

**Report Name:** *Final Investigation and Remedial Evaluation Report, Former New Haven Water Company Property, Hamden, Connecticut (Volumes I through VIII)*

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**Prepared for:** **Connecticut Department of Environmental Protection (CTDEP)**

On Behalf of: South Central Connecticut Regional Water Authority

### **What Is This Report About?**

This Final Investigation and Evaluation of Remedial Alternatives (FIERA) report is about the latest step in the investigation of the pollution at the site of the Hamden Middle School, a portion of the Newhall Community Center and two residential properties (249-251 and 253-255 Morse Street "the site." This site was owned by the New Haven Water Company before its ownership and use by the Town of Hamden for a middle school (hence the report title). The report includes a detailed explanation of more field investigations that were done at the site, with an in-depth history of the site, and offers alternative ideas for programs to remediate the pollution that is present. This stage of the investigation covers data gaps or areas where additional investigation was found to be needed as a result of previous studies.

### **Why Was This Investigation Done?**

The soil contamination that has been found in the Newhall Street neighborhood is associated with landfills that were located in the area from the late 1800s through the 1950s. A variety of fill materials (such as household garbage, industrial waste, and soil from other places) was thrown away in dumps. The study of the contamination from this dumping at or near the middle school site, formerly owned by the New Haven Water Company, has been on-going since 1979. Since 2002, environmental consultants for the South Central Connecticut Regional Water Authority have been working to complete testing of both the soil and groundwater at the site. The South Central Connecticut Regional Water Authority, which took over the New Haven Water Company, has taken responsibility for the recent studies at the site.

It is a complex challenge to find out what has caused the contamination, exactly where the soil and groundwater are contaminated, and how far the contamination extends. As each study was conducted over the years, new information led to more questions about the contamination. This study is the latest step in the process. It looked more closely at the quality of the surface soil east of the middle school. It evaluated the groundwater quality that flows off the site to the wetland north of the school. The other goals of this study were to:

- Further define how far the waste material in the ground extends;
- Determine if there is bulky material such as 55 gallon drums in with the waste materials;
- Further study what the fill material contains in the northern berm and under the tennis and basketball courts;
- Identify the source area for the Volatile Organic Compounds (VOC) soil and groundwater pollution, and potential surface water pollution; Identify the source area for the PCB pollution area and study if the groundwater has been affected by the PCB pollution ;
- Study surface water quality;

- Further study Extractable Total Petroleum Hydrocarbons (ETPH) in the groundwater;
- Better understand the path of groundwater flow.

### **Where Did They Investigate?**

The site this study covers includes not only the middle school grounds, but the middle school athletic field, a portion of the property for the Newhall Community Center, and the two apartment buildings on Morse Street that are next to the middle school entrance drive to the west. This site covers 23.9 acres.

### **How Did They Test The Soil And Water?**

Between May 3, 2004 and February 25, 2005 testing included:

- Drilling 200 test borings (digging out a long tube-shaped sample of the earth)
- Hand auguring or hand digging 39 surface soil samples
- Installing 20 new wells to monitor the ground water
- Collecting and analyzing 143 water samples
- Collecting and analyzing 995 soil samples including soil-vapor samples
- Collecting one surface water sample from the wetland on the north side of the middle school site
- Doing a complete geophysical study. This means using radar and other electronic tools to map the density of fill material underground and find locations of large buried metal objects
- Digging 3 test pits

### **What Contaminants Were Tested For?**

The contaminants tested for in the soil and groundwater samples were:

- Extractable Total Petroleum Hydrocarbons (ETPH) (oil)
- Volatile Organic Compounds (VOCs) (Halogenated and Aromatic VOCs)
- Semi-Volatile Organic Compounds (SVOCs) and Polycyclic Aromatic Hydrocarbons (PAHs)
- Metals including antimony, arsenic, barium, beryllium, cadmium, copper, cyanide, hexavalent chromium, total chromium, lead, mercury, nickel, selenium, silver, thallium, and zinc
- Asbestos (only on materials suspected of containing asbestos)
- Dioxins and furans
- PCBs
- Pesticides

An additional test was done on some of the soil samples, called a Synthetic Precipitation Leaching Procedure (SPLP). The SPLP test shows how metals and other chemicals might move from soil into the groundwater (such as when it rains). The SPLP test was done for any soil sample where cyanide was found, and where PCBs were detected above 1 mg/kg (milligram per kilogram). Also about 30 percent of the soil samples with metals were tested by SPLP.

The study compared the levels (concentrations) of each of these contaminants when found in the soil or groundwater samples to CTDEP standards which list what concentrations of substances could be harmful to people who come into contact with them.

### **What Did They Find?**

The study found the following:

**Pesticides:** There are low concentrations of pesticides scattered in the shallow soils at the site. They were not detected in deeper fill or soil. The water samples show that none of the pesticides found in the soil have been seeping into the ground water. There were no herbicides found in any of the groundwater sampled. Pesticides were found mostly on the western portion of the middle school property around the athletic fields. The source of the pesticides is most likely from use on the lawns and landscaping to control insects such as mosquitoes. The pesticides found in the soil are the types that tend to break down slowly over time.

**Cyanide and Metals:** The information about metals varied. It included:

- Thallium was not found in any of the soil or groundwater samples.
- Beryllium and selenium were found scattered at low concentrations in the soil and not found in the groundwater. It was concluded these metals are not associated with the waste dumped at the middle school site.
- Average concentrations of antimony, arsenic, lead, barium, copper, chromium, mercury, nickel, and zinc found in the underground waste and fill were 5 to 31 times higher than the concentrations in the non-fill areas. Antimony, arsenic, barium, copper, lead and mercury were all found in concentrations higher than accepted soil standards.
- Concentrations of beryllium, cadmium, cyanide, hexavalent chromium, nickel, selenium, silver, and zinc did not exceed soil standards.
- Lead arsenic and antimony were the inorganic substances most commonly found above soil standards. Of these three, lead was the only one detected above the accepted groundwater standard. In general, lead was found at different locations at the site.
- Barium was only detected once at a level above the soil standards. This was found under the basketball courts. The highest concentrations of barium were in spots of dense industrial waste fill and this concentration drops off considerably downhill and away from these spots.
- Groundwater entering the property from the east meets all water standards for all inorganic substances tested. On the middle school property, however, arsenic, barium, cadmium, lead and selenium were all found at levels above water standards. Yet, with the exception of barium, the other metals were scattered across the site, mostly in pockets of fill material saturated with water.
- The lead levels found in the soil have the ability to release lead into the groundwater. However, to date, lead was only found in a few instances above the groundwater standard.

- It was concluded that barium is clearly the main inorganic substance that has contaminated ground water. It is from industrial waste material saturated with ground water.

**Oil and ETPH:** Petroleum hydrocarbons (or oil) were found throughout soils at the site. ETPH was found in generally low concentrations in several spots of non-fill material underground. This is difficult to explain. The history of the site suggests that refuse from metal grinding mixed with oil was dumped there by Winchester Repeating Arms. Another possible source might be the use of oils in the past to control insects. This contamination may have been spread when the land was graded for use for the middle school and its athletic fields.

ETPH has only been detected in ground water west of the middle school. While the ETPH in the soil contains motor oil, the ETPH in the groundwater is only from fuel oil. The school's underground oil tank is nearby. However, because the ETPH is also near a concentration of PCBs, it is unclear if the ETPH is related to the use of a tank that has been removed.

**SVOCs and PAH:** About one-fifth of the samples collected had SVOC's that exceed the soil standards, a standard used to determine if the SVOCs could leach into the groundwater. However, all but two of the groundwater samples met water quality standards. These samples were collected from the area that abuts the northern wetland. All SVOC concentrations no longer exceed water standards beyond the middle school property line. PAHs were found in all types of materials in the ground at the middle school site. The highest concentrations were, however, in the industrial fill material. PAHs are not leaching into the groundwater at high levels.

**VOCs:** An area of Halogenated VOCs was found covering about 2,800 square feet west of the tennis and basketball courts. The source is fill that is saturated with groundwater. A narrow band of groundwater contaminated with Halogenated VOCs extends from this pocket to the southwest corner of the property. However, the concentrations have been getting less over the years and this is expected to continue. Samples of vapors beneath homes in the area were collected. The results showed these vapors do not have VOCs at a level that are a threat to human health. Aromatic VOCs were found in trace concentrations in industrial waste and in the groundwater. Two of these, benzene and chloroform, were measured at levels above the groundwater standards. A single source for this has not been found. The most common Aromatic VOC found has been chloroform. However, it is not believed to be related to the fill material on the property.

**PCBs:** PCBs were found throughout the site in both shallow and deeper material. In most cases, PCBs are at low levels and below soil standards. The exceptions were five locations on the athletic field in samples taken from 4 feet or more underground. One concentrated spot or 'hot spot' of PCBs was found on the northwestern side of the tennis and basketball courts. This material covers about 400 square feet and is 8 to 10 feet below ground. PCBs have not been found in site ground water.

### **What Will Be Done To Clean Up the Properties?**

The report evaluated a variety of possible alternatives to deal with each of the contaminants found. These alternatives will need to be evaluated by DEP and will be discussed with the community before any decisions are made.

**PCBs:** There are two options offered to deal with the PCB 'hot spot'. The first would be to dig up all the contaminated soil and dispose of it elsewhere in an approved location. About 30

cubic yards or 45 tons of contaminated soil would be removed from an area up to 10 feet deep. The hole would be filled with clean material. A second option would be to clean the contaminated soil in place. The ground would be cleaned with zero-valent particles, which break down the PCBs into safer chemicals.

**Halogenated VOCs:** A release of Halogenated VOCs was found in the area immediately west of the tennis courts. There are five options to deal with this.

- Option 1 - allow the Halogenated VOCs to break down through natural processes. This is an option because the amount of Halogenated VOCs in the ground water has improved dramatically over the past 2 ½ years without treatment.
- Option 2 - treat the soils with zero-valent particles. When this substance is used in combination with other agents to boost its effect, the Halogenated VOCs would be broken down into safer chemicals.
- Option 3 – Dig up the contaminated soils and dispose of them in an approved location. The affected soil goes to 10 to 12 feet below ground. The concern with this choice is that when the soil is dug up, this might release a pocket of Halogenated VOCs that could seep further away into the ground water.
- Option 4 – Inject the ground with varied other substances similar to Option 1. The report noted that this may be less effective in treating the contamination than Option 1
- Option 5 – install engineering systems that would selectively pull the contaminants out of the soil. While this would be effective, it could be costly

**Two residential buildings:** Contaminated soils have been found on the northern and southern sides of the Hamden Housing Authority apartments. The contamination is at levels above the soil and groundwater standards. There are 3 options offered for dealing with this contamination.

- Option 1 – dig up and remove the contaminated soils to a depth of about 4 feet
- Option 2 – dig up the soils on the northern side of the buildings and fill or cap with clean soils. There would need to be a land use restriction to ensure no disturbance of this cap in the future. This would also include installing a groundwater monitoring well.
- Option 3 – use special engineering systems to keep the contaminated soil in place and prevent the contamination from moving. There would need to be a land use restriction to ensure no disturbance of the protected area. This would also include installing a groundwater monitoring well.

**Site-wide remedies:** For the remainder of the middle school property, there should also be some remedy to deal with other types of contamination. In general, it is recommended that soils under the existing buildings be isolated or made inaccessible. In addition, 5 options for programs to deal with the contamination were offered. Each of the options includes a combination of 3 or more tools to remedy the different types of contamination.