

Introduction:

Geomatrix Consultants, Inc. (Geomatrix) contracted ORIN Remediation Technologies (ORIN) to treat pentachlorophenol (PCP) impacted soil at two former locations of a single aboveground dip tank (Locations #1 and #4). The dip tank was used to treat wood for the manufacturing of wood frame buildings from the mid-1960's to the mid-1980's in Lester Prairie, Minnesota. Soils at both Locations #1 and #4 with PCP concentrations greater than 120 milligrams per kilogram (mg/kg) were determined to be a listed hazardous waste (F032) by the Minnesota Pollution Control Agency (MPCA). The different contaminant chemistries at each Location #1 and #4 necessitated the design of two separate chemical oxidation treatments of these soils.

Objective:

The objective of the project was to treat the hazardous soils at each Location #1 and #4 by ex situ chemical oxidation (ESCO) to meet the treatment standards for a nearby Minnesota Subtitle D landfill as a non-hazardous waste.



Off-gassing and heat generation during treatment



Closeup of off-gassing

Treatment Approach:

Treatment Chemistries:

Iron-Activated Hydrogen Peroxide (aka Fenton's Reagent) at Location #1
Alkaline-Activated Sodium Persulfate at Location #4

Treatment application: Chemical oxidants were sprayed onto hazardous soils as the soils were returned to their original excavations, and then mixed with excavator.

Dosage Rate: 1% weight of hydrogen peroxide to weight of soil at Location #1
1% weight of sodium persulfate to weight of soil at Location #4

Dosage: 5,350 lbs of hydrogen peroxide were mixed with soils at Location #1
6,000 lbs of sodium persulfate were mixed to soils at Location #4

Site Characteristics:

Site: Site was sold during the soil corrective action and redeveloped for the cold storage of boats

Geology: Soils are sandy to a depth of approximately 15 feet below ground surface (ft bgs) with an organic-rich silty layer (foc > 1%) between 3 and 6 ft bgs at Location #4. Dense clay till underlies the sandy soils.

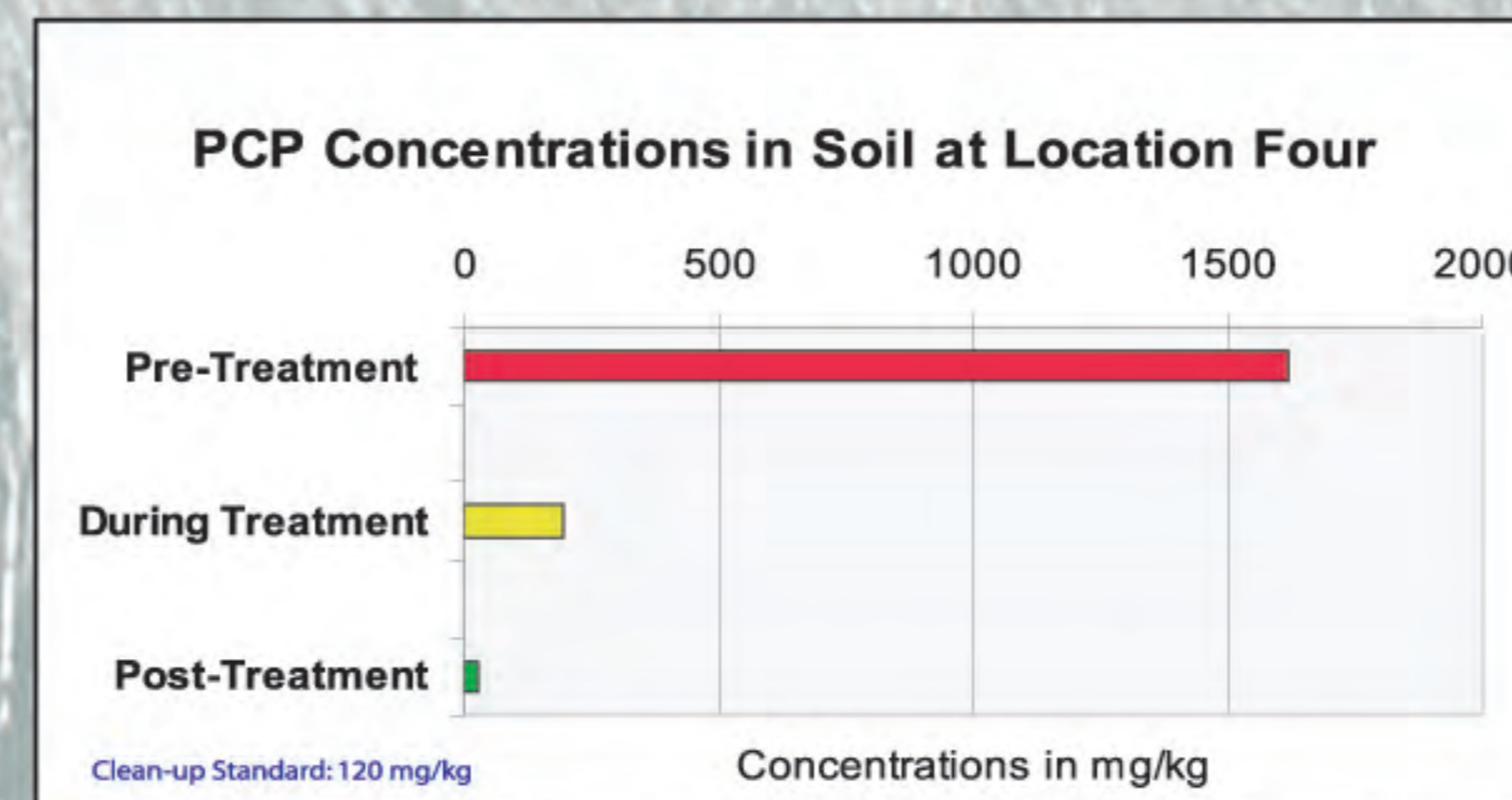
Groundwater: Depth to groundwater is approximately 5 ft bgs

Maximum Contaminant Concentrations and Treatment Standards:

	Location #1	Location #4	Treatment Standard
DRO	3,530 mg/kg	17,100mg/kg	N/A
PCP	192 mg/kg	1,620 mg/kg	120 mg/kg
Dioxins	0.0039ug/kg	1-2ug/kg	10 ug/kg

Amount of soil treated:

Location #1: 316 tons
Location #4: 340 tons



Method of Treatment:

The treatment chemistries at both Locations #1 and #4 were designed to oxidize PCP. The purpose of the treatments was to lower PCP concentrations to meet the requirements of the local waste disposal facility.

Bench-scale testing was conducted to determine the treatment chemistries and dosage rates for each Location #1 and #4. A commonly used oxidant called Fenton's Reagent successfully lowered PCP concentrations in site soil samples from Location #1 in a single application. However, the elevated petroleum concentrations at Location #4 compared to Location #1 proved to be more challenging, and Fenton's Reagent was unsuccessful despite multiple treatments. A different treatment chemistry called Alkaline-Activated Sodium Persulfate successfully lowered PCP concentrations in site soil samples from Location #4 in a single application.

Immunoassay testing completed during the soil treatment at Location #4 showed that the different Alkaline-Activated Sodium Persulfate chemistry was working at the full-scale level.

Summary

ORIN successfully lowered PCP concentrations in soils at Locations #1 and #4 using two different treatment chemistries. Post treatment laboratory confirmation sampling showed that PCP concentrations at both Locations #1 and #4 were below the treatment standard of 120 mg/kg, and the soils were disposed of at the nearby Minnesota Subtitle D landfill. The cost savings from the ESCO treatment of soils at Locations #1 and #4 is estimated to be on the order of \$500,000.



During treatment, 7,000 lb of lime were added to temporarily raise the pH and to reduce the moisture content before landfilling.



Beginning treatment



Ending treatment