

**FIFTH FIVE-YEAR REVIEW REPORT FOR
CHEMICAL CONTROL CORPORATION SUPERFUND SITE
UNION COUNTY, NEW JERSEY**



Prepared by

**U.S. Environmental Protection Agency
Region 2
New York, New York**

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**Pat Evangelista, Acting Division Director
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9/18/19
Date

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LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEA	Classification Exemption Area
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
GWQS	Ground Water Quality Standards
HRC	Hydrogen Release Compounds
ICs	Institutional Controls
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
PSDs	Primary Settling Defendants
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
SVI	Soil Vapor Intrusion
TCE	Trichloroethylene
WRA	Well Restriction Area

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the 5th FYR for the Chemical Control Corporation Superfund Site (“Chemical Control”). The triggering action for this statutory review is the previous five-year review, signed September 12, 2014. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The Site consists of a site-wide operable unit (OU), which will be addressed in this FYR.

The Chemical Control Site FYR was led by the United States Environmental Protection Agency (EPA). Participants included Remedial Project Manager, Nigel Robinson, Michael Scorca (EPA-Hydrologist), Lora Smith-Staines (EPA-Human Health Risk Assessor), Michael Clemetson (EPA-Ecological Risk Assessor) and Natalie Loney (EPA-Community Involvement Coordinator). The Chemical Control PRP (Potentially Responsible Party) Group was notified of the initiation of the five-year review. The review began on October 9, 2018.

Site Background

The 2.2-acre Chemical Control property is located at 23 South Front Street, Elizabeth, New Jersey. It is part of a narrow peninsula formed by the Elizabeth River and the Arthur Kill. This peninsula was a marsh until it was filled in to prepare it for industrial development in the 1800s. The Elizabeth River, the Arthur Kill, and the water table aquifer at the site are saline and tidally influenced.

From 1970 to 1979, Chemical Control Corporation operated as a hazardous waste storage, treatment, and disposal facility, accepting various types of chemicals including: acids, arsenic, bases, cyanides, flammable solvents, polychlorinated biphenyls (PCBs), compressed gases, biological agents and pesticides. Throughout its operations, the Chemical Control Corporation was cited for discharge and waste storage violations. The facility operated until March 1979, when it was closed due to numerous environmental and safety violations by the New Jersey Department of Environmental Protection (NJDEP).

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Chemical Control Corporation		
EPA ID: NJD000607481		
Region: 2	State: NJ	City/County: Elizabeth/Union County
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA <i>[If "Other Federal Agency", enter Agency name]:</i>		
Author name (Federal or State Project Manager): Nigel Robinson		
Author affiliation: EPA		
Review period: 10/9/2018 - 5/1/2019		
Date of site inspection: 4/30/2019		
Type of review: Statutory		
Review number: 5		
Triggering action date: 9/12/2014		
Due date (five years after triggering action date): 9/12/2019		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The Chemical Control site was listed on the National Priorities List in September 1983. A remedial investigation and feasibility study (RI/FS) was conducted at the site from 1985 to 1986. The study determined that contaminants found in the soils, groundwater, surface water and sediments included, but were not limited to, the following:

Acetone	2-butanone
vinyl chloride	benzene
toluene	ethylbenzene
chlorobenzene	trichloroethane
1,2-dichloroethene	PCBs
di-n-butyl phthalate	benzyl alcohol
benzoic acid	pyrene
naphthalene	fluorene

At the time of the RI/FS, the greatest potential risk from the site was the possible exposure to contaminated soils. Significant health threats were posed through direct contact, fugitive dust emission and volatilization. However, these risk factors were significantly reduced as the contaminated soils were below the water table and a layer of gravel; in addition, the site was fenced. The risk posed by the groundwater was minimal as it is saline and is not a drinking water source. Residents and businesses in the area are supplied with municipal water.

Very low levels of contamination were found in the Elizabeth River. Higher levels of contamination were found in the sediments, however, data failed to show any trend linking the contaminants to the site. Such a link was difficult because of the other multiple sources of contamination along the river. The river is lined with junk yards, oil tank farms, chemical manufacturers, and storm water runoff from much of the city's street. Remediation of the river sediments was not included as a component of the site remedy as remediation of the soils would eliminate the source of contaminant migrating from site soils but not from the other multiple sources.

Ecological risks were not evaluated during the RI/FS.

Response Actions

The State's initial cleanup of the site starting in March 1979 removed 55,400 pounds of bulk solids, 1,800 gallons of bulk liquids, nearly 10,000 drums of waste, 83 gas cylinders, 10 pounds of infectious wastes, seven pounds of radioactive wastes and 24 gallons of highly explosive liquids. While the emergency response action was still in its early stages, on April 21, 1980, an explosion and fire occurred at the site.

NJDEP continued its (pre-Superfund) cleanup operation after the fire and removed all building debris, drums (found on and buried below the surface), tanks and three feet of surface soil. NJDEP operated a groundwater recovery and treatment system from November 1980 through July 1981.

The first ROD issued by EPA in 1983 was an initial remedial measure to remove gas cylinders, box trailers and a vacuum truck from the site.

Based on the results of the RI/FS, EPA issued a second ROD for the site on September 23, 1987. The ROD called for:

- Treatment of 18,000 cubic yards of contaminated soil at the site using *in-situ* fixation;
- Removal of debris from earlier response actions;
- Sealing of the sanitary sewer line under the site where it connects to the South Front Street storm sewer;
- Repair of the berm that separates the site from the Elizabeth River; and
- Collection and analysis of environmental samples, as required, to ensure the effectiveness of the remedy.

Though no RAOs were identified in the ROD, the intent of the remedy was to reduce the mobility and toxicity of the contaminants in the soil, protect against any possibility of the contaminated soils being exposed, insure that the leaching of contaminants will not increase, return the site to a condition that is compatible with future development that could reasonably be expected in this industrial area.

Status of Implementation

On October 23, 1990, the Primary Settling Defendants (PSDs) for the Chemical Control Corporation entered into a Consent Decree with EPA for the implementation of the remedy as selected by the ROD. Construction started at the site in August 1993 and was completed in April 1994.

In addition to implementing the components of the ROD, the PSDs incorporated a slurry wall into the remedy. The purpose of the slurry wall was to further isolate and contain the solidified soils. The slurry wall was constructed around the perimeter of the site and anchored into a clay layer underlying the site. By anchoring the slurry wall into the clay layer, the surrounding groundwater was cut off from entering and leaving the site. The site was then divided into sections and soils in each section were mixed and solidified with the addition of Portland cement and water. The solidification extended to a depth of seventeen feet below ground surface. A virgin mixture of concrete was added to the top of the solidified mass to provide a barrier between the exterior elements, such as rainfall, and the solidified soils. The top surface of the concrete was then pitched to prevent water infiltration into the solidified mass and to maximize surface water runoff toward the Elizabeth River. The solidified mass and concrete was then covered with a layer of gravel. An 8-foot chain-link fence was installed around the site to restrict unauthorized access. The final inspection of the site was conducted on April 21, 1994 and the Remedial Action Report was finalized on September 30, 1994.

During the remedy implementation, the slurry wall was installed as close to the bank of the Elizabeth River as technically feasible. This left an untreated area of approximately 15 feet between the slurry wall and the river. Results from monitoring wells installed in this area along with soil samples, indicated that the untreated area contained indicator compounds. From 2002 through 2004, over a period of 21 months, the PSDs implemented an *in-situ* bioremediation to treat the affected areas. The affected areas were treated with Hydrogen Release Compounds (HRC). After one year groundwater analyses showed that the HRC was effective in treating the indicator parameters, vinyl chloride and 2-butanone in the vicinity of monitoring well CW-3. Groundwater monitoring showed that one year after the HRC application, vinyl chloride and 2-butanone along with other VOCs had declined to non-detectable levels. Overall, the HRC application was effective at removing dissolved concentrations of chlorinated VOCs in the groundwater.

Systems Operations/Operation & Maintenance

The PSDs have been conducting long-term monitoring and maintenance activities in accordance with the operation and maintenance (O&M) plan, approved by EPA November 1992. The primary activities associated with the O&M plan are:

- Visual inspection of the surface and solidified mass with regard to erosion, drainage and the security of the chain-link fence;
- Hydraulic conductivity testing of the stored stabilized soil samples/cores;
- Groundwater and surface water sampling; and
- Groundwater elevation monitoring.

Since 2009, primarily visual inspections and hydraulic conductivity testing of the stored stabilized soil samples/cores have been performed. Groundwater samples were collected and analyzed from the three on-site monitoring wells in 2015. The property owner uses the site as a staging area for heavy duty equipment and materials. Four feet of crushed gravel was placed on top of the site to ensure the solidified mass can accommodate additional weight from the stored equipment and materials. The three monitoring wells have been placed in protective cylinders with manhole covers to accommodate the increase in surface elevation.

Potential site impacts from climate change have been assessed and the performance of the remedy is currently not at risk due to the expected effects of climate change in the region and near the site.

III. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Short-term Protective	The remedy remains protective of human health and the environment in the short-term. In order for the remedy to be protective in the long-term, institutional controls need to be implemented and groundwater monitoring should be resumed.

Table 2: Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description*	Completion Date (if applicable)
Sitewide	Institutional Controls	Implement Institutional Controls	Completed	Deed Notice was Implemented	11/21/2017
Sitewide	Institutional Controls	Implement Institutional Controls	Completed	Classification Exemption Area was established	01/03/2018
Sitewide	Groundwater Monitoring	Resume Groundwater Monitoring	Completed	Groundwater sampling was performed in 2015	1/12/2015

Resumption of groundwater monitoring

Groundwater monitoring was not conducted at the site for the previous five-year period, 2009 – 2014. The 2014 five-year review recommended the resumption of groundwater monitoring. A single round of groundwater samples was taken on January 12, 2015.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2018, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 42 Superfund sites in New York and New Jersey, including the Chemical Control Superfund site. The announcement can be found at the following web address: <https://www.epa.gov/aboutepa/fiscal-year-2019-five-year-reviews>. The results of the review and the report will be made available at the Site information repository located at <https://www.epa.gov/superfund/chemical-control>, as well as the EPA Region 2 - Superfund Records Center, 290 Broadway, 18th Floor, New York, New York 10007 (212) 637-4308 and at: <https://www.elizabethnj.org>.

During the FYR process, EPA communicated with representatives for the property owner, the PRPs and the State of New Jersey. No interview of city officials was conducted for this FYR.

Data Review

Solidified Mass Testing

During implementation of the chemical fixation remedy, core samples were collected from the solidified mass. The core samples, which are stored at an off-site location, allow for the permeability of the solidified soils to be tested without compromising the integrity of the solidified mass which would have had to be drilled to obtain the necessary samples. The result of this testing program is extrapolated to assess the performance of the solidified mass. In accordance with the O&M plan, one solidified soil core sample is tested per year to determine its permeability. Table 4 lists the solidified core permeability test results. Results from 2013 through 2017 indicate a

hydraulic conductivity range of 1.60×10^{-7} to 1.87×10^{-7} centimeters per second (cm/sec). The overall effective permeability results have decreased when compared to the previous five-year review. However, the values still exceed the performance standard of 1.5×10^{-5} cm/sec established in the 1987 ROD and the RCRA composite landfill cap standard of 1×10^{-7} cm/sec.

Groundwater Sampling

Groundwater was sampled once for this five-year review. The three groundwater monitoring wells, CW-3, CW-4 and CW-5, were sampled in January 2015 for volatile organic compounds (VOCs). The analyses showed that only benzene, trichloroethene and vinyl chloride exceeded the New Jersey Ground Water Quality Standard (GWQS) in certain wells (see Table 5). Monitoring well, CW-3 and CW-4 showed benzene at concentrations of 25 and 83 µg/L respectively, compared with the New Jersey GWQS of 1 µg/L. Trichloroethene was found only in CW-3 at 1.2 µg/L, compared to New Jersey GWQS of 1 µg/L. Vinyl Chloride was also found only in CW-3 at 7.3 µg/L, compared with the New Jersey GWQS of 1 µg/L. No contaminant exceeded the New Jersey GWQS in CW-5.

Tables 6, 7 and 8 show the concentrations of VOCs in monitoring wells CW-3, CW-4 and CW-5 over time, from 2002, at the time the bio-remediation treatment was implemented, and post treatment concentrations in 2004, 2008 and 2015. The results show a significant reduction, particularly after the treatments. Even though the 2015 results show some increases, particularly in CW-3, most of the concentrations remain well below the pre-treatment levels.

Originally the groundwater monitoring program intended to detect any release from the solidified mass. The wells were placed in a narrow slip between the slurry wall and the bank of the Elizabeth River. After installing and conducting sampling of the three wells, it was realized that parts of the narrow slip had residual contamination. This area was not excavated and went untreated during remedial activities at the site. With some success, bio-remediation was later employed to treat this area. Over the years, some locations continue to show reduced levels of residual contamination. Because groundwater monitoring may not be the ideal tool to determine if contamination is escaping from the solidified mass due to the presence of additional sources in the area, as well as the tidal influence on the groundwater, another measure, by itself or in conjunction with groundwater monitoring should be explored.

Site Inspection

The inspection of the Site was conducted on April 30, 2019. The inspection was conducted by Nigel Robinson, EPA's Remedial Project Manager with representatives of the PRPs and the property owner. The purpose of the inspection was to assess the Site. The site is being used as temporary storage area for gas pipelines, which will be used for an upcoming project. At other times, the site is used as a storage area for marine and other types of equipment. An additional four feet of gravel was placed on the site to elevate it and accommodate the additional weight from the stored equipment and materials. The site fence and gates are in good and secure conditions. The monitoring wells have been properly secured.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

Yes, the remedy is functioning as intended by the decision document.

The 1987 ROD remedy called for the treatment of 18,000 cubic yards of contaminated soil at the site using in-situ fixation, removal of debris from earlier response actions, sealing of the sanitary sewer line under the site, repair of the berm adjacent to the Elizabeth River, and collection and analysis of environmental samples to ensure effectiveness of the remedy. As an additional protective measure, the PSDs constructed a slurry wall around the perimeter of the site, anchoring it into the clay layer. The in-situ fixation remedy, along with one to three feet of gravel cover greatly increased protectiveness by eliminating the direct contact and inhalation of fugitive dust/volatilized contaminants in the area of solidification.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

The 1983 and 1987 RODs were signed prior to the implementation of a majority of the Risk Assessment Guidance for Superfund used currently by EPA. However, the process that was used remains valid.

Contaminants of concern identified in the OU2 ROD at the Site were benzene, toluene, ethylbenzene, chlorobenzene, 1,2-dichloroethene, trichloroethylene (TCE) and tetrachloroethylene (PCE), in addition to a few metals (lead in groundwater and arsenic and chromium in surface water). The full list of indicator chemicals from the June 1987 Closure Remedial Investigation also includes: 1,2-dichloroethane, vinyl chloride, chloroform, methylene chloride, benzo(a)pyrene, 4,4'-DDT, PCB (Aroclor) 1260, N-nitrosodiphenylamine, nickel, bis (2-ethylhexyl)phthalate, 1,2-dichlorobenzene, chlorobenzene, total xylenes, mercury, phenol, acetone and 2-butanone. Contaminants were present in soil, groundwater, sediment and surface water although Elizabeth River sediments showed no observable impacts from the Site in the Remedial Investigation.

Surface water standards used at the time of the 1987 ROD were the Ambient Water Quality Criteria (AWQC) for the protection of saltwater aquatic life. Currently for surface water evaluation, the NJDEP has promulgated Surface Water Quality Standards (SWQS). No specific groundwater, soil or sediment standards were identified. As a result, site risks were likely underestimated as toxicity studies and higher instrument sensitivities have mostly resulted in more conservative standards over time. However, based on the selected remedy for an in-situ solidified mass, a discussion of standards at the time of the remedy is inconsequential as soils are immobilized, the surrounding groundwater is no longer in contact with these contaminated soils and a slurry wall serves to cut-off most residual contamination from the surface water bodies. Groundwater data from three wells located between the slurry wall and the Elizabeth River are compared with current NJDEP GWQS (Ground Water Quality Standards) for Class IIA potable water as well as State and Federal maximum contaminant levels.

The most significant exposure pathway indicated in the ROD was direct contact exposure to site soils. Since contaminated soils have been solidified and are below one to three feet of gravel, they have been immobilized and rendered inaccessible. Some residual contamination remains beyond the solidified mass along the Elizabeth River. Since this contamination is below large rip-rap, it is also likely unavailable for direct contact. Other pathways evaluated as part of the risk assessment included: direct contact with and incidental ingestion of surface water/sediments in the Elizabeth River and dermal contact with leachate from river banks at low tide. Boaters, fishermen, water skiers and swimmers were considered exposed populations accessing the Arthur Kill and the Elizabeth Rivers. While it was noted in the June 1987 Closure Remedial Investigation that a likely exposure scenario includes fisherman, no evaluation of fish consumption was made in the risk assessment. Finfish species are mobile and the site exists in a highly industrialized area with many sources contributing to contamination in the Elizabeth River, Arthur Kill and other surrounding waterways, it would be difficult to ascertain whether finfish tissue contaminant concentrations were resulting solely from the Site.

The Elizabeth River, Arthur Kill and the water table aquifer at the site are all saline and tidally influenced so groundwater at the site was not evaluated for potable use. Since site groundwater is designated as Class IIA, if the risk assessment were performed now, a potable exposure scenario would have been evaluated. This could result in additional site risk; however, it is unlikely that site-contaminated groundwater would be consumed based on salinity. Additionally, residents and businesses are supplied with municipal water. A Classification Exemption Area (CEA)/Well Restriction Area (WRA) was established at the Site on January 3, 2018, addressing concentrations of benzene and vinyl chloride that remain above the GWQS of 1 µg/L, to prohibit use of site groundwater for potable purposes. The only GWQS exceedances reported in the last five years were benzene in wells CW-3 and CW-4 at 25 and 83 µg/L, respectively, TCE (GWQS = 1 µg/L) in well CW-3 at 1.2 µg/L and vinyl chloride in well CW-3 at 7.3 µg/L. Further, the solidified mass and slurry wall prevent groundwater flow through a majority of the site. It is not believed that the groundwater ingestion pathway is complete beyond the extent of the CEA/WRA or anywhere on the Site.

As mentioned in the previous five-year review, the soil vapor intrusion (SVI) pathway was not evaluated at the time of the remedy. SVI is evaluated when soils and/or groundwater are known or suspected to contain VOCs. No buildings currently exist on the Chemical Control property. A deed notice was issued on November 21, 2017 which restricts future use of the property (e.g., redevelopment as residential, school, daycare, park or playground is prohibited). Since contaminated soils have been solidified and the deed notice would preclude site use that will disturb the protectiveness of the remedy, the SVI pathway is not a concern at the Site.

While not formally identified as RAOs, the ROD indicated that the remedial action should: reduce the mobility and toxicity of the contaminants in the soil, protect against any possibility of the contaminated soils being exposed, insure that the leaching of contaminants will not increase, return the site to a condition that is compatible with future development that could reasonably be expected in this industrial area. Implementation of the remedy serves to accomplish the stated goals.

No additional sources of contamination, contaminants of concern, exposed populations or exposure pathways have been identified since the last five-year review. There have been no other changes in site conditions that could affect the protectiveness of the remedy.

Although the ecological risk assessment screening and toxicity values used to support the 1983 and 1987 RODs may not necessarily reflect the current values, the solidification and concrete cap eliminated any potential risk from surface soil contaminants to terrestrial receptors. Further, the slurry wall helps in preventing contaminated groundwater from migrating to the surface water. Consequently, the exposure assumptions remain appropriate and thus the remedy remains protective of ecological resources.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No information that would alter the protectiveness of the remedy was identified.

VI. ISSUES/RECOMMENDATIONS

No issues affecting protectiveness were identified in the FYR. However, it is suggested that groundwater monitoring should continue at the site with a sampling frequency rate of one to two times every five years at a minimum, unless another measure of evaluating remedy performance can be identified.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
<i>Operable Unit:</i> OU1	<i>Protectiveness Determination:</i> Protective	<i>Planned Addendum Completion Date:</i> Click here to enter a date
<i>Protectiveness Statement:</i> The implemented remedy at Chemical Control is protective of human health and the environment.		

Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Choose an item	<i>Planned Addendum Completion Date:</i> Click here to enter a date
<i>Protectiveness Statement:</i> The implemented remedy at Chemical Control is protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Chemical Control Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Table 3: Chronology of Site Events	
Event	Date(s)
Initial discovery of problem or contamination	1979
Pre-NPL responses	1979
Final NPL listing	1983
Removal actions	1979
Remedial Investigation/Feasibility Study complete	1987
ROD signature	1987
Enforcement documents (CD, AOC, Unilateral Administrative Order)	1991
Remedial design start	1990
Remedial design complete	1992
On-site remedial action construction start	1992
RA Construction completion	1994
Construction completion date	1993
First five-year review	1998
Second five-year review	2004
Third five-year review	2009
Fourth five-year review	2014
Deed Notice placed on the site	2017
CEA placed on the site	2018

Table 4
Summary of Soil / Cement Permeability Testing Program
Chemical Control Corp. Site

Year	Hydraulic Conductivity Test Results (cm/sec)
1994	9.6x10 ⁻⁸
1995	7.5x10 ⁻⁸
1996	2.8x10 ⁻⁸
1997	7.3x10 ⁻⁸
1998	----
1999	1.5x10 ⁻⁸
2000	2.4x10 ⁻⁹
2001	----
2002	4.0x10 ⁻⁹
2003	4.1x10 ⁻⁹
2004	1.6x10 ⁻⁹
2005	1.65x10 ⁻⁷ *
2006	1.31x10 ⁻⁹
2007	7.76x10 ⁻⁸
2008	1.57x10 ⁻⁸
2009	1.45x10 ⁻⁷ *
2010	2.67x10 ⁻⁶ *
2011	3.94x10 ⁻⁸
2012	7.00x10 ⁻⁸
2013	5.69x10 ⁻⁸
2014	2.47x10 ⁻⁶ ^

Year	Hydraulic Conductivity Test Results (cm/sec)
2015	1.87x10 ⁻⁷
2016	1.60x10 ⁻⁷
2017	1.65x10 ⁻⁷

* Soil-cement samples had holes throughout ranging in size from ~ 0.5 to 0.05 and the top of the core sample was uneven and porous looking - (sample integrity may be compromised)

^ Sample contained interior porous section.

Note: All test results have met the Performance Standard of a hydraulic conductivity < 1x10⁻⁵ cm/sec

TABLE 5**Chemical Control Site****January 2015 Groundwater Sample Results Summary
of Detected Volatile Organic Compounds**

Well No. Sample Date	CW-3 1/12/2015	CW-4 1/16/2015	CW-5 1/12/2015	NJ Class IIA GWQS
Volatile Organic Compound	µg/L	µg/L	µg/L	µg/L
1,1-Dichloroethane	5.3	2.9 J	ND	50
1,2-Dichloroethane	1.1	ND	ND	2
2-Butanone	15	ND	ND	300
4-Methyl-2-pentanone	22	ND	ND	NA
Acetone	42	ND	ND	6000
Benzene	25	83	0.19 J	1
Carbon disulfide	1.3	ND	ND	700
Chlorobenzene	11	13	ND	50
Chloroethane	3.8	ND	ND	5
cis-1,2-Dichloroethene	9.1	ND	ND	70
Ethylbenzene	2	25	ND	700
MTBE	ND	ND	0.78 J	70
TBA	12	ND	15	100
Toluene	100	34	ND	600
trans-1,2-Dichloroethene	0.37 J	ND	ND	100
Trichloroethene	1.2	ND	ND	1
Vinyl Chloride	7.3	ND	ND	1
Xylenes, Total	6.7	188	ND	1000
Total Estimated Conc. (TICs)	49	210	26	-

Notes:

1. Concentrations are in micrograms per liter (µg/L).
2. NJ Class IIA GWQS = New Jersey Class IIA Ground Water Quality Standards (N.J.A.C. 7:9C)
3. indicates compound concentration exceeds the highlighted GWQS.
4. ND = Not Detected
5. J = Estimated concentration less than the reporting limit.

TABLE 6**Historic Volatile Organic Compound Concentrations for Monitoring Well CW-3**

Monitoring Well CW-3 VOC Concentration Summary	Pre-Treatment	Post-Treatment	Post-Treatment	Post-Treatment
Sample Month/Year	July 2002	Aug. 2004	Aug. 2008	Jan. 2015
HRC Treatment in Nov. 2002	Baseline	~ 2 years After	~ 6 years After	~ 12 years After
Volatile Organic Compounds (µg/L)				
Vinyl Chloride	480	ND	ND	7.3
Chloroethane	7.3	ND	ND	3.8
1,1-Dichloroethane	80	ND	ND	5.3
1,2-Dichloroethane	150	ND	ND	1.1
trans-1,2-Dichloroethene	7.1	ND	ND	0.37
cis-1,2-Dichloroethene	680	ND	ND	9.1
Trichloroethene	40	ND	ND	1.2
Tetrachloroethene	1.2	ND	ND	ND
2-Butanone	140	ND	ND	15
Chlorobenzene	42	38	19	11
Benzene	390	280	190	25
Toluene	820	28	1.6	100
Ethylbenzene	85	83	3.3	2
Xylenes (total)	280	250	15	6.7

1. Concentrations are in micrograms per liter (µg/L)
2. ND = Not Detected

TABLE 7**Historic Volatile Organic Compound Concentrations for Monitoring Well-CW-4****No Treatment**

Well No. CW-4 Sample Month/Year	Aug. 2004	Aug. 2008	Jan. 2015
Volatile Organic Compounds (µg/L)			
Vinyl Chloride	ND	ND	ND
Chloroethane	ND	ND	ND
1,1-Dichloroethane	ND	2.1	2.9
1,2-Dichloroethane	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND
Trichloroethene	ND	ND	ND
Tetrachloroethene	ND	ND	ND
2-Butanone	ND	ND	ND
Chlorobenzene	7.4	16	13
Benzene	63	130	83
Toluene	35	15	34
Ethylbenzene	19	38	25
Xylenes, Total	97	250	188

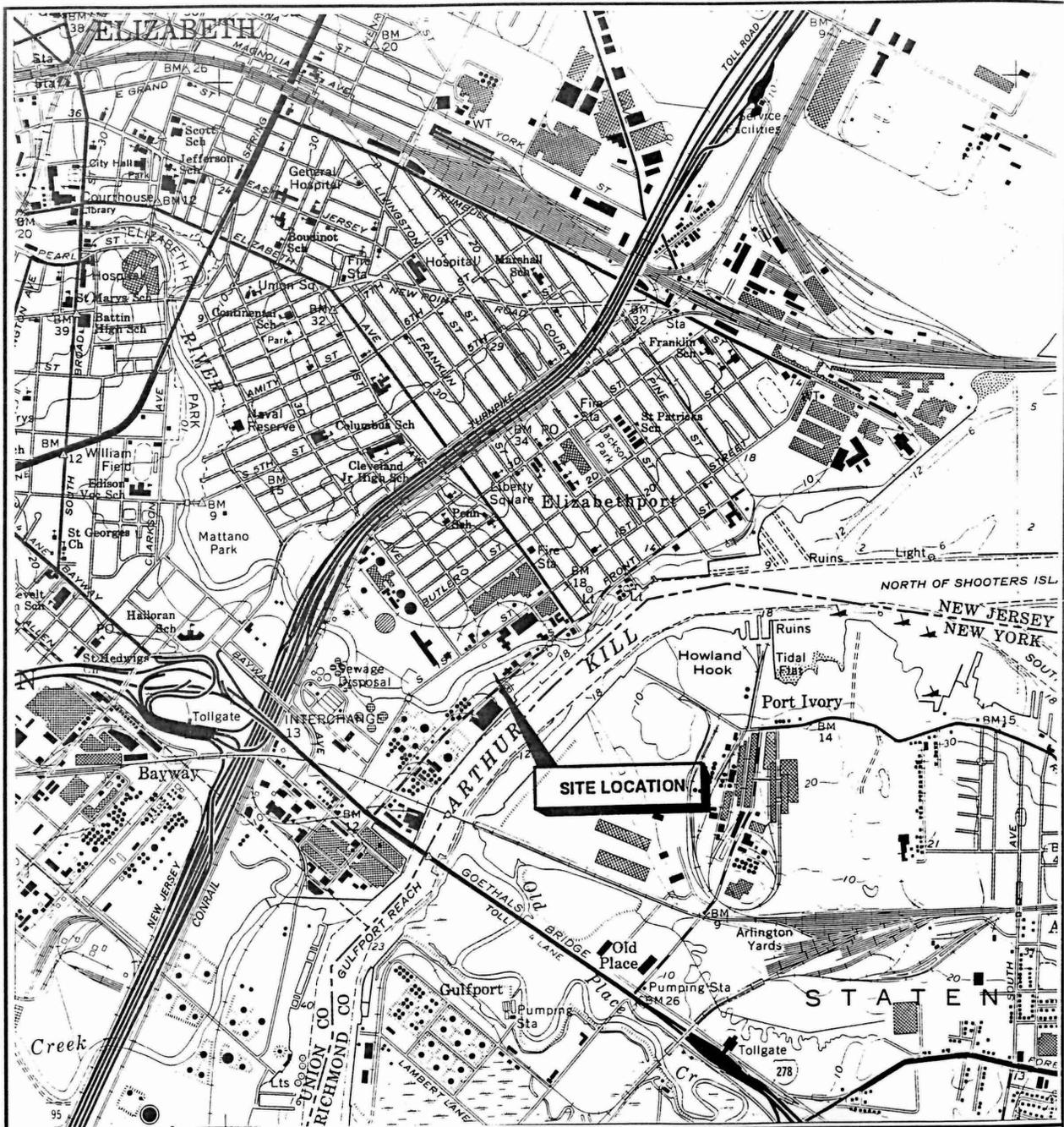
1. Concentrations are in micrograms per litre (µg/L)
2. ND = Not Detected

TABLE 8**Historic Volatile Organic Compound Concentrations for Monitoring Well CW-5****No Treatment**

Well No. CW-5 Sample Month/Year	Aug. 2004	Aug. 2008	Jan. 2015
Volatile Organic Compounds (µg/L)			
Vinyl Chloride	ND	ND	ND
Chloroethane	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND
trans-1,2-Dichloroethene	ND	ND	ND
cis-1,2-Dichloroethene	ND	ND	ND
Trichloroethene	ND	ND	ND
Tetrachloroethene	ND	ND	ND
2-Butanone	ND	ND	ND
Chlorobenzene	ND	ND	ND
Benzene	2.2	1.4	0.19
Toluene	ND	ND	ND
Ethylbenzene	ND	ND	ND
Xylenes, Total	ND	ND	ND

1. Concentrations are in micrograms per liter (µg/L)
2. ND = Not Detected

APPENDIX B-- FIGURES



Source: 7.5 Minute Series
 Topographic Maps
 Elizabeth NJ-NY Quadrangle
 Scale: 1" = 2,000'



Quest Environmental & Engineering Services, Inc.
 1741 Route 31 Clinton, NJ 08809
 (908)730-7707

Figure 1
 Site Location Map
 Chemical Control Corporation
 Elizabeth, New Jersey

