Silvex

State Road 16, 8 miles west of Interstate Highway 95; near Elwood, Florida
County: St. Johns
District: Northeast
Site Lead: Waste Cleanup Program
Approved for Cleanup: May 4, 1987
ERIC ID # 3825

Site Description and History

The Silvex Corporation site is located on State Road 16 in St. Johns County in a low density rural area in Township 06S, Range 28E, Section 30 at 29° 58′ 33.0680″ N, 81° 31′ 12.7801″ W. Silvex consisted of a plant located on one acre in the southeast corner of 32 acres of land.

The Silvex Corporation was a silver smelting operation that recovered metals from waste x-ray film. The facility utilized waste solvents for fuel, which were transported from the Jacksonville Naval Air Station by Pepper Industries. The waste solvent fuel was stored in a 25,000 gallon tank outside the plant fence adjacent to the facility. Reportedly, as a result of vandalism in December 1981, a spill from the storage tank occurred and flowed overland approximately 200 feet.

Threat

The results of investigations conducted at the site indicated that the groundwater contained aromatic, alkene, and alkane compounds above their respective maximum contaminant levels. The soil contained metals (cadmium, chromium, copper, lead, nickel, silver, and zinc) in elevated concentrations.

Response Strategy and Status (July 2021)

In 1982, shortly after learning of the spill and conducting testing, the Florida Department of Environmental Regulation (FDER, now DEP) filed suit against the facility owners and operators. The FDER amended its complaint by adding the Navy and Pepper Industries as potentially responsible parties; both parties filed motions to dismiss. In January 1985, the court granted the Navy's motion. Pepper Industries later filed for bankruptcy.

In May 1983, FDER removed 4,500 gallons of liquid waste solvents from the onsite storage tank and transported the waste to a federally approved hazardous waste disposal facility. Approximately 5,000 gallons of sludge in the tank could not be removed at that time. In April 1984, the continuing deterioration of the storage tank required FDER to take steps for groundwater protection in the event a tank leak occurred. A large hole was sealed in the upper end of the storage tank, and a lined perimeter ditch was installed to contain any contaminants leaking from the tank. In June 1984, the storage tank was cut open, and all waste sludge was removed and transported to a federally approved hazardous waste disposal facility.

Ecology and Environment (E&E) conducted a Contamination Assessment (CA) in 1985, which evaluated the levels of contamination in soil and creek water, and approximated the extent and character of the contamination plume in the surficial aquifer. The results indicated that the less

mobile compounds remained in the area formerly occupied by the 25,000-gallon storage tank. The more volatile materials migrated to the west. Shallow soil areas contained metals and organic compounds which were above background levels. The two deeper monitoring wells, MW2 (26 to 36 feet) and MW1 (46.5 to 56.5 feet) were contaminated with five organic compounds. The shallow well (8 to 18 feet) was entirely free of organics. Surface water in the creek did not appear to be affected.

The enforcement case was settled in June 1986, and court-ordered site access was granted to FDER for the purpose of conducting necessary remedial activities. DEP holds a lien against the portion of the property that is contaminated. At the discretion of DEP, that portion of the property will be sold and DEP will receive the proceeds from the sale.

An additional field investigation was completed by E&E in December 1986, which delineated the extent of contamination in the deeper portions of the surficial aquifer. A partial Risk Assessment was completed in January 1988, which established cleanup goals for contaminated soils and groundwater at the site. A Feasibility Study was completed in September 1988, which assessed remedial alternatives for site cleanup. The selected remedial alternative included soil solidification/fixation and physical/biological treatment of the contaminated groundwater.

In October 1989, FDER tasked E&E to complete a Design for Soil Solidification, and a draft design was submitted in March 1990. Multiple revisions were required by FDER, and the final design and bidding services work plan was submitted to the FDER in April 1991.

The FDER tasked E&E to develop a pilot study work plan for groundwater treatment and to conduct a groundwater odor investigation. An odor investigation was necessary due to strong odors arising from Ward's Creek. It was determined from a discharge investigation completed by E&E in March 1991 that the contaminants in Wards Creek had originated from the Silvex spill. Due to the difficulty in identifying the source of the odor, an additional odor investigation was completed in August 1991, which identified 4-mercapto-4-methyepenta-2-one (mercaptan) as the odor-causing contaminant. Mercaptan is used as an additive in natural gas in order to give off a detectable odor in the event of gas leaks. Mercaptan has no known long-term health effects, but can cause nausea and vomiting if present in sufficient concentrations.

In December 1991, the pilot study work plan was completed and FDER tasked E&E to perform a Pilot Bioremediation Study Investigation to determine the effectiveness of bioremediation as a remedial alternative for contaminated groundwater. In October 1992, E&E submitted a Draft 10% Design Report revision for groundwater treated through the Bioremediation system. In November 1992, E&E was tasked to sample soils to determine locations for additional recovery wells.
In June 1993, the FDER completed a Decision Memo to implement bioremediation as part of an Initial Remedial Measures (IRM). The IRM objective was to reduce the potential for migration of contaminated groundwater into Ward's Creek. The IRM design, installation, and startup were implemented on a 10-week schedule and began operation in September, 1993. In April 1994, eight sandpoints were installed along the edge of Ward's Creek to monitor groundwater contamination flowing towards the creek. A mounded infiltration gallery was also built for site specific disposal of treated bioremediation system effluent.

In August 1994, E&E successfully completed the excavation and removal of approximately 700 tons of chromium-contaminated soil from the Silvex site.

In July 1995, E&E completed a sandpoint well investigation to delineate migration of the contaminant plume into Wards Creek. As a result, a fifth recovery well was installed at the most recently defined frontal plume edge in November 1995. In May 1999, additional sandpoints were installed along Ward's Creek to monitor plume movement.

In March 1996, University of Waterloo staff conducted a hydropunch study to complete a vertical profile of the groundwater contamination. This profile evaluation provided data, which has improved the recovery of contaminants. Reduction in the screened intervals of recovery wells was accomplished, and decreased the amount of uncontaminated groundwater entering the bioremediation treatment system.

In October 1997, three shallow wells were constructed and a groundwater pumping system was developed for source area groundwater contamination, with treatment at the bioreactor. In September 1998, E&E submitted a phytoremediation proposal to the DEP for treatment of the shallow groundwater contamination in the source area. In July 1999, a modified version of the phytoremediation proposal was submitted for DEP consideration. In May 2000, DEP approved the modified phytoremediation proposal and a phytoremediation pilot study was begun at the site.

E&E also submitted a design modification to the IRM for preventing further migration of groundwater contamination flowing towards Ward's Creek. The design modification was approved by DEP in November 2000, and consisted of air sparging to form a barrier for intercepting the contaminants. Work was completed on the implementation of the design modification in April 2001. The IRM design modification operated successfully and prevented the further migration of groundwater contamination towards Ward's Creek. The trench system near Wards Creek was valved-off from the extraction system because of a break in the line. Once the trench system was valved-off, contaminant concentrations in the Ward's Creek area increased.

In August 2003, the system was modified to recover groundwater from shallower intervals within the aquifer in the phytoremediation area. Four temporary monitoring wells were installed to monitor the effectiveness of the dual phase extraction system.

At the beginning of the IRM, the highest groundwater contaminant concentrations were phenols and ketones. These contaminant concentrations are presently below the site remedial action goals. Volatile organic compounds (VOCs) account for any current groundwater criteria exceedances at the site. In the Ward's Creek area, all semi-volatile organic compound (SVOC) concentrations were below criteria except for bis-2-ethylhexyl phthalate. In December 2005, a small-scale lactate injection was performed within the source area to determine if bio-stimulation would be an effective remedial alternative at the site. Little to no change was seen in contaminant concentrations following the lactate injection.
The liquid ring pump operating the bio-treatment system failed in January 2006, and the treatment system has been non-operational since that time. DEP decided to conduct the regularly scheduled

semi-annual sampling event in March 2006 before deciding whether to repair and restart the treatment system. The semi-annual sampling report was received in April 2006, and showed that VOC and SVOC concentrations remained relatively unchanged across the site but had actually increased within two recovery wells located in the source area.

The trees planted for the phytoremediation pilot study were slated for removal in the fall of 2006 as specified in the pilot study workplan. However, the tree removal activities were suspended based upon the review of the April 2006 semi-annual and August 2006 annual sampling reports.

In March 2007, additional assessment activities were performed in the source area with a Membrane Interface Probe (MIP). The objective was to map the vertical and horizontal contaminant data to determine remedial options at the site. Contaminant concentrations of toluene, total xylenes, ethylbenzene, methylene chloride, TCE and cis-1,2-dichlorothene were detected in excess of their respective groundwater cleanup target levels (GCTLs). The remaining groundwater plume in the source area was approximately 45 ft wide by 330 ft long and extended from approximately 4 to 35 ft below ground surface. E&E recommended the implementation of an air sparging and soil vapor extraction system to remediate the contamination within the source area. The Remedial Action Plan (RAP) and design for the air sparging and soil vapor extraction system to address the remaining source area soil and groundwater contamination was received by DEP in December 2007.

Design of the recommended remedy (air sparging and soil vapor extraction) was determined by DEP to be unsatisfactory, and the site was transferred to another contractor, Geosyntec Consultants, Inc., in late 2008. In 2009, Geosyntec commenced additional assessment activities to recommend a suitable remedial alternative. Geosyntec submitted a Supplemental Site Assessment report (SSAR) in December 2009, which recommended: additional direct-push groundwater sample collection to delineate the horizontal extent of the dissolved alkene plume; potable well sampling within ¼ mile of the site to evaluate the residential well water quality; and remediation of the onsite source area via excavation and off-site disposal of the contaminated soils. Geosyntec submitted a Design in late 2009, discussing implementation of the soil excavation recommendations. In March 2010, the potable well sampling was completed with no detections of 1,4-dioxane or VOCs.

In May 2010, the Geosyntec Interim Source Removal Plan for source area soil excavation was approved and tasked. The source area soil excavation activities began in September 2010 and were completed in November 2010. The trees planted for the 2000 phytoremediation pilot study, along with the remaining onsite equipment from the original bio-remediation remedy, were removed, characterized, and disposed of prior to beginning the excavation. A total of 4,683 tons of contaminated soil was excavated from two onsite locations and disposed of as non-hazardous waste. In February 2011, Geosyntec conducted additional groundwater assessment activities to delineate the horizontal extent of the dissolved groundwater plume at the site. The primary contaminant of concern is 1,4-dioxane. 1,4-Dioxane was detected off-site in groundwater samples collected using direct-push technology.

In June 2011, Geosyntec submitted a Supplemental SAR presenting the results and conclusions of the February 2011 groundwater assessment activities. The dissolved 1,4-dioxane groundwater plume is generally delineated to the north, east, and west, and extends to a vertical depth of approximately 60 ft bls. Eight additional offsite monitor wells were installed and sampled in December 2011 to form a network to monitor the dissolved VOC and 1,4-dioxane plumes. Data from the Year 1 Post Active Remediation Groundwater Monitoring Report indicated TCE and VC concentrations above GCTLs in three monitor wells west of the site towards Wards Creek. One well onsite had a TCE concentration above the GCTL. TCE and TCE dechlorination products were not detected above their respective GCTLs in the remaining monitor and recovery wells. One recovery well exhibited a total xylene concentration above the GCTLs and a toluene concentration above both the GCTL and NADC. The greatest 1,4-dioxane concentration was detected near the entrance to the site, and two additional offsite monitor wells were installed in December 2011. Groundwater analytical data indicated the presence of 1,4-dioxane off site in concentrations below the GCTL in one off site monitor well. The 1,4-dioxane plume is now delineated to the south. As a precaution, surrounding potable wells within ½ mile of the site were also sampled in June 2012 for 1,4-dioxane, and the contaminant was not detected.

In January 2103, Geosyntec submitted the Year 2 Post Interim Source Removal Groundwater Monitoring Report. Prior to the groundwater sampling event, one monitor well was installed off site to the east and sampled for 1,4-dioxane. 1,4-dioxane was not detected; the 1,4-dioxane plume is now delineated to the east. The horizontal and vertical extent of the 1,4-dioxane plume exceeding the GCTL is now delineated and extends slightly offsite. Analytical data from the 2013 groundwater sampling event mirrored that of the 2012 sampling event, indicating the 1,4- dioxane plume is stable.

Laboratory analytical data for TCE and vinyl chloride indicate concentrations above GCTLs in the 50 to 60 ft depth interval onsite and along Wards Creek. The data also indicated the presence of a dissolved toluene and total xylenes plume onsite in the 20 to 25 ft depth interval. Concentrations of total xylenes were detected above the GCTL while toluene concentrations were detected below the GCTL. Both toluene and total xylenes concentrations significantly decreased from the concentrations detected during the previous sampling event.

The seven wells which exhibited GCTL exceedances during this sampling event will continue to be monitored annually. The thirteen wells which exhibited no GCTL exceedances during this sampling event will be monitored biennially.

In April 2016 Geosyntec submitted the Year 5 Post Interim Source Removal Groundwater Monitoring Report. TCE concentrations exceeding the GCTL appear to be isolated near monitoring well MW019. Offsite vinyl chloride contamination in the 50 to 60 ft bls appear to be shrinking based on 2016 groundwater data. The vinyl chloride plume is not fully delineated west of monitoring well MW021, however, there is no additional assessment recommended at this time based on the low concentrations. The exceedances of 1,4-dioxane generally occur below 30 ft bls. The exceedances were slightly above the GCTL (3.2 µg/L).

In March 2017 Geosyntec submitted the Year 6 Post Interim Source Removal Groundwater Monitoring Report. The exceedances of 1,4-dioxane generally occur below 30 ft bls. The exceedances were slightly above the GCTL (3.2 µg/L). During sampling, it was discovered damage to the property had occurred. In April 2017 repairs were made to MW011, retrofitting it with a flush mount; and to fencing surrounding the property, with debris being removed and site restored to previous conditions.

The Year 7 Post Interim Source Removal Groundwater Monitoring Report was submitted March 2018. TCE concentrations exceeding the GCTL (3 µg/L) appear to be isolated near monitoring well MW019 (14 µg/L). TCE groundwater impacts are fully delineated and stable following the ISR. 1,4-dioxane concentrations observed during the Year 7 post-ISR groundwater sampling event decreased from those detected during the previous post-ISR groundwater sampling event. 1,4-Dioxane groundwater impacts are delineated with the exception of the area to the northeast of the enclosed property boundary.

The Year 8 Post Interim Source Removal Groundwater Monitoring Report was submitted April 2019. TCE concentrations and 1,4-dioxane concentrations exceeding GCTLs remain similar to locations and concentrations in the previous report. MW018 was added to the annual sampling plan to monitor 1,4-dioxane concentrations along the northeast enclosed Site property boundary.

The Year 9 Post Interim Source Removal Groundwater Monitoring Report was submitted April 2020. Site characteristics appear to remain stable as a result of the ISR performed in 2010. Limited reductive dichlorination and abiotic process continue to act on the contaminant plume.

Schedule

Groundwater contaminant concentrations for VOCs and 1,4-dioxane will continue to be monitored annually.