

# Chemical Plant Restoration Beneficial Reuse

## CALIBRE

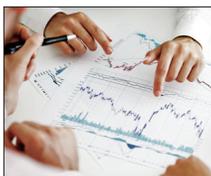
Our Success Follows Yours

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### About CALIBRE

Founded in 1989, CALIBRE Systems Inc. is an employee-owned management consulting and technology services company supporting government and industry. CALIBRE is committed to the success of our clients, and delivers enduring solutions that solve management, technology, and program challenges.

### Solutions That Make a Difference

We work in multidisciplinary teams, partnering with you to deliver practical, timely, best value solutions that solve your management, technology, and program challenges and help you achieve your business objectives. This collaborative work style helps produce the results you seek – today and where you want to be tomorrow.

### Project Background

>> *The Fox Avenue Site, located in an industrial area near the Lower Duwamish Waterway in south Seattle, was historically used as a bulk chemical repackaging and distribution facility that supplied tetrachloroethene (PCE) to Dry Cleaners throughout the Northwest. CALIBRE was hired to characterize, design, and implement a remedy for contaminated groundwater emanating from a dense non-aqueous phase liquid (DNAPL) release of tetrachloroethene (PCE) at the Site. Prior remedial efforts (initiated by others) between 1995 and 2008 had been largely ineffective with no real progress towards reaching the required site cleanup goals. CALIBRE was retained under a Remediation Cost Cap (RCC) insurance policy with a very aggressive schedule to meet the regulatory requirements and policy coverage period.*

### Benefits to the Client

>> *Since joining this project, CALIBRE has successfully established the critical biological treatment zones that have reduced contamination in groundwater by 99.98% from the historical baseline levels. These bio-treatment zones, implemented before the start of source-area treatment/removal, have met the required cleanup levels at the point-of-compliance several years ahead of the schedule required in the cleanup action plan.*

### PROJECT SUMMARY

The Fox Avenue project is located at a chemical distribution facility in Seattle, Washington approximately 600 feet from the Lower Duwamish Waterway (LDW) Superfund site (Figure 1).

A prior property owner used the facility for distribution of tetrachloroethene (PCE) including the re-packaging of PCE from railcars into drums and delivery to Dry Cleaners. On-site spills resulted in the release of PCE to groundwater as a DNAPL. Elevated levels of chlorinated volatile organic compounds (CVOCs), with concentrations in groundwater exceeding 50,000 ug/L were first identified in soil and groundwater at the site in the early 1990s. The contaminants identified in the VOC plume were PCE and degradation daughter products [trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC)].

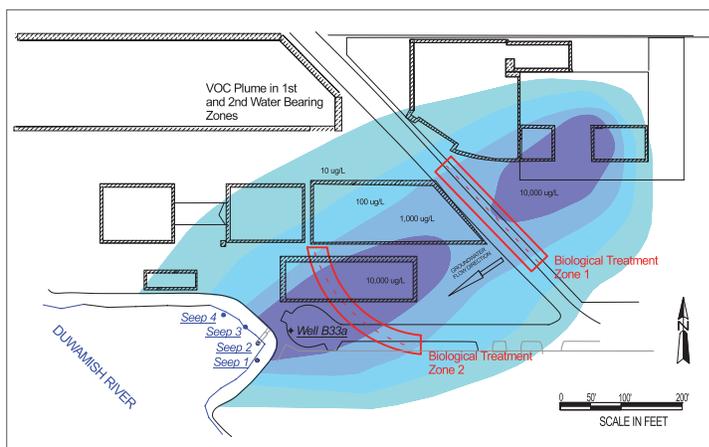


Figure 1 – Site map showing initial phase Enhanced Reductive Dechlorination (ERD) treatment areas and four seeps at the point of compliance.

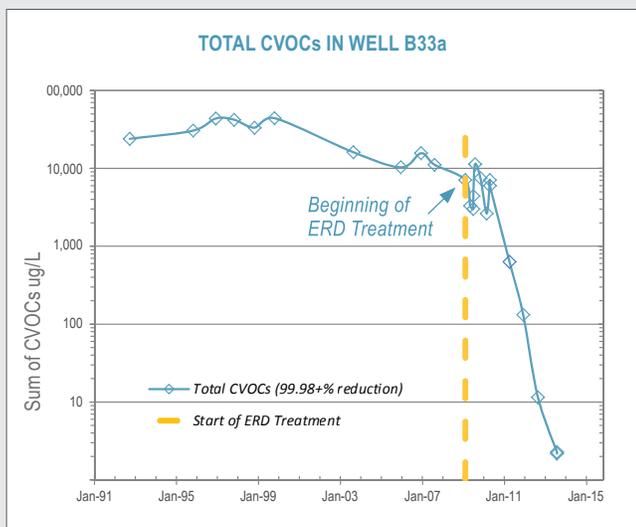


Figure 2 – Concentration trends at a monitoring well at the point of discharge to the Lower Duwamish Waterway.

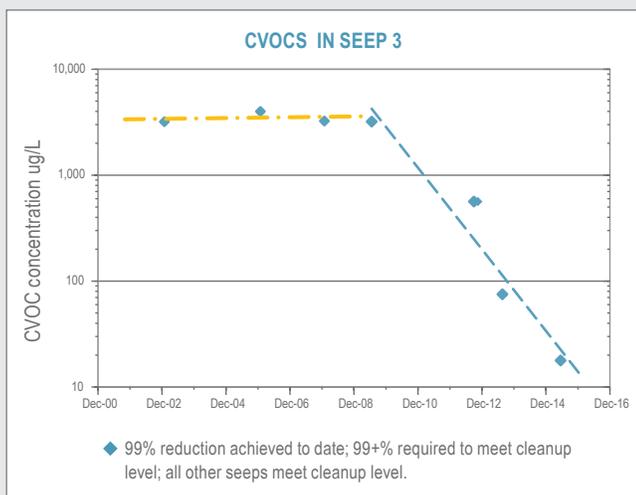


Figure 3 – CVOC Concentration in Seep SP-3

CALIBRE’s role in the project started as an Interim Action (IA) in a Feasibility Study (FS); based on the initial performance data, biological treatment was expanded to plume- wide remediation in all down-gradient areas and has achieved 99+% reductions in CVOCs in many areas, including the point of compliance.

Since the initial discovery of a release, investigations and various remedial actions commenced in the early 1990s and continued through 2008. The previous remediation approaches led to some CVOC mass removal but made no real progress in reaching the required cleanup standards.

CALIBRE was hired in 2009 by the property owner to demonstrate biological treatment within the plume, work with the Washington State Department of Ecology for approval of a RI/ FS and a Cleanup Action Plan, and implement full-scale remedial actions throughout the plume. The biological treatment approach was initiated as part of Interim Actions (IA) to mitigate the risk presented by VOCs in the site groundwater down-gradient of the main source area. The IA objective was to create a groundwater treatment zone that would fully degrade VOCs before discharging to the waterway. CALIBRE chose to meet this objective by treating the targeted plume areas using Enhanced Reductive Dechlorination (ERD), an in-situ treatment technology that promotes accelerated degradation of CVOCs by stimulating biological populations. CALIBRE installed groundwater injection wells within the central portions of the plume where concentrations exceeded 10,000 ug/L (Figure 1).

At these treatment areas CALIBRE optimized geochemical conditions by injecting food grade solutions (a substrate for the bacteria) in order to promote accelerated remediation using enhanced reductive dechlorination (ERD). The bacteria are naturally occurring in groundwater and CALIBRE’s ERD approach significantly increased the CVOC contaminant biodegradation rate meeting the required cleanup levels at the Waterway. Based on the success of the initial phase of ERD treatment, CALIBRE expanded the treatment zones to implement plume-wide remediation in the down-gradient areas. Since the expansion of the treatment areas, performance monitoring data show many areas with over 99% reductions in total CVOCs (Figure 2).

The cleanup requirements include four visible groundwater seeps located in the Waterway where the CVOC plume discharges to the LDW. This area is the point of compliance and has been sampled over the course of the project during low tides. For the four groundwater seeps, three have met the cleanup criteria established in the cleanup action plan. The final location is above standards but has demonstrated a 99% reduction to date, and concentrations have shown continued decline towards the cleanup goals (Figure 3). The levels of CVOCs measured at many wells are below remediation levels and are approaching project cleanup standards which will meet the cleanup action plan requirements several years ahead of schedule.

Work completed by CALIBRE on this project has included: 1) project scoping/planning based on data quality objectives (DQOs) to identify data gaps and develop project work plans; 2) remedial investigation and feasibility study (RI/FS); 3) implementation of interim actions that were later expanded to plume-wide treatment; and 4) site-wide monitoring and reporting. The project has successfully completed all regulatory requirements with State approval while simultaneously allowing property re-use as a chemical distribution facility.