



## SPAR PROGRAMS

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## RIVER TERRACE RV PARK



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**Status:** Active

**Database Name:** River Terrace RV Park

**Location:** Soldotna, Alaska

**Latitude/Longitude:** See database entry

**DEC Contaminated Sites contact:** [Robert Weimer](#), Project Manager, 907-269-7525

Contact updated: Jan. 27, 2014

### PDF Version

Summary updated: Jan. 31, 2014

Click on photos or maps for larger versions.

### DESCRIPTION

The River Terrace RV Park site is located on the banks of the Kenai River in downtown Soldotna. It operated as a dry cleaning facility from the 1960s to the 1980s and is currently a recreation vehicle parking area.

In 1992, the Alaska Department of Environmental Conservation investigated a complaint regarding leaking barrels at the site and discovered 22 barrels containing used oil and other substances. One barrel was labeled "Perchloroethylene," a dry cleaning solvent also known as PCE. However, the nature and extent of the contamination wasn't discovered until 1997 – both the soil/sediment and groundwater were contaminated with perchloroethylene (PCE).

During the remediation (or cleanup) process, PCE degrades biologically in a process known as reductive dechlorination where PCE sequentially breaks down into trichloroethene (TCE), then cis-1,2-dichloroethene (DCE), then to vinyl chloride (VC), and finally to ethene, a harmless end product. The amounts of each chemical change as the breakdown occurs, as they have for River Terrace: as the amount of PCE decreased, the amount of TCE went up, and, as TCE went down, the amount of DCE went up, and so forth.

Once the extent and nature of the contamination was discovered in 1997, DEC contractors began soil cleanup activities that fall, and began groundwater cleanup work in the fall of 2000. The goal was to treat the contamination before it migrated into the Kenai River.

Because the contamination is linked to a dry cleaner, the U.S. Environmental Protection Agency, in addition to DEC, has oversight of the site and regulatory authority.



Workers inject Hydrogen Release Compound (HRC) around monitoring well No. 47 during the HRC treatment phase VI in August 2009 (see photos, above). HRC has been used at the River Terrace RV Park site to enhance the natural attenuation (primarily bioremediation) of PCE and its degradation products to treat the groundwater before it migrates off the River Terrace property.

In the top photo, the worker on the right pours the HRC, which has the consistency of honey at room temperature, into the hopper while the worker on the left uses a hose attached to the drill to inject the HRC – heated, so it's more fluid – underground. An instrument connected to the drill head has already pinpointed where the contamination is. The workers inject the HRC about every vertical foot in the groundwater area that's contaminated.

The contamination at the site can be broken down into six parts: (1) the groundwater, (2) the sediment (the soil in the river and on the banks of the river), (3) the pore water in that sediment (the water in the spaces between the soil particles), (4) the surface water in the Kenai River, (5) potential vapor intrusion of contaminant vapors into nearby and future structures, and (6) remaining contaminated soil.

Most of the injection holes are installed on a permanent basis with a perforated steel pipe underground and capped, so more HRC can be injected later if necessary. The view is facing north; the Sterling Highway is in the background, along with the building that's the former dry cleaner.

The bottom photo shows the site looking southeast with the Kenai River in the background. The HRC is in the white buckets. (DEC photos, August 2009)

Two contaminant groundwater plumes exist on the site. The division line between the two plumes is near where the former dry cleaner building is located, about 250 feet from the river. The upper plume flows with the groundwater toward the northeast. The lower plume flows with the groundwater to the southwest toward the Kenai River and extends to the river.

Contractors in 1996 excavated 600 yards of contaminated soil, and in 1997/1998 an additional 2,700 yards of soil. The soil in both excavations represents the major source of the soil contamination that was practical to excavate. The EPA issued a "Contained in" decision in March 2000, which allows the on-site management of the contaminated soils without triggering hazardous waste disposal requirements.

The excavated soil was subsequently treated, and was reused on-site in 2003. Some soil underneath the excavation, about 100 feet from the river, still has contamination in deep pockets (30 feet below ground surface) in the lower plume area.

DEC began monitoring the groundwater, sediment and river surface water in 1997, and began monitoring the pore water in 2004.

Beginning in 2000, DEC used a treatment technology called Hydrogen Release Compound (HRC) to treat the contamination in the groundwater by enhancing the natural attenuation (the natural breakdown of hazardous substances in the environment). The HRC is injected underground in the area of the groundwater that's contaminated (see caption for the photos, above).

The HRC was immediately effective in breaking down the PCE, but the degradation process stalled at the DCE stage – the contamination did not degrade further into the nontoxic ethene.

Because the contamination was persistent, DEC in 2002 did a study to see if the stall in the degradation process was caused by a lack of PCE-degrading bacteria or because the degradation process had used up the HRC that had been injected. In the study, DEC set up two test areas. In one area, the contractors added PCE-degrading bacteria; in another area, the contractors used HRC alone. The study results showed that while bioaugmentation (the injection of bacteria) sped up natural attenuation, HRC alone – without bioaugmentation – worked just as well.

That same year, in 2002, additional work in the lower plume area showed that the contamination remaining after the 1997/1998 excavation of 2,700 cubic yards was more extensive than previously thought. Elevated levels of contamination were found in the area of the deepest excavation (around monitoring well No. 44).

Between 2000 and 2004, DEC focused on using HRC to treat the bigger areas (HRC Treatment Phases I-III). Between 2005 and 2012, DEC focused on using HRC to treat the smaller "hot spots" in the remaining source area in the deeper lower plume (HRC Treatment Phases IV-VII).

Between April and June 2010, DEC conducted a vapor intrusion assessment that included the installation and sampling of 32 soil gas monitoring points; the collection of indoor air, outdoor air and sub-slab samples at the former dry cleaner building; and the collection of indoor air, outdoor air and crawl space samples at three nearby mobile homes.

Only the former dry cleaner building had indoor air sample results that exceeded screening levels for PCE and its degradation products. While there were exceedances for PCE and TCE in the former dry cleaner building, a 2010 assessment concluded that it's unlikely that there was a current unacceptable risk to human occupants at that time based on the current use of the building. (For instance, downstairs it's used only during spring and fall, primarily by occupants of the RV park for laundry/showers. Upstairs, it's used only during spring and fall as a fish processor, and the front door is open most of the time.) Because soil gas samples exceeded screening levels, the 2010 assessment concluded that there is the potential risk to future structures placed above or near the remaining contaminated areas.

Here is a rundown of monitoring results for the whole site:

Groundwater – The monitoring data from 1997 to 2013 show a significant decrease in contaminant concentrations in the groundwater at all areas of the site. Also, monitoring data from 1997 to 2010 show that the on-property drinking water well that draws water from a deeper aquifer is nondetect for PCE and its degradation products. In 2000, the property owners signed a legal agreement with the State of Alaska stating that they will not install any drinking water wells in the contaminated shallow unconfined aquifer of

the property.

Sediment – The monitoring data from 1997 to 2013 show a significant decrease in contaminant concentrations in the sediment.

Pore Water – The monitoring data from 2004 to 2013 show a significant decrease in contaminant concentrations in the pore water.

Surface water of the Kenai River – Since DEC began the HRC injections into groundwater in 2000, the samples from the water column of the river near the River Terrace site have all been below the surface water quality criteria for contamination (in this case, PCE and its degradation products). (Anything above the surface water quality criteria is considered to be harmful to fish and other organisms in the river.) Furthermore, the monitoring data from 2010 to 2013 show nondetects for the contamination.

Potential vapor intrusion of contaminant vapors into nearby and future structures – Based on the April to June 2000 vapor intrusion assessment mentioned earlier, there wasn't a current indoor air risk. But, because the soil gas samples exceeded screening levels, there's the potential risk to future structures placed above or near the remaining contaminated areas. In the 2000 legal agreement with the State of Alaska also mentioned earlier, the property owners agreed that before any new buildings are constructed in those areas, they would conduct appropriate vapor intrusion testing, and if necessary, install mitigation systems.

Contaminated Soil – Based on the site soil sampling data from 1996 to 2013, the remaining contaminated soil is mainly confined to deeper soil (30 feet below ground surface) on limited portions of site property. Institutional controls are in place to limit human exposure to those soils. (For more detail, see the August 2000 Record of Decision under "More Information" below.)

## PUBLIC HEALTH AND ENVIRONMENTAL CONCERNS

Groundwater and some soil contaminated with PCE and its breakdown products are the main threat to public health and the environment. The EPA lists PCE as highly toxic and a suspected human carcinogen. Avenues of human exposure have been blocked, so the area of concern is now to help protect the Kenai River – specifically its sediments – from contamination.

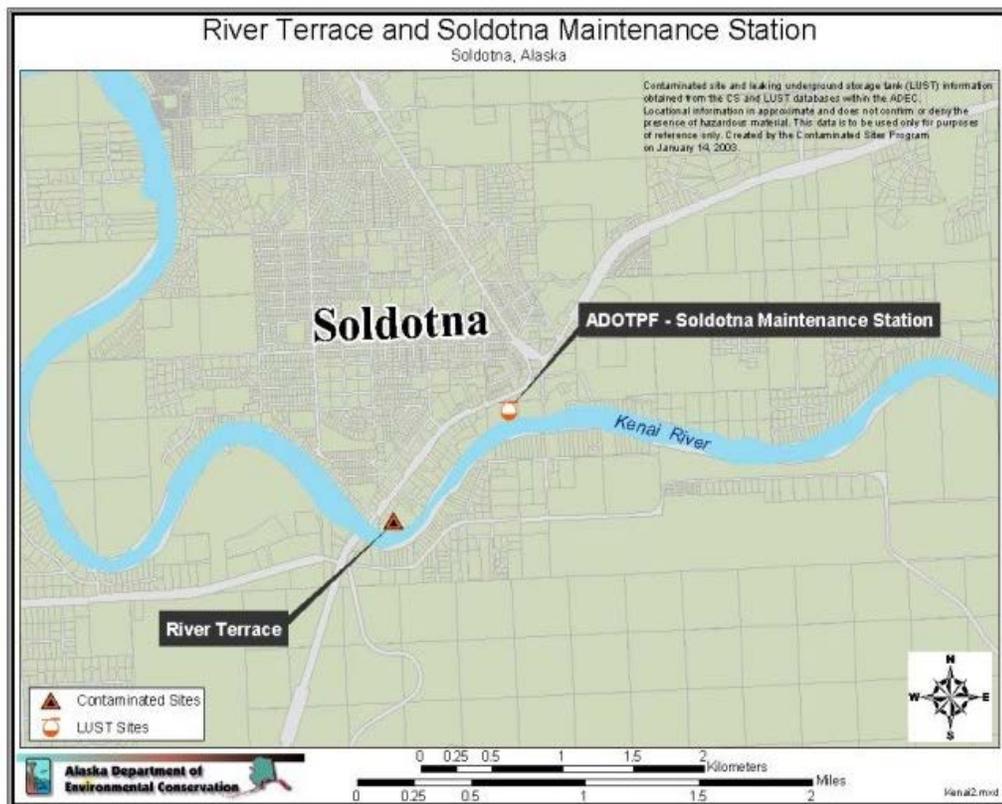
## CURRENT STATUS

In 2012, DEC contractors installed three additional long-term HRC injection points in the vicinity of monitoring wells Nos. 47, 48 and 51. The contractors injected HRC into the site source areas for a fourth time. The 2012 injection included using a less-viscous (more free-flowing) type of HRC to obtain greater penetration into the tighter soils in those areas. The 2013 monitoring data indicate that reductive dechlorination (bioremediation) is occurring in all three source areas (the upper plume, lower plume and deep till area).

The monitoring data to be collected in 2014 will be used to monitor the progress of the enhanced natural attenuation process and to determine whether additional HRC injections will be necessary. If the 2014 concentrations meet the site cleanup levels, DEC will begin site closeout monitoring in accordance with the August 2000 Record of Decision.

## MORE INFORMATION

<a href="#">River Terrace 2013 Figures</a> (April 2013 to September 2013)		<a href="#">(PDF 2.3MB)</a>
<a href="#">Cover Letter for 10-Year Review of Record of Decision</a>	(Aug. 4, 2010)	<a href="#">(PDF 45K)</a>
<a href="#">Summary of 10-Year Review of Record of Decision</a>	(Aug. 4, 2010)	<a href="#">(PDF 1.5MB)</a>
<a href="#">Cover Letter for Five-Year Review of Record of Decision</a>	(April 7, 2006)	<a href="#">(PDF 35K)</a>
<a href="#">Summary of Five-Year Review of Record of Decision</a>	(April 7, 2006)	<a href="#">(PDF 105K)</a>
<a href="#">Attachments to Summary of Five-Year Review of Record Decision</a>	(March 29, 2002)	<a href="#">(PDF 177K)</a>
<a href="#">Record of Decision, August 2000</a>	(August 2000)	<a href="#">(PDF 2.3MB)</a>
<a href="#">See older fact sheets and documents below.</a>		



#### Older Site Summaries and Fact Sheets

- ▶ March 2004 ([PDF 153K](#))
- ▶ January 2003 ([PDF 153K](#))
- ▶ September 2002 ([PDF 120K](#))
- ▶ June 2002 ([PDF 23K](#))
- ▶ October 2001 ([PDF 22K](#))
- ▶ December 1999 ([PDF 25K](#))
- ▶ November 1999 ([PDF 26K](#))
- ▶ July 1999 ([PDF 120K](#))

#### Public Notices

- ▶ [May 2000](#) (PDF 87K)

#### Site Reports/Plans

- ▶ *May 2000 Remedial Investigation/Feasibility Study*, prepared by Oasis/Bristol Environmental Services for the Alaska Department of Environmental Conservation. This document is divided into parts to allow for easier downloading. If you would prefer to get a copy on a compact disc, please email the [CSP webmaster](#).
- ▶ **RI/FS report**, 225 pages ([PDF 879K](#))
- ▶ **Figures**, 33 pages ([PDF 41MB](#))
- ▶ **Plate 1**, ([PDF 3.6MB](#))
- ▶ **Plate 2**, ([PDF 4.76MB](#))
- ▶ **Plate 3**, ([PDF 3.0MB](#))
- ▶ **Plate 4**, ([PDF 2.4MB](#))
- ▶ **Plate 5**, ([PDF 23MB](#))
- ▶ **Plate 6**, ([PDF 6.8MB](#))
- ▶ **Plate 7**, ([PDF 5.8MB](#))
- ▶ **Appendix A**, ([PDF 16MB](#))
- ▶ **Appendix B**, ([PDF 2.3MB](#))
- ▶ **Appendix C**, ([PDF 3.6MB](#))
- ▶ **Appendix D**, ([PDF 4.1MB](#))
- ▶ **Appendix E**, ([PDF 37MB](#))

- ▶ [Appendix F, \(PDF 35MB\)](#)
- ▶ [Appendix G, \(PDF 4MB\)](#)
- ▶ [Appendix H, \(PDF 2.3MB\)](#)
- ▶ [Appendix I, \(PDF 10.5MB\)](#)
- ▶ [Appendix J, \(PDF 8.7MB\)](#)
- ▶ [Appendix K, \(PDF 2.6MB\)](#)
- ▶ [Appendix L, \(PDF 15MB\)](#)
- ▶ [Appendix M, \(PDF 27MB\)](#)
- ▶ [Appendix N, \(PDF 7.5MB\)](#)
- ▶ [Appendix O, \(PDF 268K\)](#)
- ▶ [Appendix P, \(PDF 1.9MB\)](#)
- ▶ [Appendix Q, \(PDF 30.6MB\)](#)
- ▶ [Appendix R, \(PDF 2.9MB\)](#)
- ▶ [Appendix S, \(PDF 64.8MB\)](#)

[All review documents -- cover letter, public comment form, plan with graphics \(PDF 1.8 MB\)](#)

**View specific parts of the review package:**

- ▶ [cover letter \(PDF 423K\)](#)
- ▶ [public comment form \(PDF 6K\)](#)
- ▶ [plan -- excluding figures \(PDF 248K\)](#)

**Figures Only (high resolution for printing):**

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| <a href="#">Figure 2 (PDF 1.6 MB)</a> | <a href="#">Figure 4 (PDF 1.6 MB)</a> | <a href="#">Figure 6 (PDF 1.6 MB)</a> |

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