



DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY

5090
Ser OPAE.RP/190
July 20, 2016

Ms. Beatrice Griffey
California Environmental Protection Agency
California Regional Water Quality Control Board
Mitigation & Cleanup Unit
2375 Northside Drive, Suite 100
San Diego, CA 92108

Mr. Tayseer Mahmoud
California Environmental Protection Agency
Department of Toxic Substances Control
Brownfields and Environmental Restoration Program
5796 Corporate Avenue
Cypress, CA 90630

Mr. Martin Hausladen
U. S. Environmental Protection Agency
Region IX, Code SFD-8-3
75 Hawthorne Street
San Francisco, CA 94105-3901

SUBJECT: MEETING MINUTES FOR THE 118TH FEDERAL FACILITIES
AGREEMENT (FFA) MEETING DATED June 7, 2016,
MARINE CORPS BASE CAMP PENDLETON

Dear Ms. Griffey, Mr. Mahmoud, Mr. Hausladen:

Enclosed are the minutes to the Marine Corps Base, Camp Pendleton Federal Facilities Agreement (FFA) Meeting Number 118, held on June 7, 2016. Should you have questions, please call Mr. Ralph Pearce at (619) 532-3768.

Sincerely,

Theresa Morley

THERESA MORLEY
By direction

5090
Ser OPAE.RP/190
July 20, 2016

Enclosures: (1) 118th FFA Meeting Agenda
(2) Sign in Sheet
(3) FFA Schedule
(4) Deliverables/Fieldwork Spreadsheets
(5) AG Field Pilot Study Presentation
(6) Remedial Investigation/Feasibility Study IR
Site 150 Presentation

Copy to: CG, MCB Camp Pendleton (Attn: ACOS, Environmental
Security - Mr. Luis Ledesma)

PARSONS

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PROJECT NOTE NO. 68

SUBJECT: Marine Corps Base (MCB) Camp Pendleton Federal Facilities Agreement (FFA) Meeting (No. 118)

DATE HELD: June 7, 2016

Attendees:

Ralph Pearce (Naval Facilities Engineering Command Southwest [NAVFAC SW]), Theresa Morley (NAVFAC SW), Jennifer Sullivan (MCB Camp Pendleton), Luis Ledesma (MCB Camp Pendleton), Kelsey Duckworth (MCAS Camp Pendleton), Christian Hur (Marine Corps Installations West [MCI West] Western Area Counsel Office [WACO]), Martin Hausladen (US Environmental Protection Agency [USEPA]), Lucrina Jones (USEPA), Tayseer Mahmoud (California [Cal] EPA/Department of Toxic Substances Control [DTSC]), Beatrice Griffey (San Diego Regional Water Quality Control Board [RWQCB or Water Board]), Karen Collins (WSI-IO), Mike Bilodeau (WSI-IO), Bob Breglio (Trevet), Mehrdad Javaherian (Endpoint Consulting), Steve Griswold (Parsons), and Josh Sacker (Parsons).

Attendees via Conference Call:

Kelly Dorsey (RWQCB), Kimberly Gettmann (DTSC), and Sophie di Campalto (RWQCB).

Introduction

A meeting was held at MCB Camp Pendleton (Pacific Views Event Center) to update the FFA Team (Team) on program status. The agenda, Deliverables Spreadsheet (including status on fieldwork and responses to agency comments), and updated FFA Schedule are attached.

Following introductions of each attendee, Mr. Hausladen noted that Ms. Jones will be taking over as the USEPA Region 9 Project Manager for this program. Mr. Hausladen will be retiring from the USEPA in June 2016.

Deliverables Schedule Discussion

Mr. Griswold and Mr. Pearce discussed each item on the Deliverables Spreadsheet (attached), and noted that the items that are marked as final will be removed from the

next version of the spreadsheet. There was some additional team discussion on certain items as follows:

- Item 3, Remedial Investigation Report - Site 1121 (Site 1D Groundwater): The Site 1121 Remedial Investigation (RI) Report was delivered to the agencies May 18, the Responses to Comments are being provided as a handout during this meeting, and an electronic version will be emailed after the meeting.
- Item 6, Remedial Investigation Report - Site 1117 (15/16 Area Groundwater): Trevet and the Navy are working with the RWQCB to resolve the final comments. Ms. Dorsey said her understanding was that a meeting or call would be held to finalize the responses, and that a date will be set up in June for the discussion.
- Item 8, Post-SVE Site Closure Report for 12 Area Site 13 (Bldg 1280): For the Post-Soil Vapor Extraction (SVE) Site Closure Report for 12 Area Site 13, recent data indicates a detection of 1,2,3-trichloropropane (TCP) above risk-based levels, so the Navy will be evaluating path-forward for the site.
- Item 10, Post-NTCRA Groundwater Monitoring and Soil Gas Report for Site 33 (52 Area Armory): For the Post-Non-Time Critical Removal Action (NTCRA) Groundwater Monitoring and Soil Gas Report for Site 33 (52 Area Armory), the responses to agency comments and report went final June 3 and the FFA Team will be receiving copies.
- Item 12, ROD for Site 33 (52 Area Armory): The agency comments on the Record of Decision (ROD) for Site 33 (52 Area Armory) are currently under review by Navy legal.
- Item 15, Remedial Investigation report for IR Site 150 (SEERMA Site): The delivery date for the RI Report for Site 150 was extended to allow for collection of additional data, and is currently planned for delivery on June 30, 2016.

Field Work Schedule Discussion

- Item 8, Site 1119 Design Study: For the Site 1119 Design Study, a technical memorandum will be provided to the FFA Team describing the latest findings before the installation of injection wells at the site.

Following the discussion of schedule items, it was noted that the FFA schedule has been updated in accordance with the updated deliverables schedule (refer to attached updated FFA schedule).

Ag Field Pilot Study Update

Ms. Collins provided an overview and discussion of the planned scope for the pilot study for remediation of pesticide contaminated soils removed from the tree line area of the Stuart Mesa East Agricultural Field (refer to attached presentation). Following the removal of approximately 1,500 eucalyptus trees, approximately 10,000 cubic yards of soil from the tree line berm area were excavated in March, and soils were staged on the treatment pad and segregated by concentration levels (i.e., non-hazardous, California hazardous, and Resource Conservation and Recovery Act [RCRA] hazardous).

Confirmation sampling of the excavated area is pending Work Plan finalization and Sampling and Analysis Plan (SAP) approval.

Bench testing was conducted for two technologies, in situ chemical oxidation (ISCO) and in situ chemical oxidation (ISCR). Results were very unfavorable, which prompted a re-evaluation of Vapor Energy Generator (VEG) technology. The bench test of VEG was very effective at reducing pesticide concentrations in the RCRA-level stockpile. Ms. Collins noted that the ISCO and ISCR sections in the current version of the Work Plan can be discarded and will be replaced with a section dealing with VEG.

Mr. Javaherian provided an overview of the VEG technology (refer to slides). The technology involves thermal treatment with a patented filtration technology for air discharges. A detailed discussion of the technical aspects of the system were described, including temperatures and residence times needed to achieve results for different contaminant classes. Following treatment using the VEG system, approximately 1.5 drums of waste material is generated for every 15,000 cubic yards of treated soil. Cleanup rate is approximately 3,000 yards of soil in a week to 10 days per treatment unit. Ms. Morley asked if the treatment unit would run 24-hours per day, and Mr. Javaherian said no, that about 300 cubic yards would be treated per day, with a target cost reduction of 50 to 60% compared to a landfill option. The system has been tested at multiple sites (see slides), and results tend to be better with soils having a lower moisture content.

Mr. Mahmoud said that the VEG technology was not included in the Remedial Investigation/ Feasibility Study (RI/FS) for Site 1120, so it would need to be added to that document. Ms. Morley said that it is a treatability study work plan for the tree line berm area at this stage to determine the effectiveness of the technology. Ms. Griffey said that the work plan for the site does not include the VEG technology, and asked how the document will be revised to include it. Mr. Pearce said that the pages dealing with ISCO/ISCR can be replaced with the VEG technology instead. Ms. Collins suggested that the agencies can provide comments and the additional material regarding VEG technology can be provided via the response to comments. Ms. Griffey said that the additional information should be forwarded as soon as possible so that the work plan document can be reviewed all at once. After some discussion, the consensus was that replacement pages will be forwarded to the FFA Team as soon as possible for inclusion in the document for review.

Site 150 RI/FS Update

Mr. Breglio provided an overview of the latest data and status of site investigation at Site 150, a possible former disposal pit adjacent to the Del Mar Boat Basin. Following a Discovery Site Assessment in 2008, there has been a Site Inspection (SI) in 2012 followed by a RI started in 2013, with several phases of soil, groundwater, and soil gas sampling guided by previous results, including the latest sampling conducted in October 2015.

Based on results to date (refer to slides), Mr. Breglio noted that the site does not warrant further investigation, and that site closure would be appropriate following the remediation of the free product in monitoring well MW02A. Alternatives 2 in the FS

involves free product extraction and groundwater monitoring, and Alternative 3 involves source area excavation. Mr. Mahmoud noted that Alternatives 2 and 3 do not appear to account for land use controls (LUCs). Mr. Breglio said that LUCs could be added to the alternative until remedial goal are met. Mr. Hausladen suggested that the extra effort should be expended to get the source area cleaned up and minimize the risk of free product returning. There was discussion of the drain near the affected monitoring well, and whether it is currently needed for something. Mr. Breglio said that there may have been a need in the past, but since it is now capped it does not appear to be needed.

Schedule for Next FFA Meeting

The next FFA Meeting is scheduled to be held in Pasadena at Parsons offices on October 6, 2016.

Site Visits

Most of the attendees visited several sites to see site conditions, particularly sites that have current actions or work plans in progress. Sites visited were Site 150, Site 1118 Building 210568, Site 1119, Site 1115, and Site 1116.

At Site 150, site conditions and logistics were discussed, including utilities and site use in the vicinity of well MW02A. For Building 210568, there was discussion of possibly using SVE to address contaminants in soil gas at the site.

At Site 1119, groundwater sampling was recently conducted and the latest data will be forthcoming. The new data will be used to refine placement of the injection wells.

At Site 1115, the thermal treatment has been completed at TTZ-2, which has caused groundwater to be removed from the treatment area, with no measureable recovery yet.

At TTZ-1, two bioinjection events have been conducted, and a third performance monitoring event is planned for September 2016.

At Site 1116, the features of the site were pointed out, including the path of the drainage through the site, which roughly corresponds to the location of the newly-discovered TCE plume connecting former Subsites 140008 and 1491.

Following the site visits, the meeting was adjourned.

**MCB Camp Pendleton
118th FFA Meeting Agenda**

**Pacific Views Events Center
MCB Camp Pendleton, CA**

June 7, 2016

- | | |
|--------------------|--|
| 1000 – 1015 | Welcome and Introductions (Navy) |
| 1015 – 1100 | Project Deliverables, FFA Schedule Update and
Planned/In Progress Field Work Status (Navy) |
| 1100 – 1130 | Agricultural Fields Pilot Study Update (WSI-IO) |
| 1130 – 1200 | Site 150 RI and FS Update (Trevet) |
| 1200 – 1300 | Lunch |
| 1300 – 1500 | Site Visits <ul style="list-style-type: none">• Site 150• Site 1118 (Building 210568)• Site 1119• Site 1115• Site 1116 (if time permits) |
| 1500 | Meeting Conclusion |

PARSONS

CLIENT _____
 SUBJECT SIGN-IN SHEET
118th FFA Meeting

JOB NO. _____ SHEET _____ OF _____
 BY _____ DATE 6/7/16
 CKD. _____ REVISION _____

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FFA Schedule for Draft Documents – June 7, 2016

Original schedule was agreed to by all FFA signatories at the May 17, 2011 FFA meeting. Updates are made every four months, prior to the FFA meetings. Dates marked with an asterisk are tentative, based on funding and subject to change. Once funding becomes available for a site, the date will be updated and the asterisk removed. Items in italics represent field work and are not enforceable. Dates in green have changed since the January 19, 2016 FFA schedule.

Site 6 (Site number is for funding purposes only) – 22/23 Area Groundwater

This site consists of VOC plumes in the groundwater under the 22 and 23 Areas. Various industrial activities have historically taken place in the 22 and 23 Areas. A Remedial Investigation/Feasibility Study (RI/FS) was completed in January 2011. The Proposed Plan outlined the various alternatives from the FS and proposed the preferred alternative which is a combination of alternatives 2, 3 and 4. Alternative 2 includes Land Use Controls and Long-Term Monitoring, Alternative 3 involves an Alternate Water Supply and Alternative 4 is Source Area Treatment via In-Situ Technologies. A public comment period and public meeting for the Proposed Plan were held in July/August 2011. A Record of Decision has been completed. To evaluate the effectiveness of the remedies proposed for Alternative 4, two pilot studies were completed: a Zero Valent Zinc (ZVZ) Permeable Reactive Barrier for the TCP plume; and, Enhanced In Situ Bioremediation (EISB) for the TCE plume. The production well is scheduled to be installed soon. A pilot study to remediate the 1,4-dioxane plume, which is an issue now that the screening level criteria for dioxane was reduced, is planned.

- | | |
|---|--------------------|
| – Proposed Plan | complete |
| – Geotechnical and Design Information for ZVZ PRB Pilot Study | complete |
| – <i>Implementation of ZVZ PRB Pilot Study</i> | complete |
| – Record of Decision | complete |
| – Well Siting Study Sampling and Analysis Plan | complete |
| – <i>Field Work for Well Siting Study</i> | <i>complete</i> |
| – Work Plan for Enhanced In Situ Bioremediation (EISB) | complete |
| – <i>Field Work for EISB Pilot Study</i> | <i>complete</i> |
| – Work Plan to Install Wells and Conduct Groundwater Monitoring | complete |
| – <i>Installation of Alternative Water Supply Well</i> | <i>in progress</i> |
| – Land Use Control Implementation Plan | complete |
| – Tech Memo to Implement Alternate Water Supply | complete |
| – Baseline LTM Groundwater Monitoring Tech Memo | complete |
| – ZVZ Pilot Study for TCP Report | complete |
| – EISB Pilot Study for TCE Report | complete |
| – Annual LTM Groundwater Monitoring Report | 3/16/2016 |
| – Work Plan for EISB Expanded System | 7/19/16 |

****POST ROD Site 7 – Box Canyon Landfill**

This site is a Corrective Action Management Unit (CAMU) situated above an old municipal landfill. This site is post-Record of Decision (ROD). The selected remedy was an EvapoTranspiration (ET) cap with land use controls. The site must be fenced and signed. Annual inspections are made in relation to the monitoring systems, cover maintenance, drainage/erosion control, cracks, settlement and movement and vegetation growth. Additionally, groundwater monitoring wells are sampled every year and gas probes are sampled according to the percent of methane in the probe. The groundwater monitoring results and the annual maintenance activities are summarized in annual reports. The methane results are emailed to the FFA team monthly. A Gas Collection and Control System (GCCS) was installed and has reduced methane concentrations to below compliance standards.

- Memo to File for Site 7 (pv panels) complete
- *Field Work for Non Methane Organic Compounds* complete
- Memo To File complete
- Report for Non Methane Organic Compounds complete
- Annual Post Closure Maintenance Report (for CY15) complete
- Annual Groundwater Monitoring Report (for CY16) 7/3/2016
- Five Year Review complete

12 Area Site 13 – Former Building 1280 and 1283

This site is the site of a former Underground Storage Tank (UST) and has some low level concentrations of Volatile Organic Compounds (VOCs) in groundwater. An RI/FS has been completed. Due to an impending construction project through the site, contaminated soil and groundwater were removed from the area to be impacted by construction. A year of groundwater monitoring has been completed and a Project Completion Report is complete. A Soil Vapour Extraction system has reduced concentrations in groundwater; only one well has levels barely above the Maximum Contaminant Level (MCL). A site closure report is in review.

- Groundwater Monitoring Report complete
- Project Completion Report for Soil and Groundwater complete
- *AS/SVE Pilot Study* complete
- Post SVE Closure Report 10/20/2015
- **Proposed Plan** TBD
- **Record of Decision** TBD

Site 21 – 14 Area Surface Area Impoundment

This site was a former oxidation pond near a maintenance facility which has some low levels of VOCs in groundwater. A Remedial Investigation has been completed for the site. A pilot study to evaluate the effectiveness of in-situ bioremediation of chlorinated solvents at low concentrations in groundwater is complete. Technical Memorandums reporting on the effectiveness of both phases of the pilot study were finalized and the Feasibility Study is in agency review. A Proposed Plan is final and a Record of Decision is

being finalized with the following preferred alternatives: land use controls and long-term monitoring; biosparging/venting for the shallow plume; and, enhanced in situ bioremediation for the deep plume.

- | | |
|---|-----------------|
| – Pilot Study Tech Memo | complete |
| – Site 21 Pilot Study Work Plan Addendum | complete |
| – <i>Second Phase of Pilot Study Field Work</i> | <i>complete</i> |
| – Feasibility Study | complete |
| – Proposed Plan | complete |
| – Record of Decision | 3/9/2015 |
| – Remedial Design | 5/4/2016 |
| – <i>Remedial Action</i> | <i>Aug 2016</i> |
| – Land Use Control Implementation Plan (LUCIP) | 2017* |

Site 33 – 52 Area Armory

Gun cleaning in the armory contributed to a PCE plume downgradient of the armory. A Remedial Investigation and Feasibility Study have been completed for this site. An Engineering Evaluation/Cost Analysis and a Non-Time Critical Action Memorandum have also been completed. The selected remedy was excavation of the source material, and treatment of groundwater from the site. Two interim Removal Actions were completed, concentrating on the worst part of the plume and the source area. Groundwater monitoring, Enhanced InSitu Bioremediation (EISB) injections and soil gas sampling are currently in progress. A Proposed Plan is complete and a Record of Decision is in agency review. The recommended alternatives are: land-use controls, long-term monitoring and monitored natural attenuation.

- | | |
|--|-----------------|
| – Removal Action Work Plan for plume | complete |
| – <i>Plume Removal Action (geophysical work started 15 Nov 11)</i> | <i>complete</i> |
| – Plume Removal Action Completion Report | complete |
| – Removal Action Work Plan for source | complete |
| – <i>Source Removal Action/EISB Injection</i> | <i>complete</i> |
| – SAP Addendum for Soil Gas Monitoring | complete |
| – Source Removal Action Completion Report | complete |
| – Proposed Plan | complete |
| – Post- NTCRA Groundwater Monitoring & Soil Gas Report | 12/7/2015 |
| – Record of Decision | 12/14/2015 |

Site 150 – 21 Area, Location 1

This site became an IR site after a discovery investigation conducted based on information gained from a former Marine stationed at Camp Pendleton. During the discovery investigation, one location had vinyl chloride in soil gas that exceeded risk screening criteria. Field work for the Site Inspection has located groundwater contamination. This site is in the Remedial Investigation phase.

- *Site Inspection Field Work* complete
- Site Inspection Report complete
- Remedial Investigation Work Plan complete
- *Field Work for Remedial Investigation* in progress
- **Remedial Investigation Report/Feasibility Study** **June 2016**
- NFA Proposed Plan 2016
- NFA Record of Decision 2017

SITE CLOSED Site 1003 (Site number is for funding purposes only) – Site 1D Soil

This site was a former burn ash site and has undergone a Remedial Investigation and Feasibility Study for soil only. A ROD was signed documenting the selected remedy consisting of excavation and off-base disposal of contaminated soil. During the remedial action a cell with 90 drums and drum fragments containing liquid and solid chemicals was discovered. The drums were removed but the material in the drums had reached groundwater. A Remedial Action Closure Report (RACR) was completed to close out the soil portion of the site, but the groundwater contamination remains to be addressed. As an interim measure, until funding could be secured for further investigation, 650,000 gallons of the groundwater was pumped from the site, treated and disposed of in the base sanitary sewer system. This lowered the concentrations of contaminants in groundwater, however, additional work is planned under a new site, IR Site 1121 Site 1D Groundwater. This site is for soil only; and was closed through the ROD and the RACR.

- Data Gap Analysis for Groundwater Work Plan complete
- *Data Gap Analysis Field Work* complete
- Data Gap Analysis Report complete

SITE CLOSED Site 1111 – 26 Area Ash and Debris Disposal Area

This burn ash site was remediated and four quarters of groundwater monitoring have been completed. The site was revegetated and a report was written summarizing the actions that had been completed to date, and why the site qualified for unrestricted land use. A No Further Action Record of Decision (ROD) was signed on April 19, 2013.

- Proposed Plan for No Further Action complete
- Record of Decision for NFA complete

Site 1114 – 41 Area Arroyo

This site was created to investigate the PCE concentrations in one well that used to be associated with IR Site 9 (closed). A Site Inspection (SI) was carried out and described low-level concentrations of TPH and vinyl chlorides in soil gas and groundwater. A Remedial Investigation was conducted to validate the findings of the SI and to complete a risk assessment for the site. The EPA did not agree with the proposed No Further Action (NFA) recommendation, so an interim Removal Action was completed to address elevated concentrations in

groundwater. Performance monitoring to examine the effectiveness of the substrate injected during the removal action is underway.

- Remedial Investigation Report complete
- Engineering Evaluation/Cost Analysis & Action Memorandum complete
- Removal Action Work Plan complete
- *Removal Action* complete
- Work Plan for Performance Monitoring complete
- Removal Action Completion Report complete
- *Performance Monitoring* in progress
- Performance Monitoring Report 4/4/2016
- **Proposed Plan** TBD
- Record of Decision 2017

Site 1115 – 13 Area FSSG Lot

There are two plumes underneath the parking lot at this site, one shallow and one deep, containing chlorinated solvents and benzene. A pilot study to evaluate the effectiveness of in-situ bioremediation of chlorinated solvents in groundwater was completed. The technology was successful at reducing contaminant concentrations, but the site geology limited its effectiveness. A Technical Memorandum detailing the pilot study is complete. A work plan to collect more data is final and the results have been included in a Remedial Investigation/Feasibility Study. The Feasibility Study identified remedial alternatives for various Target Treatment Zones (TTZs) throughout the site. TTZ-1S was excavated and an EISB pilot study is in progress at TTZ-1D. A pilot study to evaluate the effectiveness of insitu thermal conductive heating was recently completed at TTZ-2S. Once groundwater recharges, samples will be collected and the results will be presented in a report.

- Tech Memo complete
- Work Plan to collect additional data for site complete
- *Field Work to collect additional data* complete
- Remedial Investigation/Feasibility Study Report complete
- Pilot Study Work Plan for TTZ-2L and TTZ-2S complete
- Pilot Study Work Plan for TTZ-1S complete
- *Field Work for TTZ-2L and TTZ-2S Pilot Study* complete
- *Field Work for TTZ-1S Pilot Study* in progress
- Pilot Study Report for TTZ-2L and TTZ-2S 2016
- Pilot Study Report for TTZ-1L and TTZ-1S 2017
- Proposed Plan 2017*
- Record of Decision 2018*

Site 1116 – 14 Area Groundwater

Nine USTs were transferred from the UST Program to the IR Program due to low-levels of chlorinated solvents. A Site Inspection was completed and six of the subsites do not warrant further action under the IR Program. The three other subsites will be remediated. An Engineering Evaluation/Cost Analysis (EE/CA) and Action Memo has been completed for this site. A Removal Action Work Plan, with a report detailing the results of a limited investigation to close data gaps as an appendix, is complete. The removal action addressed the mainly petroleum sources at the old USTs, along with Dual-Phase Extraction (DPE) at one subsite and an Enhanced In Situ Bioremediation (EISB) pilot study at another subsite. A Removal Action Completion Report (RACR) for the excavations and pilot studies is complete; however, a performance monitoring report for the pilot studies is in agency review. The limited investigation that was conducted in 2012 indicated that the TCE plumes at the site are not likely associated with the USTs. Therefore, an additional investigation was completed to delineate the TCE plumes and to find a source, if possible. The investigation report is in agency review.

– EE/CA and Action Memorandum	(3 subsites – Moving Forward)	complete
– Expanded Site Inspection WP	(3 subsites – Moving Forward)	complete
– <i>Field Work for Site Inspection</i>	<i>(3 subsites – Moving Forward)</i>	<i>complete</i>
– Expanded Site Inspection Report	(3 subsites – Moving Forward)	appendix to RAWP
– Removal Action Work Plan (RAWP)	(3 subsites – Moving Forward)	complete
– <i>Interim Removal Action</i>	<i>(3 subsites – Moving Forward)</i>	<i>in progress</i>
– Additional Investigation Work Plan		complete
– Performance Monitoring SAP		complete
– <i>Additional Investigation Field work</i>		<i>complete</i>
– <i>Performance Monitoring Field Work</i>		<i>complete</i>
– Removal Action Completion Report	(3 subsites – Moving Forward)	complete
– Additional Investigation Report		complete
– Performance Monitoring Report		12/14/2015
– Optimization/Characterization Tech Memo for Site Groundwater		6/10/2016
– Proposed Plan		2016*
– Record of Decision		2017*

Site 1117 – 15/16 Area Groundwater

Six USTs were transferred from the UST Program to the IR Program due to low-levels of chlorinated solvents. The agencies have concurred with the Site Inspection Report recommending the site move into the Remedial Investigation phase. A Remedial Investigation Report justifying No Further Action at all subsites is currently under agency review.

– <i>Field Work for Site Inspection</i>		<i>complete</i>
– Site Inspection Report		complete
– Remedial Investigation Work Plan		complete
– <i>Remedial Investigation Field Work</i>		<i>complete</i>
– Remedial Investigation Report		7/24/2015

- NFA Proposed Plan 2016
- NFA Record of Decision 2016

Site 1118 – 21/26/52 Area Groundwater

Three USTs were transferred from the UST Program to the IR Program due to low-levels of chlorinated solvents. A Site Inspection and Extended Site Inspection have been completed for this site, resulting in No Further Action for one subsite, 2664. Additional investigation is needed at Subsite 520400 and an interim removal action will begin at Subsite 21565 soon.

- Extended Site Inspection (ESI) Work Plan complete
- *Field Work for Site Inspection* complete
- Extended Site Inspection Report complete
- EE/CA and Action Memo Subsite 21565 complete
- Removal Action Work Plan Subsite 21565 complete
- *Field Work for Subsite 21565 Removal Action* in progress
- Removal Action Completion Report Subsite 21565 2016
- **Work Plan/SAP for Subsite 520400** **5/31/2016**
- *Field Work for Subsite 520400* 2016
- Tech Memo for Subsite 520400 2017
- Proposed Plan 2017*
- Record of Decision 2018*

Site 1119 – 26 Area Groundwater

This site was created to investigate the source or sources of chlorinated solvents in the 26 Area production wells. Field work for the Remedial Investigation has been completed. TCE had been discovered at two of the wells and further investigation was needed to delineate the extent of contamination and to locate the source. The results of the additional investigation and proposed remedial alternatives were included in the Remedial Investigation/Feasibility Study Report. The preferred alternative has been documented in a Proposed Plan, and the Record of Decision is currently in agency review. There are three preferred alternatives: land use controls and long-term monitoring; enhanced in-situ bioremediation at the source area; and, a permeable reactive barrier downgradient of the plume and upgradient of the production wells.

- *Field Work for Remedial Investigation* complete
- Work Plan Addendum to Delineate Source complete
- *Additional RI Field Work* complete
- RI/FS Report complete
- Proposed Plan complete
- Record of Decision 3/9/2015
- EISB Pilot Study Work Plan complete
- *EISB Pilot Study Field Work* in progress

- EISB Pilot Study Report 2018
- Permeable Reactive Barrier (PRB) Work Plan 3/21/2016
- *PRB Field Work* 2016
- PRB Completion Report 2017

SITE CLOSED Site 62 – Asphalt Batch Plant

This site was created when a transformer containing PCBs tipped over and spilled. A Site Inspection was performed, however data was missing and further investigation was needed. An Extended Site Inspection, including trenching, has been completed. The ESI Report recommended No Further Action (NFA) at the site and a Proposed Plan has been completed. The NFA Record of Decision is final and signed.

- Extended Site Inspection Work Plan complete
- *Field Work for Extended Site Inspection* complete
- Extended Site Inspection Report complete
- Proposed Plan complete
- Record of Decision complete

Site 1120 – Stuart Mesa Pesticide Maintenance Areas

This site was created in 2012 to address pesticide contamination due to releases from agricultural maintenance activities. A Phase II Environmental Assessment was completed for this site in support of real estate agreement closure. The Environmental Assessment is analogous to a Site Inspection, so this site entered the Installation Restoration Program at the Remedial Investigation stage. The field work for the Remedial Investigation is complete and the Remedial Investigation/Feasibility Study Report is in progress. A Treatability Study to treat pesticide contaminated soils is planned for soil located near Site 1120.

- Remedial Investigation Work Plan complete
- *Remedial Investigation Field Work* complete
- Treatability Study Work Plan 2/29/2016
- Remedial Investigation/Feasibility Study Report 3/31/2016
- *Treatability Study Field Work* 2016
- Treatability Study Completion Report 2016
- Proposed Plan 2017*
- Record of Decision 2018*

Site 1121 – Site 1D Groundwater

This site was created in 2012 to differentiate Site 1D groundwater from Site 1D soil, which was closed with a previous remedial action and Record of Decision. There is a plume consisting of elevated concentrations of

VOCs, metals, and pesticides. A Remedial Investigation is almost complete and a Feasibility Study is currently in progress.

- Remedial Investigation Work Plan complete
- *Remedial Investigation Field Work* complete
- Remedial Investigation Report 5/13/2015
- Feasibility Study 2016
- Proposed Plan 2017*
- Record of Decision 2018*

Site 1122 – Shot Fall Zone

This site was created in 2013 to address lead and Polycyclic Aromatic Hydrocarbon contamination due to overshoot from skeet range activities off base. Limited soil samples were collected that indicated elevated levels of lead, so the site came into the Installation Restoration Program at the Site Inspection stage. The Site Inspection is complete; however, headquarters has determined that the DON must go after the responsible parties before they will fund anymore work under this IR site.

- Site Inspection Work Plan complete
- *Site Inspection Field Work* complete
- Site Inspection Report complete

MCB Camp Pendleton Deliverables Spreadsheet

Date: 6/07/16

Item	Document	Contractor	Status	Date Due to Agencies	Agency Comments Due By	Response Received From:		
						EPA	DTSC	RWQCB
1	Record of Decision for Site 21 (14 Area Surface Impoundment)	SDVJV	ROD out for signature	3/9/15	5/8/15	5/5/15	4/29/15	5/4/15
2	Record of Decision for Site 1119 (26 Area Groundwater)	Tidewater	ROD out for signature	3/9/15	5/8/15	4/17/15	4/28/15	5/11/15
3	Remedial Investigation Report - Site 1121 (Site 1D Groundwater)	SDVJV	FINAL?	5/13/15	7/30/15	6/30/15	7/9/15	7/21/15
4	Draft EISB Pilot Study Report - 22/23 Area Groundwater	Battelle	FINAL	6/29/15	8/28/15	8/31/15	8/26/15	9/30/15
5	Revised Draft EISB Pilot Study Report - 22/23 Area Groundwater	Battelle	FINAL	12/22/15	2/12/16	2/12/16	2/12/16	2/3/16
6	Remedial Investigation Report - Site 1117 (15/16 Area Groundwater)	Trevet	Responding to agency comments	7/24/15	9/22/15	9/8/15	9/14/15	10/6/15
7	Pilot Study Work Plan - Site 1119 (26 Area Groundwater)	Tidewater	FINAL	8/3/15	10/2/15	9/15/15	9/28/15	11/9/15
8	Post-SVE Site Closure Report for 12 Area Site 13 (Bldg 1280)	SDVJV	Responding to agency comments	10/20/15	12/21/15	NC	12/7/16	11/13/15
9	Additional Investigation Report for Site 1116 (14 Area Groundwater)	TetraTech	FINAL	11/20/15	1/19/16	1/7/16	1/11/16	1/15/16
10	Post-NTCRA Groundwater Monitoring and Soil Gas Report for Site 33 (52 Area Armory)	Trevet	Agencies Approved RTCs, Going Final	12/7/15	2/5/16	NC	2/2/16	2/8/16
11	Performance Monitoring Report for Site 1116 (14 Area Groundwater)	ECM	Responding to agency comments	12/14/15	2/12/16	NC	2/4/16	1/14/16
12	ROD for Site 33 (52 Area Armory)	ECM	Responding to agency comments	12/14/15	2/12/16	2/10/16	2/11/16	1/25/16
13	Annual Post-Closure Maintenance Report for Site 7 (Box Canyon Landfill)	Trevet	FINAL	2/22/16	4/22/16		4/11/16	4/6/16
14	Treatability Study Work Plan for Site 1120 (Ag Fields)	WSI-IO	Draft in Agency Review	2/29/16	4/29/16		4/14/16	Note 1
15	Remedial Investigation report for IR Site 150 (SEERMA Site)	Trevet	Draft RI/FS to be submitted in June 2016	Note 2				
16	Annual Groundwater LTM Report for 22/23 Area Year 1	Tidewater	Draft in Agency Review	3/16/16	5/15/16		5/11/16	
17	Permeable Reactive Barrier Work Plan Site 1119 (26 Area Groundwater)	CB&I	Draft in Agency Review	3/21/16	5/10/16	NC	5/5/16	
18	RI/FS Report for Site 1120 (Stuart Mesa Pesticide Maintenance Areas)	Tidewater	Draft in Agency Review	3/31/16	5/31/16		5/31/16	
19	NTCRA Performance Monitoring Report for Site 1114 (41 Area Arroyo)	TetraTech	Draft in Agency Review	4/4/16	6/4/16	5/31/16	5/27/16	

MCB Camp Pendleton Deliverables Spreadsheet

Date: 6/07/16

Item	Document	Contractor	Status	Date Due to Agencies	Agency Comments Due By	Response Received From:		
						EPA	DTSC	RWQCB
20	Work Plan for Site 1118 (Subsites 520400)	WSI-IO	Draft in Agency Review	5/31/16	7/30/16			
21	Remedial Design for Site 21 (14 Area Surface Impoundment)	CB&I	Draft in Agency Review	5/4/16	7/1/16			
22	Optimization Tech Memo Site 1116 (14 Area Groundwater)	WSI-IO	Navy Review	6/10/16	8/9/16			
23	Annual Groundwater Monitoring Report - Site 7 (Box Canyon)	Trevet	Pre-draft in progress	7/3/16				
24	Remedial Design for EISB at TCE Plume (22/23 Area Groundwater)	WSI-IO	Navy QAO Review	7/19/16	9/17/16			
25	Design Study Technical Memorandum for Site 1119	Tidewater	Pre-draft in progress					
26	Pilot Study Report Site 1115 TTZ-2S and 2L	Insight	Pre-draft in progress					

Agencies have commented

NC = No Comments

Note 1 = Extension Requested

Note 2 = Extended from March 11, 2016 to June 2016 to collect additional data

MCB Camp Pendleton Fieldwork Spreadsheet

Date: 6/7/16

Item	Field Work		Planned Start Date	Planned Completion Date
1	Install Production Well - 22/23 Area GW	Battelle	18-Jan-16	15-Aug-16
2	22/23 Area LTM Semi-Annual Sampling – Year 2	Tidewater	Jan-2016	Jul-2016
4	Pilot Study Site 1115 TTZ-1S and 1D	Tidewater	Injections (April and September 2016) 1st quarter groundwater monitoring (Dec 2015)	Sep-2016
8	Site 1119 Design Study	Tidewater	Design Study Well Installation - Feb 2016; Design Study Sampling Event – April 2016; Injection Well Installation – TBD pending Design Study Technical Memorandum	2016
	Site 1114 Performance Monitoring	TetraTech	First Semi Annual GWM May 2016	May 2016
	Site 1114 Performance Monitoring	TetraTech	Second Semi Annual GWM November 2016	November 2016
9	22/23 Area EISB Expansion	WSI-IO	Oct-2016	
	Site 1118 Subsite 520400	WSI-IO	Sep-2016	Oct-2016
	Pilot Study or Ag Fields	WSI-IO	Jul-2016	Oct-2016
	Optimization Tech Memo Site 1116 (14 Area Groundwater)	WSI-IO	Oct-2016	Nov-2016

SIOH Bearing

MCB Camp Pendleton RTC Spreadsheet

Date: 6/07/16

Item	Document	Contractor	RTCs to Agencies	RTCs Approved		
				EPA	DTSC	RWQCB
1	Record of Decision for Site 21 (14 Area Surface Impoundment)	SDVJV		12/21/15 out for signature		
2	Record of Decision for Site 1119 (26 Area Groundwater)	Tidewater		12/21/15 out for signature		
3	Remedial Investigation Report - Site 1121 (Site 1D Groundwater)	SDVJV	9/30/15			
5	Revised Draft EISB Pilot Study Report - 22/23 Area Groundwater	Battelle	2/25/16			5/18/16
6	Remedial Investigation Report - Site 1117 (15/16 Area Groundwater)	Trevet	3/9/16		3/15/16	
10	Post-NTCRA Groundwater Monitoring and Soil Gas Report for Site 33 (52 Area Armory)	Trevet	5/18/16	5/18/16	5/26/16	5/18/16
11	Performance Monitoring Report for Site 1116 (14 Area Groundwater)	ECM	5/11/16		5/16/16	

AG FIELD PILOT STUDY

June 7, 2016 FFA Meeting

MCB Camp Pendleton

IO-WSI JV

Mike Bilodeau, WSI-IO JV

Mehrdad Javaherian, PhD, MPH, PE, LEED GA

Karen Collins, WSI-IO JV

Project Scope

- Excavate and dispose of contaminated soil hotspots at IR Site 1120
- Conduct Pilot Study to determine if there is an effective remediation method to lower concentrations of toxaphene, dieldrin, and other pesticides in the tree line area of the site.



Project Location



**SMEAF Soil Pilot Study
Current Treatment Pad Location**

Site Layout

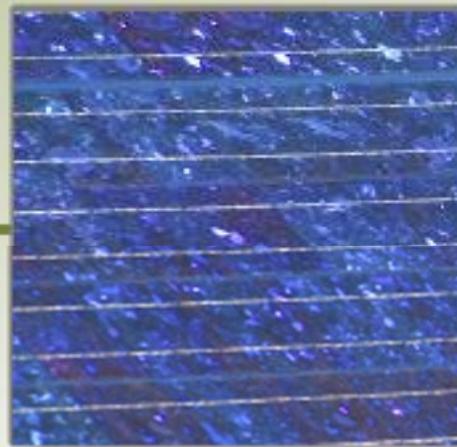


Project Progress Through May 2016

- Approximately 1,500 eucalyptus trees cut down and root balls removed.
- In February 2016, PPV construction in project area began, limiting access to tree line and portions of Site 1120.
PPV-related earthwork threatened site integrity.
- Tree line berm was excavated in March, and soil was staged on treatment pad, segregated into three piles by concentration levels.
- Confirmation samples of tree line soil and excavation of Site 1120 soil is pending Work Plan finalization and SAP approval.

Pilot Study Bench Testing

- ISCO and ISCR technologies were selected for evaluation based on prior Treatability Study results.
- Bench testing of ISCO and ISCR was initiated to confirm prior Treatability Study results. Results received in April were highly unfavorable, prompting the team to reevaluate Vapor Energy Generator (VEG) technology.
- VEG technology was initially considered for Pilot Study, but dismissed due to equipment unavailability at that time.
- Bench test of VEG conducted in May proved highly effective at reducing pesticide concentrations in RCRA-level stockpile.



green remediation solutions

VEG Thermal Desorption & Treatment Technology

2016

Mehrdad Javaherian, Ph.D., MPH, PE, LEED®GA

www.endpoint-inc.com

SUSTAINABLE REMEDIATION

VEG Soil Remediation Technology



VEG In-Situ Soil Remediation System



VEG Ex-Situ Soil Remediation System

SUSTAINABLE REMEDIATION

Patented VEG Technology

- **At its core:** A mobile, compact, high efficiency vapor generator
 - Air, recycled water and propane used to generate steam at 1300 F°

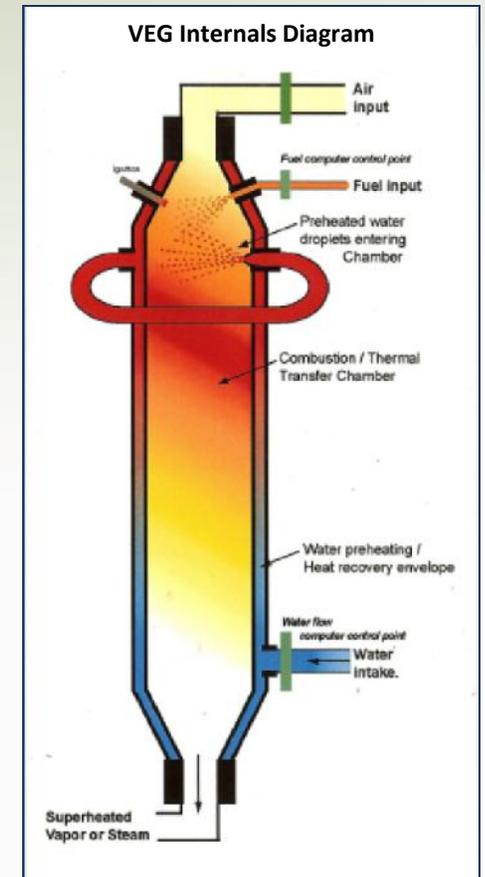
Various In-Situ and Ex-Situ Applications

• Enhanced oil recovery

- Unclog and recover refined oil from old, abandoned, and/or frozen aboveground pipelines.
- Enhanced crude oil recovery from deep oil wells
- In-situ LNAPL (gasoline and diesel) mobilization and recovery

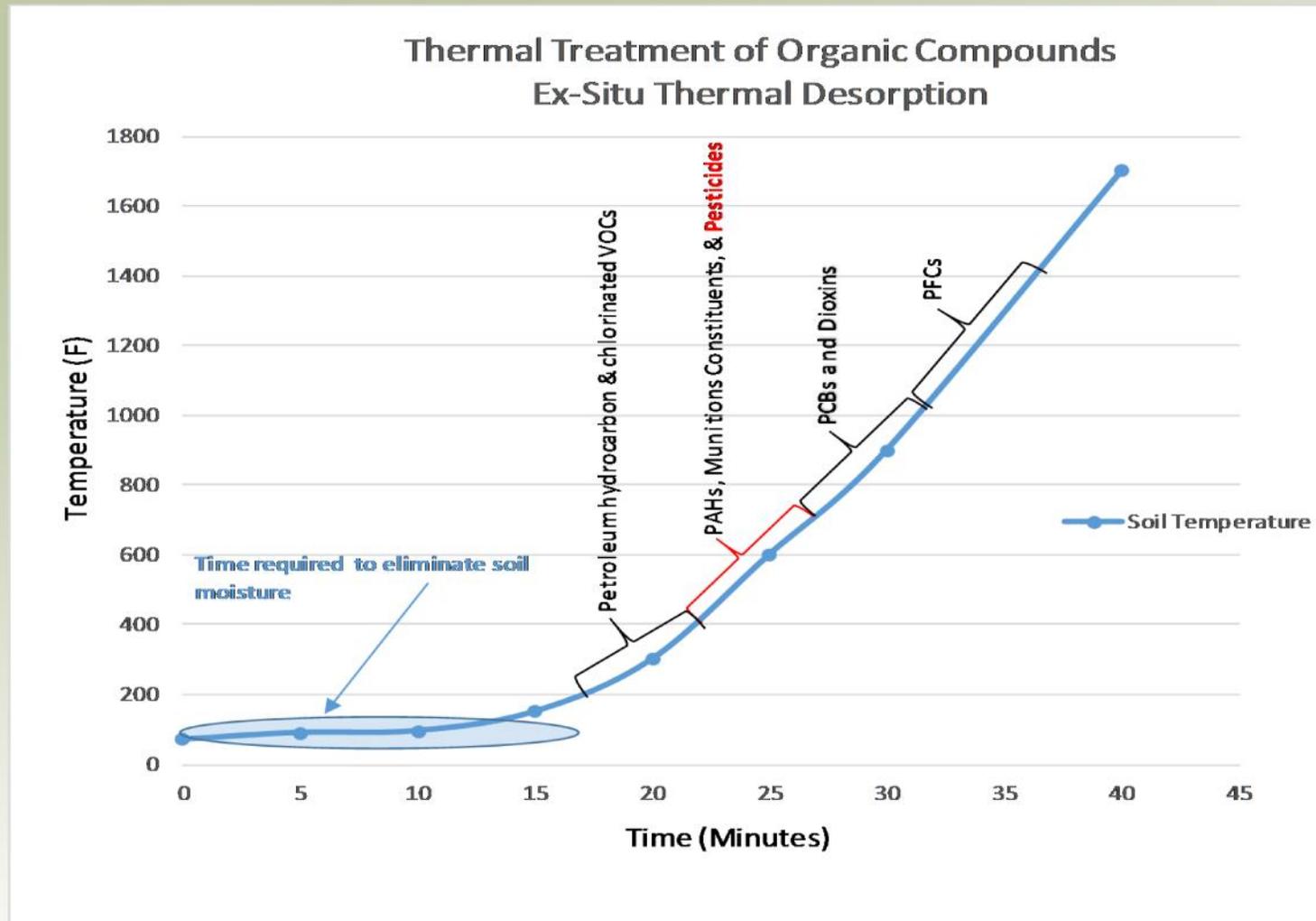
• Onsite soil remediation for unrestricted reuse

- Full range of TPH's, waste oils, crude oils, refined oils
- VOCs and SVOCs- BTEX, MTBE, TCE, PCE, VC, PAHs
- Pesticides and PCBs
- Munitions constituents- TNT, RDX, HMX, etc.



VEG SOIL REMEDIATION TECHNOLOGY

Thermal Treatment of Pesticides



SUSTAINABLE REMEDIATION

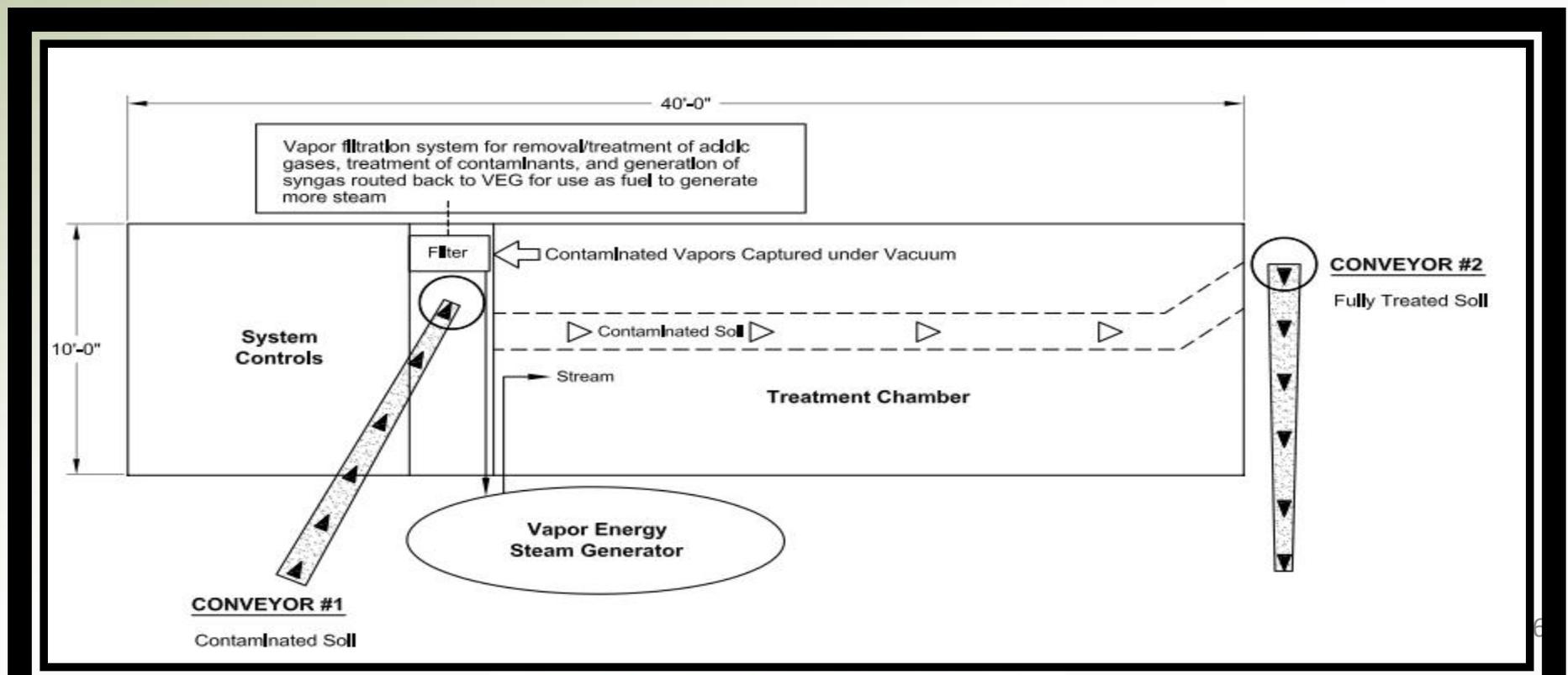
VEG Ex-Situ Soil Remediation System



SUSTAINABLE REMEDIATION

VEG Soil Remediation Technology

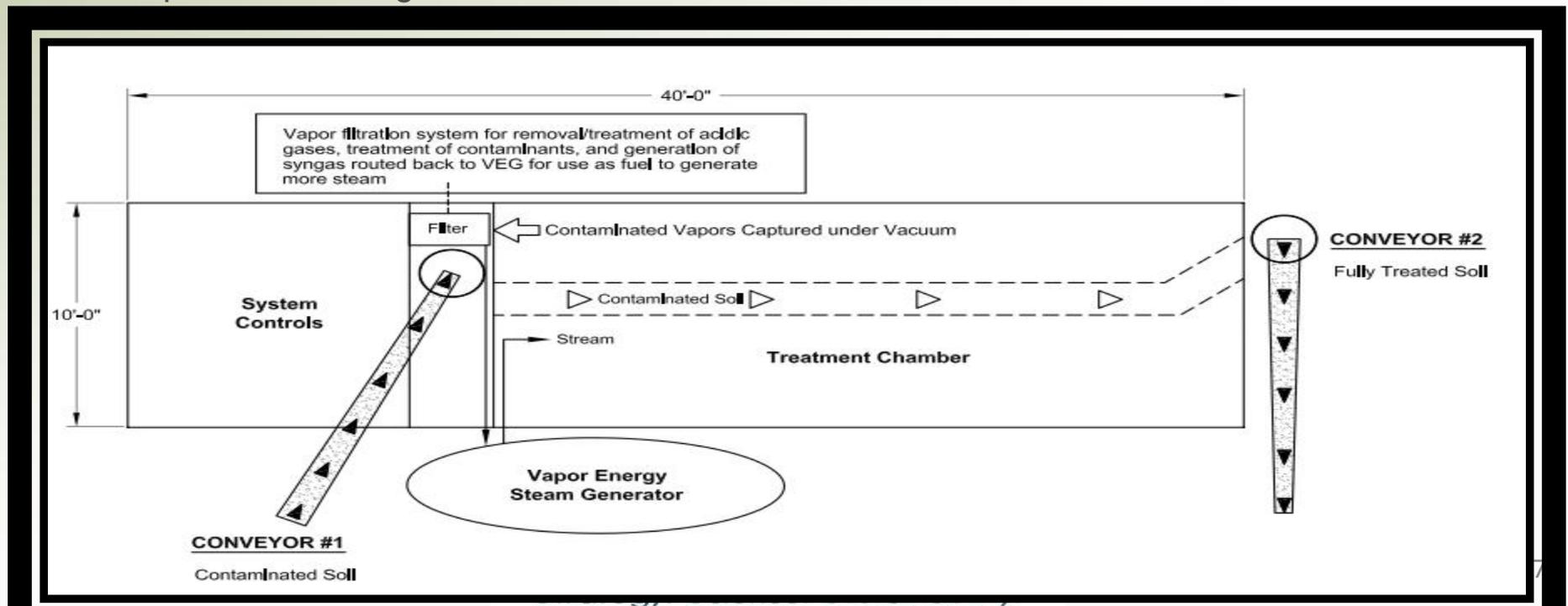
- Enclosed, rotational treatment chamber with 20 to 30-inch auger
- Variable-speed hydraulic system: rotates & moves soil through treatment chamber
- Fully enclosed system captures ALL combustion heat generated; **No heat or vapors are lost** to the atmosphere
- Contaminated vapors desorbed from soil and vacuumed into the box head space



SUSTAINABLE REMEDIATION

VEG Soil Remediation Technology

- Patented Filtration System (engineered mixture of caustic soda, ZVI, lime, water, steam):
 - Chemical reduction (ZVI) and thermal oxidation to treat organic compounds
 - Removal of acidic gases NO_x (HNO₃), SO_x (H₂SO₄) HCl (hydrogen chloride), and HF (hydrogen fluoride) gases
 - Transition of remaining hot vapor into syngas containing hydrogen and CO₂, sent back to vapor generator to replace propane as renewable source of fuel for soil treatment
- CO₂ emissions reduced through Endpoint's patented CO₂ filter.
- Disposal of a benign solution of sodium nitrate, sodium bisulfate, and sodium chloride.



VEG SOIL REMEDIATION TECHNOLOGY

Attributes

- Easily transportable, mobile system for onsite applications,
- Treats 15 to 30 yd³ of soil per hour per unit,
- Complete 3,000 yd³ cleanup in less than 10 days with 1 unit,
- Enclosed, Emission-Reducing System-
 - Captures all vapor and combustion heat generated
 - Provides complete control over target temperature and soil residence time through treatment chamber
- Induced vapors are recycled as fuel to operate system
- Use of recycled water eliminates potable water use
- Propane use increases clean energy production by 250%
- Indirect-fire, low-temperature thermal treatment process
(NO INCINERATION, NO DIOXINS/FURANS GENERATED)



**Ex-Situ VEG Application for Remediation of Chlorinated Solvents in Soil
USACE ERDC Facility, Vicksburg, MS**

VEG SOIL REMEDIATION TECHNOLOGY

Benefits

- Eliminates offsite transport and landfill disposal of soils & associated costs
- Eliminates landfill waste generator liability
- Eliminates need to import fill soils to site
- Allows for unrestricted reuse of soils and eliminates LUCs
- Ideal for PBCs
- Significantly reduces remediation costs (typically 50% to 90% reduction)
- Reduces remediation carbon footprint (typically >80% reduction)



Ex-Situ VEG Application for Remediation of Petroleum Hydrocarbons, Industrial Facility, Alameda, CA

VEG SOIL REMEDIATION TECHNOLOGY

Applications and Success Stories-VEG Ex-Situ Remediation System

- Application on over 35 remediation projects across the US completed
- Over 16 bench-scale and 17 pilot tests across the US
- Over 18,000 soil treatment runs

<i>Application Results</i>		
Chemical	Pre-VEG Treatment (mg/kg)	Post-VEG Treatment (mg/kg)
TPH-g	150,000	<50
TPH-d	130,000	<50
BTEX	2,500	<0.05
MTBE	500	<0.05
PAHs	10,000	<0.01
TCE/PCE/VC	2000	<0.001
PCBs	50	<0.2
Pesticides	10,000	<0.001
MCs, including TNT/RDX/HMX	55,000	<0.015
PFCs, including PFOA and PFOS	87	<0.0001
As/Hg/Zn	450/50/25,000	<0.3/<0.03/<100

VEG SOIL REMEDIATION TECHNOLOGY-Pesticide Applications

Select US Air Force Applications- Ex-Situ Treatment

- Hurlburt Airfield, Ft. Walton Beach, FL (AFCEC)
 - Ex-Situ Pilot Test for Treatment of Pesticides
 - Dieldrin concentrations ~ 1.6 mg/kg
 - Cleanup goals: Soil Leaching to Groundwater (<0.002 mg/kg per FDEP, 2015)
 - Optimal treatment conditions: T = 600 F and t= 5 minutes

Ex-Situ Treatment of Pesticides in Support of Residential Redevelopment Pilot Study, Hurlburt Air Field, FL

Ex-Situ VEG Thermal Treatment Bench-Scale Test Results
Hurlburt Air Field, FL

Sample/Treatment Conditions			Pesticides Detected in at Least One Sample								
Sample ID	Sample Location	Treatment Conditions	4,4'-DDE	4,4'-DDT	Chlordane (Technical)	Chlordane (alpha)	Chlordane (gamma)	Dieldrin	Endrin	Endrin ketone	Heptachlor epoxide
			(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Pre-1	16 Home	Prior to Treatment	<0.005	<0.005	<0.12	<0.005	<0.005	0.17	<0.005	<0.005	<0.005
Post-1	16 Home	575 F 8 minutes	<0.001	<0.001	<0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pre-2	6 & 8 Walters	Prior to Treatment	0.019	0.019	0.036	0.0036	0.0046	0.059	<0.001	<0.001	0.0011
Post-2	6 & 8 Walters	600 F 5 minutes	<0.001	<0.001	<0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pre-3	34 & 36 Harrison	Prior to Treatment	<0.005	<0.005	<0.12	<0.005	<0.005	1.6	0.081	0.023	<0.005
Post-3	34 & 36 Harrison	600 F 5 minutes	<0.001	<0.001	<0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Post-4	34 & 36 Harrison	700 F 5 minutes	<0.001	<0.001	<0.025	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Leachability Based on Groundwater Criteria			18	11	9.6	NA	NA	0.002	1	NA	0.6
Direct Exposure Residential (mg/kg)			2.9	2.9	2.8	NA	NA	0.06	25	NA	0.1

Notes:

NA= Not Available

Exceeds leachability based on groundwater criteria limits

Exceeds both leachability based on groundwater criteria limits and direct exposure residential limits

VEG SOIL REMEDIATION TECHNOLOGY

Bench-Scale Test- Ex-Situ Treatment

- Camp Pendleton, CA
 - Ex-Situ Bench-Scale Test for Treatment of Pesticides
 - Toxaphene concentrations ~ 24 mg/kg > Residential RSLs
 - DDD, DDE, and DDT > Residential RSLs
 - Optimal treatment conditions: T = 710 F and t= 5 minutes



Bench-Scale Ex-Situ Treatment of Pesticides in Soil
Camp Pendleton, CA

Table 1. Internal Bench-Scale Test Results
Ex-Situ Thermal Treatment Using VEG Technology
Camp Pendleton, CA

Sample/Treatment Conditions			Pesticides Detected in at Least One Sample			
Sample ID	Stockpile	Treatment Conditions	p,p-DDD	p,p-DDE	p,p-DDT	Toxaphene
			(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Pre-1	1	Prior to Treatment	0.16	2.6	5.4	24
Post-1	1	725 F 5 minutes	<0.001	<0.001	<0.001	<0.05
Pre-2	2	Prior to Treatment	0.11	2.1	3.7	21
Post-2	2	805 F 5 minutes	<0.001	<0.001	<0.001	<0.05
Pre-3	3	Prior to Treatment	0.072	1.4	2.6	12
Post-3	3	710 F 5 minutes	<0.001	<0.001	<0.001	<0.05
USEPA Residential (Direct Exposure) RSL (mg/kg)			2.3	2.0	1.9	0.49

Notes:

NA= Not Available

Exceeds Residential Soil RSLs

MOBILIZATION OF VEG SYSTEM



VEG TREATMENT OF ~~IDW DECONTAMINATION WASTES~~



INITIATION OF EX-SITU THERMAL TREATMENT

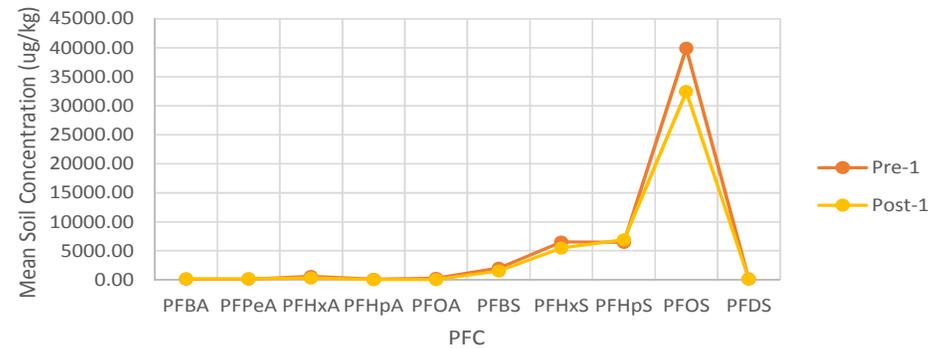


VEG SOIL REMEDIATION TECHNOLOGY

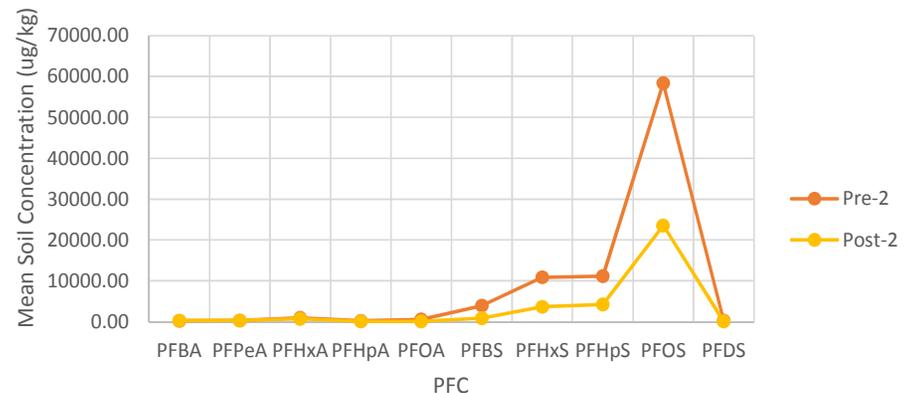
Other Ongoing Ex-Situ Applications

- Ex-Situ Bench-Scale Study to treat Per- and Polyfluorinated Alkyl Compounds (PFCs)- Colorado School of Mines
 - Emerging chemical ubiquitous across all DoD sites
 - Increased regulatory recognition
 - Targeting treatment at temperatures on the order of 1,000 F to 1,500 F
 - Results:
 - 16% removal at 900 F
 - 62% removal at 1100 F
 - 100% removal at 1750 F
 - Small portion of PFC mass removed via chemical reduction
 - Majority of PFC mass thermally oxidized
 - 100 % of HF gases captured and treated

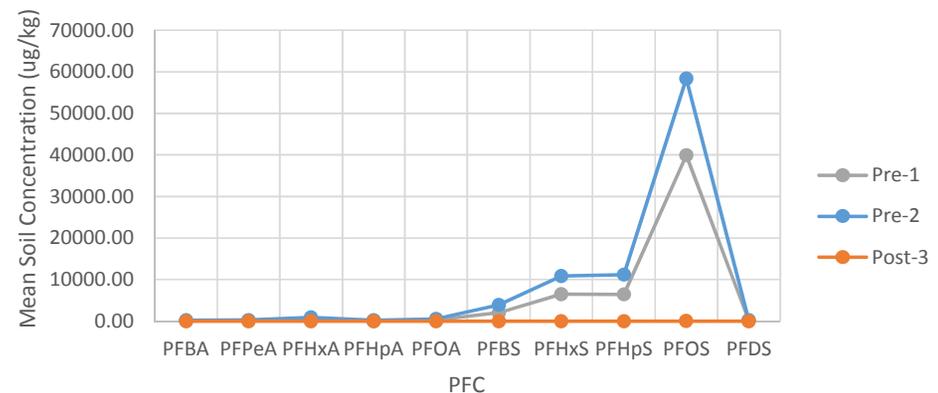
Pre- vs. Post-Treatment Soil Concentrations-Drum 1
Treatment at 900 F for 15 minutes



Pre- vs. Post-Treatment Soil Concentrations-Drum 2
Treatment at 1100 F for 15 minutes



Pre- vs. Post-Treatment Soil Concentrations-Drums 1 & 2
Treatment at 1750 F for 30 minutes



QUESTIONS?

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Burlingame, CA 94010

591 Telegraph Canyon Road, #726
Chula Vista, CA 91910



**Remedial Investigation/Feasibility Study
IR Site 150
MCB Camp Pendleton**

7 June 2016

History of IR Site 150



**SITE 150
LOCATION MAP**

0 0.05 0.1 0.2 Miles

N

History of IR Site 150

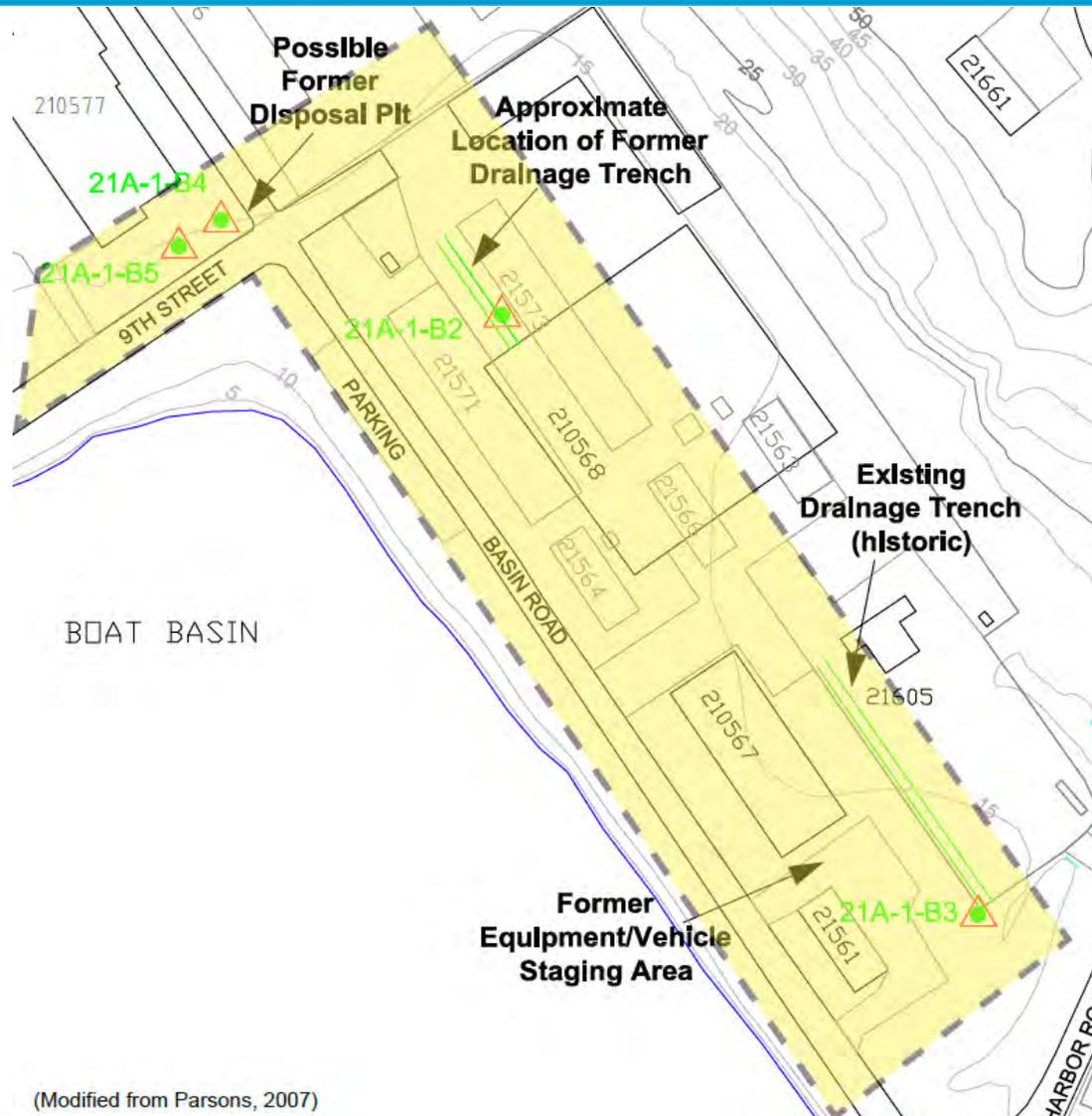


History of IR Site 150

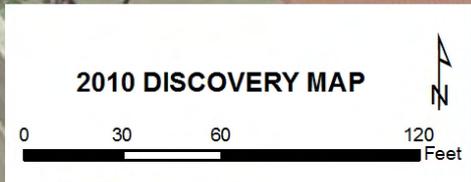


- **A Discovery Site Assessment was conducted in the 21 Area following a Freedom of Information Act request to the United States Marine Corps, NAVFAC, and U.S. EPA regarding the use of chemicals at Camp Pendleton to support a claim by former Marine and Vietnam veteran Mr. Tom Bowen.**
- **According to personal accounts of waste disposal actions from Mr. Bowen, who was stationed at Camp Pendleton during the latter portion of the 1960s, a disposal pit located within the project area was used to dispose of various chemical wastes during his time at the installation.**
- **The Discovery Site Assessment was conducted in 2008 and samples were collected from six locations in the 21 Area.**
- **One of the locations (Location 1) was near the intersection of 9th Street and Basin Road. Samples were collected from two locations at what is now IR Site 150.**

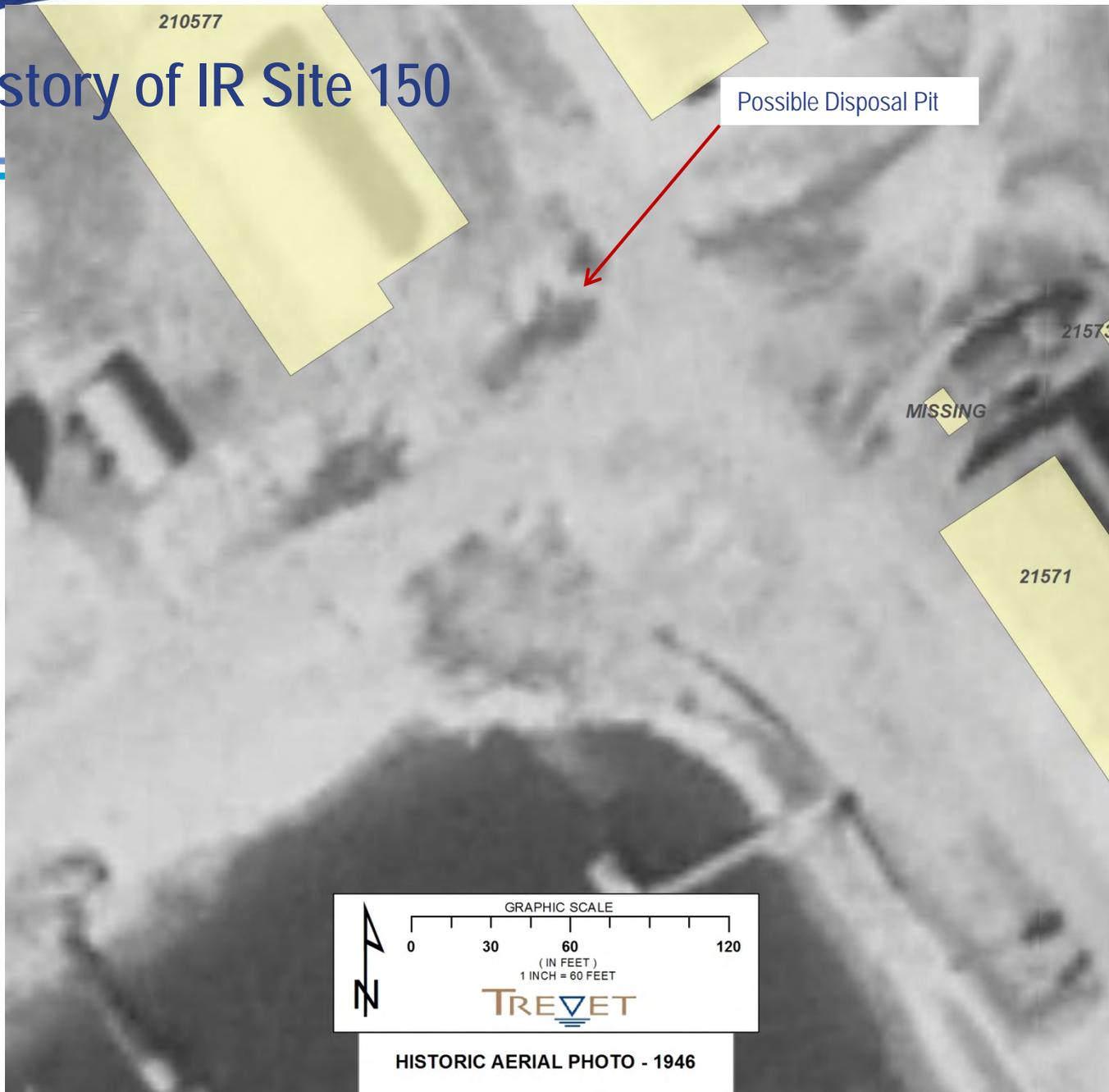
History of IR Site 150



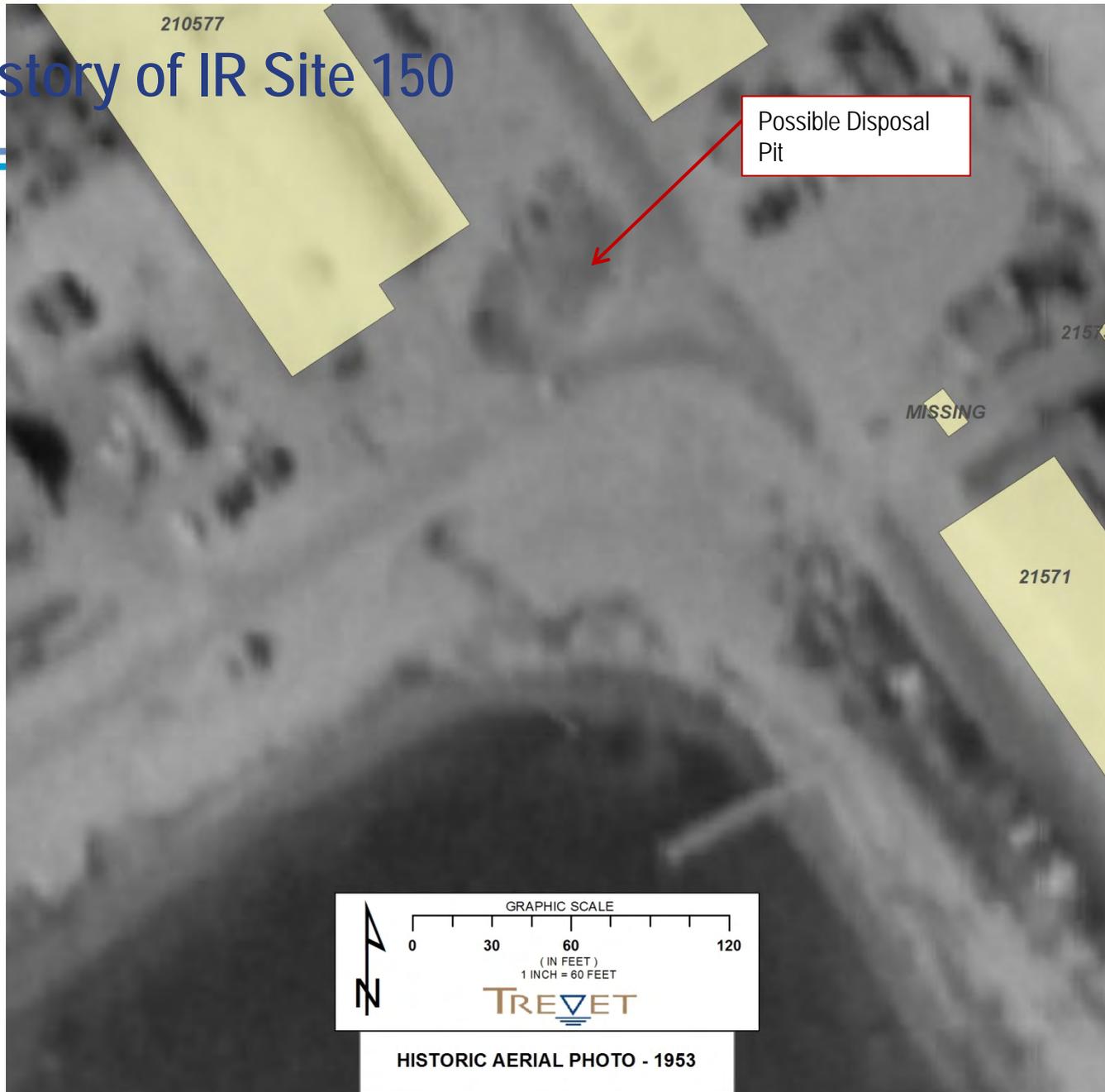
History of IR Site 150



History of IR Site 150



History of IR Site 150



210577

Possible Disposal Pit

21573

MISSING

21571

GRAPHIC SCALE
0 30 60 120
(IN FEET)
1 INCH = 60 FEET
TRENET

HISTORIC AERIAL PHOTO - 1953

Soil and soil gas samples were collect for the two locations

➤ Soil

- Ten soil samples collected and analyzed for VOCs, SVOCs, dioxins/furans, TPH, and metals.
- No soil samples had detected concentrations of VOCs, SVOCs, or dioxins/furans above residential or industrial soil RSLs.
- TPH in soils were detected in 2 samples from boring 21A-1-B4 (2.0-2.5 feet and 5.0-5.5 feet); the highest concentration was 130 mg/kg.

➤ Soil Gas

- Vinyl Chloride was detected (1,600 $\mu\text{g}/\text{m}^3$) above the residential and industrial CHHSL from 21A-1-B5.
- PCE, TCE, 1,1,1-TCA, 1,1-DCE, cis-1,2-DCE, and 1,1-DCA were also detected (but below CHHSL) in the gas sample collected from the same location.

History of IR Site 150 – Site Inspection



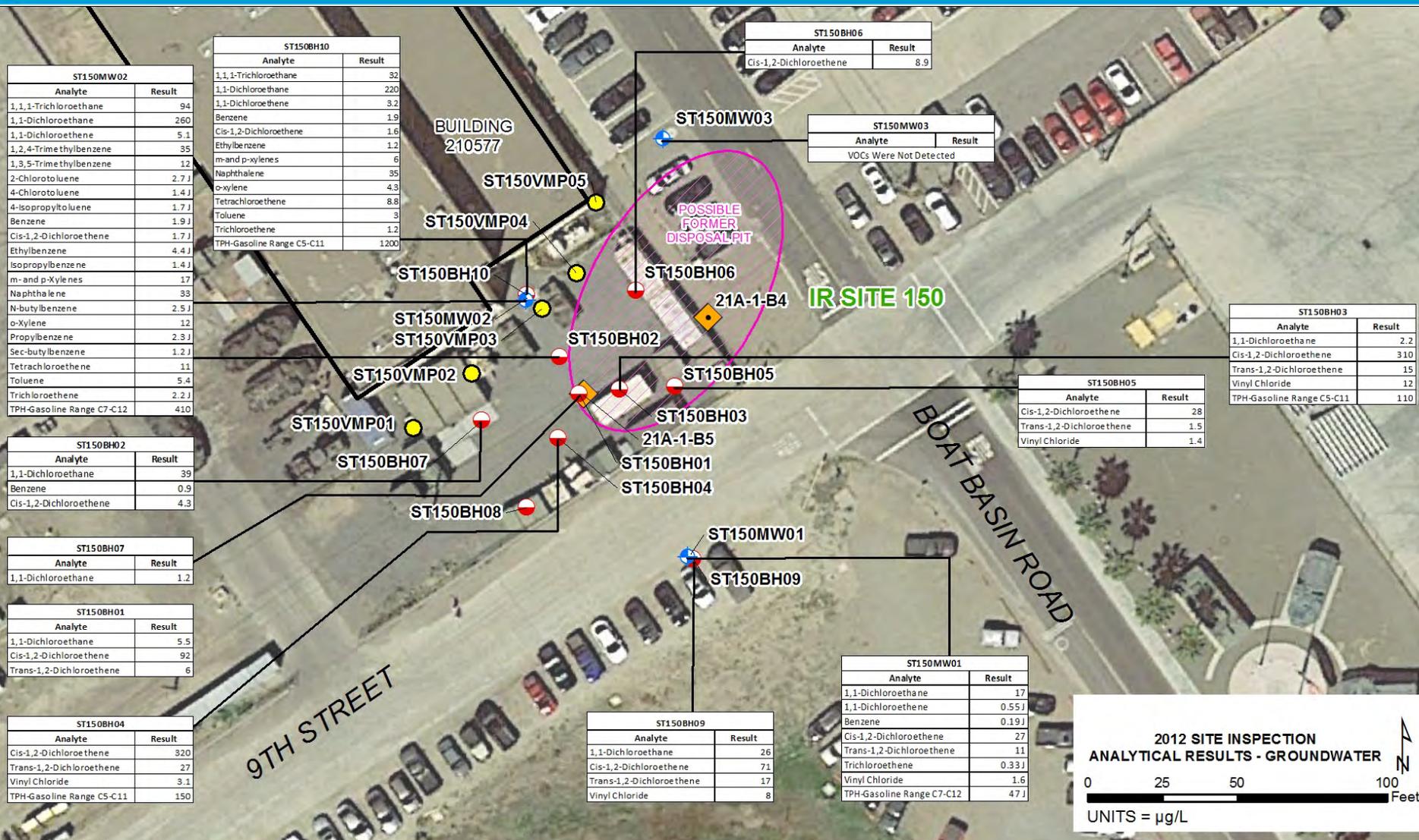
Based on the Results of the Discovery Site Assessment, NAVFAC Established IR Site 150

Site Inspection (SI) conducted in 2012

- **Collected Soil, groundwater (3 monitoring wells), and soil gas samples**
- **VOCs detected in soil, groundwater, and soil gas at concentrations above screening levels**

SI Recommended an Remedial Investigation (RI) be conducted

History of IR Site 150 – Site Inspection (GW Results)

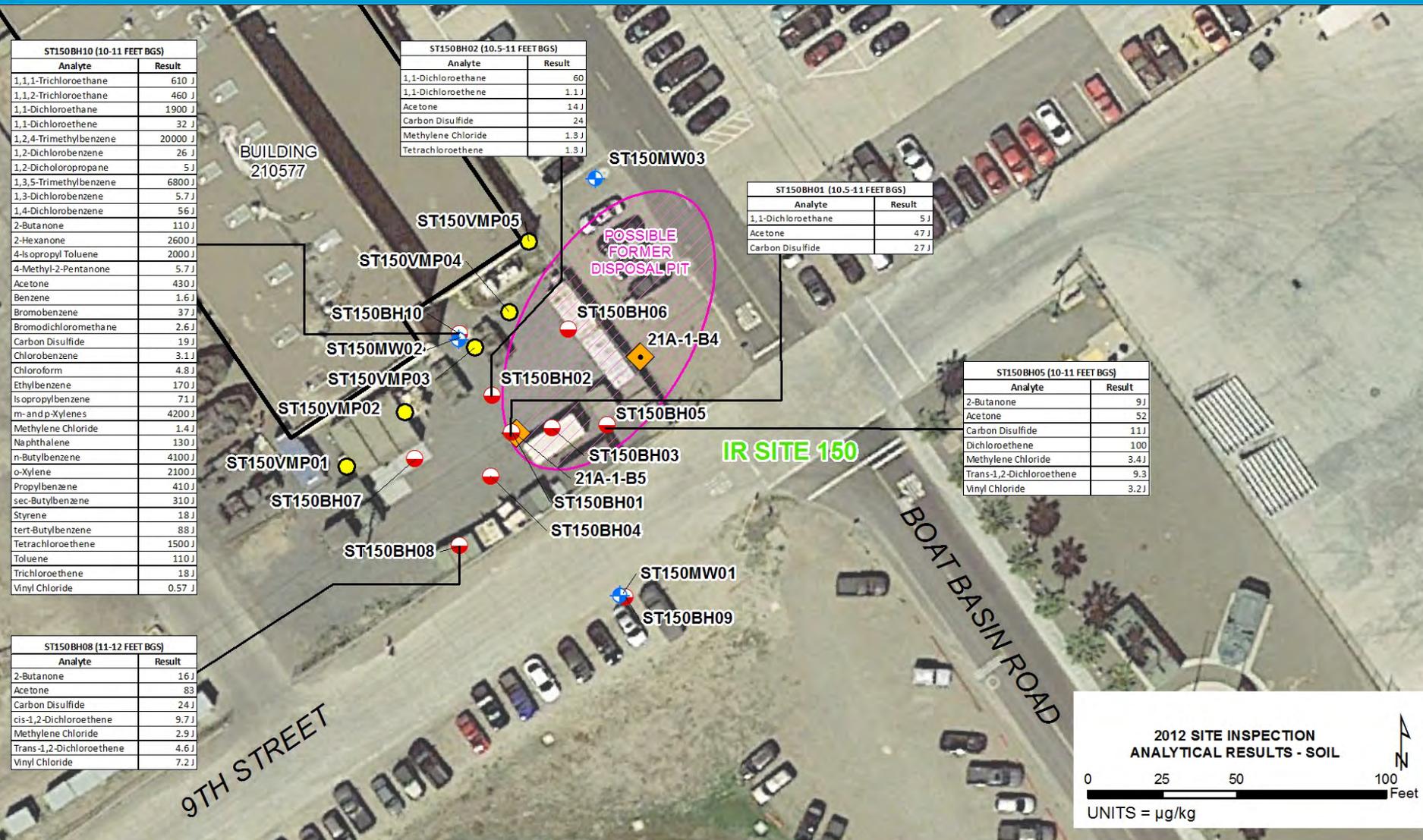


**2012 SITE INSPECTION
ANALYTICAL RESULTS - GROUNDWATER**

0 25 50 100 Feet

UNITS = µg/L

History of IR Site 150 – Site Inspection (Soil Results)



Remedial Investigation Results



Final RI Work Plan submitted on October 30, 2013

Field Work began in November 2013

- **Continuously cored 9 boring locations**
- **Samples collected from surface, 2.5 ft bgs, 5 ft bgs, 7.5 ft bgs, 10 ft bgs, and at capillary fringe. Analyzed for VOCs**
- **Installed temporary monitoring wells (TMW) at each of the 9 locations and collected groundwater samples**

Remedial Investigation Results



- **54 Soil samples collected from the 9 boring locations (six samples per location).**
 - 1,1-Dichloroethane (one detection)
 - 2-Butanone (six detections)
 - Acetone (14 detections)
 - Benzene (one detection)
 - Carbon disulfide (24 detections)
 - Chloroform (one detection)
 - Cis-1,2-dichloroethene (seven detections)
 - Styrene (one detection)
 - Tert-butyl alcohol (two detections)
 - Trans-1,2-dichloroethene (three detections)
 - Vinyl Chloride (two detections)
- No analyte exceeded its EPA Region 9 RSLs for residential soil

Remedial Investigation Results – Soil Results



150-SB-02			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-02-1	Acetone	61,000,000	3.3 J
150-SB-02-1	Methylene Chloride	9,000	1.9 J
150-SB-02-3	Acetone	61,000,000	5.8 J
150-SB-02-3	Methylene Chloride	9,000	1.7 J
150-SB-02-5.5	Acetone	61,000,000	5.2 J
150-SB-02-5.5	Methylene Chloride	9,000	1.9 J
150-SB-02-8	Styrene	6,000,000	1.5 J
150-SB-02-8	Acetone	61,000,000	6.5 J
150-SB-02-8	Methylene Chloride	9,000	2.1 J
150-SB-02-10.5	Acetone	61,000,000	4.3 J
150-SB-02-10.5	Methylene Chloride	9,000	2.5 J
150-SB-02-11	Acetone	61,000,000	6.7 J
150-SB-02-11	Methylene Chloride	9,000	2.1 J
150-SB-02-11	Carbon Disulfide	770,000	0.9 J

150-SB-03			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-03-1	Methylene Chloride	9,000	5.1 J
150-SB-03-3	Acetone	61,000,000	3.3 J
150-SB-03-3	Methylene Chloride	9,000	3.8 J
150-SB-03-5.5	Methylene Chloride	9,000	5.2 J
150-SB-03-8	Acetone	61,000,000	6.7 J
150-SB-03-8	Methylene Chloride	9,000	5.1 J
150-SB-03-10.5	Acetone	61,000,000	9.9 J
150-SB-03-10.5	Methylene Chloride	9,000	3 J
150-SB-03-10.5	Carbon Disulfide	770,000	2.9 J
150-SB-03-20	Cis-1,2-dichloroethene	160,000	1.1 J
150-SB-03-20	Acetone	61,000,000	1.2 J
150-SB-03-20	Methylene Chloride	9,000	5.1 J
150-SB-03-20	Carbon Disulfide	770,000	1.5 J

150-SB-05			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-05-1	Methylene Chloride	9,000	1.5 J
150-SB-05-3	Methylene Chloride	9,000	1.7 J
150-SB-05-5.5	Methylene Chloride	9,000	1.8 J
150-SB-05-8	Acetone	61,000,000	8.5 J
150-SB-05-8	Methylene Chloride	9,000	3 J
150-SB-05-10.5	Acetone	61,000,000	15 J
150-SB-05-10.5	Methylene Chloride	9,000	3.1 J
150-SB-05-10.5	Carbon Disulfide	770,000	1.9 J
150-SB-05-20	Cis-1,2-dichloroethene	160,000	3.5 J
150-SB-05-20	Acetone	61,000,000	21 J
150-SB-05-20	Methylene Chloride	9,000	3.1 J
150-SB-05-20	Carbon Disulfide	770,000	7 J

150-SB-07			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-07-1	Acetone	61,000,000	4.1 J
150-SB-07-1	Methylene Chloride	9,000	2.2 J
150-SB-07-3	Methylene Chloride	9,000	2.1 J
150-SB-07-5.5	Acetone	61,000,000	5.8 J
150-SB-07-5.5	Methylene Chloride	9,000	1.9 J
150-SB-07-8	Acetone	61,000,000	8.1 J
150-SB-07-8	Methylene Chloride	9,000	2.1 J
150-SB-07-10.5	Acetone	61,000,000	13 J
150-SB-07-10.5	Methylene Chloride	9,000	1.8 J
150-SB-07-10.5	Carbon Disulfide	770,000	1.2 J
150-SB-07-20	Acetone	61,000,000	17 J
150-SB-07-20	Methylene Chloride	9,000	1.8 J
150-SB-07-20	Carbon Disulfide	770,000	7.2 J

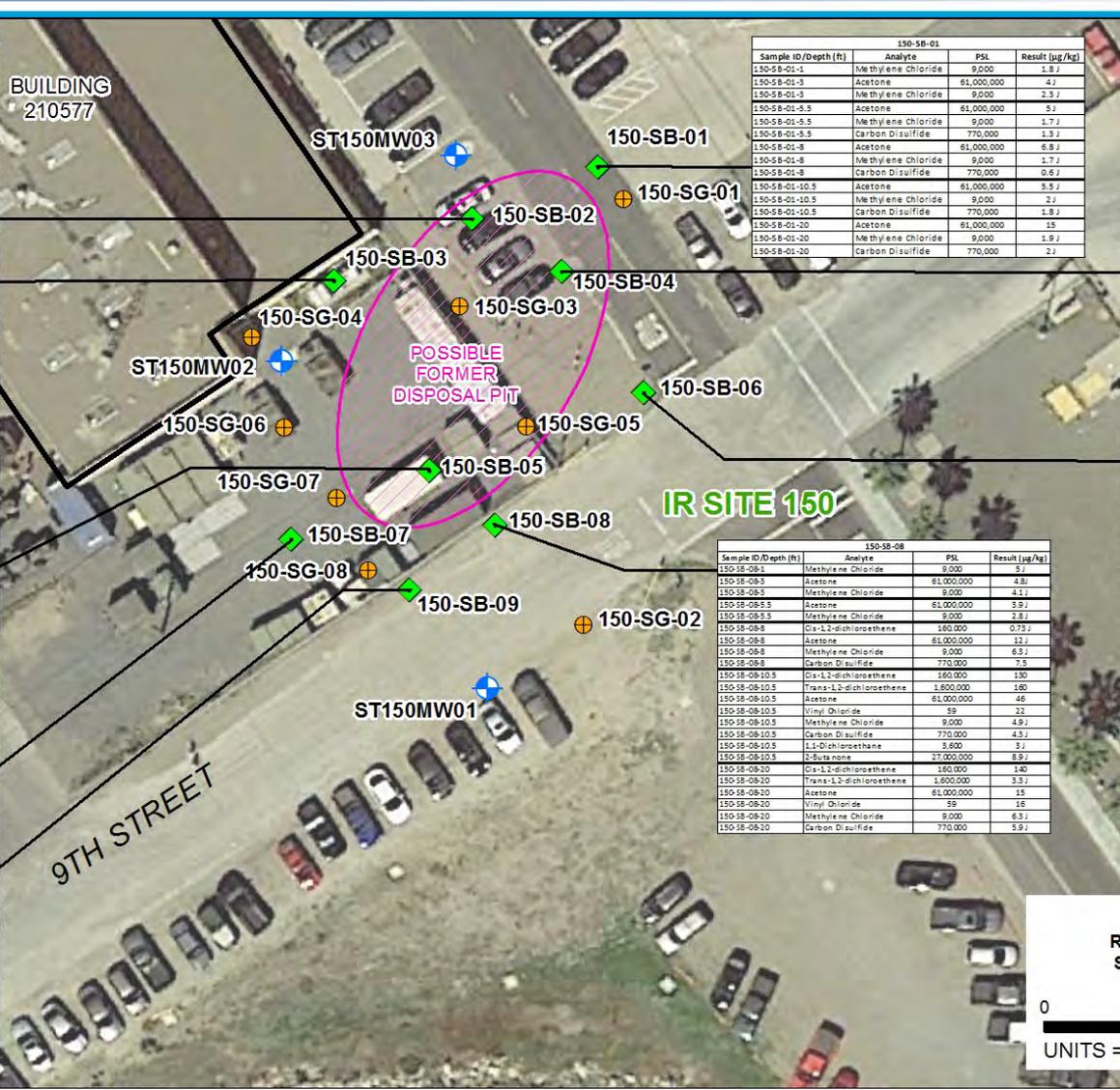
150-SB-09			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-09-1	Methylene Chloride	9,000	4.4 J
150-SB-09-3	Methylene Chloride	9,000	4.2 J
150-SB-09-5.5	Acetone	61,000,000	3.3 J
150-SB-09-5.5	Methylene Chloride	9,000	5.2 J
150-SB-09-8	Acetone	61,000,000	16 J
150-SB-09-8	Methylene Chloride	9,000	2.2 J
150-SB-09-8	Carbon Disulfide	770,000	1.1 J
150-SB-09-10.5	Cis-1,2-dichloroethene	160,000	0.98 J
150-SB-09-10.5	Trans-1,2-dichloroethene	1,600,000	1.2 J
150-SB-09-10.5	Acetone	61,000,000	11 J
150-SB-09-10.5	Methylene Chloride	9,000	2 J
150-SB-09-10.5	Carbon Disulfide	770,000	4.8 J
150-SB-09-20	Cis-1,2-dichloroethene	160,000	8.8 J
150-SB-09-20	Acetone	61,000,000	14 J
150-SB-09-20	Methylene Chloride	9,000	2 J
150-SB-09-20	Carbon Disulfide	770,000	6.7 J

150-SB-01			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-01-1	Methylene Chloride	9,000	1.8 J
150-SB-01-3	Acetone	61,000,000	4 J
150-SB-01-3	Methylene Chloride	9,000	3.3 J
150-SB-01-5.5	Acetone	61,000,000	5 J
150-SB-01-5.5	Methylene Chloride	9,000	1.7 J
150-SB-01-5.5	Carbon Disulfide	770,000	1.3 J
150-SB-01-8	Acetone	61,000,000	6.8 J
150-SB-01-8	Methylene Chloride	9,000	1.7 J
150-SB-01-8	Carbon Disulfide	770,000	0.6 J
150-SB-01-10.5	Acetone	61,000,000	5.5 J
150-SB-01-10.5	Methylene Chloride	9,000	2 J
150-SB-01-10.5	Carbon Disulfide	770,000	1.8 J
150-SB-01-20	Acetone	61,000,000	15 J
150-SB-01-20	Methylene Chloride	9,000	1.9 J
150-SB-01-20	Carbon Disulfide	770,000	2 J

150-SB-04			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-04-1	Acetone	61,000,000	5.2 J
150-SB-04-1	Methylene Chloride	9,000	1.8 J
150-SB-04-3	Acetone	61,000,000	3.2 J
150-SB-04-3	Methylene Chloride	9,000	1.8 J
150-SB-04-5.5	Acetone	61,000,000	4.8 J
150-SB-04-5.5	Methylene Chloride	9,000	2.1 J
150-SB-04-8	Acetone	61,000,000	4.6 J
150-SB-04-8	Methylene Chloride	9,000	1.9 J
150-SB-04-8	Carbon Disulfide	770,000	0.6 J
150-SB-04-10.5	Acetone	61,000,000	9.8 J
150-SB-04-10.5	Methylene Chloride	9,000	2.1 J
150-SB-04-10.5	Carbon Disulfide	770,000	1.8 J
150-SB-04-20	Acetone	61,000,000	6.6 J
150-SB-04-20	Methylene Chloride	9,000	2 J
150-SB-04-20	Carbon Disulfide	770,000	4.1 J

150-SB-08			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-08-1	Methylene Chloride	9,000	5 J
150-SB-08-3	Acetone	61,000,000	4.8 J
150-SB-08-3	Methylene Chloride	9,000	4.1 J
150-SB-08-5.5	Acetone	61,000,000	3.9 J
150-SB-08-5.5	Methylene Chloride	9,000	2.8 J
150-SB-08-8	Cis-1,2-dichloroethene	160,000	0.73 J
150-SB-08-8	Acetone	61,000,000	12 J
150-SB-08-8	Methylene Chloride	9,000	6.9 J
150-SB-08-8	Carbon Disulfide	770,000	7.5 J
150-SB-08-10.5	Cis-1,2-dichloroethene	160,000	130 J
150-SB-08-10.5	Trans-1,2-dichloroethene	1,600,000	160 J
150-SB-08-10.5	Acetone	61,000,000	46 J
150-SB-08-10.5	Vinyl Chloride	59	22 J
150-SB-08-10.5	Methylene Chloride	9,000	4.9 J
150-SB-08-10.5	Carbon Disulfide	770,000	4.5 J
150-SB-08-10.5	1,1-Dichloroethane	3,600	3 J
150-SB-08-10.5	2-Butanone	37,000,000	8.9 J
150-SB-08-20	Cis-1,2-dichloroethene	160,000	140 J
150-SB-08-20	Trans-1,2-dichloroethene	1,600,000	3.3 J
150-SB-08-20	Acetone	61,000,000	15 J
150-SB-08-20	Vinyl Chloride	59	16 J
150-SB-08-20	Methylene Chloride	9,000	6.3 J
150-SB-08-20	Carbon Disulfide	770,000	5.9 J

150-SB-06			
Sample ID/Depth (ft)	Analyte	PSL	Result (µg/kg)
150-SB-06-1	Acetone	61,000,000	72 J
150-SB-06-4	Methylene Chloride	9,000	1.7 J
150-SB-06-1	tert-Butyl Alcohol	NE	24 J
150-SB-06-1	2-Butanone	27,000,000	7 J
150-SB-06-3	Acetone	61,000,000	46 J
150-SB-06-3	Benzene	1,200	0.84 J
150-SB-06-3	Methylene Chloride	9,000	1.6 J
150-SB-06-3	tert-Butyl Alcohol	NE	17 J
150-SB-06-3	2-Butanone	27,000,000	5.7 J
150-SB-06-5.5	Acetone	61,000,000	29 J
150-SB-06-5.5	Methylene Chloride	9,000	2.2 J
150-SB-06-5.5	Carbon Disulfide	770,000	1.3 J
150-SB-06-5.5	2-Butanone	27,000,000	3.8 J
150-SB-06-8	Acetone	61,000,000	71 J
150-SB-06-8	Chloroform	320	0.92 J
150-SB-06-8	Methylene Chloride	9,000	1.9 J
150-SB-06-8	Carbon Disulfide	770,000	0.84 J
150-SB-06-8	2-Butanone	27,000,000	4.8 J
150-SB-06-10.5	Acetone	61,000,000	7.3 J
150-SB-06-10.5	Methylene Chloride	9,000	2.2 J
150-SB-06-10.5	Carbon Disulfide	770,000	1.2 J
150-SB-06-20	Methylene Chloride	9,000	2.3 J
150-SB-06-20	Carbon Disulfide	770,000	7.6 J
150-SB-06-20	2-Butanone	27,000,000	3.4 J



**REMEDIAL INVESTIGATION
SOIL SAMPLING RESULTS
NOVEMBER 2013**

N
↑

0 25 50 100
Feet

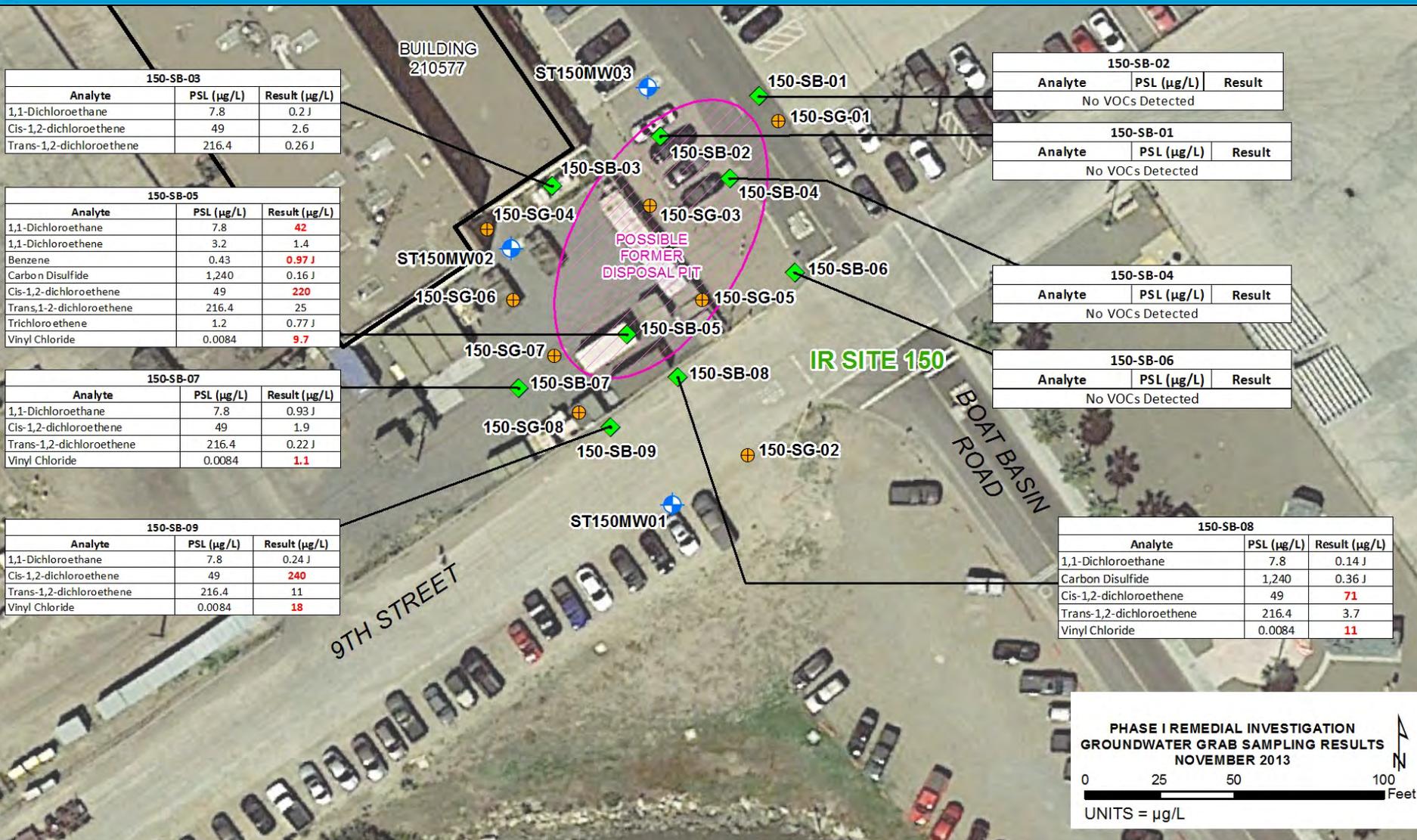
UNITS = µg/kg

Remedial Investigation Results – GW Results



- **The following VOCs were detected in groundwater samples from the 9 TWMs**
 - **1,1-Dichloroethane (five detections)**
 - 1,1-Dichloroethene (one detection)
 - **Benzene (one detection)**
 - Carbon disulfide (two detections)
 - **Cis-1,2-dichloroethene (five detections)**
 - Trans-1,2-dichloroethene (five detections)
 - **Vinyl Chloride (four detections)**
- Four analytes (bolded) exceeded the groundwater PSL protective of Vapor Intrusion ($\text{GW PSL}_{\text{VI}}$)
- Detections above $\text{GW PSL}_{\text{VI}}$ in borings 150-SB-05, -07, -08, and -09
- Only Vinyl Chloride in 150-SB-05, -08, and -09 exceeded the NRWQC for the consumption of organisms ($1.6 \mu\text{g/L}$)
- No concentrations exceeded AHGs or CTR criteria

Remedial Investigation Results – GW Results Temp Wells



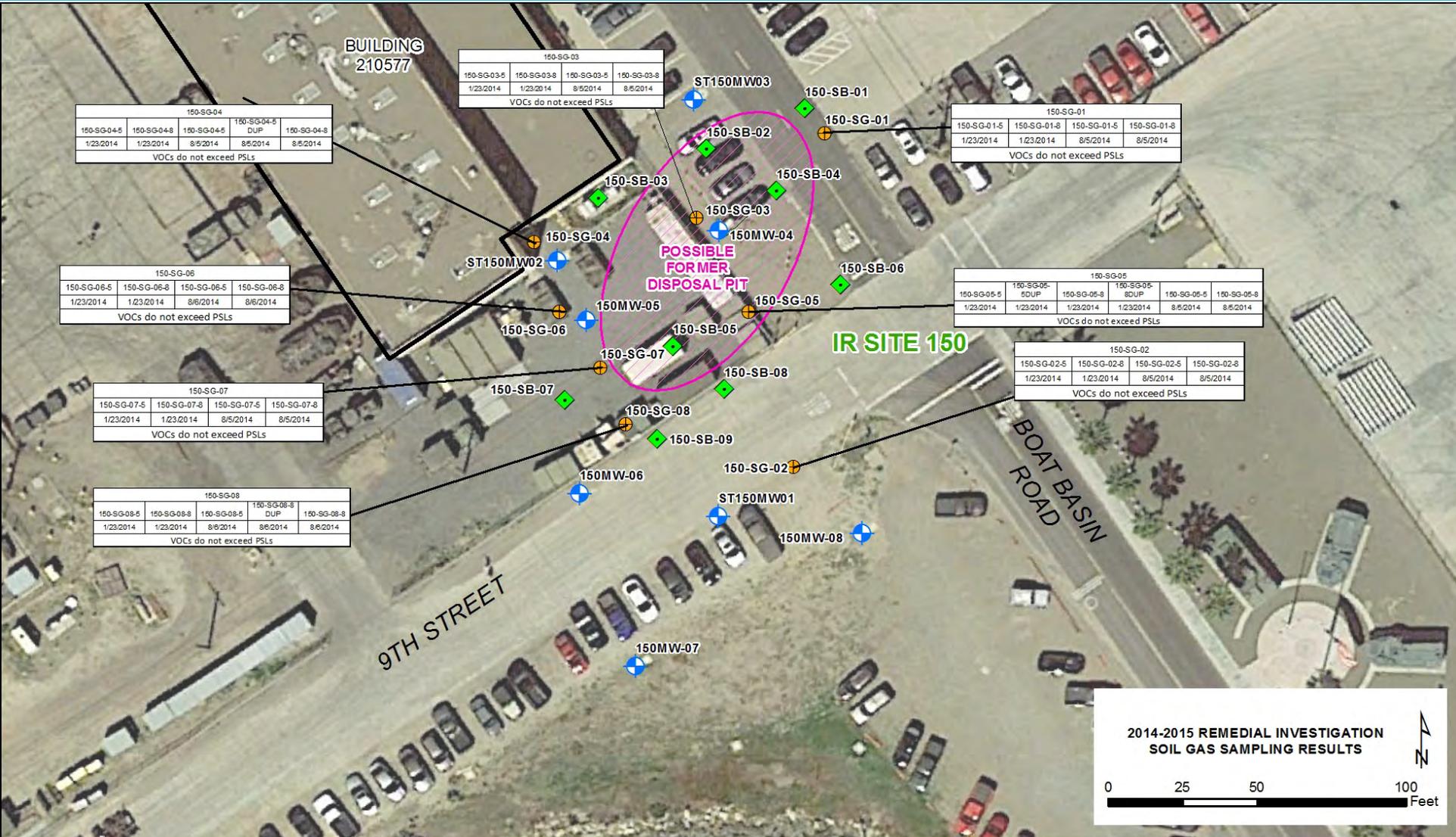
Based on the soil and the initial groundwater sample results

- **Five monitoring wells installed (January 2014)**
- **Eight dual-nested soil gas probes installed (January 2014)**

Soil Gas Results

- **Sampled January and June 2014**
- **52 VOCs detected in soil gas**
- **None of the VOCs concentrations exceeded the soil gas screening level based on the Residential Air RSL (or DTSC modified RSL) divided by the DAF of 0.001.**

Remedial Investigation Results – SG Results



Remedial Investigation Results – GW Results



- **Four Quarter of groundwater monitoring conducted between February and October 2014)**
 - **Sampled all at monitoring wells**
 - **Free product discovered in monitoring well ST150MW02 during the first event**
 - **Free-product initially measured at 7.5 feet in the well**
 - **Periodically bailed from the well (will discuss at end of presentation)**
 - **Analytical results indicated the product to be a mixture of gasoline, diesel, and motor oil**

Remedial Investigation Results – GW Results



Groundwater Results

- 25 VOCs were detected during the four quarterly sampling events.
- six analytes exceeded their Groundwater PSLs Protective of Vapor Intrusion
 - 1,1-dichloroethane - (ST150MW02)
 - Benzene - (ST150MW02)
 - cis-1,2-dichloroethene - (150MW-08)
 - PCE - (ST150MW02)
 - TCE - (ST150MW02)
 - vinyl chloride - (ST150MW01, 150MW-04, -05, -06, and -08)

Remedial Investigation Results



Groundwater Results

- Two analytes exceeded their NRWQC for the Consumption of Organisms
 - PCE (3.3 $\mu\text{g/L}$) in well ST150MW02
 - Vinyl chloride (2.4 $\mu\text{g/L}$) in wells ST150MW01, 150MW-06, and -08). These are down gradient wells
- One analyte exceeded the San Francisco Regional Board Estuary Aquatic Habitat Goals screening level.
 - 1,1-dichloroethane (47 $\mu\text{g/L}$) in well ST150MW02

Remedial Investigation Results – GW Results wells



ST150MW02/ST150MW02A					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
1,1,1-Trichloroethane	1422	NS	25	19	18
1,1-Dichloroethane	7.8	NS	50	44	41
1,1-Dichloroethene	68	NS	2.5	1.3	1
1,2,4-Trimethylbenzene	29	NS	2.1	1.3	0.98
1,3,5-Trimethylbenzene	117.1	NS	1.0U	0.54U	0.55U
Acetone	22,363,547	NS	3.1J	10U	10U
Benzene	0.43	NS	0.42J	0.62J	0.70J
Carbon Disulfide	1,240	NS	0.34U	1.0U	1.0U
Cis-1,2-dichloroethene	49.8	NS	0.63J	0.83J	0.81J
Ethylbenzene	3.4	NS	2.2	2	2.1
Isopropyl Benzene	893	NS	0.52J	0.61J	0.63J
m,p-Xylenes	369	NS	5.7	4.2	4.4
Naphthalene	4.6	NS	2.4	1.7J	1.7J
n-Butylbenzene	323.1	NS	0.98J	0.88J	0.76J
n-Propylbenzene	2,330	NS	0.88J	0.96J	0.87J
o-Xylene	472	NS	5.1	4.5	4.6
p-Isopropyltoluene	165	NS	0.36J	0.22J	0.18J
sec-Butylbenzene	58.4	NS	0.71J	0.67J	0.61J
Tetrachloroethene	3.2	NS	4.0	3.5	3.8
Toluene	1142	NS	3.9	2.5	2.7
Trichloroethene	1.2	NS	1.4	1.4	1.6

150MW-05					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	0.71J	0.84J	0.82J	0.84J
Cis-1,2-dichloroethene	49.8	0.41J	7.2	7.2	6.0
Trans-1,2-dichloroethene	216.4	0.82J	0.72J	0.76J	0.66J
Trichloroethene	1.2	0.47J	0.46J	0.46J	0.49J
Vinyl Chloride	0.0084	0.22J	0.14J	0.13J	0.12J

150MW-06					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	0.14J	ND	0.20J	0.12J
Carbon Disulfide	1,240	1.0U	1.0U	0.23J	1.0U
Cis-1,2-dichloroethene	49.8	0.25J	0.17J	0.41J	0.23J
Toluene	1142	0.19J	0.12J	0.33J	1.0U
Trans-1,2-dichloroethene	216.4	3.3	2.4	8.2	2.1
Vinyl Chloride	0.0084	2.2	1.3	2.5	0.95J

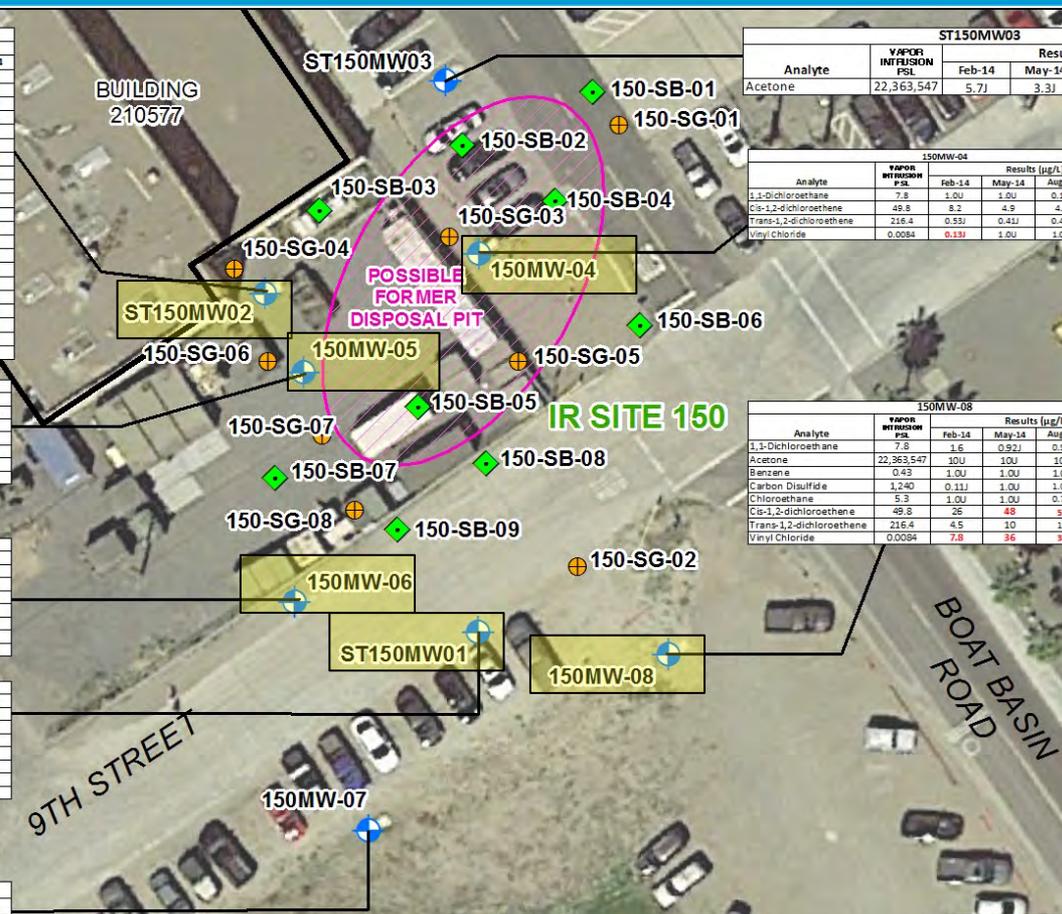
ST150MW01					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	4.1	6.4	5	7.0
1,1-Dichloroethene	68	1.0U	1.0J	1.0U	0.19J
Benzene	0.43	1.0U	0.11J	0.11J	0.17J
Cis-1,2-dichloroethene	49.8	19	25	21	30
Trans-1,2-dichloroethene	216.4	4.1	7.1	6.6	9
Vinyl Chloride	0.0084	2.9	4.6	3.6	5.9

150MW-07					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
Trichlorofluoromethane	NE	1.0U	1.0U	1.0U	0.31U

ST150MW03					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
Acetone	22,363,547	5.7J	3.3J	10U	4.1U

150MW-04					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	1.0U	1.0U	0.11J	0.11J
Cis-1,2-dichloroethene	49.8	8.2	4.9	4.9	3.6
Trans-1,2-dichloroethene	216.4	0.53J	0.41J	0.47J	0.35J
Vinyl Chloride	0.0084	0.13J	1.0U	1.0U	1.0U

150MW-08					
Analyte	VAPOR INTRUSION PSL	Results (µg/L)			
		Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	1.6	0.92J	0.94J	1.1
Acetone	22,363,547	10U	10U	10U	3.0U
Benzene	0.43	1.0U	1.0U	1.0U	0.10J
Carbon Disulfide	1,240	0.11J	1.0U	1.0U	1.0U
Chloroethane	5.3	1.0U	1.0U	0.78J	0.33J
Cis-1,2-dichloroethene	49.8	26	48	55	51
Trans-1,2-dichloroethene	216.4	4.5	10	11	11
Vinyl Chloride	0.0084	7.8	36	34	40



**PHASE II 2014-2015 REMEDIAL INVESTIGATION
GROUNDWATER SAMPLING RESULTS
PROTECTIVE OF VAPOR INTRUSION**

0 25 50 100 Feet

UNITS = µg/L

Remedial Investigation Results



Initial Risk Assessment

Pathway	Cancer Risks					
	Residents		Industrial Workers		Construction Workers ¹	
	USEPA	California	USEPA	California	USEPA	California
Soil - direct contact	3E-09	3E-09	0E+00	0E+00	-	-
Swimming	4E-04	4E-04	-	-	-	-
Vapor intrusion - GW	9E-05	8E-04	6E-06	9E-05	-	-
Vapor intrusion - SG	1E-06	2E-06	7E-08	1E-07	-	-
Trench air	-	-	-	-	9E-08	2E-06
Total²	5E-04	1E-03	6E-06	9E-05	9E-08	2E-06

Total risk does not include Vapor Intrusion risk for Soil Gas. Risk calculations done this way because of detected concentration of VOCs in downgradient monitoring well 150MW-08.

Remedial Investigation Results -Summary



Summary of Initial Results

Because of:

- Elevated concentrations of VOCs (primarily vinyl chloride) in groundwater in the downgradient wells
- Having to assess risk from vapor intrusion based off of groundwater concentrations (no soil gas points near monitoring well 150MW-08)
- Risk from swimming (4E-4)
- Concentrations of VOCs in groundwater immediately adjacent to the Del Mar Boat Basin not assessed

Navy decided to assess these data gaps

Remedial Investigation Results – Data Gap

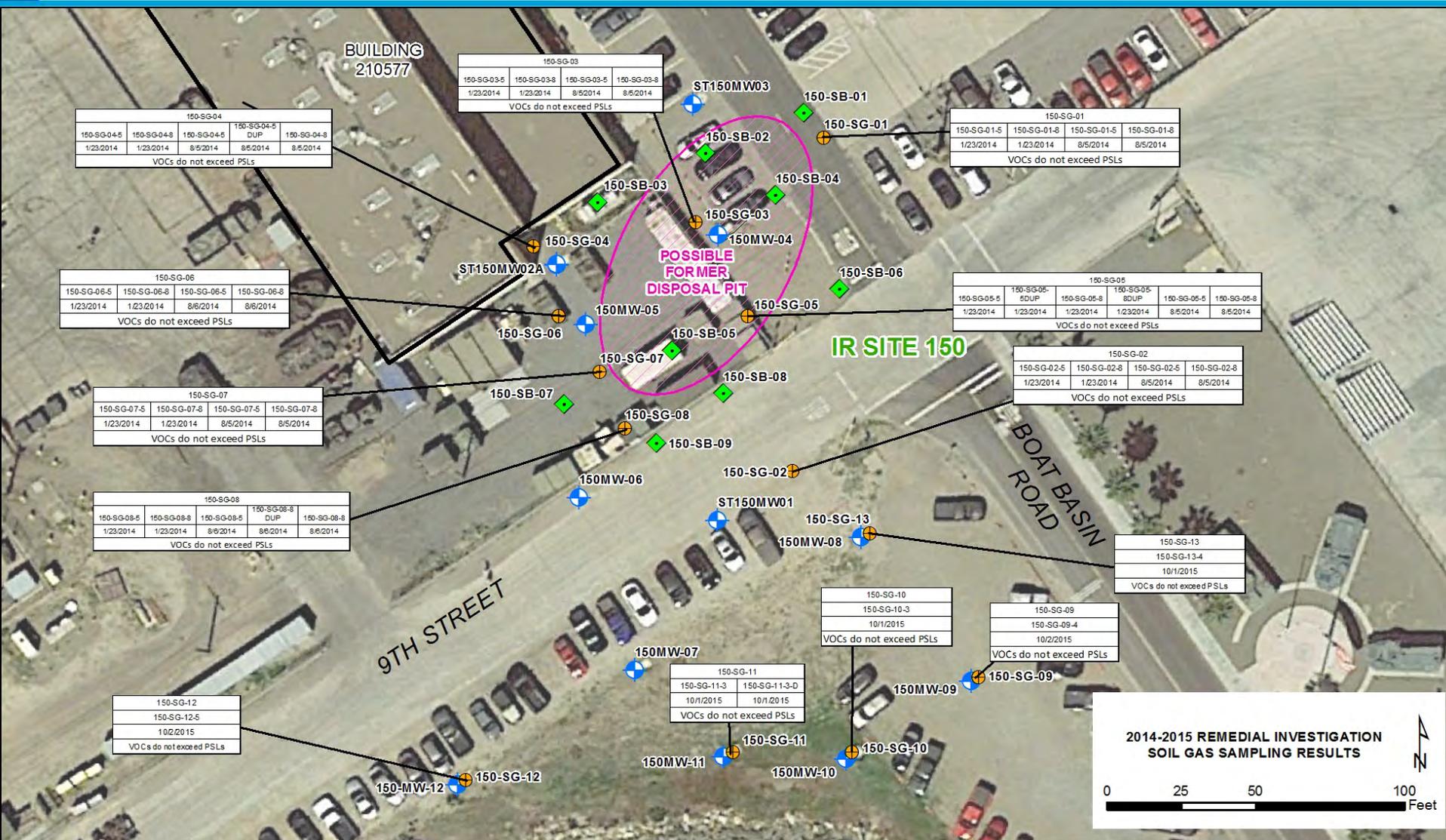


Summary of Data Gap Investigation

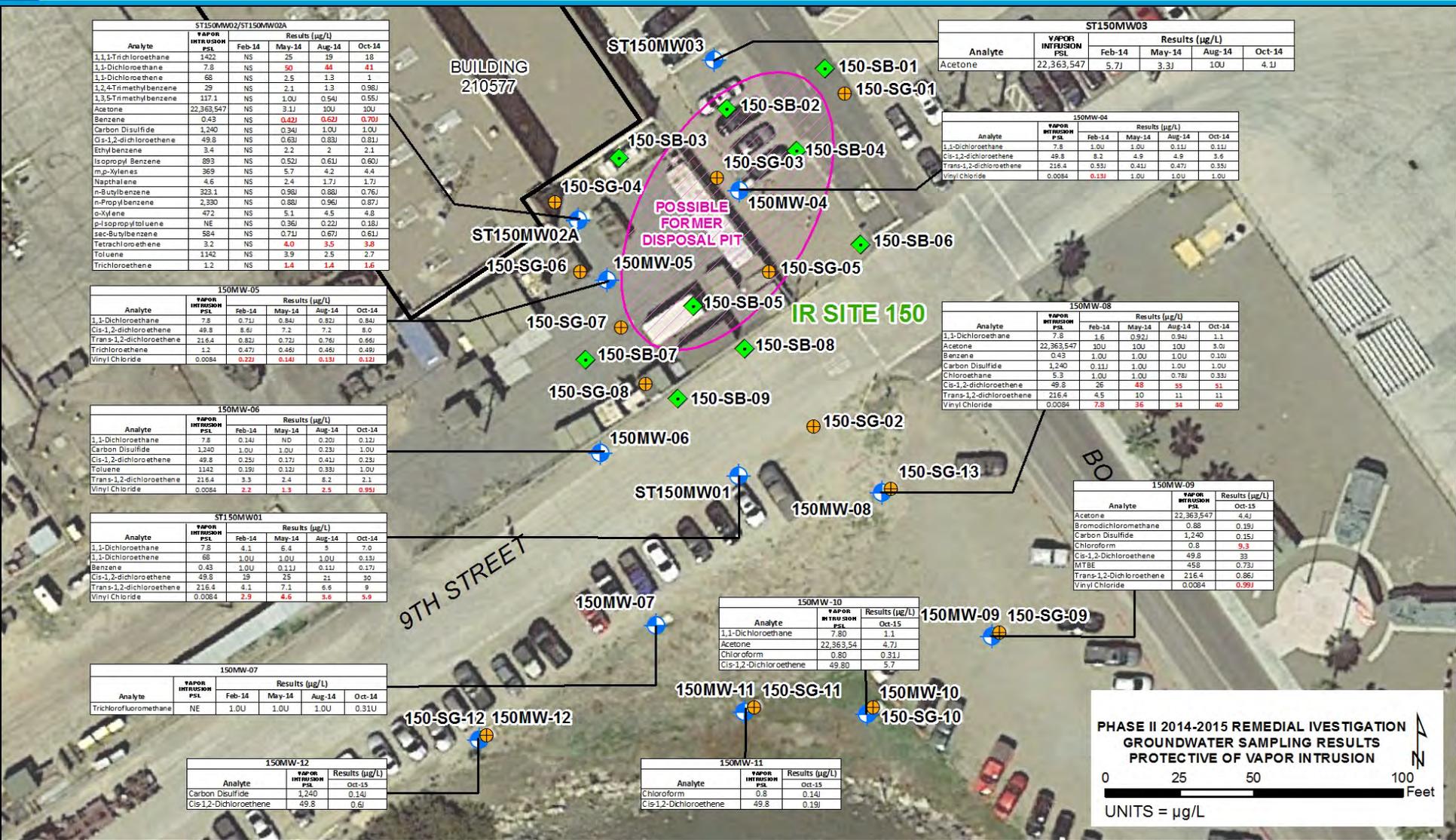
Technical Memorandum for additional sampling prepared August 2015

- **Four additional monitoring wells to assess the down gradient extent of VOCs in groundwater and to serve as sentry wells immediately adjacent to the Del Mar Boat Basin**
- **Five additional soil gas probes**
 - **Co-located with each of the new GW monitoring wells**
 - **One next to existing well 150MW-08**

Remedial Investigation Results – SG data gap



Remedial Investigation Results – GW data gap (protective of VI)



ST150MW02/ST150MW02A		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
1,1,1-Trichloroethane	1422	NS	25	39	18
1,1-Dichloroethane	7.8	NS	50	44	41
1,1-Dichloroethene	68	NS	2.5	1.3	1
1,2,4-Trimethylbenzene	29	NS	2.1	1.3	0.98
1,3,5-Trimethylbenzene	117.1	NS	1.0	0.54	0.55
Acetone	22,363,547	NS	3.1	10.0	10.0
Benzene	0.43	NS	0.42	0.63	0.70
Carbon Disulfide	1,240	NS	0.24	1.0	1.0
Cis-1,2-dichloroethene	49.8	NS	0.63	0.83	0.81
Ethylbenzene	3.4	NS	2.2	2	2.1
Isopropyl Benzene	893	NS	0.52	0.61	0.60
m,p-Xylenes	369	NS	5.7	4.2	4.4
Napthalene	4.6	NS	2.4	1.7	1.7
n-Butylbenzene	323.1	NS	0.58	0.58	0.76
n-Propylbenzene	2,330	NS	0.38	0.96	0.87
o-Xylene	472	NS	5.1	4.5	4.8
p-Isopropyltoluene	NE	NS	0.36	0.22	0.18
sec-Butylbenzene	58.4	NS	0.71	0.67	0.61
Tetrachloroethene	3.2	NS	4.0	3.5	3.8
Toluene	1142	NS	3.9	2.5	2.7
Trichloroethene	1.2	NS	1.4	1.4	1.6

ST150MW03		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
Acetone	22,363,547	5.7	3.3	10.0	4.1

150MW-04		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	1.0	1.0	1.1	1.1
Cis-1,2-dichloroethene	49.8	8.2	4.9	4.8	3.6
Trans-1,2-dichloroethene	216.4	0.53	0.41	0.47	0.35
Vinyl Chloride	0.0084	0.13	1.0	1.0	1.0

150MW-05		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	0.71	0.84	0.82	0.84
Cis-1,2-dichloroethene	49.8	8.6	7.2	7.2	8.0
Trans-1,2-dichloroethene	216.4	0.82	0.72	0.76	0.66
Trichloroethene	1.2	0.47	0.46	0.46	0.49
Vinyl Chloride	0.0084	0.22	0.14	0.13	0.12

150MW-08		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	1.6	0.92	0.94	1.1
Acetone	22,363,547	10.0	10.0	10.0	3.0
Benzene	0.43	1.0	1.0	1.0	0.10
Carbon Disulfide	1,240	1.1	1.0	1.0	1.0
Chloroethane	5.3	1.0	1.0	0.78	0.33
Cis-1,2-dichloroethene	49.8	26	48	55	51
Trans-1,2-dichloroethene	216.4	4.5	10	11	11
Vinyl Chloride	0.0084	7.8	9.6	9.4	48

150MW-06		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	0.14	ND	0.30	0.12
Carbon Disulfide	1,240	1.0	1.0	0.23	1.0
Cis-1,2-dichloroethene	49.8	0.25	0.17	0.41	0.23
Toluene	1142	0.19	0.12	0.33	1.0
Trans-1,2-dichloroethene	216.4	3.3	2.4	8.2	2.1
Vinyl Chloride	0.0084	2.2	1.3	3.5	0.99

150MW-09		Results (µg/L)	
Analyte	VAPOR INTRUSION PSL	2014	Oct-15
Acetone	22,363,547	4.4	
Bromodichloromethane	0.88	0.19	
Carbon Disulfide	1,240	0.15	
Chloroform	0.8	9.3	
Cis-1,2-Dichloroethene	49.8	33	
MTBE	458	0.73	
Trans-1,2-Dichloroethene	216.4	0.86	
Vinyl Chloride	0.0084	0.99	

ST150MW01		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	7.8	4.1	5	7.0	
1,1-Dichloroethene	68	1.0	1.0	1.0	0.13
Benzene	0.43	1.0	0.11	0.11	0.17
Cis-1,2-dichloroethene	49.8	19	25	21	30
Trans-1,2-dichloroethene	216.4	4.1	7.1	8.6	9
Vinyl Chloride	0.0084	2.9	4.6	3.6	3.9

150MW-10		Results (µg/L)	
Analyte	VAPOR INTRUSION PSL	Oct-15	
1,1-Dichloroethane	7.8	1.1	
Acetone	22,363,54	4.7	
Chloroform	0.8	0.31	
Cis-1,2-Dichloroethene	49.8	5.7	

150MW-07		Results (µg/L)			
Analyte	VAPOR INTRUSION PSL	Feb-14	May-14	Aug-14	Oct-14
Trichlorofluoromethane	NE	1.0	1.0	1.0	0.31

150MW-11		Results (µg/L)	
Analyte	VAPOR INTRUSION PSL	Oct-15	
Chloroform	0.8	0.14	
Cis-1,2-Dichloroethene	49.8	0.19	

150MW-12		Results (µg/L)	
Analyte	VAPOR INTRUSION PSL	Oct-15	
Carbon Disulfide	1,240	0.14	
Cis-1,2-Dichloroethene	49.8	0.6	

**PHASE II 2014-2015 REMEDIAL INVESTIGATION
GROUNDWATER SAMPLING RESULTS
PROTECTIVE OF VAPOR INTRUSION**

UNITS = µg/L

Remedial Investigation Results – GW data gap (Protective Boat Basin)



ST150MW02/ST150MW02A					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
1,1,1-Trichloroethane	62	NS	25	19	18
1,1-Dichloroethane	47	NS	50	44	41
1,1-Dichloroethene	32	NS	2.5	1.3	1
1,2,4-Trimethylbenzene	NE	NS	2.1	1.3	0.88
1,3,3-Trimethylbenzene	NE	NS	1.0U	0.54U	0.55U
Acetone	1,500	NS	3.1	10U	10U
Benzene	46	NS	0.42	0.62	0.70
Carbon Disulfide	NE	NS	0.34	1.0U	1.0U
Cis-1,2-dichloroethene	590	NS	0.63	0.83	0.81
Ethylbenzene	43	NS	2.2	2	2.1
Isopropyl Benzene	NE	NS	0.52	0.61	0.60
m,p-Xylenes	NE	NS	5.7	4.2	4.4
Naphthalene	24	NS	2.4	1.7	1.7
n-Butylbenzene	NE	NS	0.98	0.88	0.78
n-Propylbenzene	NE	NS	0.88	0.98	0.87
o-Xylene	NE	NS	3.1	4.5	4.8
p-Isopropyltoluene	NE	NS	0.36	0.22	0.18
sec-Butylbenzene	NE	NS	0.71	0.67	0.61
Tetrachloroethene	8.88	NS	4.0	3.5	3.8
Toluene	130	NS	3.9	2.5	2.7
Trichloroethene	81	NS	1.4	1.4	1.6

ST150MW03					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
Acetone	1,500	5.7	3.3	10U	4.1

150MW-04					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	47	1.0U	1.0U	0.11U	0.11U
Cis-1,2-dichloroethene	590	8.2	4.9	4.9	3.6
Trans-1,2-dichloroethene	590	0.53U	0.41U	0.47U	0.35U
Vinyl Chloride	1.6	0.13U	1.0U	1.0U	1.0U

150MW-05					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	47	0.71	0.84	0.82	0.84
Cis-1,2-dichloroethene	590	8.6	7.2	7.2	8.0
Trans-1,2-dichloroethene	590	0.82	0.72	0.75	0.66
Trichloroethene	81	0.47	0.46	0.46	0.49
Vinyl Chloride	1.6	0.22	0.14	0.13	0.12

150MW-08					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	47	1.6	0.92	0.94	1.1
Acetone	1,500	10U	10U	10U	1.0
Benzene	46	1.0U	1.0U	1.0U	0.10U
Carbon Disulfide	NE	0.11U	1.0U	1.0U	1.0U
Chloroethane	16	1.0U	1.0U	0.78U	0.33U
Cis-1,2-dichloroethene	590	26	48	55	51
Trans-1,2-dichloroethene	590	4.5	10	11	11
Vinyl Chloride	1.6	7.8	36	34	40

150MW-06					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	47	0.14	ND	0.20	0.12
Carbon Disulfide	NE	1.0U	1.0U	0.23U	1.0U
Cis-1,2-dichloroethene	590	0.25	0.17	0.41	0.23
Toluene	130	0.19	0.12	0.33	1.0U
Trans-1,2-dichloroethene	590	3.3	2.4	8.2	2.1
Vinyl Chloride	1.6	2.2	1.3	2.5	0.95

150MW-09			
Analyte	BOAT BASIN PSL	Results (µg/L)	Oct-15
Acetone	1,500	4.4	
Bromodichloromethane	1,100	0.19	
Carbon Disulfide	NE	0.15	
Chloroform	620	9.3	
Cis-1,2-Dichloroethene	590	33	
MTBE	8,000	0.73	
Trans-1,2-Dichloroethene	590	0.86	
Vinyl Chloride	1.6	0.99	

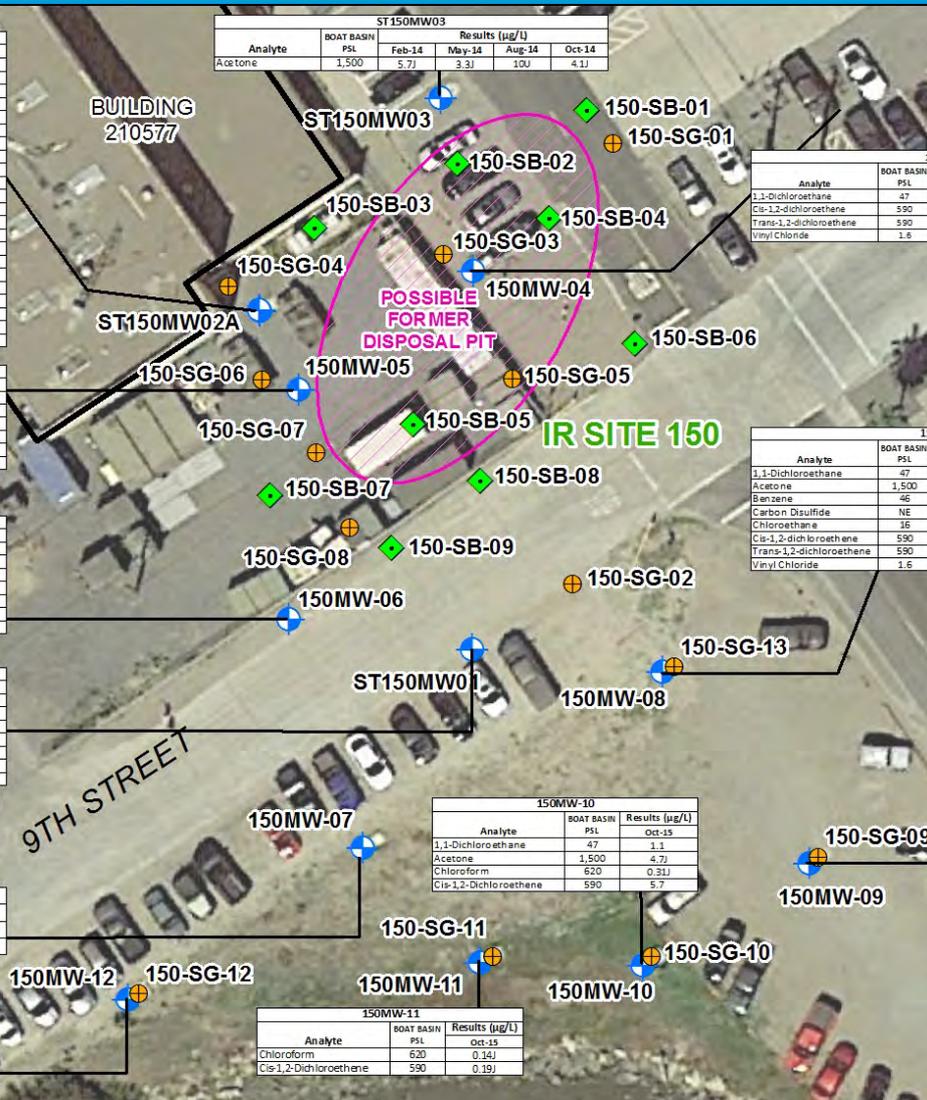
ST150MW01					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
1,1-Dichloroethane	47	4.1	6.4	5	7.0
1,1-Dichloroethene	32	1.0U	1.0U	1.0U	0.13
Benzene	46	1.0U	0.11	0.11	0.17
Cis-1,2-dichloroethene	49.8	19	25	21	30
Trans-1,2-dichloroethene	590	4.1	7.1	6.6	9
Vinyl Chloride	1.6	2.9	4.6	3.6	5.9

150MW-10					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-15
1,1-Dichloroethane	47				1.1
Acetone	1,500				4.7
Chloroform	620				0.31
Cis-1,2-Dichloroethene	590				5.7

150MW-07					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-14
Trichlorofluoromethane	NE	1.0U	1.0U	1.0U	0.31U

150MW-12					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-15
Carbon Disulfide	NE				0.14
Cis-1,2-Dichloroethene	590				0.6

150MW-11					
Analyte	BOAT BASIN		Results (µg/L)		
	PSL	Feb-14	May-14	Aug-14	Oct-15
Chloroform	620				0.14
Cis-1,2-Dichloroethene	590				0.19



**PHASE II 2014-2015 REMEDIAL INVESTIGATION
GROUNDWATER SAMPLING RESULTS
PROTECTIVE OF BOAT BASIN**

UNITS = µg/L

Remedial Investigation Results – Revised Risk



Summary of Data Gaps Investigation - Risk

Pathway	Cancer Risks					
	Residents		Industrial Workers		Construction Workers ¹	
	USEPA	DTSC	USEPA	DTSC	USEPA	DTSC
Soil - direct contact	3E-09	5E-09	0E+00	0E+00	-	-
Swimming	6E-06	6E-06	-	-	-	-
Vapor intrusion - GW	1E-04	8E-04	6E-06	9E-05	-	-
Vapor intrusion - SG	2E-06	2E-06	1E-07	2E-07	-	-
Trench air	-	-	-	-	3E-07	5E-06
Total²	8E-06	8E-06	1E-07	2E-07	3E-07	5E-06

HI<1

Free-Product in Monitoring Well ST150MW02

- It is not believed that the free product in well ST150MW02 is associated with the waste reportedly disposed of in the former waste disposal pit.
- It is likely that petroleum waste was disposed of by pouring into the open-bottom grated drain located 6 to 8 feet away from well ST150MW02.
- This open-bottom grated drain is approximately 2 feet by 3 feet and approximately 1.5 to 2 feet deep. According to on-site personnel, the drain discharged via subsurface piping to the jetty and was capped in 1993 (TEC-SDVJV 2012b). It is unknown at this time whether the drain was used by on-site personnel to discharge oily waste materials.

Remedial Investigation Results – Free Product



Remedial Investigation Results - Free Product



**Table 4-3
Free-Product Measurements and Removal from Monitoring Well ST150MW02
Installation Restoration Site 150
Marine Corps Base Camp Pendleton, San Diego, California**

Date	Depth to Product (ft bgs)	Depth to Water (ft bgs)	Amount of Product Removed (Estimated Gallons)	Notes
1/17/2014	9.52	16.99	n/a	7.47 feet of product
2/7/2014	10.35	11.55	3	1.2 feet of product
2/10/2014	10.40	11.70	1	1.3 feet of product
5/28/2014	10.17	10.87	1	0.7 feet of product
7/28/2014	10.16	11.16	1	1.0 feet of product
9/30/2014	10.07	10.87	1	0.8 feet of product
5/1/2015	n/a	9.9	0	Sheen on water in bailer. Hydrocarbon odor.
9/22/2015	n/a	-	0	Sheen on water in bailer. Hydrocarbon odor. Original 2 inch diameter well (ST150MW02) overdrilled and a new 4-inch diameter well (ST150MW02A) install
10/22/2015	n/a	9.93	0	
2/18/2016	9.63	11.55	0	1.92 feet of product

Notes:

ft bgs - feet below ground surface

n/a - no free-product in the well

Remedial Investigation Results



Free-Product in Monitoring Well ST150MW02

- No evidence of stained soil was observed during the drilling of soil boring 150-SB-03 (near well ST150MW02), the collection of a groundwater grab sample from 150-SB-03, or the installation of monitoring well 150MW-05 (installed approximately 25 feet down gradient of well ST150MW02)
- Free-product was not found in monitoring well 150MW-05 following well development or during the groundwater sampling events.
- Soil gas probe 150-SG-04 was installed between well ST150MW02 and Building 210577. No VOCs in the soil gas sample from 150-SG-04, including naphthalene, exceeded the soil gas PSLs, suggesting that the product identified in monitoring well ST150MW02 is not coming from the direction of Building 210577.

Remedial Investigation Results Conclusions



The site does not warrant further investigation. If not for the free product detected in monitoring well ST150MW02A (formerly ST150MW02), then it is the Navy's opinion that the site would warrant site closure and NFA determination. This is supported by the following conclusions.

- **The nature and extent of VOCs in soil at IR Site 150 has been adequately delineated.**
- **The nature and extent of VOCs in soil gas at IR Site 150 has been adequately delineated.**
- **The nature and extent of dissolved-phase VOCs in groundwater at IR Site 150 has been adequately delineated.**

Remedial Investigation Conclusions



Although the cumulative risk for the site is at the lower end of the risk management range, and based on conservative nature of each of the exposure scenarios, the site warrants a NFA determination following the successful remediation of the free-product. IR Site 150 is within an industrial area of MCB Camp Pendleton. The land use here is not expected to change in the foreseeable future. In addition, groundwater at the site is not designated for potable use.

Three alternatives were developed to address the floating free-product in groundwater in monitoring well ST150MW02A at IR Site 150:

- **Alternative 1: No Action;**
- **Alternative 2: Free Product Extraction (Bailing and Absorbant Socks) and Off-Site Disposal with Groundwater Monitoring;**
- **Alternative 3: Free Product Extraction, Source Area Excavation and Off-Site Disposal**

Alternative 1: No Action

The NCP requires that a no action alternative be retained for detailed evaluation as a baseline against which the other alternatives are compared. Under the no action alternative, no remedial actions of any kind would be undertaken. Existing monitoring wells would be destroyed. No remediation or sampling of the groundwater would be conducted. No cost is associated with this alternative.

Natural attenuation processes would continue to degrade VOC mass in groundwater over time; however, there would be no groundwater monitoring data collected to monitor the volume of floating free-product or document natural attenuation.

Feasibility Study



Alternative 2: Free Product Extraction (Bailing and Absorbent Socks) and Off-Site Disposal with Product Monitoring



Feasibility Study



Alternative 3: Free Product Extraction, Source Area Excavation and Off-Site Disposal



Feasibility Study



Table K1 - Summary Cost

IR Site 150, Camp Pendleton

Alternative Description	Remedial Design and Project Management	Capital Cost (including Off-site Disposal)	30-Year O&M Cost	30-Year O&M NPV Cost	Total Cost (Capital and O&M)	Total NPV Cost (Capital and O&M NPV)
Alternative 1 (No Action)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Alternative 2*	\$ 3,604	\$ 14,960	\$ 24,000	\$ 23,471	\$ 42,564	\$ 42,034
Alternative 3	\$ 53,490	\$ 231,399	\$ -	\$ -	\$ 284,889	\$ 284,885

Notes

* 30-year O&M for Alternative 2 assumes monitoring for 2 years. There are no long-term (30-year) work elements for Alternatives 2 or 3.

Pictures



Pictures

