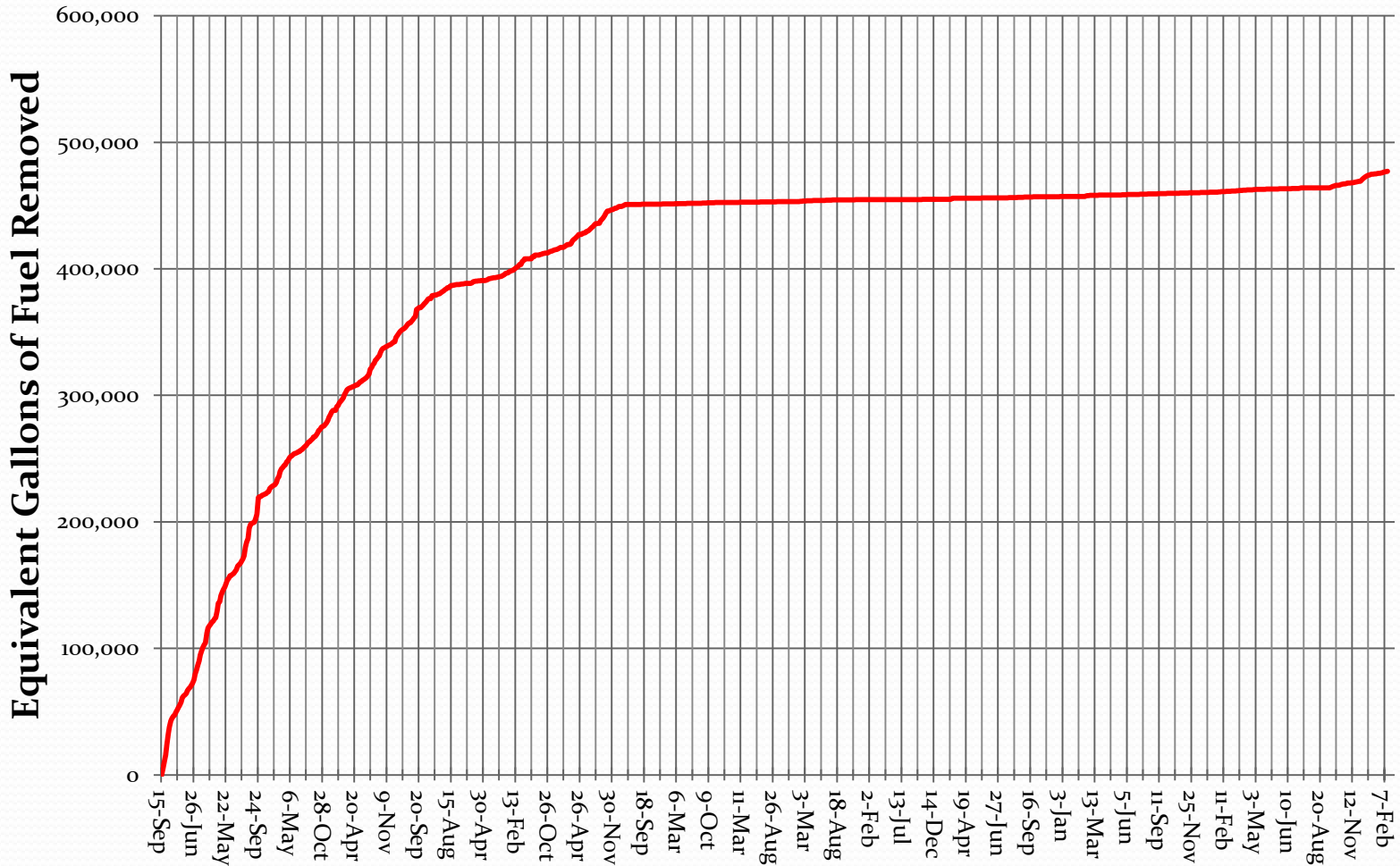
SVE System Operations Summary

- Equivalent Fuel Treated

- Based on weekly monitoring of influent vapor concentration, vapor extraction flow rate, and hours of operation.
- Pounds / 6.6 lbs/gal = gallons
- 3rd Quarter 2013– 2,062 gallons (13,615 pounds)
- 4th Quarter 2013– 8,729 gallons (57,611 pounds)
- Since Second Addendum – 22,505 gallons (148,530 pounds)
- Since 1995 – Approx. 476,000 gallons (3.1 million pounds)

SVE System Operations Summary

Cumulative Fuel Removed by Vapor Extraction To Date



TFE/GWE System Operations Summary

- Groundwater Extracted
 - 3rd Quarter 2013
 - South-Central and Southeast Areas -1,517,182 gallons
 - West Side Barrier – none (shutdown in third quarter 2008)
 - 4th Quarter 2013
 - South-Central and Southeast Areas 1,514,205 gallons
 - West Side Barrier – none (shutdown in third quarter 2008)
 - Since 1995
 - South-Central and Southeast Areas– 58 million gallons
 - West Side Barrier – 26.9 million gallons

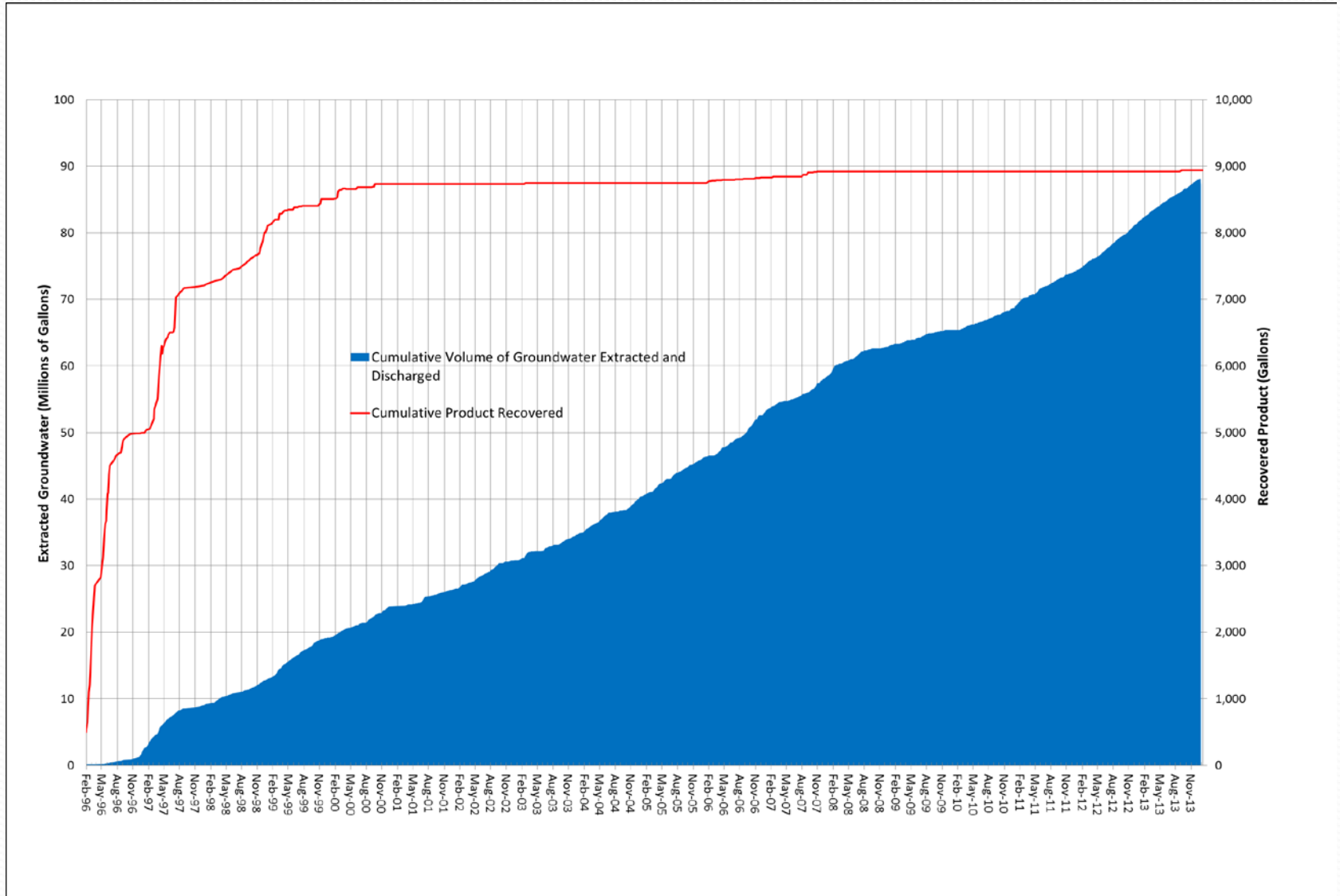
TFE/GWE System Operations Summary

- Mass of TPH removed in Groundwater Extracted
 - 3rd Quarter 2013– 22 gallons (148 pounds)
 - 4th Quarter 2013– 24 gallons (158 pounds)
 - Since implementing Second Addendum
 - 377 gallons (2,487 pounds)

TFE System Operations Summary

- Free Product Extracted
 - 3rd and 4th Quarter 2013
 - Free product has generally decreased since implementing the Second Addendum
 - Volume of free product recovered is small and emulsified
 - Approximately 22 gallons of free product observed to accumulate in the product holding tank in 3rd Quarter.
 - Since 1995 – 8,939 gallons

TFE System Operations Summary



Remediation System Operations Summary

- SVE System
 - 3rd Quarter 2013
 - Operated 12% of time (downtime for blower replacement)
 - 4th Quarter 2013
 - Operated 72% of time
 - Operated 85% of time (excluding planned shutdowns)
- TFE/GWE System
 - 3rd Quarter 2013
 - Operated 98% of time
 - 4th Quarter 2013
 - Operated 80% of time
 - Operated 94% of time (excluding planned shutdowns)

Remediation System Downtime

- SVE System
 - Groundwater monitoring
 - Routine maintenance activities
 - Drain water condensate from manifold
 - Replacement of blower and motor
- TFE/GWE System
 - Groundwater monitoring
 - Carbon change outs
 - High level alarms for transfer tank
 - Changed bag filters, cleaned bag filter housing, backwash LGAC vessels
 - Cleaning of OWS, EQ tank, sump and transfer tank
 - Installed backwash tank and recirculation pump

Preventative Maintenance

- Check pump operation – monthly
- Pump inspection/cleaning/maintenance – ongoing
- Redevelopment of offsite wells and GMW-10
- Bag filter replacements – twice per week minimum
- Inspection and minor repairs of SVE wells
- Backwashing of lead and polishing LGAC vessels
- Pre-catalyst back pressure monitoring – Weekly
 - Monitor for particulate buildup on catalyst cells
- Sampling between LGAC vessels – Monthly
 - Monitor for breakthrough between carbon vessels; concentrations alert technicians when a change out is required
 - Carbon change outs in lead or polishing LGAC vessels

Preventative Maintenance

- System-specific preventative maintenance schedule for each of the other components of the remediation system
 - South-central System
 - Southeastern System
- Example system-specific preventative maintenance activities
 - Check/inspect valves, blowers, chemical pumps, level switches, hoses, and catox flame arrestor
 - Clean filters (various types), flow sensors, valves, transfer pumps, and catox catalyst
 - Change oil and air filters in various equipment
 - Check/replace belts and hoses on various equipment
 - Maintain pneumatic pumps
 - Clean oil/water separator, sump, and equalization tank
 - Drain and/or pressure wash holding tanks

Pipeline Integrity Testing

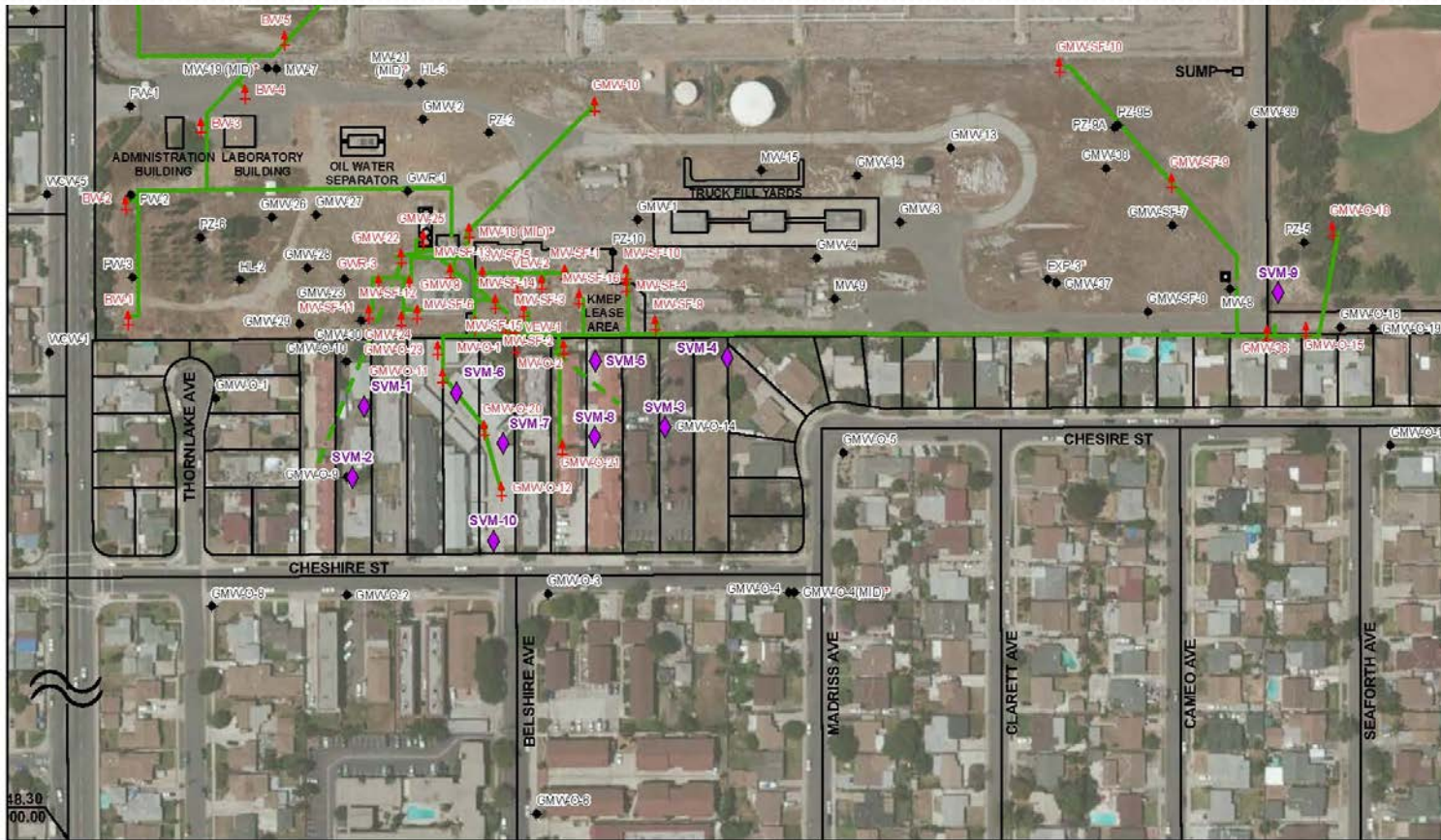
- Southern Area
3 pipelines
- Eastern Area
1 pipeline
- Fuels transported - gasoline (various grades), marine diesel, diesel, jet fuels (various grades)



Pipeline Integrity Testing

- Current Pipeline Integrity Testing
 - Performed every 5 years, as required by law
 - Law only requires static pressure testing
 - Kinder Morgan runs smart tools in the pipelines, which exceeds requirements
 - Two of the lines were assessed with smart tools in May and August 2012, respectively
 - Third line was assessed with the smart tool in July 2009 and is scheduled for next assessment in mid 2014

Soil Vapor Monitoring



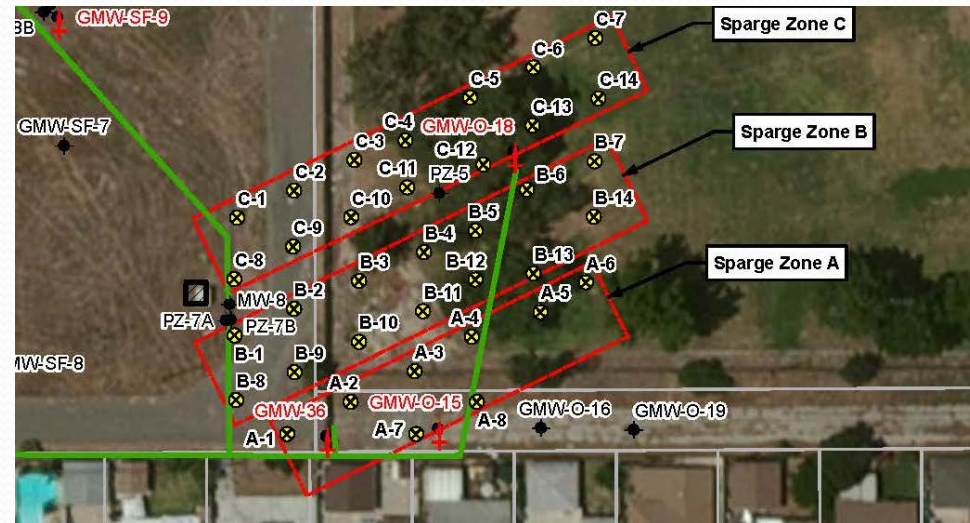
- Existing 10 nested soil vapor monitoring probes (9 in southern offsite and 1 in southeastern area); probes screened at ~ 5 and 15 feet bgs
- Sampled probes in August 2013 for VOCs analysis using mobile lab and fixed lab

Soil Vapor Monitoring

- Data indicate no risk to human health in offsite areas
 - Mobile lab: With exception of toluene in one sample (SVM-5; 0.001 J $\mu\text{g}/\text{L}$), mobile lab sample results are all non-detect for COPCs
 - Fixed lab: Low detections of BTEX and 1,2,4-trimethylbenzene in SVM-4 and SVM-5; toluene detected in SVM-1.
 - Mobile and fixed lab sample results are all below screening levels for future residential and commercial use
- Planned follow up soil vapor sampling is scheduled for early to mid 2014 as part of baseline biosparge pilot testing activities

Air Sparge Well Abandonment

- Air Sparge System in SE Area installed in late 1990s
 - Operated from 1999 to 2001
 - 36 ¾ -inch vertical PVC wells to ~ 50 feet bgs
 - System is old and has not been in operation since 2001
 - Evaluation of system condition conducted in May 2013 and results indicate system is not useable
 - Approval to properly abandon wells per State guidelines provided by RWQCB on October 15, 2013



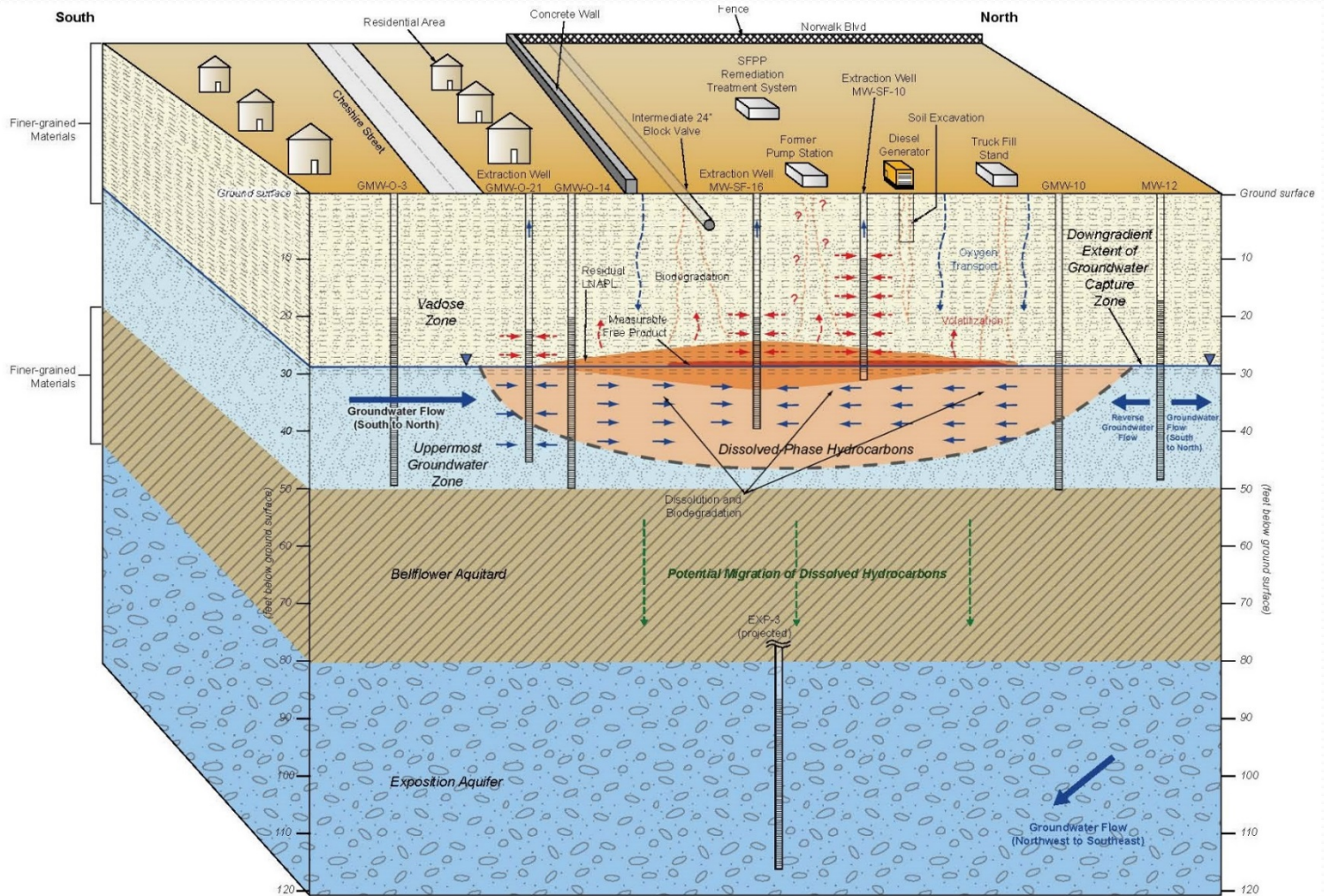
Air Sparge Well Abandonment

- Utility clearance (Nov/Dec 2013)
 - Geophysical survey
 - Air knife to 10 feet bgs at onsite locations
 - Hand auger to 8 feet bgs at offsite locations
- Used hollow stem auger methods to over-drill and pressure grout 35 of 36 wells to 50 feet bgs (Dec 2013/Jan 2014)
 - WellB-9 was not over-drilled due to subsurface water line conflict
- Well abandonment report in progress

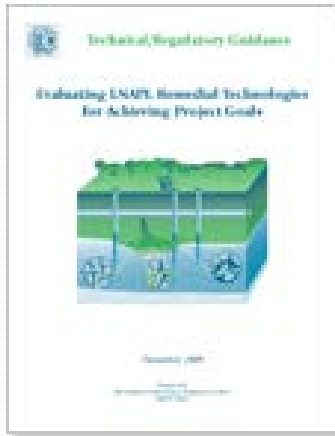
Conceptual Site Model and Alternate Interim Remedy

- SFPP submitted CSM to RWQCB on Sept 3, 2013
 - Addresses soil/soil vapor/groundwater/LNAPL
 - Updates Preliminary CSM (AMEC, February 13, 2009) with data from additional assessments
 - Identifies remediation objectives, goals, and performance metrics
 - Provides technology screening and selection of interim remedy
 - Provides implementation plan for interim remedy
- CSM approved by RWQCB on December 13, 2013

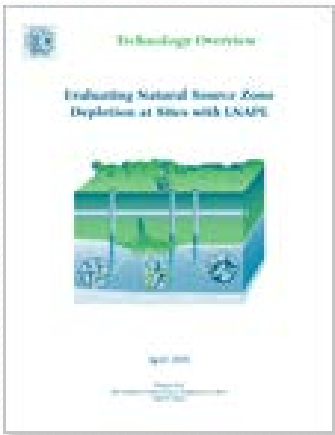
Conceptual Site Model – SC Area



ITRC Guidance



- Held Technical Meeting with Paul Cho/RWQCB on April 23, 2013
 - Paul requested KMEP use ASTM 2006 Guidance
- ITRC Guidance consistent with ASTM 2006 Guidance
- December 2009 ITRC guidance provides decision framework to
 - Identify appropriate remedial objectives
 - Systematically screen LNAPL remedial technologies to identify best suited technology (ies) to achieve objectives
- April 2009 ITRC guidance provides overview of NSZD for LNAPL
 - Serves as objective benchmark to compare to effectiveness of remedial alternatives
 - Will address residual hydrocarbons



ITRC Decision Framework



Collect
Additional Data
or Further
Evaluate
Objectives,
Goals, or
Technologies
Needed

- Site Characterization / Develop CSM
- Identify LNAPL Concerns
- Screening Steps
 - Step 1 – Identify LNAPL Objectives and Goals
 - Step 2 – Screen Technologies with Geologic Factors
 - Step 3 – Screen Technologies via Evaluation Factors
- Establish Goals and Metrics
 - Implement Remediation
 - Monitor/Assess LNAPL Remediation Performance
 - Demonstrate Goals are Met

17 LNAPL Remediation Technologies

- Saturation (Mass Recovery)
 - Dual-pump Liquid Extraction ✓
 - Multiphase Extraction (single or dual pump) with SVE ✓
 - Bioslurping/enhanced Fluid Recovery ✓
 - LNAPL Skimming ✓
 - Water Flooding ✓
- Saturation or Compositional (Mass Recovery and Phase Change)
 - Surfactant-enhanced Subsurface Remediation ✓
 - Steam/hot-air Injection ✓
 - Cosolvent Flushing ✓
- Compositional (Phase Change)
 - Air Sparging (including Biosparging) ✓
 - In Situ Chemical Oxidation ✓
 - Natural Source Zone Depletion ✓
- Immediately Screened Out
 - Excavation
 - Physical or Hydraulic Containment
 - In situ Soil Mixing
 - Radio-frequency Heating
 - Three and Six Phase Electrical Resistance Heating

LNAPL Objectives, Goals, and Performance Metrics

LNAPL Objectives, Goals, and Performance Metrics from the LNAPL CSM

No.	Item	Concern	Objective	Goal	Performance Metric
1	LNAPL Saturation	LNAPL occurs in wells and above residual saturation at the smear zone	Reduce LNAPL saturation	Recover LNAPL mass with existing TFE wells and reduce LNAPL mass with biosparge system via volatilization	Limited or infrequent LNAPL thickness in wells
2	LNAPL Chemistry Phase	LNAPL is the source of dissolved plume COPCs, which are primarily VOCs (BTEX, TPH, MTBE, TBA)	Change chemistry phase of LNAPL	Remove volatile fraction of LNAPL with horizontal biosparge wells	Dissolved-phase and vapor-phase hydrocarbons do not pose a human health threat without use of active remediation
3	Dissolved Plume	Containment of dissolved plume COPCs (BTEX, TPH, MTBE, TBA)	Hydraulically contain plume and switch to NSZD when concern Nos. 1 and 2 are addressed	Achieve stable or shrinking plume and stable or declining concentrations	Concentrations of dissolved-phase hydrocarbons meet NSZD criteria

Notes:

COPC – chemical of potential concern; VOC – volatile organic compound; BTEX – benzene, toluene, ethylbenzene, and xylenes; TPH – total petroleum hydrocarbons; MTBE – methyl tertiary butyl ether;

TBA – tertiary butyl alcohol; NSZD – natural source zone depletion; TFE – total fluids extraction

Evaluation Criteria

- Effectiveness
- Relative Cost
- Implementability
- Third Party Impacts

Selected Interim Remedy

- Biosparging with SVE
 - Horizontal Well Approach
 - Optimal contact with smear zone
 - Reduces number of wells
 - Minimizes offsite access constraints
 - Minimizes conflicts with future redevelopment
 - SVE used to mitigate potential offgassing
 - Continue TFE for hydraulic containment until plume is stable
- Natural Source Zone Depletion
 - Monitoring and testing conducted in parallel to demonstrate enhanced mass removal and natural attenuation

Project Status

- Short Term Goals
 - Prepare work plan for pilot scale system (1 to 2 wells)
 - Work plan submitted on November 18, 2013
 - RWQCB provided comments on December 5, 2013
 - RWQCB provided concurrence with biosparge well construction
 - Response to comments submitted on February 14, 2014
 - Install horizontal well and additional soil vapor monitoring points in south-central area First Quarter 2014
 - Implement pilot testing for 1 year (anticipated to commence in June 2014)
 - Monitor for VOCs, CO₂, O₂, methane, electron acceptor chemistry
- Long Term Goals
 - Expand biosparge system
 - Shut down pump and treat system
 - NSZD monitoring

Five-Year Action Plan Progress Report

Status	Task	Date Completed or Projected	Second RAP Addendum
Completed	Receive Approval from RWQCB	7-Apr	6-Dec
	Begin Remediation System Expansion	7-May	--
	Begin Upgrades to Groundwater Treatment System	7-Aug	--
	Complete Remediation System Improvements	7-Dec	7-Feb
	Full-Scale Remediation Startup	8-Jan	--
	Begin SVE Rebound Testing	8-Dec	8-Aug
	Submit First Annual Remediation Progress Report	9-Jan	8-Feb
	Submit Second Annual Remediation Progress Report	10-Jan	--
	Complete SVE Rebound Testing	As conditions allow	9-Feb
	Submit Third Annual Remediation Progress Report	11-Jan	--
	Submit Fourth Annual Remediation Progress Report	12-Jan	--
	Submit Fifth Annual Remediation Progress Report	13-Jan	--
	Submit Sixth Annual Remediation Progress Report	14-Jan	--
	Future	Begin Bioventing Operation	After free product removal
Begin Bioventing Rebound Testing		TBD	9-Dec
Begin Verification Groundwater Monitoring		January 2010 (ongoing)	10-Jun
Complete Bioventing Testing		TBD	10-Jun
Complete Verification Groundwater Monitoring		When cleanup objectives are met	10-Jun
Submit Closure Request to RWQCB		When cleanup objectives are met	12-Aug
Install pilot biosparge test well in SC area		14-Mar	--
Complete pilot testing (1 year duration)		15-Jul	--

Planned Remediation Activities

- Continue focusing remedial efforts on South-central and Southeastern areas
 - Continue operating TFE, GWE, and SVE systems
 - Continue system maintenance, inspections, and data collection on weekly basis
 - Continue pumping from onsite and offsite wells with measurable free product
- Monitor concentrations of 1,2-DCA, MTBE, and TBA in western area and restart WSB if necessary
- Replace bag filter housings for FBBRs
- Install horizontal biosparge well in south-central area of the site; install soil vapor monitoring points and commence pilot testing



Questions?