

DRAFT

**2014 ANNUAL GROUNDWATER MONITORING REPORT
INSTALLATION RESTORATION PROGRAM SITE 40**

19 February 2016

**Naval Weapons Station Seal Beach
800 Seal Beach Boulevard, Seal Beach
Orange County, California 90740**



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ACRONYMS

COC	chemical of concern
COD	chemical oxygen demand
DCE	dichloroethene
DO	dissolved oxygen
DON	Department of the Navy
DTSC	Department of Toxic Substances Control
EISB	enhanced in-situ bioremediation
ERSE	extended removal site evaluation
HRC	hydrogen release compound
IRP	Installation Restoration Program
LUC	land use control
MNA	monitored natural attenuation
msl	mean sea level
NAVWPNSTA	Naval Weapons Station
ORP	oxidation reduction potential
PCE	tetrachloroethene
RAP	Remedial Action Plan
ROD	Record of Decision
TCE	trichloroethene
TCG	target cleanup goal
TDS	total dissolved solids
TOC	total organic carbon
VC	vinyl chloride
VOC	volatile organic compound

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1.0 INTRODUCTION

This report provides an overview of site activities conducted in December 2014 and February, April, and July 2015 associated with enhanced in situ bioremediation (EISB) of groundwater at Installation Restoration Program (IRP) Site 40 at Naval Weapons Station (NAVWPNSTA) Seal Beach, Seal Beach, California. This report includes the presentation and assessment of relevant monitoring data collected during this period. The Site is currently in Monitored Natural Attenuation (MNA) phase and this was the sixth sampling event conducted after the final application of Hydrogen Release Compound (HRC[®]) in November 2008. A summary of the general status of the project and recommendations based on the conclusions are also provided.

The field activities for this period included groundwater, soil gas, and ambient air monitoring in various wells/locations as well as surface gas emissions monitoring. These activities, along with the dates they were conducted, are listed in Table 1. For this monitoring event (December 2014), chemicals of concern (COCs), including primary COCs tetrachloroethene (PCE) and trichloroethene (TCE), and secondary COCs including cis-1,2-dichloroethene (DCE) and vinyl chloride (VC), were assessed in groundwater samples from monitoring wells MW-40-07, -08, -14, -22, -27, -30, -31 -32, -35, -36, and -37; and injection wells IW-2, -4, -10, and -18. These wells were proposed for annual monitoring based on the Final 2013 Annual Groundwater Monitoring Report, Installation Restoration Program Site 40 (CKY 2014). Most of these wells are key compliance wells located in the central portion of the site where low-level contamination is still being detected.

Additionally, ambient air samples were collected to evaluate air quality in and around Site 40 and to provide data for a risk assessment in support of site closure. Section 4.0 of this report includes the risk assessment.

Appendix A includes the laboratory data from the 2014 groundwater and soil vapor monitoring event and the 2015 ambient air monitoring events.

2.0 LAND USE CONTROLS

Land use controls (LUC) and their implementation were inspected and reviewed as part of the Navy's Project Review Process in accordance with Naval Weapons Station Seal Beach Instruction 5090.5B, Environmental Aspects and Requirements Review Procedures for Actions, Projects, Business Practices and Land Use (DON 2012). The land use controls for Site 40 are as follows:

- No new groundwater extraction, injection, or drinking water wells shall be installed within the IR Site 40 groundwater plume or associated buffer zone without prior review and written concurrence from the DON [Department of the Navy] and the DTSC [Department of Toxic Substances Control]
- Injection and monitoring wells and associated piping and equipment that are included in the remedial action shall not be altered, disturbed, or removed without the prior review and written concurrence from the DON and DTSC.
- The DON, DTSC, and their authorized agents, employees, contractors, and subcontractors will have the right to:
 - enter the premises to conduct investigations, tests, or surveys;
 - inspect field activities;
 - construct, operate, and maintain the remedial action described in this ROD/RAP [Record of Decision/Remedial Action Plan]; and
 - undertake any other remedial response or remedial action as required or necessary under the cleanup program.

No new groundwater wells were installed in IRP Site 40 or the 500-foot buffer zone, and all existing wells and associated piping were in proper working condition and did not appear to be tampered with or altered. The DON, regulatory agencies, and contractors had full access to the Site to perform monitoring activities as prescribed in the ROD (DON 2004). If required, the LUCs will be inspected and reviewed during the next annual monitoring event and summarized in the 2015 groundwater monitoring report.

3.0 SUMMARY OF DATA

Data from the 2012, 2013 and 2014 sampling events are presented on Figure 1. The analytical data reports from the December 2014 groundwater and soil vapor sampling event as well as the 2015 ambient air data are included on a CD in Appendix A. Current (December 2014) concentrations and inferred plume delineations for the COCs remaining above target cleanup goals (TCG), TCE and cis-1,2-DCE, and VC, are presented on Figures 2 and 3, respectively. Results from the ambient air monitoring are presented on Figure 4 and summarized in Section 4.0 and results from the soil gas sampling are presented on Figure 5.

3.1 Changes from Previous Monitoring Event

The following changes from the previous monitoring event were implemented:

1. Ambient air samples were added to the scope of work pursuant to No Further Action discussions with the DTSC. The ambient air sample data is being used to evaluate the future risk at the Site in regards to soil vapor intrusion.

3.2 COCs in Regularly Monitored Wells

This subsection provides a summary of data collected in December 2014 to assess existing COC concentrations across the Site in relation to their respective target cleanup goal (TCG), followed by key observations regarding COC concentrations in the selected groundwater monitoring wells sampled during the December 2014 event.

The following are the TCGs for the COCs at Site 40:

Chemicals of Concern	TCG (µg/L)
Tetrachloroethene	5
Trichloroethene	5
cis-1,2-Dichloroethene	6
Vinyl chloride	0.5

Evaluation of COC concentrations and plume dynamics included assessment of shallow interval groundwater monitoring wells MW-40-07, -08, -22, -27, -30, -32, -36, and -37; shallow interval injection wells IW-2, -4, -10, and -18; and mid-shallow interval wells MW-40-14, -31, and -35 (refer to Figure 1 for well locations).

All wells monitored in the December 2014 monitoring event had concentrations of PCE below the TCGs. One well, MW-40-14, had a concentration of TCE slightly above the TCG. Concentrations of cis-1,2-DCE and VC varied but were generally similar to previous reporting periods. Table 2 presents the concentrations of COCs in groundwater.

Figure 2 presents the interpreted plume delineations for TCE and cis-1,2-DCE, and Figure 3 presents the interpreted plume delineations for VC, based on the December 2014 data. Observations on the fate of COCs in monitoring points above the TCGs are presented below compared to the previous year's results. A concentration followed by the letter "J" indicates that the concentration is an estimated level and a "U" indicates the concentration was not detected above the associated reporting limit.

- Increases in concentrations of TCE above the TCG include:
 - 1.2 to 5.5 µg/L in MW-40-14

- Decreases in concentrations of cis-1,2-DCE above the TCG include:
 - 25 to 15 µg/L in MW-40-08

- Increases in concentrations of cis-1,2-DCE above the TCG include:
 - 3 to 11 µg/L in MW-40-14
 - 6 to 10 µg/L in MW-40-36

- Decreases in concentrations of VC above the TCG include:
 - 0.96J to 0.50U µg/L in IW-4
 - 1.6 to 0.53J µg/L in IW-10
 - 7.5 to 1.3 µg/L in MW-40-07
 - 1.7 to 1.0 µg/L in MW-40-08
 - 3.5 to 3.2 µg/L in MW-40-14
 - 3.6 to 2.3 µg/L in MW-40-30
 - 0.88J to 0.54J µg/L in MW-40-32
 - 4.9 to 4.8 µg/L in MW-40-37

- Increases in concentrations of VC above the TCG include:
 - 0.50J to 0.96J µg/L in IW-18
 - 0.53J to 0.6J in MW-40-27
 - 3.5 to 4.6 in MW-40-36

The presence of TCE above the TCG has not been reported since before the 2010 monitoring event. There have been fluctuations of TCE concentrations since with a high of 4 µg/L in 2010. The 5.5 µg/L reported in this event is only a slight exceedance of the TCG and is not evidence of a significant rebound event. The Site has continued a decreasing trend of cis-1,2-DCE in one of the two monitoring points (MW-40-08) that have consistently been above the TCG. This represents evidence that reductive dechlorination is still occurring at the Site. However, with TCE remaining there is expected to be continuing fluctuations of cis-1,2-DCE. The two monitoring points that had increased concentrations of cis-1,2-DCE for the 2014 monitoring event exhibited larger than usual increases than were observed in previous results. MW-40-14 went from 3 to 11 µg/L and MW-40-36 went from 6 to 10 µg/L. The increase at MW-40-14 likely correlates to the increase in TCE in this location. Results from the other monitoring points are consistent with minor fluctuations observed from previous results. Increases in VC are likely due to continued biodegradation of cis-1,2-DCE. The differences in COC increases and decreases are considered relatively minor and in small pockets of the Site. These fluctuations are expected based on the relatively low concentrations as the contaminants are affected more dramatically at low concentrations by their surrounding environment.

3.3 Plume Interpretations

- Concentrations of PCE have not exceeded the TCGs (5 µg/L) in any wells since the 2010 monitoring event.

- Concentrations of TCE have exceeded the TCGs (5 µg/L) once and in only one well (MW-40-14) since the 2010 monitoring event.
- Concentrations of cis-1,2-DCE exceed the TCG (6 µg/L) in four of the seventeen monitoring points (MW-40-08, MW-40-14, MW-40-36, and MW-40-37). The concentrations in these wells are approximately from two to five times the TCG.
- Low concentrations of VC, generally in the 0.5 to 2.0 µg/L range, form a residual plume across the Site. Higher concentrations exist slightly downgradient from the source but have not migrated significantly. Four wells (MW-40-14, -30, -36, and -37) had concentrations over 2 µg/L.

A decrease in VC concentrations across the Site was noted during this event. Most COC concentrations are consistent with previous monitoring results and are attributed to the reductive dechlorination occurring at the Site. The plume is not migrating and there is evidence to suggest that dechlorination will continue, however, at a slower rate than previously observed.

3.4 Field Parameters

Field parameters were measured during this monitoring event including DO, ORP, and pH, which are included in Table 3. Monitoring of these parameters provide additional indication of the potential for further reductive dechlorination.

Key observations regarding field parameter data are as follows:

- Based on the December 2014 readings, DO concentrations in the monitoring wells remained at or less than 0.9 mg/L (given limitations associated with this measurement, this essentially represents not detected).
- ORP values measured during the December 2014 event were negative for all monitoring points, ranging from -87.1 millivolts (mV) to -149.0 mV. These values reflect conditions favorable for reductive dechlorination, however, above the optimum value of -240 mV.
- The pH readings ranged from 6.27 to 6.96 pH units. These values are only slightly out of the optimum range of 6.5 to 8.5.

The December 2014 field parameter data indicate the presence of sufficient parameters supportive of continued reductive dechlorination. While reductive dechlorination will continue to occur at the Site, the rates will decrease as concentrations of COCs decrease. Field parameter data is useful as an indicator of site conditions; however, it should not be the only consideration to determine expected future results.

3.5 Soil Gas Data

Soil gas field parameters were measured at IW-1, -3, -7, -10, MW-40-32, -34, -35, -36, -37, and VW-40-01, -02, -03, -04, and -06 from December 17–19, 2014. Methane gas was present at concentrations from 0.0 to 58.6 percent (%) in air. The highest methane concentration was in the soil gas probe in injection well IW-7. The average methane concentration was 15% in air, which is lower than the average of 26% recorded in 2013 and the 36% recorded in 2012. Hydrogen sulfide was reported in 6 of 14 probes with concentrations ranging from 0 to 29 parts per million (ppm). The highest hydrogen sulfide concentration was in vapor monitoring well VW-40-03. Table 4 summarizes the soil gas field parameter data.

In addition, soil gas samples were collected in 6-liter SUMMA™ canisters from four vapor monitoring wells (VW-40-02, -03, -04, and -06) and soil gas monitoring probes that are installed in groundwater monitoring wells MW-40-32 and -37 and injection wells IW-1 and -3. Table 5 lists the analytical results for the soil gas analyses.

Although certain COCs such as PCE and TCE are near or well below the target cleanup goals in groundwater, they are still present in the vadose zone in soil gas (Figure 5). PCE was reported in the soil

gas samples ranging from <10.3 to 9003 $\mu\text{g}/\text{m}^3$ and TCE was reported ranging from 7.1 to 658 $\mu\text{g}/\text{m}^3$. The maximum reported concentration in 2013 was 278 and 1074 $\mu\text{g}/\text{m}^3$ for PCE and TCE, respectively, and in 2012, 454 and 3,866 $\mu\text{g}/\text{m}^3$, respectively. There was a significant increase in PCE in one sampling location (IW-1) that is not consistent with previous monitoring periods. However, the presence of Site COCs in soil gas can be affected by many different site conditions, and the main concern is soil vapor effects on human and ecological receptors. Soil gas field screening and ambient air monitoring were performed during this reporting period and an analysis on the Site COCs in air is provided in Section 4.

Concentrations of cis-1,2-DCE were reported in all sampled wells at concentrations ranging from 5.7 $\mu\text{g}/\text{m}^3$ in the soil gas probe installed in vapor monitoring well VW-40-04 to 971 $\mu\text{g}/\text{m}^3$ in vapor monitoring well VW-40-03. The average cis-1,2-DCE concentration was 229 $\mu\text{g}/\text{m}^3$ compared to 900 $\mu\text{g}/\text{m}^3$ in 2013 and 1,320 $\mu\text{g}/\text{m}^3$ in 2012. The average concentration is lower year over year reflecting the continuing reductive dechlorination.

VC was reported at concentrations from 1.1 $\mu\text{g}/\text{m}^3$ in the vapor monitoring well VW-40-04 to 3,391 $\mu\text{g}/\text{m}^3$ in vapor monitoring well VW-40-03. The average VC concentration was 845 $\mu\text{g}/\text{m}^3$ compared to 1,265 $\mu\text{g}/\text{m}^3$ in 2013 and 1,525 $\mu\text{g}/\text{m}^3$ in 2012. The average concentration is lower likely due to continued reduction of Site COC concentrations.

Methane gas concentrations in samples collected in SUMMA™ canisters from the soil gas monitoring probes and vapor monitoring wells ranged from below the detection limit in soil gas monitoring wells VW-40-04, IW-01, and MW-40-32 to 40.6% by volume in the soil gas monitoring well VW-40-03. In comparison to 2013 results, methane gas concentrations are similar but trending lower. Methane gas is expected to be present as a result of volatilization and bio-fermentation, referred to as methanogenesis.

Methane gas and volatile organic compound (VOC) surface emissions monitoring was performed on December 30, 2014. During this monitoring event, neither methane gas nor VOC emissions were detected within Buildings 239 or 240, or in the surrounding areas.

In addition to routine monitoring of soil gas data, ambient air monitoring was performed in accordance with the approved Final 2013 Annual Groundwater Monitoring Report, Installation Restoration Program Site 40 (CKY 2014). Section 4.0 includes the results of the risk analysis performed of the data.

3.6 Groundwater Level Measurements

Groundwater level measurements were collected on December 29, 2014. Groundwater elevations within the Site ranged from 1.82 feet above mean sea level (msl) in MW-40-08 to 2.55 feet above msl in IW-2. In general, water level measurements collected in December 2014 were similar to the elevations measured during the previous monitoring event in 2013. Minor fluctuations are likely due to seasonal/annual variation in weather. Differences in groundwater elevation are not significant enough to have an impact on achieving the remedial goals of this project.

4.0 Risk Assessment

A risk assessment was completed to determine if potential risks at IRP Site 40 are acceptable for site closure.

4.1 Previous risk Evaluations

This section discusses previous risk assessments and evaluations that have been performed at IRP Site 40.

4.1.1 1998 Screening Level Risk Assessments

A screening-level human health risk assessment (HHRA) and an ecological risk assessment were conducted in 1998 at IRP Site 40 during the Extended Removal Site Evaluation (ERSE; BNI 1999). The ERSE report recommended further action to address volatile organic compounds (VOCs) in groundwater (based on the use of groundwater as tap water) and no further action for soil. DTSC and RWQCB Santa Ana Region

concurrent with these recommendations (2004 ROD/Remedial Action Plan).

4.1.2 2014 Preliminary Risk Evaluation

Based on the 1998 screening level risk assessments, a preliminary risk evaluation was performed in 2014 initially considering on the following potential groundwater exposure pathways (CKY 2014):

- Inhalation of VOCs that may intrude into buildings from the subsurface,
- Inhalation of VOCs from groundwater being used as tap water for showering and general household use, and
- Ingestion of groundwater used as tap water.

Groundwater at IRP Site 40 is not currently being used as tap water and will not be used as tap water in the future due to salt water intrusion and because the shallow aquifer is not capable of producing sufficient groundwater for use as tap water. Therefore, the two tap water-related exposure pathways are not complete.

In addition to these three potential human health exposure pathways, another potential groundwater exposure pathway is the migration of VOCs in groundwater to the Seal Beach National Wildlife Refuge; approximately 500 feet southeast of Building 239. However, based on groundwater monitoring results conducted since 2005, it does not appear that the VOC groundwater contamination extends southeast of Building 239. Therefore, the migration of VOCs to the wildlife refuge is not a complete exposure pathway.

Because the other potential exposure pathways discussed above are not complete at IRP Site 40, the preliminary risk evaluation was conducted focusing on the inhalation of VOCs that may intrude into buildings from the subsurface. Groundwater and soil vapor VOC data are available at IRP Site 40; soil vapor data better represent the potential for vapor intrusion into buildings than groundwater data and were used in the 2014 preliminary risk evaluation. The preliminary risk evaluation was limited to the two primary groundwater contaminants of concern: (COCs) tetrachloroethene (PCE) and trichloroethene (TCE) and the two secondary COCs cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride, and was conducted using 2012 and 2013 soil vapor data.

The preliminary risk evaluation generally followed procedures outlined in DTSC–Cal/EPA’s 2011 Vapor Intrusion Guidance Document (VI Guidance, DTSC – Cal/EPA 2011) and resulted in the following conclusions:

- **Future Buildings.** The preliminary screening evaluation showed potential risks from vapor intrusion for future residential and industrial buildings within the excess carcinogenic risk range of 1×10^{-6} to 1×10^{-4} (NCP, 40 CFR 300.430). Risks less than 1×10^{-6} are allowable, while risks greater than 1×10^{-4} may require additional evaluation or remedial action. However, due to a change in the vinyl chloride DTSC residential air screening level (from $0.031 \mu\text{g}/\text{m}^3$ to $0.0095 \mu\text{g}/\text{m}^3$ [DTSC 2015]), the potential future residential risk associated with vinyl chloride is greater than 1×10^{-4} . These conclusions, which were based on 2012 and 2013 soil vapor data, would not change using 2014 soil vapor data. Based on this, vapor mitigation (e.g., constructive vapor barriers) may be required for future buildings at IRP Site 40.
- **Existing Buildings.** Excess carcinogenic risks for the existing buildings (based on industrial use) are within the carcinogenic risk range of 1×10^{-6} to 1×10^{-4} . These conclusions, which were based on 2012 and 2013 soil vapor data, would not change using 2014 soil vapor data. Based on these results, it was recommended to collect two rounds of indoor air samples within Buildings 239 and 240 and ambient (outdoor) air samples outside of the VOC groundwater plume so that potential risks can be calculated using actual, instead of estimated, indoor air concentrations.

4.2 2015 Indoor and Ambient air sampling

Indoor and ambient air samples were collected in February and July 2015. Ambient air samples were also collected in April 2015 to confirm the February 2015 ambient air results (discussed further below). The February and July sampling times are consistent with DTSC's recommendations for conducting air sampling during winter and summer months (DTSC-Cal/EPA 2011). Sample locations, discussed below, were agreed upon by the Navy and DTSC and RWQCB project managers during a site visit on July 23, 2014.

The indoor sample locations shown in Figure 5 were selected to represent areas of the buildings where workers presumably spend the largest amount of their time. The storage and office areas are separated by walls and doors and may collect vapors. These rooms were sampled to evaluate workers that may enter these areas temporarily and could be exposed to contaminated vapor, if present.

- Building 240: Two sample locations - storage area in the back (west end) of the building and main shop area of the building.
- Building 239 – Four sample locations - storage area where the cubicles are located, cubicle area, warehouse where the workers have work stations set up and the warehouse storage area.

In addition, four ambient air locations were sampled; one upwind (north of Building 240), one on either side of the plume between the two buildings and one downwind. Ambient air sample results from these locations provide the necessary information to facilitate preparation of a risk assessment that is more representative of expected exposure threats from subsurface contamination than the data set that previously existed.

Indoor and ambient air samples were analyzed in accordance with the existing Sampling and Analysis Plan for the Site for PCE, TCE, cis-1,2-DCE and vinyl chloride.

Indoor and ambient air samples were collected concurrently using 6-liter stainless steel Summa canisters over an 8-hour period, which represents a typical work day. Air sampling was conducted using vacuum gauges and 8-hour flow controllers. The indoor air canisters were placed so that the samples were collected in the breathing zone, approximately 3- to 5-feet above ground. The ambient air canisters were located approximately 6-feet above ground. The canisters were filled until the vacuum equivalent of approximately 5-inches of mercury remained in the Summa canister. The initial and final canister vacuums and sampling times were recorded.

4.3 2015 Risk assessment

The 2014 preliminary risk evaluation concluded that excess carcinogenic risks for the Buildings 239 and 240 (based on industrial use) are within the carcinogenic risk range of 1×10^{-6} to 1×10^{-4} . These conclusions are based on the use of soil vapor data to evaluate the vapor intrusion exposure pathway. Indoor and ambient air samples were collected in February and July 2015 so that potential risks can be calculated using actual, instead of estimated, indoor air concentrations.

The February, April and July 2015 indoor and ambient air sample analytical results are presented in Table 6.

4.3.1 February 2015 Indoor and Ambient Air Results

PCE was detected in indoor air samples collected at Buildings 239 and 240 at concentrations greater than DTSC residential and/or industrial air screening levels (DTSC 2015). However, the indoor air PCE concentrations ranging from 0.71 to 3.1 $\mu\text{g}/\text{m}^3$ are equal to or less than the outdoor air PCE concentrations, which ranged from 1.6 to 34 $\mu\text{g}/\text{m}^3$. TCE concentrations in the indoor air samples, which are equal to or less than TCE concentrations in the ambient air samples, did not exceed DTSC residential and industrial air screening levels. Vinyl chloride and TCE were also detected from ambient air at concentrations greater than DTSC residential and/or industrial air screening levels.

Due to the elevated ambient air concentrations detected in collected in February 2015, another set of ambient

air samples were collected in April 2015 to confirm the February 2015 results. As shown in Table 6, the four COCs were either not detected or were detected at concentrations less than DTSC residential and industrial air screening levels.

The similarity between the indoor and ambient air PCE and TCE concentrations in February 2015 and the lack of PCE detections in April 2015 indicate that the PCE and TCE indoor air detections in February 2015 may be associated with an outdoor source, and are not associated with vapor intrusion from subsurface contamination. In subsequent discussions with building occupants, it was discovered that the February ambient sample location (S40AA-4) was in an area where cleaning solvents are routinely used during the course of normal business operations. The sample location was moved out of the area for the April 2015 sampling event, approximately 20 feet to the east.

4.3.2 July 2015 Indoor and Ambient Air Results

PCE, TCE, cis-1,2-DCE and vinyl chloride concentrations in the indoor air samples collected at Buildings 239 and 240 did not exceed DTSC's residential and industrial air screening levels.

Vinyl chloride was detected at ambient air sample location S40AA-4 at a concentration greater than the DTSC residential air screening level. However, as noted in Table 6, the results for the four COCs are qualified due to potential laboratory contamination. The summa canister for this sample, through instrument malfunction, was exposed to a low level calibration standard during the analytical procedure. Vinyl chloride was not detected in ambient air samples at concentrations greater than the DTSC industrial air screening level.

PCE was detected in ambient air samples at concentrations greater than DTSC residential and industrial air screening levels.

The lack of indoor air COC detections at concentrations greater than DTSC residential and industrial air screening levels and higher PCE detections from ambient air are consistent with an outdoor source, not vapor intrusion from subsurface contamination.

4.3.3 Risk Assessment Summary

As noted above, the purpose of the 2015 air sampling events was to allow the evaluation of the vapor intrusion exposure pathway using actual indoor air COC concentrations, rather than estimated indoor air concentrations. Following the 1998 screening level assessments and the 2014 preliminary risk evaluation, the vapor intrusion exposure pathway was determined to be the only potentially complete exposure pathway to COCs in groundwater.

Summary of Results for each COC:

- Vinyl Chloride and cis-1,2-DCE are the primary groundwater COCs at IRP Site 40. Neither COC was detected in indoor air at concentrations greater than DTSC residential or industrial air screening levels.
- TCE has been detected in groundwater infrequently in the vicinity of buildings 239 and 240. The preliminary screening evaluation using existing soil vapor data indicated a potential for indoor air concentrations greater than the DTSC residential air screening level for TCE. However, TCE was not detected in indoor air at concentrations greater than DTSC residential or industrial air screening levels for TCE.
- PCE was generally not detected in groundwater in the vicinity of Buildings 239 and 240 and the preliminary risk evaluation using existing soil vapor data predicted PCE indoor air concentrations less than DTSC residential and industrial air screening levels for PCE. However, this prediction would have been different if the 2014 soil vapor data were used in the preliminary risk evaluation. During the February 2015 sampling event, PCE was detected in indoor air at concentrations greater

than DTSC residential and industrial air screening level for PCE. However, as noted in Section 4.3.1, these concentrations appear to be associated with ambient air as the indoor and ambient air PCE air concentrations are similar. During the July 2015 sampling event, PCE was detected in indoor air at concentrations less than the DTSC air screening levels and less than the PCE concentrations detected in ambient air.

There is nothing in the indoor and ambient air data collected in February, April and July 2015 that indicates vapor intrusion is occurring at Buildings 239 and 240. Indoor air detections of TCE and PCE appear to be associated with ambient air as the indoor air TCE and PCE concentrations are consistent with the TCE and PCE ambient air concentrations. Therefore, because the vapor intrusion pathway is not complete, COCs in groundwater at IRP Site 40 do not pose an unacceptable risk to potential receptors.

5.0 CONCLUSIONS

While the contaminant plume boundaries have shifted slightly (as expected due to dechlorination activity), significant reductions in total chloroethene concentrations have been observed in all monitoring wells over the life of the project. Trichloroethene has had a slight increase in concentrations during the December 2014 monitoring event. However, the single exceedance was at a concentration of 5.5 µg/L, only slightly above the TCG of 5.0 µg/L.

Field parameter data suggest an environment favorable for reductive dechlorination to continue. However, COC concentrations have decreased to very low levels across the site, which would limit the rate of dechlorination.

The risk assessment concluded that there are no complete exposure pathways to COCs in groundwater at IRP Site 40 and that the COCs in groundwater do not pose an unacceptable risk to potential receptors.

6.0 RECOMMENDATIONS

In accordance with the approved Final 2013 Annual Groundwater Monitoring Report, Installation Restoration Program Site 40 (CKY 2014), additional ambient air monitoring was performed and the data analyzed for potential risks from Site COCs. The additional data presented in this report supports a request for No Further Action at this Site based on the following main conclusions:

- While COC concentrations in groundwater remain above the TCGs in some monitoring points at the Site, it is highly unlikely that there will be any contact between potential receptors and the groundwater.
- Given the Site's proximity to the ocean and brackish groundwater, the groundwater offers no beneficial use for consumption.
- The plume has not shown evidence of migration and the site conditions remain favorable to continued dechlorination.
- The anticipated use of the Site is projected to remain Navy property.
- As outlined in Section 4.0, the vapor intrusion pathway does not appear to be complete and COCs in groundwater at IRP Site 40 do not pose an unacceptable risk to potential receptors.

Based on the above, it is recommended that the Site receive a No Further Action determination.

7.0 REFERENCES

- BNI 1999. Final Extended Removal Site Evaluation Report, Installation Restoration Sites 40 and 70, Naval Weapons Station Seal Beach, Seal Beach, California. October.
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TABLES

TABLE 1**SUMMARY OF MONITORING ACTIVITIES CONDUCTED**

Date	Event	Wells Sampled^a	Analytes/Parameters	Notes
29 December 2014	Groundwater level measurement	MW-40-07, 08, -14, -22, -27, -30, -31, -32, -35, 36, and -37, and IW-2, -4, -10, and -18.	Not applicable	Groundwater level measurements
30 December 2014	Surface emissions monitoring	Not applicable	Methane gas and VOC concentrations	Inside Building 240 and western portion of Building 239, and areas between the buildings in the Site 40 vicinity
29 and 30 December 2014	Groundwater sampling	MW-40-07, 08, -14, -22, -27, -30, -31, -32, -35, 36, and -37, and IW-2, -4, -10, and -18.	VOCs and field parameters	Laboratory and field parameters
29 and 30 December 2014	Soil vapor/gas probe monitoring	Probes in wells VW-40-01, -02, -03, -04, and -06, and nested probes in MW-40-32, -34, -35, -36, and -37 and IW-1, -3, -7, and 10	Methane, oxygen, carbon dioxide, hydrogen sulfide, VOCs, and carbon monoxide	Field testing
29 and 30 December 2014	Soil vapor sampling	Probes in wells VW-40-02, 03, 04, and VW-40-06, and nested probes in MW-40-32 and -37, and IW-1 and IW-3	VOCs and fixed gases	Laboratory analysis
February 2015 April 2015 July 2015	Ambient Air Monitoring	Select locations throughout Site 40 (See Figure 5)	VOC concentrations	Laboratory analysis

Notes:

^a Refer to figures for well/sampling locations.

Abbreviations and Acronyms:

VOC – volatile organic compound

TABLE 2
CONCENTRATIONS OF COCs IN GROUNDWATER

Location	PCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	VC (µg/L)
IW-2	0.50U	0.50U	0.50U	0.50U
IW-4	0.50U	0.50U	0.50U	0.50U
IW-10	0.50U	0.47J	0.89J	0.53J
IW-18	0.50U	0.84J	0.70J	0.96J
MW-40-07	0.50U	0.44J	1.5	1.3
MW-40-08	0.50U	0.50U	15	1.0
MW-40-14	0.50U	5.5	11	3.2
MW-40-22	0.50U	0.50U	1.0	1.3
MW-40-27	0.50U	1.1	0.50U	0.60J
MW-40-30	0.50U	0.50U	3.7	2.3
MW-40-31	0.50U	0.50U	0.50U	0.50U
MW-40-32	0.50U	0.50U	1.2	0.54J
MW-40-35	0.50U	0.50U	0.58J	0.50U
MW-40-36	0.50U	2.4	10	4.6
MW-40-37	0.50U	0.50U	33	4.8

Notes:

J – estimated value

U – not detected above the associated reporting limit

Abbreviations and Acronyms:

µg/L – micrograms per liter

PCE – tetrachloroethene

TCE – trichloroethene

DCE – dichloroethene

VC – vinyl chloride

TABLE 3

**Groundwater Field Parameter Data
Dissolved Oxygen, Oxygen Reduction Potential, and pH**

Location	DO (mg/L)	ORP (mV)	pH (pH units)
IW-2	0.55	-94.1	6.88
IW-4	0.30	-116.8	6.87
IW-10	0.9	-87.1	6.42
IW-18	0.29	-107.0	6.41
MW-40-07	0.28	-104.8	6.54
MW-40-08	0.72	-119.3	6.75
MW-40-14	0.42	-102.7	6.31
MW-40-22	0.16	-130.4	6.87
MW-40-27	0.80	-119.2	6.96
MW-40-30	0.29	-101.3	6.27
MW-40-31	0.28	-149.0	6.77
MW-40-32	0.36	-102.8	6.39
MW-40-35	0.10	-174.6	6.76
MW-40-36	0.31	-116.0	6.28
MW-40-37	0.21	-96.4	6.27

Abbreviations and Acronyms:

DO – dissolved oxygen
mg/L – milligrams per liter
mV – millivolt
ORP – oxidation/reduction potential

TABLE 4**SOIL GAS FIELD PARAMETER DATA**

Probe/Well ID	Oxygen (%)	Carbon Dioxide (%)	Methane (%)	Barometric Pressure (in.Hg)	Hydrogen Sulfide (ppm)	Carbon Monoxide (ppm)	VOCs (ppm)
IW-1	0.0	9.3	0.0	30.19	0	0	0.0
IW-3	0.1	15.2	12.3	29.98	5	0	0.0
IW-7	0.0	22.4	58.6	30.02	6	0	0.0
IW-10	6.8	6.3	0.0	29.97	0	0	0.0
MW-40-32	2.9	5.7	0.0	29.97	0	0	0.0
MW-40-34	0.0	11.2	0.3	29.98	0	0	0.0
MW-40-35	0.0	26.0	42.9	30.02	0	0	0.0
MW-40-36	0.0	15.3	2.3	30.03	0	0	0.0
MW-40-37	0.0	23.5	4.7	30.13	26	0	0.0
VW-40-01	0.0	14.6	27.8	29.98	0	0	0.0
VW-40-02	0.0	6.0	12.0	30.13	1	0	0.0
VW-40-03	0.0	22.9	49.1	30.17	29	0	0.0
VW-40-04	11.7	5.4	0.0	30.13	0	0	0.0
VW-40-06	0.0	25.1	6.4	30.16	14	0	0.0

Abbreviations and Acronyms:

in.Hg – inches of mercury

ppm – parts per million

TABLE 5
CONCENTRATIONS OF COCs IN SOIL GAS

Probe/Well ID	PCE		TCE		cis-1,2-DCE		Vinyl Chloride		methane
	ppbv	µg/m ³	ppbv	µg/m ³	ppbv	µg/m ³	ppbv	µg/m ³	%v
IW-1	1300	9003.1	85	466.4	5.6	22.7	3.6	9.4	0.613 U
IW-3	1.5 U	<10.3	1.3	7.1	2.1	8.4	170	440.6	9.84
MW-40-32	6.5	44.7	6.1	33.2	1.9	7.6	0.80 J	2.1	0.179 U
MW-40-37	10	69.1	16	87.6	87	351.6	170	442.8	3.95
VW-40-02	20	138.2	99	542.2	77	311.1	800	2083.9	13.1
VW-40-03	600	4152.5	120	658	240	971.1	1300	3390.8	40.6
VW-40-04	100	691.2	3.7	20.3	1.4	5.7	0.42 J	1.1	0.255 U
VW-40-06	190	1314.5	33	180.9	38	153.7	150	391.1	6.43

Abbreviations and Acronyms:

%v – percent by volume
µg/m³ – micrograms per cubic meter
DCE – dichloroethene
ID – identification
J – estimated value
PCE – tetrachloroethene
ppbv – parts per billion by volume
TCE – trichloroethene
U – not detected above the associated reporting limit

Table 6
Draft Indoor and Ambient Air Data Evaluation and Comparison
Site 40, Seal Beach Naval Weapons Station
Seal Beach, California

Sample Location/Sample ID	Air Data Evaluation - Residential ($\mu\text{g}/\text{m}^3$)				Air Data Evaluation - Industrial ($\mu\text{g}/\text{m}^3$)			
	Vinyl Chloride	cis-1,2-DCE	TCE	PCE	Vinyl Chloride	cis-1,2-DCE	TCE	PCE
Indoor and Ambient Air Monitoring - Round 1; Winter/Spring 2015								
Building 239 (February 2015)								
B239AA-1	0.016 U	0.025 U	0.11	0.71	0.016 U	0.025 U	0.11	0.71
B239AA-2	0.016 U	0.025 U	0.25	2.2	0.016 U	0.025 U	0.25	2.2
B239AA-3	0.017 U	0.026 U	0.26	2.7	0.017 U	0.026 U	0.26	2.7
B239AA-4	0.019 U	0.029 U	0.28	2.9	0.019 U	0.029 U	0.28	2.9
Building 240 (February 2015)								
B240AA-1	0.022 U	0.034 U	0.27	3.1	0.022 U	0.034 U	0.27	3.1
B240AA-2	0.016 U	0.025 U	0.38	2.6	0.016 U	0.025 U	0.38	2.6
Ambient Air (February 2015)								
S40AA-1	0.010 J	0.025 U	0.28	2.6	0.010 J	0.025 U	0.28	2.6
S40AA-2	0.024 J	0.038 U	0.37	3.6	0.024 J	0.038 U	0.37	3.6
S40AA-3	0.0095 J	0.025 U	0.26	1.6	0.0095 J	0.025 U	0.26	1.6
S40AA-4	0.12	4.2	87	34	0.12	4.2	87	34
Ambient Air (April 2015)								
S40AA-1	--	--	--	--	--	--	--	--
S40AA-2	0.016 U	0.025 U	0.034 U	0.15 U	0.016 U	0.025 U	0.034 U	0.15 U
S40AA-3	0.016 U	0.025 U	0.034 U	0.14 U	0.016 U	0.025 U	0.034 U	0.14 U
S40AA-4	0.016 U	0.015 J	0.10 J	0.17 U	0.016 U	0.015 J	0.10 J	0.17 U
Indoor and Ambient Air Monitoring - Round 2; Summer 2015								
Building 239 (July 2015)								
B239AA-1	0.016 U	0.025 U	0.056 J	0.19	0.016 U	0.025 U	0.056 J	0.19
B239AA-2	0.016 U	0.025 U	0.034 U	0.21	0.016 U	0.025 U	0.034 U	0.21
B239AA-3	0.0087 J	0.025 U	0.045 J	0.091 J	0.0087 J	0.025 U	0.045 J	0.091 J
B239AA-4	0.016 U	0.025 U	0.20	0.19	0.016 U	0.025 U	0.20	0.19
Building 240 (July 2015)								
B240AA-1	0.016 U	0.025 U	0.089 J	0.38	0.016 U	0.025 U	0.089 J	0.38
B240AA-2	0.016 U	0.025 U	0.048 J	0.28	0.016 U	0.025 U	0.048 J	0.28
Ambient Air (July 2015)								
S40AA-1	0.016 U	0.025 U	0.018 J	0.57	0.016 U	0.025 U	0.018 J	0.57
S40AA-2	0.016 U	0.025 U	0.041 J	0.49	0.016 U	0.025 U	0.041 J	0.49
S40AA-3	0.016 U	0.037 J	0.35	5.1	0.016 U	0.037 J	0.35	5.1
S40AA-4	0.12 J*	0.17 J*	0.26 J*	0.43 J*	0.12 J*	0.17 J*	0.26 J*	0.43 J*
DTSC Air Screening Levels	0.0095^a	8.3	0.48 (2/6)	0.48	0.16	35	3.0 (8/24)	2.1

U = Analyte not detected at a concentration greater than the reported value.

J = Results are below reporting limit and qualified by laboratory as estimated.

^a Non-detect vinyl chloride results in this table are reported at the laboratory Limits of Detection (LOD), which are slightly greater than the DTSC residential Air Screening Level of $0.0095 \mu\text{g}/\text{m}^3$. However, the vinyl chloride method detection limits (DL) reported by Eurofins Calscience for the samples in this table are less than the DTSC residential Air Screening Level of $0.0095 \mu\text{g}/\text{m}^3$. The vinyl chloride LOD and DL are less than the DTSC industrial Air Screening Level of $0.16 \mu\text{g}/\text{m}^3$.

* = Results qualified due to potential laboratory contamination. The summa canister, through instrument malfunction, was exposed to low level calibration standard during the analytical procedure.

Detected concentration greater than DTSC Air Screening Level

DTSC Air Screening Levels: DTSC HERO Note Number 3 (May 2015)

Trichloroethene: values in parentheses are Accelerated Response Action Levels and Urgent Response Action Levels for indoor air (DTSC Hero Note Number 5 [August 23, 2014])

FIGURES

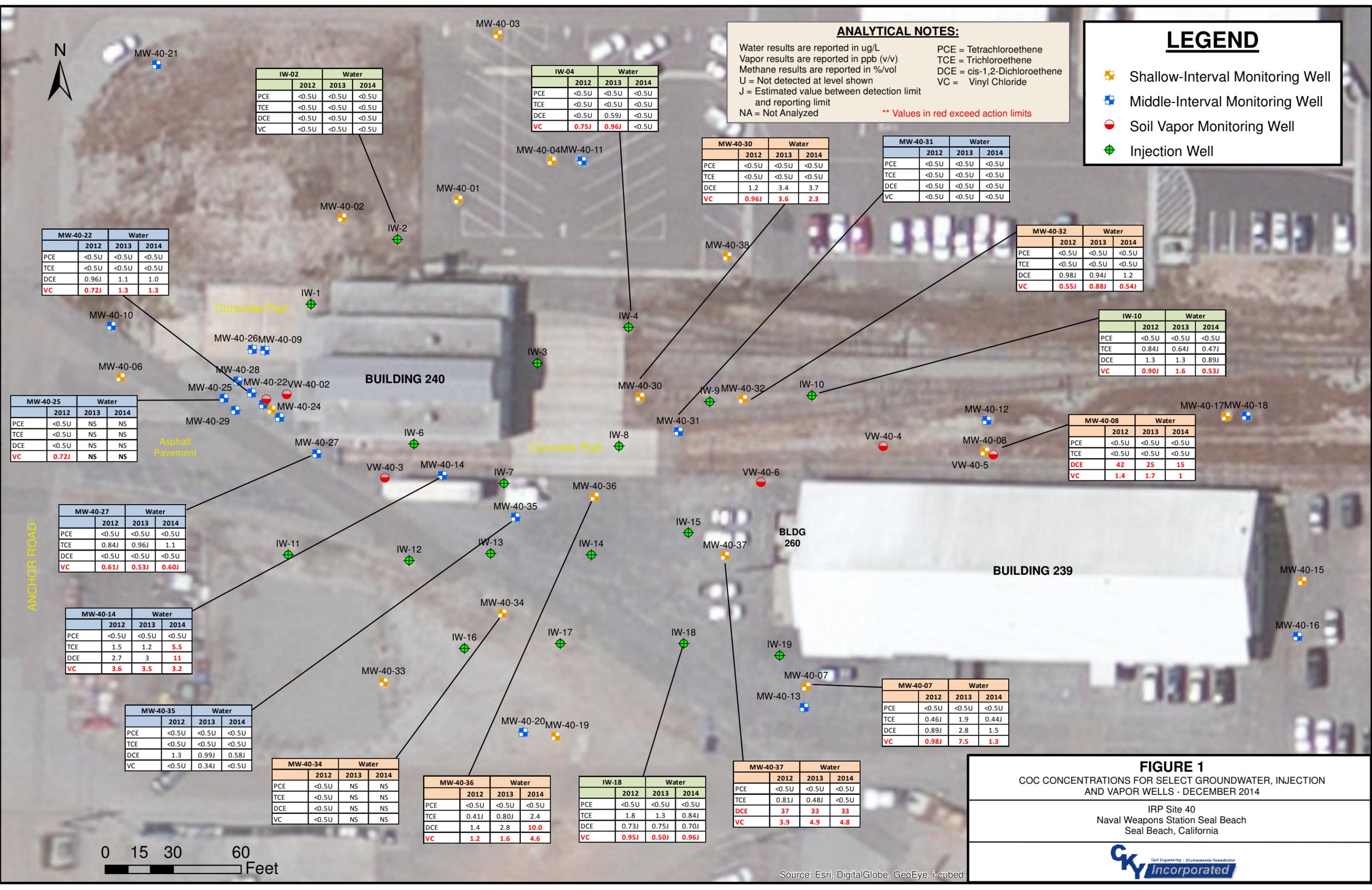
ANALYTICAL NOTES:
 Water results are reported in ug/L
 Vapor results are reported in ppb (v/v)
 Methane results are reported in %/vol
 U = Not detected at level shown
 J = Estimated value between detection limit and reporting limit
 NA = Not Analyzed

PCE = Tetrachloroethene
 TCE = Trichloroethene
 DCE = cis-1,2-Dichloroethene
 VC = Vinyl Chloride

**** Values in red exceed action limits**

LEGEND

- Shallow-Interval Monitoring Well
- Middle-Interval Monitoring Well
- Soil Vapor Monitoring Well
- Injection Well



IW-02	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	<0.5U	<0.5U	<0.5U
VC	<0.5U	<0.5U	<0.5U

IW-04	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	<0.5U	0.59J	<0.5U
VC	0.75J	0.96J	<0.5U

MW-40-30	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	1.2	3.4	3.7
VC	0.96J	3.6	2.3

MW-40-31	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	<0.5U	<0.5U	<0.5U
VC	<0.5U	<0.5U	<0.5U

MW-40-32	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	0.98J	0.94J	1.2
VC	0.55J	0.88J	0.54J

IW-10	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	0.84J	0.64J	0.47J
DCE	1.3	1.3	0.89J
VC	0.90J	1.6	0.53J

MW-40-08	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	42	25	15
VC	1.4	1.7	1

MW-40-22	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	0.96J	1.1	1.0
VC	0.72J	1.3	1.3

MW-40-25	Water		
	2012	2013	2014
PCE	<0.5U	NS	NS
TCE	<0.5U	NS	NS
DCE	<0.5U	NS	NS
VC	0.72J	NS	NS

MW-40-27	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	0.84J	0.96J	1.1
DCE	<0.5U	<0.5U	<0.5U
VC	0.61J	0.53J	0.60J

MW-40-14	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	1.5	1.2	5.5
DCE	2.7	3	11
VC	3.6	3.5	3.2

MW-40-35	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	<0.5U	<0.5U	<0.5U
DCE	1.3	0.99J	0.58J
VC	<0.5U	0.34J	<0.5U

MW-40-34	Water		
	2012	2013	2014
PCE	<0.5U	NS	NS
TCE	<0.5U	NS	NS
DCE	<0.5U	NS	NS
VC	<0.5U	NS	NS

MW-40-36	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	0.41J	0.80J	2.4
DCE	1.4	2.8	10.0
VC	1.2	1.6	4.6

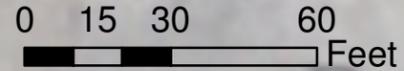
IW-18	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	1.8	1.3	0.84J
DCE	0.73J	0.75J	0.70J
VC	0.95J	0.50J	0.96J

MW-40-37	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	0.81J	0.48J	<0.5U
DCE	37	33	33
VC	3.9	4.9	4.8

MW-40-07	Water		
	2012	2013	2014
PCE	<0.5U	<0.5U	<0.5U
TCE	0.46J	1.9	0.44J
DCE	0.89J	2.8	1.5
VC	0.98J	7.5	1.3

FIGURE 1
 COC CONCENTRATIONS FOR SELECT GROUNDWATER, INJECTION AND VAPOR WELLS - DECEMBER 2014

IRP Site 40
 Naval Weapons Station Seal Beach
 Seal Beach, California



Source: Esri, DigitalGlobe, GeoEye, i-cubed,



ANALYTICAL NOTES:
 Water results are reported in ug/L
 U = Not detected at level shown
 J = Estimated value between detection limit and reporting limit
 NA = Not Analyzed
 PCE = Tetrachloroethene
 TCE = Trichloroethene
 DCE = cis-1,2-Dichloroethene
 VC = Vinyl Chloride

LEGEND

- Shallow-Interval Monitoring Well
- Middle-Interval Monitoring Well
- Injection Well
- TCE_Contours_2014 *TCE Contours 2014 Action Limit is 5.0 ug/L*
- DCE_Contours_2014 *DCE Contours 2014 Action Limit is 6.0 ug/L*

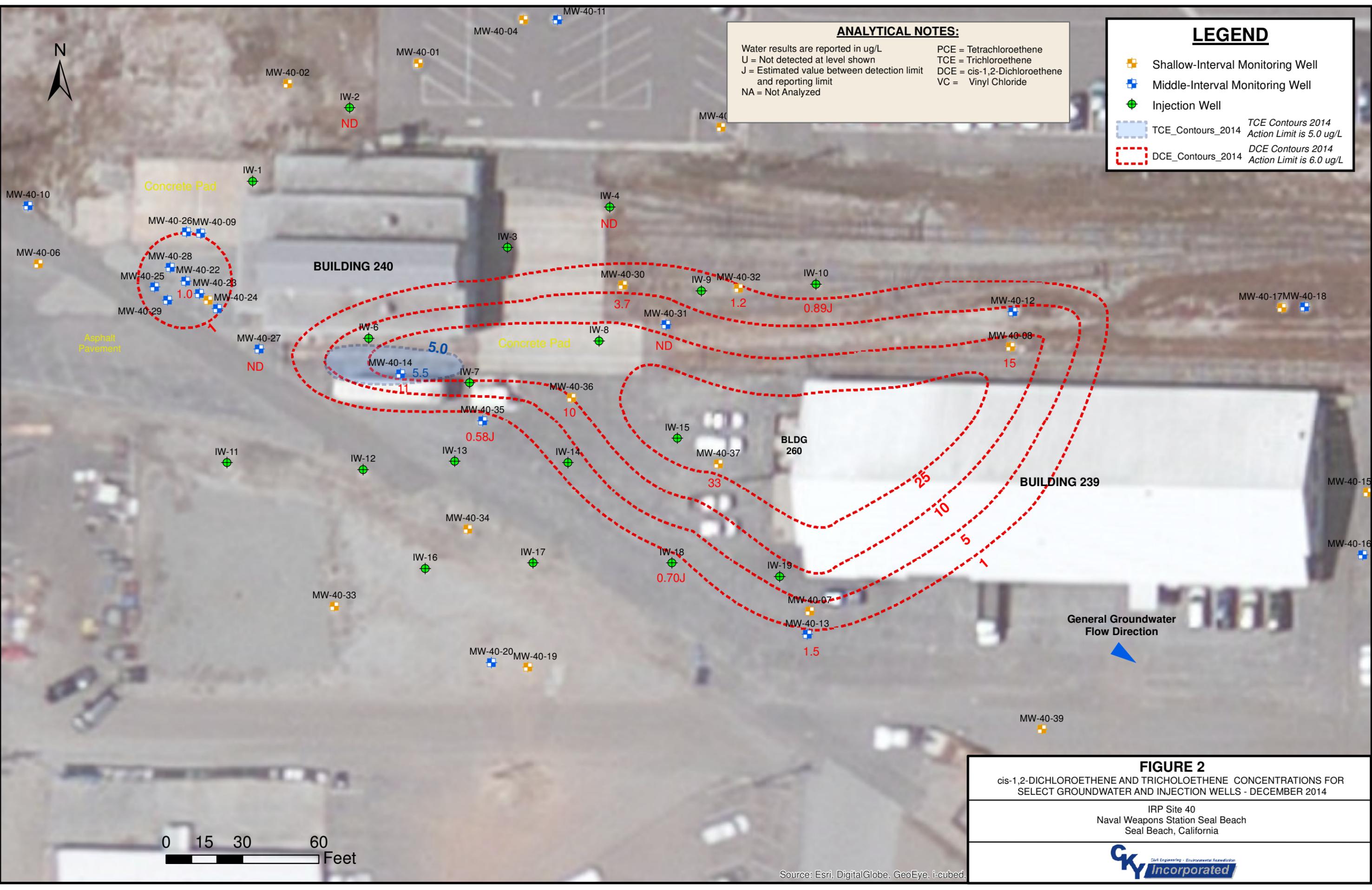


FIGURE 2
 cis-1,2-DICHLOROETHENE AND TRICHOLOETHENE CONCENTRATIONS FOR SELECT GROUNDWATER AND INJECTION WELLS - DECEMBER 2014
 IRP Site 40
 Naval Weapons Station Seal Beach
 Seal Beach, California



Source: Esri, DigitalGlobe, GeoEye, i-cubed,

ANALYTICAL NOTES:
 Water results are reported in ug/L
 Vapor results are reported in ppb (v/v)
 Methane results are reported in %/vol
 U = Not detected at level shown
 J = Estimated value between detection limit and reporting limit
 NA = Not Analyzed

PCE = Tetrachloroethene
 TCE = Trichloroethene
 DCE = cis-1,2-Dichloroethene
 VC = Vinyl Chloride

LEGEND

- Shallow-Interval Monitoring Well
- Middle-Interval Monitoring Well
- Injection Well
- VC_Contours_2014 *VC Contours 2014 Action Limit is 0.50 ug/L*

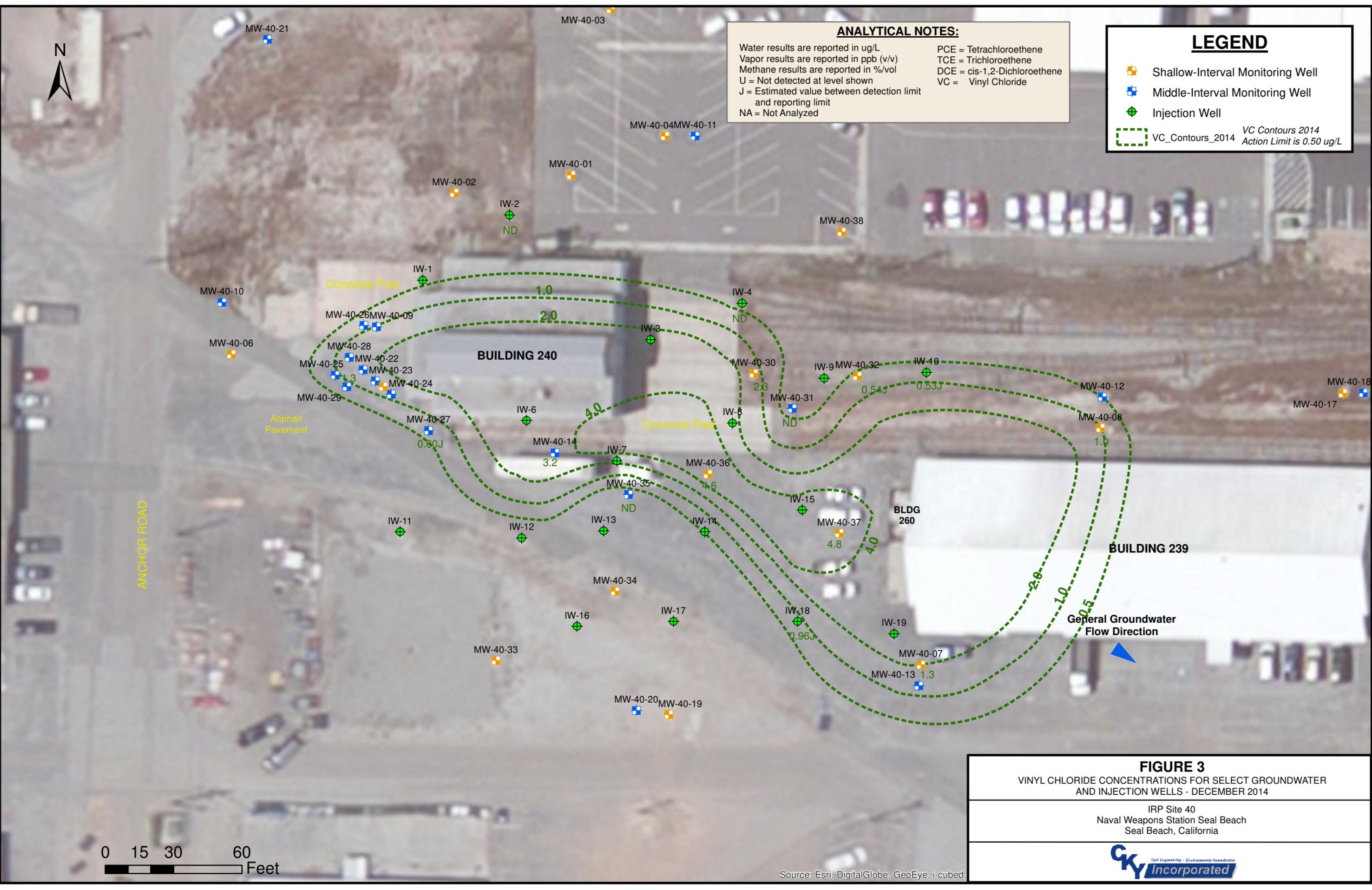


FIGURE 3
 VINYL CHLORIDE CONCENTRATIONS FOR SELECT GROUNDWATER AND INJECTION WELLS - DECEMBER 2014

IRP Site 40
 Naval Weapons Station Seal Beach
 Seal Beach, California



Source: Esri, DigitalGlobe, GeoEye, i-cubed,



ANALYTICAL NOTES:
 Vapor results are reported in ug/m3
 U = Not detected at level shown
 J = Estimated value between detection limit and reporting limit
 * = Qualified due to lab contamination
 ns = Not Sampled

PCE = Tetrachloroethene
 TCE = Trichloroethene
 DCE = cis-1,2-Dichloroethene
 VC = Vinyl Chloride

Results in red are > DTSC Industrial Screening Levels

LEGEND

● Ambient/Building Air Sampling Location

Building 240			
B240AA-2	Feb. 15	Apr. 15	Jul. 15
PCE	2.6	ns	0.28
TCE	0.38	ns	0.048J
DCE	0.025U	ns	0.025U
VC	0.016U	ns	0.016U

Ambient Air			
S40AA-2	Feb. 15	Apr. 15	Jul. 15
PCE	3.6	0.15U	0.49
TCE	0.37	0.034U	0.041J
DCE	0.038U	0.025U	0.025U
VC	0.024J	0.016U	0.016U

Building 239			
B239AA-1	Feb. 15	Apr. 15	Jul. 15
PCE	0.71	ns	0.19
TCE	0.11	ns	0.056J
DCE	0.025U	ns	0.025U
VC	0.016U	ns	0.016U

Ambient Air			
S40AA-1	Feb. 15	Apr. 15	Jul. 15
PCE	2.6	ns	0.57
TCE	0.28	ns	0.018J
DCE	0.025U	ns	0.025U
VC	0.010J	ns	0.016U

Concrete Pad

BUILDING 240
 B240AA-1
 B240AA-2

S40AA-2

Asphalt Pavement

Concrete Pad

Building 240			
B240AA-1	Feb. 15	Apr. 15	Jul. 15
PCE	3.1	ns	0.38
TCE	0.27	ns	0.089J
DCE	0.034U	ns	0.025U
VC	0.022U	ns	0.016U

ANCHOR ROAD

Building 239			
B239AA-2	Feb. 15	Apr. 15	Jul. 15
PCE	2.2	ns	0.21
TCE	0.25	ns	0.034U
DCE	0.025U	ns	0.025U
VC	0.016U	ns	0.016U

B239AA-1

B239AA-2

B239AA-3

B239AA-4

BUILDING 239

Building 239			
B239AA-4	Feb. 15	Apr. 15	Jul. 15
PCE	2.9	ns	0.19
TCE	0.28	ns	0.20
DCE	0.029U	ns	0.025U
VC	0.019U	ns	0.016U

S40AA-3

Ambient Air			
S40AA-3	Feb. 15	Apr. 15	Jul. 15
PCE	1.6	0.14U	5.1
TCE	0.26	0.034U	0.35
DCE	0.025U	0.025U	0.037J
VC	0.0095J	0.016U	0.016U

Building 239			
B239AA-3	Feb. 15	Apr. 15	Jul. 15
PCE	2.7	ns	0.091J
TCE	0.26	ns	0.045J
DCE	0.026U	ns	0.025U
VC	0.017U	ns	0.0087J

S40AA-4

Ambient Air			
S40AA-4	Feb. 15	Apr. 15	Jul. 15
PCE	34	0.17U	0.43*
TCE	87	0.10J	0.26*
DCE	4.2	0.015J	0.17*
VC	0.12	0.016U	0.12*

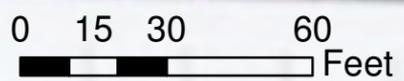


FIGURE 4
 AMBIENT AIR SAMPLING RESULTS - 2015

IRP Site 40
 Naval Weapons Station Seal Beach
 Seal Beach, California

ANALYTICAL NOTES:
 Water results are reported in ug/L
 Vapor results are reported in ug/m3
 Methane results are reported in %/vol
 U = Not detected at level shown
 J = Estimated value between detection limit and reporting limit

PCE = Tetrachloroethene
 TCE = Trichloroethene
 DCE = cis-1,2-Dichloroethene
 VC = Vinyl Chloride

LEGEND

- Shallow-Interval Monitoring Well
- Middle-Interval Monitoring Well
- Soil Vapor Monitoring Well
- Injection Well

IW-3	Vapor		
	2012	2013	2014
PCE	<2.71U	1.90J	10
TCE	3.87J	5.40	7.1
DCE	9.10	8.70	8.4
VC	614	434	440
Methane	41.8	20.7	9.9

MW-40-32	Vapor		
	2012	2013	2014
PCE	81.4	29.2	45
TCE	30.6	23.6	33
DCE	55.4	5.90	7.6
VC	81.9	0.90J	2.1
Methane	5.28	<0.25U	<0.18U

VW-40-04	Vapor		
	2012	2013	2014
PCE	454	278	691
TCE	4.08	3.20	20
DCE	<0.79U	<0.80U	5.7
VC	<1.28U	<1.30U	1.1
Methane	<0.25U	<0.25U	<0.25U

IW-1	Vapor		
	2012	2013	2014
PCE	31.9	24.4	9,003
TCE	537	494	466
DCE	1,307	991	23
VC	2,406	1,278	9.4
Methane	11.2	3.71	<0.61U

VW-40-02	Vapor		
	2012	2013	2014
PCE	156	13.6	138
TCE	2,866	64.5	542
DCE	2,960	3,686	311
VC	4,608	4,344	2,084
Methane	39.1	31.9	13.1

VW-40-03	Vapor		
	2012	2013	2014
PCE	52.9	20.3	4,153
TCE	2,578	1,074	658
DCE	4,752	1,942	971
VC	2,816	3,066	3,391
Methane	54.8	51.3	40.6

MW-40-37	Vapor		
	2012	2013	2014
PCE	8.14J	31.9	69
TCE	118	107	88
DCE	325	476	352
VC	1,203	639	443
Methane	41.3	18.4	4.0

VW-40-06	Vapor		
	2012	2013	2014
PCE	16.3	15.6	1,315
TCE	145	118	181
DCE	151	87	154
VC	486	358	391
Methane	44.5	19.3	6.4

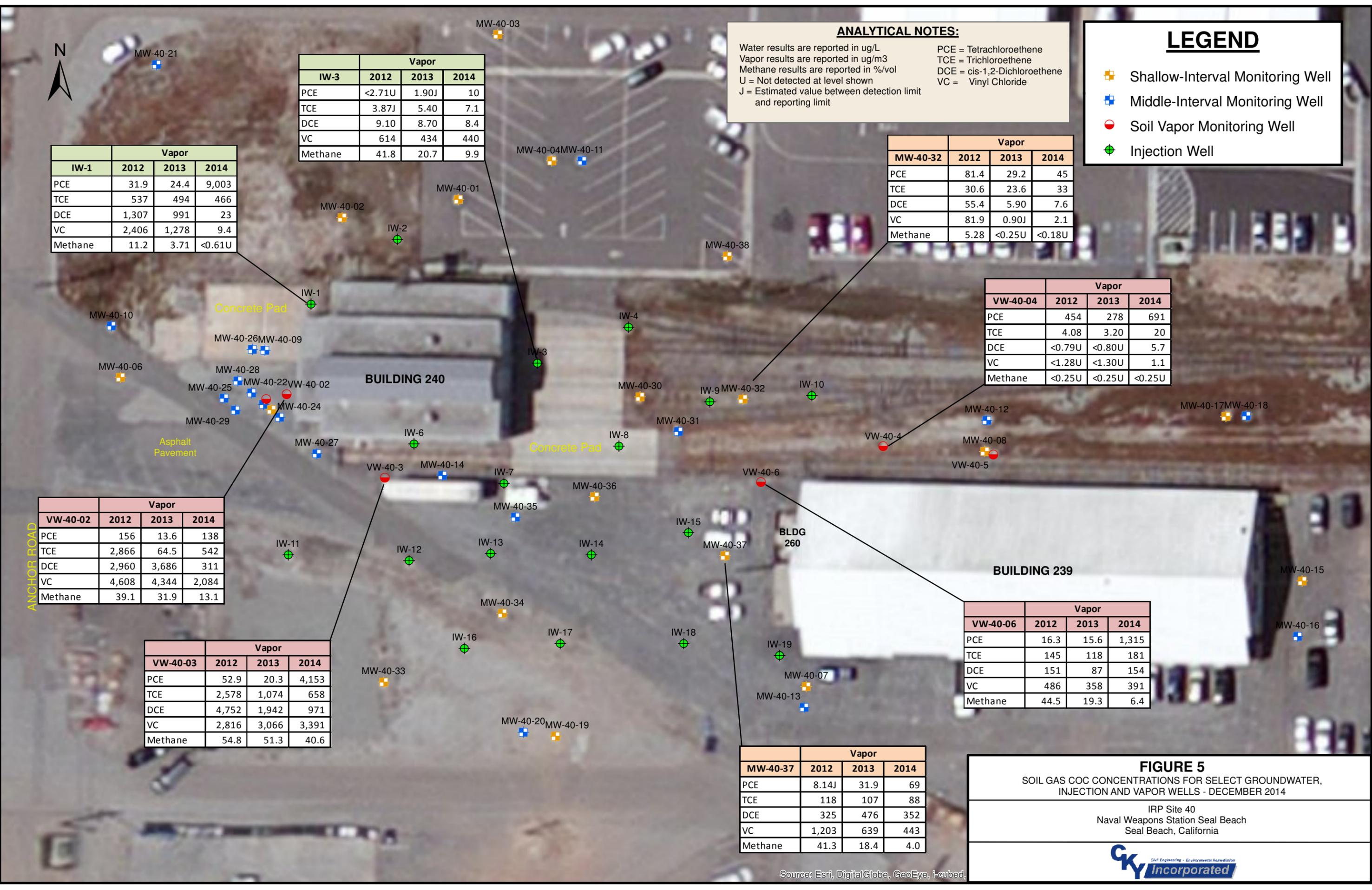


FIGURE 5
 SOIL GAS COC CONCENTRATIONS FOR SELECT GROUNDWATER, INJECTION AND VAPOR WELLS - DECEMBER 2014

IRP Site 40
 Naval Weapons Station Seal Beach
 Seal Beach, California



Source: Esri, DigitalGlobe, GeoEye, i-cubed.

APPENDICES

**APPENDIX A
LABORATORY DATA**

(included on CD)