PROPOSED CLEANUP PLAN

River Terrace Recreational Vehicle Park

COMMENT PERIOD ENDS JUNE 26, 2000

Alaska Department of Environmental Conservation, 555 Cordova, Anchorage, Alaska 99501

INTRODUCTION

This Proposed Plan describes the cleanup levels and cleanup options proposed by the Department of Environmental Conservation (DEC) for soil and groundwater contamination at the River Terrace Recreational Vehicle Park (RTRVP). RTRVP is located on the bank of the Kenai River in Soldotna, Alaska (see Figure 1). A dry cleaner formerly operated on the RTRVP property. Contamination measured in the soil and groundwater includes the common dry cleaning solvent tetrachloroethene (PCE), along with its degradation products trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC). Contamination from the site has also migrated into groundwater beneath the Department of Transportation (DOT) Sterling Highway right-of-way (ROW) and into the Kenai River adjacent to the property.

ADEC is requesting public comment on the proposed cleanup actions discussed in this plan. A decision will not be made until the public comment period ends and all comments are reviewed and considered. After all public comments have been considered, the DEC will issue its cleanup decision.

PURPOSE AND SCOPE OF PROPOSED PLAN

The purpose of the Proposed Plan is to provide the public with information about the RTRVP contamination and cleanup alternatives, and to solicit public comment on the proposed cleanup levels and plan.

This Proposed Plan contains the following sections:

- Introduction
- Purpose and Scope of Proposed Plan

How You Can Participate

Final decisions will not be made until after the community has the opportunity to review and comment on this Proposed Plan. You are encouraged to comment on this Proposed Plan. **You are encouraged to comment on this Proposed Plan during the public comment period, which ends Monday, June 26, 2000,** You are invited to write or use email to provide your comments. A comment form is provided on page 30 of this Proposed Plan. Please send your comments to the following address:

Rich Sundet
ADEC
555 Cordova
Anchorage, AK 99501
email: rich_sundet@envircon.state.ak.us

The DEC will host a public meeting in Soldotna on **June 15, 2000** to discuss this Proposed Plan and take your comments. The meeting will be held in the **Kenai Borough Chambers in Soldotna.** An availability session to personally meet with DEC staff will occur from 4 to 5:30 pm. From 7 to 9 pm DEC will give a short presentation on the findings of its investigation and the Proposed Plan to clean up remaining contamination and will hear public comments.

If you would like to meet and comment on the plan individually with DEC, please call Mr. Sundet who will schedule an appointment at the ADEC Soldotna office on June 16, 2000.

This plan is also available on this website:: http://www.state.ak.us/dec/dspar/csites/sites/rivterr/pl_0500.pdf

- Site History
- Nature and Extent of Contamination
- Actions To Date
- Risk Summary
- Development of Cleanup Levels
- Summary of Cleanup Alternatives
- Evaluation of Cleanup Alternatives
- Preferred Cleanup Alternative
- Public Participation Request
- Glossary of Terms

The Proposed Plan summarizes information that can be found in greater detail in the *River Terrace RV Park, Remedial Investigation/ Feasibility Study Report* (RI/FS), dated May 2000. The report can be reviewed at the DEC offices in Anchorage, Soldotna, and Juneau, and in the Soldotna and Kenai public libraries.

SITE HISTORY

A dry cleaning facility operated at the RTRVP from the 1960s until 1988. PCE was the solvent used for dry cleaning at this facility.

Contamination at the RTRVP was first brought to the attention of the ADEC with a public complaint in 1992. The complaint was about leaky drums, which were removed and disposed of. Site assessment work began in 1995. Since 1995, several site assessments have been performed, and numerous soil, groundwater, surface water, and sediment samples have been collected.

Three different RTRVP cleanup activities have been completed to-date.

- Approximately 600 cubic yards of PCE-contaminated soil were excavated in May 1996 and stockpiled on the property. Contaminated soil was discovered when the RTRVP property owners were installing a water line in May 1996.
- Approximately 2,700 cubic yards of contaminated soil were excavated in September and October 1997 and June 1998 (see Figure 2). The purpose of the excavation was to remove all known soil that contained levels of PCE or its degradation products at levels above the soil cleanup levels established by the DEC for the site. A few areas of known soil contamination above cleanup levels remained after the excavation was completed.

  The total volume of excavated soil (3,300 cubic yards) was treated in two soil vapor extraction treatment cells located on the RTRVP property (see Figure 2). The vapor extraction system operated from fall 1998 through spring 1999. Currently, the soil remains on-site in the two treatment cells. On March 2, 2000, the EPA determined that the treated soil no longer contains hazardous waste and can therefore be disposed of on-site, subject to conditions to minimize surface runoff and subsurface leaching.
- PCE from the RTRVP site has entered the Sterling Highway storm sewer and discharged into the Kenai River from the Kenai River Bridge Outfall (KRBO). In May 2000, an aeration system was installed in the storm sewer to stop contamination from entering the Kenai River at levels above the surface water cleanup level. This is an interim treatment system, which addresses contamination in the storm sewer until the selected cleanup system for the RTRVP reduces the contamination on a permanent basis or until the storm sewer is reconfigured by DOT so that it no longer transports contamination.

  The interim treatment system is an aeration system that blows air bubbles through the water in the storm drain before it exits the drain. The PCE volatilizes from the water into the air instead of flowing with the storm water into the Kenai River. Based on the historical contaminant concentrations in the storm water, the volatilized PCE will not pose a risk to people or the environment.

NATURE AND EXTENT OF CONTAMINATION

In this section of the Proposed Plan, the soil, groundwater, surface water, and sediment contamination on and adjacent to the RTRVP property is discussed with respect to applicable cleanup levels. The cleanup levels that apply to the RTRVP property and adjacent properties are presented in the Development of Cleanup Levels Section, on page 8 of this Proposed Plan. Figure 2 outlines the groundwater contamination plumes and shows the key site features with respect to the site investigation results.

Soil

RTRVP soil contamination has been measured in a detailed soil investigation performed by the property owner in 1997 and in samples collected from soil borings since then. The 1997 soil investigation included a surface grid of 56 points spaced 20 feet apart, with soil samples collected at 5-foot depth intervals from each grid point. A total of 204 soil samples were collected in this investigation, of which 161 contained detectable concentrations of PCE. 126 additional soil samples have been collected from soil borings at the site, of which 57 contained detectable concentrations of PCE.

Contaminated soil is suspected to be underneath the former dry cleaner building, because contaminated groundwater has been detected downgradient of the building but highly contaminated soil hasn't been detected. Although several soil samples have been collected from under the building, attempts to characterize this area have been unsuccessful because the drilling rigs have been unable to drill through the rocky soil under the building.

The maximum PCE concentrations detected on the site were removed during the fall 1997-summer 1998 excavations. The maximum PCE concentration remaining after the excavations is 20 mg/kg in a sample located below the deepest part of the excavation (30 feet below ground surface [bgs]). Of post-excavation soil samples, only three samples from the base of the excavation and two later soil boring samples from the same general area (near MW-9; see Figure 2) have exceeded the RTRVP property soil cleanup level.

No soil samples collected from off-RTRVP property (the Sterling Highway DOT ROW) have exceeded the applicable cleanup levels.

Groundwater

Groundwater at the site has been categorized into three different water-bearing zones: a deep confined aquifer, hypothesized shallow semi-confined water-bearing zones, and a shallow unconfined aquifer. The deep confined aquifer is an artesian aquifer, which means that there is pressure in the aquifer to force the water to flow upward. Most monitoring wells are completed in the unconfined aquifer, but 5 are completed in the semi-confined water-bearing zones.

Contamination has been detected in the shallow unconfined aquifer only. Two groundwater contamination plumes exist in this aquifer. The lower contaminant plume extends south of the former dry cleaner building to the Kenai River (Figure 2). The upper contaminant plume extends north of the former dry cleaner building to the Sterling Highway (Figure 2).

The two groundwater plumes are separated by a ridge, or high area, in the silty till underlying the unconfined aquifer. This ridge causes the groundwater flow direction to split across this part of the site, which is south of the former dry cleaner building (Figure 2). The upper contaminant plume migrates to the north, and the lower contaminant plume migrates to the south.

Although the two contaminant plumes migrate in different directions, both of them discharge into the Kenai River. As indicated on Figure 2, the lower contaminant plume flows directly into the Kenai River. Water levels measured in a monitoring well located 15 feet from the river (MW-20, see Figure 2) mimic the water levels measured in the Kenai River. The upper contaminant plume migrates to the Kenai River along a stormwater sewer system under the Sterling Highway.

Lower Contaminant Plume

Groundwater in the lower contaminant plume is contaminated with PCE and its degradation products. Concentrations of PCE and the degradation products have been relatively stable since 1997; that is, the concentrations are generally not increasing or decreasing.

As indicated on Figure 2, there are currently two areas of PCE contamination in the lower contaminant plume that exceed the groundwater cleanup level for the RTRVP property (840 µg/L); one near MW-4A and one extending from MW-9 toward the Kenai River. The highest historical PCE concentration detected in the lower plume is 3,540 µg/L in a 1998 sample from MW-4A.

- All four 1999 samples from MW-4A exceeded the groundwater cleanup level for PCE (although the March 2000 sample level was below the cleanup level).
- Three of four 1999 samples from MW-9 (in addition to the March 2000 sample) exceeded the groundwater cleanup level for PCE.
- One of four 1999 samples from MW-10 exceeded the groundwater cleanup level for PCE.
- One 1999 sample from MW-6 contained PCE above its groundwater cleanup level (one of four samples from 1999; the March 2000 sample did not exceed the cleanup level).

One PCE degradation product, vinyl chloride, has also been detected at concentrations above its groundwater cleanup level (2 µg/L).

- Two of four samples collected from MW-6 in 1999 exceeded the cleanup level for vinyl chloride.
- Two of three samples collected from MW-20 in 1999, in addition to the March 2000 sample, exceeded the cleanup level for vinyl chloride.

Continuing impact to the Kenai River is indicated by 1999/March 2000 sampling results from the monitoring wells located approximately 15 feet uphill from the Kenai River. The shallow aquifer is hydraulically connected to the Kenai River.

- All 1999 samples and March 2000 samples collected from the seven monitoring wells beside the Kenai River (from MW-13 to MW-5; see Figure 2) exceeded the surface water cleanup level for PCE (5 µg/L).
- All 1999 and March 2000 samples collected from the six monitoring wells beside the Kenai River (from MW-12 to MW-5), except one of three samples from MW-5, exceeded the surface water cleanup level for two PCE degradation products, TCE and cis-1,2-DCE.

Upper Contaminant Plume

Groundwater in the upper contaminant plume is contaminated mainly with PCE. Degradation products have been detected only at very low concentrations in the upper plume. The upper plume has been monitored since summer 1999; no trend of increasing or decreasing PCE concentrations has been observed over this time.

As indicated on Figure 2, there is currently one area of PCE contamination in the upper contaminant plume exceeding the groundwater cleanup level for the RTRVP property (840 µg/L). It is located near MW-16, adjacent to the former dry cleaner building. The highest historical PCE concentration in the upper plume is 5,500 µg/L in a sample from MW-16 in September 1999.

- All five 1999 - 2000 samples from MW-16 exceeded the groundwater cleanup level for PCE.
- One of four 1999 – 2000 samples collected from MW-25, located within the Sterling Highway ROW near the RTRVP property boundary, exceeded the groundwater cleanup level for PCE.

A soil gas survey conducted along the northwest and northeast sides of the former dry cleaner building (see Figure 2) encountered PCE vapor concentrations ranging from 860 parts per billion [ppb] to 13,000 ppb spread relatively uniformly over the area of investigation, with the highest vapor concentrations in a sample adjacent to the former dry cleaner building. The soil gas survey results indicate that the groundwater underlying the entire survey area probably contains high levels of PCE.

The DOT storm sewer backfill under the west side of the Sterling Highway appears to provide a conduit for contamination to flow from the upper contaminant plume to the Kenai River. The storm sewer was installed below the top of the till surface adjacent to the RTRVP; therefore its backfill is also a good conduit for groundwater flow.

Water samples from the storm sewer system (the Kenai River Bridge Outfall [KRBO], Manhole 1 (MH-1) and Manhole 2 (MH-2), see Figure 2) indicate that PCE enters the storm sewer system between MH-2 and MH-1. PCE has been detected above its surface water cleanup level (5 µg/L) in six of seven samples taken from the storm sewer outfall (KRBO) between June 1997 and March 2000. The highest PCE concentration was 23 µg/L detected in a May 1997 KRBO sample. As stated in the Site History Section of this Proposed Plan, water in the storm sewer system is now being treated before it discharges to the Kenai River.

Kenai River Water and Shoreline Sediments

Sediment and surface water samples were collected from the Kenai River adjacent to the RTRVP site in 1997 and 1999 (see Figure 2).

PCE was detected at 2.5 µg/L, which is one-half of the surface water cleanup level, in a water sample from the Kenai River adjacent to the RTRVP. Samples collected up-river and down-river from the RTRVP were clean.

PCE and its degradation products have been detected in sediment samples collected from the Kenai riverbank adjacent to the RTRVP. There are no specific numerical cleanup levels set in regulation for sediment contamination; however, sediment concentrations can be compared to screening numbers to evaluate whether the contamination poses a potential risk to sediment-dwelling and aquatic organisms that depend on the sediment area. PCE and/or two of its degradation products (TCE and cis-1,2-DCE) were detected above risk screening concentrations in seven samples from four sediment sample locations (SD-5, SD-6, SD-7, and SD-8 on Figure 2). The maximum cis-1,2-DCE concentration was 670 micrograms per kilogram (µg/kg) in a 1997 sample from SD-8 (compared to the risk screening concentration of 144 µg /kg). The maximum PCE concentration was 510 µg/kg (compared to the risk screening concentration of 147 µg/kg), and the maximum TCE concentration was 170 µg/kg (compared to the risk screening concentration of 79 µg/kg). These results indicate a zone of potentially contaminated sediments extending from SD-5 to SD-8 (Figure 2), a shoreline length of approximately 60 feet. The sediment risk screening concentrations are discussed further in the Summary of Site Risks Section below.

SUMMARY OF SITE RISKS

Risk is broadly defined as the potential for contaminants to have an adverse health effect on people, animals, plants, or even habitat. Higher contaminant concentrations pose more risk than lower contaminant concentrations. Toxicity studies have indicated that PCE adversely affects the liver and kidneys of exposed people and animals and may cause cancer. PCE in surface water increases the mortality of aquatic organisms. The breakdown products of PCE have similar effects. Vinyl chloride is the most toxic of the breakdown products and is known to cause cancer in people.

Two distinct zones were identified at the site: a commercial/residential zone and an aquatic habitat zone. The uses and risks posed by each zone are different. Figure 3 shows the approximate locations of these two zones and the receptors (people, plants, or animals) that can be found in each zone. The commercial/residential zone (the uplands) is the part of the site where people camp, work and live. There is very little ecological habitat in this zone. The aquatic habitat zone includes the wetlands and river. This area is fish and wildlife habitat and represents the part of the site where people fish.

Commercial/Residential Zone

Because there is very little ecological habitat in the commercial/residential zone, no ecological receptors were identified as potentially at risk in this zone. People (e.g., residents, site workers, and recreational/subsistence users) are the receptors who could potentially encounter any contaminants in this zone. Risks posed by each of the contaminated media in the commercial/residential zone (e.g., soil and groundwater) are discussed below.

Soil on RTRVP Property

Residents, site workers, and recreational/subsistence users could potentially come into contact with contaminated soil by accidentally eating bits of dust or getting contamination on their skin. While these exposure pathways are likely, the contaminant levels identified in site soils are below the screening levels normally associated with risk posed by ingestion or direct contact with contaminated soil.

The risk posed by direct exposure to contaminated soil was mitigated by the excavation performed in 1997. Only one known area contains soil contamination above the applicable cleanup level. The area does not pose a significant risk because of its location approximately 20-30 feet below ground surface. Contaminated soil buried so deep beneath the ground surface is unlikely to be encountered in the future.

Contaminated soil, even soil containing contaminants below the applicable cleanup level, may continue to leach contaminants into the groundwater. Through leaching and groundwater transport, the contamination will continue to migrate to surface water and sediment (in the aquatic zone).

Soil off RTRVP Property

No soil contamination above the applicable cleanup level has been detected off-RTRVP property. Off-site soil is not expected to pose a significant risk to people or the environment.

Groundwater on RTRVP Property

Groundwater from the deep confined aquifer on RTRVP property is used as a drinking water source. No contamination has been detected in this groundwater.

Shallow groundwater on RTRVP property remains highly contaminated. It is not currently used for drinking water. Groundwater from the shallow unconfined aquifer would pose a serious health hazard if the water were used as drinking water. Institutional controls prohibiting the installation of drinking water wells in shallow groundwater on the RTRVP property are necessary to prevent risk associated with drinking the contaminated water.

Contaminated groundwater appears to be the source of contaminant vapors detected in soil around the former dry cleaning building. Based on a conservative screening evaluation, these vapors may pose an increased risk of cancer to people residing full-time in the building and to any people who may live in a dwelling constructed above the contaminated groundwater plumes in the future (as shown in Figure 2). Indoor air sampling could be used to determine if vapors are actually getting into the former dry cleaning building or any other permanent dwellings that may be constructed over the highly contaminated groundwater plume, before it is cleaned up.

Site workers could also come into contact with contaminated groundwater during excavation or de-watering activities. Groundwater contaminant levels are below the screening levels normally associated with risk posed by incidental contact by workers. Contaminated water removed from the ground must be treated or disposed of properly to eliminate risk associated with improper disposal.

Groundwater off RTRVP Property

Shallow groundwater off RTRVP property is also highly contaminated. Contaminated off-RTRVP property groundwater appears to be confined to the Sterling Highway ROW, including the storm sewer backfill, and the Kenai River bank. No significant human health risk is associated with off-RTRVP property groundwater as long as institutional controls are put in place to prevent the installation of drinking water wells in the ROW.

Site workers could also come into contact with contaminated groundwater during excavation or de-watering activities. Groundwater contaminant levels are below the screening levels normally associated with risk posed by incidental contact by workers. Contaminated water removed from the ground must be treated or disposed of properly to eliminate risk associated with improper disposal. A review of preliminary bridge upgrade plans indicate that it is unlikely contaminated water will be encountered during construction of the new bridge.

Aquatic Habitat Zone

Ecological receptors are potentially at risk in the aquatic habitat zone. Risks posed by each of the contaminated media in the aquatic zone (e.g., Kenai River shoreline sediments and water) are discussed below.

Shoreline Sediments

Approximately 60 feet of the Kenai Riverbank adjacent to the RTRVP property contains levels of contamination considered potentially harmful to aquatic organisms. The source of the sediment contamination is contaminated groundwater migrating into the river through the sediments. The sediments tend to accumulate contamination over time, becoming more toxic the longer contaminated groundwater flows through them. Consequently, contamination levels in the sediments may increase until the contamination concentration is significantly decreased in the groundwater.

Numerical regulatory criteria specific to sediments have not been developed; however, toxicological studies have been performed to determine safe concentrations of sediment contamination. These safe levels are called sediment quality benchmarks. The sediment quality benchmarks are recognized as appropriate, scientific-based sediment screening levels by Alaska regulations. Contamination levels as much as four times the sediment quality benchmark have been detected in shoreline sediments adjacent to RTRVP.

Lower reproduction success, higher mortality, and loss of species diversity in bottom-dwelling creatures and fish fry rearing in the area are some of the potential effects of the contaminated sediments.

Some uptake of contaminants into the food chain also occurs when predator species such as birds or larger fish feed on smaller organisms exposed to the contamination. The risk posed to these predator species is small, because PCE has a low potential to bioaccumulate.

There is no risk to human health associated with exposure to the sediments.

SURFACE WATER

Groundwater near the river has contained PCE levels as high as 1,900 µg/L (as measured in the monitoring wells installed 15 feet uphill from the river).

The Kenai River is protected for all uses. The most stringent of these uses are drinking water, contact recreation, irrigation, and animal water supply. The federal and state water quality standard for all of these uses is 5 µg/L PCE. This standard is based on the increased risk of developing cancer that results from long-term exposure (30 years) to this chemical. River water containing 2.5 µg/L PCE (one-half the water quality standard) has been detected. There has been limited surface water sampling, and levels could potentially be higher during different seasons or flow levels.

The Kenai River in this area is probably only occasionally used for drinking water by children or recreational users. The river is used extensively for recreation at certain times, but exposure is probably limited to no more than a few hours per week in the summer.

Because of the limited use of the river and high dilution, risk to humans is unlikely. There is no risk to people from handling or eating fish caught in the river.

Toxicological studies have been performed to determine safe concentrations of water contamination for aquatic organisms. In 1986, the EPA published Quality Criteria for Water that cited a “no observed adverse effects level” for PCE of 840 µg/L. Although this level represented the best data available at the time, more recent studies indicate that EPA’s Water Quality Criteria for PCE is not protective of aquatic resources. The newer reports recommend a value of 98 µg/L for PCE. Using the same methodology, the EPA derived an ecological screening value (ecotox) of 120 µg/L for PCE.

Since measured PCE concentrations in the monitoring wells 15 feet from the river have been ten times higher than the aquatic benchmarks (1,900 µg/L versus 98 µg/L or 120 µg/L), PCE in the Kenai River is likely to exceed aquatic benchmarks under certain conditions. In particular, water seeping out of the sediments where many of the insects and larval creatures live is likely to contain high contamination levels. The dynamic nature of a river makes surface water sample data an unreliable method to assess exposure and risk when contaminated groundwater is discharging into the river. Consequently, groundwater data next to the surface water body is a more reliable method to assess the discharge to surface water.

SITE RISK SUMMARY

In summary, risk in the commercial/residential zone is limited to people who may drink the shallow groundwater. Institutional controls are planned to prevent drinking the shallow groundwater. Further evaluation (e.g., air sampling) may be needed to determine whether living in a building over the contaminated groundwater plumes poses a risk to people. No residential buildings are currently present.

Risk in the aquatic zone primarily affects aquatic organisms living all or most of their life in the section of the river adjacent to the RTRVP property near the sediment interface.

The actual damage to the environment has not been quantified; however, risk to the ecosystem immediately adjacent to the property will likely continue until the influx of contamination is stopped.

DEVELOPMENT OF CLEANUP LEVELS

Overall goals for site cleanup are compliance with applicable state and federal regulations and protection of human health and the environment. When the contamination in RTRVP soil, groundwater, and surface water is decreased below numerical cleanup levels established for the site, the overall goals of regulatory compliance and protection of human health and the environment are met.

Selection of appropriate cleanup levels involves several steps.

- First the contamination concentrations were determined by collecting samples.
- Next, the contamination concentrations were compared to regulatory levels. Regulatory levels are maximum allowed contamination levels as specified by law. For RTRVP, the most appropriate regulatory levels are found in the state's Oil and Hazardous Substance Pollution Control Regulations for soil and groundwater and the state's Water Quality Criteria for surface water and sediment. In addition, certain provisions of the federal hazardous waste regulations (Resource Conservation and Recovery Act ([RCRA]) apply to the site. Where contaminant concentrations exceed any of the regulatory levels, cleanup or mitigation may be required. No numerical regulatory criteria exist for sediments.
- The final step in developing cleanup levels is selecting the appropriate value from the various regulatory numbers and establishing that value as the cleanup level for each contaminant.

Specific remedial action objectives for all contaminants and media are discussed below and listed in Table 1. The basis for each cleanup level, the maximum contamination levels detected, and the cleanup levels are presented in this table.

Soil

Alternative cleanup levels (ACLs) for RTRVP property soil were established based on a risk evaluation performed in 1997. The ACLs are listed in Table 1. These levels must be met in all soils on RTRVP property.

Table -1. Cleanup Levels for RTRVP

Media	Contaminant	Maximum Detected Concentration.	Cleanup Levels		
			Point of Compliance	Concentration	Basis
On-RTRVP Property Soil (mg/kg)	PCE	** 20	Throughout property	11.5	ACL
	TCE	** 0.21	Throughout property	300	ACL
	Cis-DCE	** 0.62	Throughout property	72.1	ACL
	Trans-DCE	ND	Throughout property	87.3	ACL
	1,1 DCE	ND	Throughout property	7.1	ACL
	Vinyl Chloride	ND	Throughout property	2.1	ACL
Off-RTRVP Property Soil (mg/kg)	PCE	0.19	Anywhere off-property	0.3	18 AAC 75
	TCE	0.009	Anywhere off-property	0.27	18 AAC 75
	Cis-DCE	0.006	Anywhere off-property	2	18 AAC 75
	Trans-DCE	ND	Anywhere off-property	4	18 AAC 75
	1,1 DCE	ND	Anywhere off-property	0.3	18 AAC 75
	Vinyl Chloride	ND	Anywhere off-property	.09	18 AAC 75
On-RTRVP Property Shallow (Unconf-ined) Aquifer	PCE	5,500	Throughout property	840	ACL
	TCE	970	Throughout property	21,900	ACL
	Cis-DCE	4,600	Throughout property	11,600	ACL
	Trans-DCE	44	Throughout property	11,600	ACL
	1,1 DCE	3.3	Throughout property	7	ACL
	Vinyl Chloride	7.6	Throughout property	2	ACL
Off-RTRVP Property Shallow (Unconf-ined) Aquifer	PCE	920	RTRVP Property boundary	50	18 AAC 75
	TCE	180	RTRVP Property boundary	50	18 AAC 75
	Cis-DCE	1,500	RTRVP Property boundary	700	18 AAC 75
	Trans-DCE	9	RTRVP Property boundary	1,000	18 AAC 75
	1,1 DCE	ND	RTRVP Property boundary	70	18 AAC 75
	Vinyl Chloride	ND	RTRVP Property boundary	20	18 AAC 75
Confined Aquifer (µg/L)	PCE	ND	Throughout property	5	MCL
	TCE	ND	Throughout property	5	MCL
	Cis-DCE	ND	Throughout property	70	MCL
	Trans-DCE	ND	Throughout property	100	MCL
	1,1 DCE	ND	Throughout property	7	MCL
	Vinyl Chloride	ND	Throughout property	2	MCL
Surface Water (µg/L)	PCE	*23	Sentry wells	5***	WQC
	TCE	*0.6	Sentry wells	5***	WQC
	Cis-DCE	*0.18	Sentry wells	70***	WQC
	Trans-DCE	ND	Sentry wells	100***	WQC
	1,1 DCE	ND	Sentry wells	7***	WQC
	Vinyl Chloride	ND	Sentry wells	2***	WQC

* Maximum detected concentrations were in samples from the KRBO.

** Areas of highest soil contamination have been removed and treated. The maximum detections remaining in RTRVP property soil are listed in this table.

ACL: Alternative cleanup levels established for the site in an August 1997 letter from the DEC
18 AAC 75: Alaska Oil and Hazardous Substance Pollution Control Regulations
MCL: Maximum contaminant level; from Alaska Drinking Water Regulations (18 AAC 80)
WQC: Water Quality Criteria (18 AAC 70)

*** A maximum concentration three times the indicated concentration (e.g., 0.015 µg/L PCE) may be detected in only one sentry well.

Contaminated soils located off RTRVP property were not addressed in the 1997 letter; consequently, the state's current Oil and Hazardous Substance Pollution Control regulations apply to these soils. The regulations provide standard soil cleanup levels, along with a provision to increase these levels by a factor of ten ("the ten times rule") if the groundwater is not a current or potential source of drinking water. The groundwater in question is beneath the Sterling Highway and is not considered a viable source of drinking water; consequently, the cleanup levels specified in state regulation as modified by the 10 times rule are the proposed cleanup levels for off-site soils (see Table 1). Property owner acceptance (the Alaska DOT is the only known affected property owner) and public input will be required to implement this cleanup level. This level must be met in all soils off the RTRVP property.

Groundwater

ACLs were also established for RTRVP property groundwater in 1997. The ACLs apply only to the shallow unconfined aquifer and are not applicable to the confined aquifer. The ACLs are listed in Table 1. These cleanup levels must be met in the groundwater throughout the RTRVP property.

Off-RTRVP groundwater must be cleaned up to the concentrations specified in the state's Oil and Hazardous Substance Pollution Control regulations. As with soil, a cleanup level 10 times the cleanup level in the regulation can be applied to off-RTRVP groundwater not considered a viable source of drinking water. The groundwater in question is beneath the Sterling Highway and is not considered a viable source of drinking water; consequently, the cleanup levels specified in state regulation as modified by the 10 times rule are the proposed cleanup levels for off-site groundwater (see Table 1). As with soil, property owner acceptance (the Alaska DOT) and public input will be required to implement this cleanup level. These cleanup levels must be met at the RTRVP property boundary (before the groundwater moves to adjacent property).

A confined aquifer is present beneath the site. The confined aquifer is a water-bearing zone that is currently used as a source of drinking water. All on and off-RTRVP property confined aquifer groundwater already meets the maximum contaminant levels (MCLs) as specified in the state's Drinking Water Standards. The MCLs are the federal standards applicable for protection of drinking water sources.

Surface Water

Surface water is regulated by the Alaska Water Quality Criteria. Allowable contamination levels for surface water depend on the use of the surface water body. The Kenai River is classified for all uses. In particular, the river is considered suitable as a drinking water source, for use in food processing, as a site for contact recreation, and for use in agriculture (e.g. watering gardens). The WQS for PCE and all of its degradation products for the uses listed is the MCL. Consequently, the MCLs are the cleanup levels for surface water and any groundwater hydrologically connected to surface water.

The points of compliance for surface water are sentry wells that monitor groundwater hydrologically connected to the Kenai River and the KRBO, which discharges directly into the Kenai River. The line of monitoring wells located approximately 15 feet from the river (monitoring wells MW-5 through MW-27, as shown on Figure 2) can be used as the sentry wells. Some contamination dilution will occur between the sentry wells and the Kenai River. For example, modeling indicates that a maximum PCE value of 15 µg/L in one of the sentry wells would result in no more than 5 µg/L PCE actually entering the river. Consequently, the allowable point of compliance concentration for groundwater connected hydrologically to surface water has been increased to accommodate the predicted dilution.

Potential for Increasing Cleanup Levels for Surface Water

State law provides for discharges above the MCL to enter the river by way of water body reclassification. The responsible party can propose to reclassify a small stretch of the Kenai River (approximately 25 yards) from its current use category to a less stringent category that does not include contact recreation, irrigation, drinking water, or food processing. If the river were reclassified then discharge at 840 µg/l for PCE would be legal. Compliance would still be evaluated at the sentry wells. The state invites public comment on the appropriateness of river reclassification.

Sediments

State water quality criteria qualitatively address sediment contamination. However, there are no numerical standards for sediment. State regulations define procedures to evaluate the risk to ecological receptors posed by contaminated sediments in the Risk Assessment Procedures Manual and the Water Quality Regulations outline procedures that must be followed to develop sediment standards. However, specific cleanup standards for sediment were not developed because cleanup of the groundwater hydrologically connected to the surface water was considered protective of the sediments.

SUMMARY OF CLEANUP ALTERNATIVES

Various technologies were considered to clean up the soil, shallow groundwater, and surface water to the cleanup levels given in Table 1. A range of technologies are capable of cleaning the soil and water to the applicable cleanup levels; these technologies were screened to determine which looked the most promising for use at the RTRVP site. Impacts of the potential cleanup alternatives on the RTRVP and adjacent property land use were considered along with the technological merit of the alternatives. Specifically, the cleanup alternatives would be expected to:

- Comply with the Kenai River Management Plan;
- Maintain the integrity of wetlands;
- Minimize impacts to the Sterling Highway and the planned Highway upgrade project;
- Minimize impacts on land use; and
- Minimize migration of contamination off RTRVP property.

The decision was made to focus on active groundwater cleanup technologies, with less focus on the other media for the following reasons:

- If the flow of contaminated groundwater from the lower RTRVP contaminant plume is stopped, then the contamination levels in Kenai River water and shoreline sediments adjacent to the RTRVP will decrease naturally.
- If the flow of contaminated groundwater from the upper RTRVP contaminant plume is stopped, then the contamination levels in the Sterling Highway ROW will decrease naturally.
- Treatment or removal of contaminated sediments was not considered a reasonable alternative because of the damage that could be caused to the riverbank.
- Treatment of remaining soil contamination is difficult. Known areas of remaining soil contamination are isolated and buried deeply. The estimated cost to remove and treat the remaining contaminated soil at the RTRVP was in excess of $10 million. This amount was considered prohibitively expensive.

  Where possible, some level of soil cleanup is considered as part of some of the groundwater remedial alternatives. Otherwise, natural attenuation (by dilution and biodegradation) will gradually clean up remaining soil contamination.

The initial screening process identified five different remedial technologies that were capable of meeting the site cleanup objectives, i.e., cleaning up groundwater migrating off-RTRVP property while minimizing potential impact to other land uses, as described above. The five active cleanup technologies, along with no action and intrinsic remediation alternatives, were evaluated for both the upper contaminant plume and the lower contaminant plume.

Any of the cleanup alternatives for the lower contaminant plume may be combined with any of the cleanup alternatives for the upper contaminant plume. A relatively aggressive cleanup alternative would be to combine Alternative F for the upper contaminant plume (cost between $1.75 million and $3.5 million), which involves demolition of the former dry cleaner building and removal and on-site treatment of contaminated soil under the building, with any of the lower contaminant plume alternatives.

All of the cleanup alternatives, except the no action and intrinsic remediation alternatives, are considered protective of people and the environment. All of the five active cleanup alternatives stop the flow of contaminated groundwater from the site in the near-term (within approximately 6 months after being installed). It is estimated that all of the cleanup levels will be met within approximately 5 and 15 years, depending on the technology selected. All of the cleanup alternatives, except the no action alternative, include long-term monitoring for the duration of the 5 to 15-year time period.

The seven remedial technologies are described below.

Alternative A: No action

The no action alternative provides a basis for comparing the other remedial alternatives.

Alternative B: Intrinsic remediation

Intrinsic remediation would not involve active remedial technologies. Groundwater, soil, and shoreline sediments would be left in their current state, and natural processes would continue to reduce contaminant concentrations. The natural processes that assist in reducing contaminant concentrations include dilution with uncontaminated groundwater, adsorption to organic carbon in the soil, volatilization to the atmosphere, and biological degradation.

Intrinsic remediation is not the same as "no action." Intrinsic remediation requires modeling and evaluation of contaminant attenuation. This alternative would also include a groundwater and surface water monitoring program to confirm predicted results. Institutional controls prohibiting use of shallow site groundwater as drinking water would be included in this alternative. Intrinsic remediation involves no excavation or handling of contaminated materials; therefore, there would be no risk to site workers or the community from handling contaminated water and soil.

The estimated restoration timeframe is 15 years. Since this alternative includes no active cleanup, there would be no interim protection of the Kenai River or off-property groundwater from contaminated groundwater migrating off-RTRVP property until the restoration timeframe has been reached.

Alternative C: Permeable Reactive Barrier

Alternative C would use a permeable reactive barrier to treat contaminated groundwater before it leaves the RTRVP property. The permeable reactive wall consists of iron granules installed in a trench across the flow path of a contaminant plume. This type of barrier allows the passage of water while removing dissolved contaminants (PCE and its degradation products) by chemical dechlorination. The iron is oxidized, releasing electrons, which are then used to remove a chlorine atom from the contaminant (e.g., PCE). The process continues until the chlorine atoms are sequentially removed from PCE, leaving non-toxic degradation products, such as ethene. The iron granules are dissolved by the process, but the metal disappears so slowly that the remediation barriers can be expected to remain effective for many years, possibly even decades.

The contaminant source areas (contaminated soil leaching to the groundwater) and contaminated shoreline sediments would not be actively treated using this technology; intrinsic remediation would address the remaining soil and shoreline sediment contamination.

Monitoring of the groundwater would be required to document the effectiveness and regulatory compliance of this alternative. Institutional controls prohibiting use of shallow site groundwater as drinking water would also be included in this alternative.

This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in near-term protection of the DOT ROW and the Kenai River. It is estimated that the remaining contamination source will be exhausted in 15 years, after which the treatment system will be unnecessary. However, this treatment system would not need to be removed from the ground and would continue to afford some protection from off-property migration of contaminated groundwater indefinitely.

Alternative D: In situ air sparging curtain or grid

This alternative would involve injecting air into the contaminated groundwater, creating an underground stripper that removes contaminants through volatilization. Air sparging is usually operated with soil vapor extraction (SVE) systems that capture volatile contaminants stripped from the saturated zone.

In the lower contaminant plume, this technology would use a "curtain" of air bubbles to treat contaminated groundwater before it leaves the RTRVP property (similar to Alternative C). In the upper contaminant plume, two options are available for this technology: a curtain application and a grid application. In the grid application, the contaminant source area would be treated by an air sparging grid. The grid application is not appropriate for the lower contaminant plume, because soils in the source area are not conducive for air sparging (they are too silty).

When an air sparging curtain is used, the contaminant source areas (contaminated soil leaching to the groundwater) are not actively treated; intrinsic remediation is used to treat the source area. The curtain would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in near-term protection of the DOT ROW and the Kenai River. It is estimated that the remaining contamination source will be exhausted in 15 years, after which the treatment system will be unnecessary.

When an air sparging grid is used (in the upper contaminant plume only), the contaminant source area is treated, which results in a shorter cleanup time (10 years instead of 15 years). This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 6 months after installation, resulting in near-term protection of the DOT ROW and the Kenai River.

For either an air sparging grid or curtain, monitoring of the groundwater and SVE discharge would be required to document the effectiveness and regulatory compliance of this alternative. Institutional controls prohibiting use of shallow site groundwater as drinking water would be included in this alternative. Contaminated shoreline sediments would be cleaned up by intrinsic remediation.

Alternative E (Lower Contaminant Plume only): Funnel and gate with in-well air stripping

Alternative E for the lower contaminant plume includes collecting and treating the contaminated water without removing it from the shallow ground water zone. A funnel wall, consisting of an impermeable barrier between the hard packed till-layer and the ground surface, would trap and direct the contaminated groundwater plume to a permeable gate area for treatment.

An in-well air stripping system can be used to remove the volatile contaminants. The collected groundwater can be directed to two diffused air bubble stripping wells that will have baffled chambers. Within each chamber, air would be injected into the water by a fine bubble diffuser to enhance volatilization. Air strippers provide one of the most aggressive and controllable methods of treating contaminated water, and they are particularly effective at volatilizing the types of chemical contaminants found at this site.

Similar to Alternatives C and D, this alternative would use a barrier system to treat contaminated groundwater before it leaves the RTRVP property. This alternative was evaluated only for the lower contaminant plume, because the buried utilities and greater groundwater depth would pose problems for installing this system.

Monitoring of the groundwater and air stripper discharge would be required to document the effectiveness and regulatory compliance of this alternative. Institutional controls prohibiting use of shallow site groundwater as drinking water would be included in this alternative.

The contaminant source areas (contaminated soil leaching to the groundwater) would not be actively treated using this technology; intrinsic remediation would be used to treat the source area. In addition, contaminated shoreline sediments would be cleaned up by intrinsic remediation.

This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in near-term protection of the Kenai River. It is estimated that the remaining contamination source will be exhausted in 15 years, after which the treatment system will be unnecessary.

Alternative F (Lower Contaminant Plume only): Groundwater extraction wells with ex situ air stripping

Alternative F for the lower contaminant plume uses groundwater extraction wells to capture and direct shallow-groundwater flow to an above-ground treatment system. The collected water would be pumped to the surface for treatment with air stripping equipment. Air strippers work by introducing air into contaminated water to maximize the air-water contact and thus contaminant volatilization. Once treated, the water would be returned to a drainage gallery in the alluvial deposits along the Kenai River.

Similar to Alternatives C, D, and E, this alternative would use a barrier system to treat contaminated groundwater before it leaves the RTRVP property. This alternative was evaluated only for the lower contaminant plume, because the groundwater is at a greater depth in the upper contaminant plume, which would greatly increase the cost and complexity of implementing this alternative.

Monitoring of the groundwater and air stripper air and water discharges would be required to document the effectiveness and regulatory compliance of this alternative. Institutional controls prohibiting use of shallow site groundwater as drinking water would be included in this alternative.

The contaminant source areas (contaminated soil leaching to the groundwater) would not be actively treated using this technology; intrinsic remediation would be used to treat the source area. In addition, contaminated shoreline sediments would be cleaned up by intrinsic remediation.

This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in near-term protection of the Kenai River. It is estimated that the remaining contamination source would be exhausted in 15 years, after which the treatment system will be unnecessary.

Alternative F: Source Area Excavation (Upper Plume Only)

This alternative would involve excavating upper plume contaminated soils adjacent to and underneath the former dry cleaner building and *ex situ* treatment of contaminated soils in treatment cells. The building would also be removed. This technology was evaluated only for the upper contaminant plume because that plume's source area is smaller and thus is more amenable to excavation than the much larger lower plume source area. Much of the lower plume source area has already been excavated, and the known remaining contamination "hot spots" are at depths greater than 20-30 feet.

This alternative would include constructing a soil treatment cell. Soils in the treatment cell would be remediated by SVE. Blowers would aerate the soil, causing the VOCs (e.g., PCE and its degradation products) to volatilize. Only soil contaminated above the site cleanup level would require remediation. Any soil remediation would be performed in accordance with federal RCRA regulations.

Soil monitoring would be required to document the removal of contaminated soil from the excavation and performance of the soil treatment process. Institutional controls prohibiting use of shallow site groundwater as drinking water would be included in this alternative.

As an *ex situ* remedy, the excavation associated with this alternative would pose a potential health and safety risk to site workers through skin contact and air emissions.

It is estimated that only minimal remaining contamination would be present in site soil; and the contamination should be exhausted within 5 years. Protection to the ROW and the Kenai River should be experienced within approximately 1 year after excavation.

Alternative G: Reductive Anaerobic Biological In situ Treatment Technology

Alternative G would use a combination of a barrier technology to stop the flow of contaminated groundwater leaving the RTRVP property in the short term and source treatment to reduce the timeframe necessary for operating the barrier. This alternative would involve injecting Hydrogen Release Compound (HRC™) into the contaminated groundwater to enhance biological degradation of PCE and its degradation products. HRC™ is a proprietary substance, manufactured by Regenesis Bioremediation Products, that provides both a food source and a hydrogen source to assist the microorganisms that degrade PCE.

The anaerobic conditions enhanced by HRC™ favor PCE and TCE degradation, but some daughter products like DCE and VC can be degraded faster under aerobic conditions. Therefore, optimal results for chlorinated compound remediation may also require the addition of oxygen to the groundwater at a point downgradient of the HRC™ injection.

Because the HRC™ is consumed during the dechlorination process, it must be replenished for the chlorinated compound remediation to continue. HRC™ is expected to last for several months due to its time-release feature.

Monitoring of the groundwater chemistry and contaminant concentrations would be required to document the effectiveness of this alternative and determine if the compliance objectives are being met. Institutional controls prohibiting use of shallow site groundwater as drinking water would be included in this alternative.

Contaminated shoreline sediments would be cleaned up by intrinsic remediation.

The estimated restoration timeframe for the upper contaminant plume is 10 years, and the estimated restoration timeframe for the lower contaminant plume is 5 years. This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in protection of the DOT ROW and the Kenai River in the near-term.

EVALUATION OF CLEANUP ALTERNATIVES

The remedial alternatives were evaluated using criteria provided in the DEC Contaminated Site Remediation Program Handbook. These criteria are listed in Table 2.

A comparative analysis was performed to identify the advantages and disadvantages of each remedial alternative relative to the other alternatives. The relative performance of each alternative is evaluated with respect to each of the evaluation criteria, using the descriptors of “better”, “above average”, “average”, “below average,” and “worse.” The scores have no independent value; they are only meaningful when compared among the different alternatives. The comparative analysis scores for each remedial alternative are summarized in Tables 3 and 4. Graphical symbols are used in Tables 3 and 4 to show the ratings of each alternative relative to the other alternatives.

Only the cleanup alternatives that met the threshold criteria (e.g., they are protective of people and the environment and comply with regulations) are included in Tables 3 and 4. The alternatives are evaluated against the “public input” criteria after comments are received on this Proposed Plan.

The cleanup goals discussed in the Development of Cleanup Levels Section of this Proposed Plan were used as the basis for evaluating the remedial alternatives. Specifically, the cleanup alternatives were expected to meet surface water cleanup levels of 5 µg/L PCE in sentry well samples and 50 µg/L PCE in off-RTRVP property groundwater. However, for comparison purposes, the remedial alternatives were also evaluated assuming that the cleanup goals for the RTRVP site allowed off-site groundwater PCE levels of 840 μg/L (the ACL). This second evaluation assumes that groundwater migrating off-RTRVP property into the Sterling Highway ROW and into the Kenai River at 840 μg/L is allowed. Graphical symbols and costs for both evaluations (cleaning groundwater to 5 μg/L and to 840 μg/L) are shown in Tables 3 and 4. As shown in Tables 3 and 4, some cost savings would be realized if the higher cleanup level were selected. The DEC is soliciting public input on which cleanup level is more appropriate for the site.

Table 2. Cleanup Alternative Evaluation Criteria

Protectiveness

Protectiveness of Human Health and the Environment – Determines whether a cleanup alternative provides adequate protection of human health and the environment.

Regulations

Compliance with Regulations – Evaluates whether a cleanup alternative will meet all of the applicable federal and state regulations.

Short- and Long-Term Effectiveness

Long-Term Effectiveness and Permanence – Considers the ability of a cleanup alternative to protect human health and the environment over time and the reliability of the remedial alternative.

Reduction of Toxicity, Mobility, and Volume– Evaluates a cleanup alternative's use of treatment to reduce harmful effects of contaminants, their ability to move in the environment, and the amount of residual contamination remaining.

Short-Term Effectiveness – Considers how fast a cleanup alternative reaches the cleanup goal and the risk to workers, residents, and the environment posed by implementing the remedial alternative.

Practicable

Implementability – Considers the technical and administrative feasibility of a cleanup alternative, based on the availability of materials and services needed to implement the alternative. This criterion also considers whether the technology has been used successfully at other similar sites.

Cost – Addresses the cost of a cleanup alternative based on design, construction, start-up, monitoring, and maintenance costs. Cost estimate is accurate to within –30 percent to + 50 percent.

Public Input

Agency Acceptance – Addresses concerns of state and federal agencies.

Community Acceptance – Addresses concerns of the community.

Remedial Alternative		Effectiveness Scores				Cost[1]			
		Long-term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume through Treatment	Short-term Effectiveness	**Implementability Score**	Cost Score	Estimated Present Worth Costs to Meet **5 ug/L**	Estimated Present Worth Costs to Reach **840 ug/L**	**Estimated Restoration Time (Years)**
C	Permeable Reactive Barrier	● ●	◑ ◑	◑ ◑	○ ○	◑ ●	$848 $1,818	$508 $1,089	15 10
D	In-Situ Air Sparging Curtain	◑ ◑	◔ ◔	◑ ◑	◕ ◕	● ◑	$764 $1,637	$557 $1,194	15 10
E	Funnel and Gate System	●	◑	◑	○	◔	$934 $2,002	NA NA	15
F	Extraction Wells with Air Stripping	◕ ◕	◔ ◔	◔ ◔	◑ ◑	◕ ◑	$793 $1,699	$569 $1,220	15 10
G	In-Situ Biological Treatment	◕ ◕	◕ ◕	◕ ◕	◔ ◔	○ ○	$1,195 $2,561	$657 $1,409	5 5

Notes:

[1] Range of costs is provided in thousands of dollars

NA: Alternative not evaluated for ACL of 840 ug/L

Symbol Key

- ● Better
- ◕ Above Average
- ◑ Average
- ◔ Below Average
- ○ Worse

Rating for Alternative to meet 5 ug/L cleanup level → ●

Rating for Alternative to meet 840 ug/L cleanup level → ◑

Table 3: Comparative Analysis of Cleanup Alternatives for RTRVP Lower Contaminant Plume

Remedial Alternative		Effectiveness Scores				Cost[1]			
		Long-term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume through Treatment	Short-term Effectiveness	**Implementability Score**	Cost Score	Estimated Present Worth Costs to Meet **5 ug/L**	Estimated Present Worth Costs to Reach **840 ug/L**	**Estimated Restoration Time (Years)**
C	Permeable Reactive Barrier	● ●	◑ ◑	◑ ◑	◔ ○	● ●	$522 $1,118	$403 $865	15 15
D	In-Situ Air Sparging Grid	◕ ◕	◕ ◕	◑ ◑	◕ ◕	◔ ○	$1,087 $2,330	$642 $1,375	10 5
E	In-Situ Air Sparging Curtain	◑	◔	◑	◕	◑	$730 $1,565	NA NA	15
F	Source Area Excavation	● ●	◕ ◕	◑ ◑	○ ○	○ ◔	$1,750 $3,500	$557 $1,194	5 5
G	In-Situ Biological Treatment	◕ ◕	◕ ◕	◕ ◕	◔ ◑	◕ ◕	$602 $1,290	$443 $949	10 5

Notes:

[1] Range of costs is provided in thousands of dollars

NA: Alternative not evaluated for ACL of 840 ug/L

Symbol Key

● Better
◕ Above Average
◑ Average
◔ Below Average
○ Worse

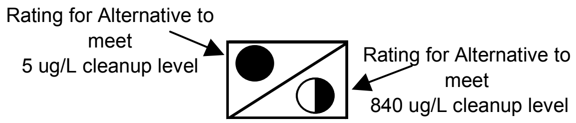

Table 4: Comparative Analysis of Cleanup Alternatives for RTRVP Upper Contaminant Plume

PREFERRED CLEANUP ALTERNATIVES

After careful evaluation by DEC, preferred alternatives were selected for both the upper and lower contaminant plumes at the RTRVP site. The preferred alternatives address the concerns of the site owner and other agencies, as specified below.

- They will not interfere with the DOT's construction plans for a new Kenai River Bridge and upgrading the adjacent Sterling Highway. They will stop contaminated groundwater from migrating into the DOT ROW above regulatory levels.
- They will protect the Kenai River in the short-term, as requested by the Alaska Department of Fish and Game (ADF&G).
- They will include source treatment, as requested by the City of Soldotna.
- They will be cost-effective, as requested by the RTRVP property owners.

In situ biological treatment was selected as the preferred alternative for both the lower and upper contaminant plumes. Several factors were weighed in selecting this alternative. In particular, considerations such as effectiveness, cost effectiveness, impact to future use of the site, comments from the RTRVP property owners, treatment time frame, and construction related issues were considered.

Although *in situ* biological treatment is the preferred remedial alternative, the permeable reactive barrier (PRB) was actually determined to be both the most effective treatment method and potentially the most cost-effective. However, *in situ* biological treatment has several advantages over a PRB:

- the source area can be treated, thereby reducing remediation time frame,
- iron staining, which is a potential side-effect of the PRB that would be undesirable in the lower contaminant plume (visible staining of groundwater entering the Kenai River), is not an issue with *in situ* biological treatment,
- the system can be installed in phases as needed, potentially reducing costs (note that the cost comparison used in the feasibility study assumed that complete systems would be installed, with no phased installation based on changes in site data.)

Because there is greater uncertainty associated with the *in situ* biological treatment technology than the PRB technology, two levels of treatability studies will be performed, with PRB as a contingent remedy should *in situ* biological treatment fail the treatability studies. *In situ* biological treatment using HRC™ is a newer technology that has never been used in a cold climate. The site-specific degradation rate is not known. The lower contaminant plume may already be naturally degrading near the optimum rate, i.e. the degradation rate may already be at a maximum. Because of the possibility that *in situ* biological treatment will not perform as anticipated, a contingency plan to implement a PRB in the event that laboratory and on-site pilot studies indicate that *in situ* biological treatment is not viable is also part of this preferred alternative.

Ultimately, *in situ* biological treatment was selected because of the potential for cost savings and the reduced treatment time frame. *In situ* biological treatment could cost less than the PRB if the pilot study shows that an injection well density less than initially anticipated is necessary.

The design factors that must be determined before a full scale *in situ* biological treatment system can be installed are: a site-specific degradation rate, the minimum treatment distance required, the required spacing between injection points/wells, and solubility of HRC™ in cold climates. Treatability studies will be performed to estimate degradation rates for the upper and lower contaminant plumes. The treatability studies will use HRC™ to treat samples of soil and groundwater from the upper and lower contaminant plumes at usual ambient temperatures in a laboratory. If the treatability studies indicate that *in situ* biological treatment should be effective, a pilot system will be installed at the site. If the pilot study is successful, it will be expanded to a complete system.

As a contingency plan, should either the treatability study or pilot test indicate that *in situ* biological treatment is not as effective as anticipated, a treatability study for the PRB will be performed concurrent with the *in situ* biological laboratory test. The PRB treatability study will evaluate site groundwater chemistry to determine the reaction rate and identify potential problems (e.g., iron staining or other adverse chemical reactions). Should *in situ* biological treatment prove ineffective, the laboratory PRB test will allow installation of a PRB this construction season.

Implementation of the preferred alternative for both the lower and upper contaminant plumes is described below.

Lower Contaminant Plume

Preferred Alternative: In situ biological treatment

Estimated Total Present Worth Cost (based on 5 µg/L cleanup level): $1,200,000 to $2,600,000

The method of HRC™ application for the lower contaminant plume includes both an HRC™ barrier and HRC™ source area injection points.

An HRC™ barrier will be installed across the downgradient edge of the groundwater plume (Figure 4). This HRC™ barrer would be constructed using two rows of 40 4-inch injection wells to allow for frequent reapplication of the HRC™. Due to the potential for increased VC concentrations and the potential for driving the groundwater and Kenai River sediments anaerobic, re-oxygenation of the groundwater was assumed necessary. A series of 50 Oxygen Release Compound (ORC™) injection wells between the HRC™ barrier and the Kenai River is proposed for re-oxygenation of the groundwater.

The remaining contaminated plume/soil area would be treated using 100 HRC™ injection points during the first year, with 25 new HRC™ injection points being installed annually for reapplication at any remaining contaminated hot spots.

In addition, 20 HRC borings will be installed in the Sterling Highway ROW to address remaining contamination between the RTRVP property and the storm sewer.

Contaminated shoreline sediments will be cleaned up by intrinsic remediation.

Monitoring of the groundwater chemistry and contaminant concentrations would be required to document the effectiveness and regulatory compliance of this alternative.

Institutional controls prohibiting use of shallow site groundwater as drinking water will be included in this alternative.

A restoration time of five years is estimated. This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in protection of the DOT ROW and the Kenai River in the near-term.

Contingent Alternative: Permeable reactive barrier

Estimated Total Present Worth Cost: $850,000 to $1,800,000

The lower contaminant plume permeable reactive wall would extend across the lower portion of the contaminant plume parallel to the Kenai River as shown in Figure 5. The subsurface wall would be approximately 220-feet long by 20-feet in depth with an active treatment layer of approximately 6 feet.

Monitoring of the groundwater chemistry and contaminant concentrations would be required to document the effectiveness and regulatory compliance of this alternative.

A restoration time of 15 years is estimated. This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in protection of the DOT ROW and the Kenai River in the near-term.

Upper Contaminant Plume

Preferred Alternative: In situ biological treatment

Estimated Total Present Worth Cost (based on 5 µg/L cleanup level): $600,000 to $1,300,000

The method of HRC™ application for the upper contaminant plume consists of an HRC™ injection grid. This HRC™ grid would be constructed using 100 HRC™ injection points during the first year, with 25 new HRC™ injection points being installed annually for reapplication at the remaining contaminated hot spots (Figure 6). Additional injections of liquid HRC™ or sodium lactate to the soils adjacent to or underneath the building will be performed to promote biodegradation of any PCE contamination under the building.

Monitoring of the groundwater chemistry and contaminant concentrations would be required to document the effectiveness and regulatory compliance of this alternative.

Institutional controls prohibiting use of shallow site groundwater as drinking water will be included in this alternative.

A restoration time of ten years is estimated. This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in protection of the DOT ROW and the Kenai River in the near-term.

Contingent Alternative: Permeable reactive barrier

Estimated Total Present Worth Cost: $500,000 to $1,100,000

The permeable reactive wall for the upper contaminant plume would extend along the western property boundary parallel to the Sterling Highway and on across part of the northern portion of the site. The subsurface wall would be approximately 240-feet long by 24-feet in depth with an active treatment layer of approximately 7 feet.

Monitoring of the groundwater chemistry and contaminant concentrations would be required to document the effectiveness and regulatory compliance of this alternative.

A restoration time of 15 years is estimated. This cleanup technology would stop migration of contaminated groundwater off-RTRVP property within approximately 3 months after installation, resulting in protection of the DOT ROW and the Kenai River in the near-term.

DECISION REVIEW

The final decision will be reviewed at least once every five years until all cleanup levels are achieved. New data are collected for the RTRVP contaminated site on a quarterly basis. Once a remedial alternative has been installed, the system will be closely monitored. All relevant new data will be reviewed during the five-year review to determine whether the implemented alternative continues to be both appropriate and sufficiently protective. The review will include consideration of any new toxicological data pertinent to the contaminants of concern, discernable trends in contamination concentrations, concerns of the public, and any other relevant information.

IF YOU WANT MORE INFORMATION ABOUT THIS PROPOSED CLEANUP DECISION

The Proposed Plan summarizes information that can be found in greater detail in the *River Terrace RV Park, Remedial Investigation/ Feasibility Study Report*, dated May 2000. The public is encouraged to review this report to gain a more comprehensive understanding of the site. The report can be reviewed at the ADEC offices in Anchorage, Soldotna, and Juneau and the Soldotna and Kenai public libraries.

PUBLIC PARTICIPATION REQUEST

The DEC would like you to review this Proposed Plan and provide us with your comments. Specifically, we are requesting your comments on the cleanup levels and the cleanup alternatives evaluated for this site. The final decision for the site will not be made until public comments are considered. Your comments can be presented either in writing, email, or at the public meeting held on Thursday, June 15, 2000. The public comment period ends June 26, 2000.

All comments received during the comment period and public meeting will be addressed in a document called a Responsiveness Summary. That document becomes part of the Record of Decision (ROD) for DEC's final decision.

If you have questions or wish to provide comments on this project, please contact :

Mr. Richard Sundet (ADEC) at (907) 269-7578
(email: rich_sundet@envircon.state.ak.us).

GLOSSARY OF TERMS

ACL – Alternative cleanup level; a site-specific contaminant cleanup level granted by the DEC for a contaminated site

bgs – below ground surface

DCE – Dichloroethene (has 3 isomers: 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene). All 3 isomers are PCE degradation products.

DEC – Alaska Department of Environmental Conservation.

DOT – Alaska Department of Transportation

EPA – United States Environmental Protection Agency

FS – Feasibility Study, an evaluation of site conditions and potentially applicable remedial actions.

HRC – Hydrogen Release Compound, a proprietary compound manufactured by Regenesis that is used to augment anaerobic biodegradation of chlorinated solvents.

Intrinsic Remediation – Natural chemical, physical, and biological processes that reduce or eliminate contaminant concentrations in soil, surface water, or groundwater

KRBO – Kenai River Bridge Outfall; storm sewer outfall adjacent to the Sterling Highway Kenai River Bridge at Soldotna

MCL – Maximum Contaminant Level, the maximum level of a contaminant allowable by law in water used for drinking

Mg/kg – Milligrams per kilogram (parts per million of contamination measured in soil)

Mg/L – Milligrams per liter (parts per million of contamination measured in water)

Monitoring – Periodic analysis of soil, surface water, and/or groundwater quality to determine the extent of contamination and the degree to which it has been cleaned up.

ORC – Oxygen Release Compound, a proprietary compound manufactured by Regenesis that is used to augment anaerobic biodegradation of chlorinated solvents.

PCE – Tetrachloroethene (also known as tetrachloroethene, perchloroethene, and perc), a common dry-cleaning solvent. PCE is highly toxic and a suspected carcinogen.

PRB – Permeable reactive barrier. In this Proposed Plan, PRB refers to a groundwater treatment technology involving a “wall” containing iron filings that groundwater flows through. Contamination in the groundwater is treated by chemical reactions with the iron, as the groundwater flows through the PRB.

Proposed Plan – A document that informs the public about alternatives that are considered for cleanup of a contaminated site and identifies a preferred cleanup alternative. The document encourages public comment on all alternatives.

Remedial Action – Action taken to eliminate, reduce, or control the hazards posed by contamination at a site.

Residual Product – Small globs of product cut-off from the mobile, free phase product by the presence of water or air. The residual product is trapped in the subsurface pore spaces.

Responsiveness Summary – A summary of oral and/or written public comments received during a comment period and the responses to those comments

ROD – Record of Decision, documentation of the selected remedy for a site and the rationale for its selection

ROW – Right-of-way; used in the document to refer to land adjacent to the Sterling Highway

RTRVP – River Terrace RV Park

TCE – Trichloroethene, a degradation product of PCE.

VC – Vinyl chloride, a PCE degradation product.

VOCs- Volatile organic chemicals

Water Table – The groundwater surface in an unconfined aquifer.

µg/L – Micrograms per liter (parts per billion of contamination measured in water)