REMEDIATION SYSTEM EVALUATION

FCX-STATESVILLE SUPERFUND SITE
STATESVILLE, NORTH CAROLINA

Report of the Remediation System Evaluation,
Site Visit Conducted at the FCX-Statesville Site
20-22 September, 2000

Final Report Submitted to Region 4
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NOTICE

Work described herein was performed by GeoTrans, Inc. (GeoTrans) and the United States Army Corps of Engineers (USACE) for the U.S. Environmental Protection Agency (U.S. EPA). Work conducted by GeoTrans, including preparation of this report, was performed under Dynamac Contract No. 68-C-99-256, Subcontract No. 91517. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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EXECUTIVE SUMMARY

The FCX property was an agriculture distribution center that formulated, repackaged, and warehoused pesticides and fertilizers. The former Burlington Industries property to the north and upgradient of the FCX property was a textile facility that used chlorinated solvents. These two properties comprise the FCX-Statesville Superfund Site. Pesticides and chlorinated solvents, mainly PCE, are present in soil and groundwater at the site. The groundwater VOC plume extends to the north, west and south from the site while the pesticide plume is comingled only in the southern extension of the VOC plume. The site is underlain by 15 to 65 feet of saprolite and residual soil hydraulically interconnected with underlying fractured bedrock generally consisting of gneisses and schists.

USEPA has divided the site into three operable units:

OU1: The groundwater contamination beneath the FCX property and to the south of the FCX property.

OU2: The soil contamination (mainly pesticides, polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol, and dioxin) at the FCX property.

OU3: All other contamination which was not characterized during the initial RI/FS (mainly soil, groundwater, and surface water/sediment contaminated with volatile organic compounds centered at the former textile facility).

This RSE only pertains to the ongoing groundwater remediation of OU1. OU1 and OU2 are being remediated by USEPA, while OU3 is being remediated separately by PRPs.

The RSE suggests several potential modifications to address effectiveness/ protectiveness issues, including:

- Updating the target containment zone considering the interconnection of the saprolite with bedrock and reconsidering the OU1 system goals to possibly concentrate pumping on the pesticide plume.
- Cleaning up the site including debris removal, landscaping, and sediment control measures.
- Improving or replacing the existing treatment system enclosure and header piping. The enclosure has inadequate space and no secondary containment or leak alarm system and the air and groundwater header piping have had leaks.

The RSE also suggest several potential modifications to reduce long-term costs including:

- Discharging to surface water by NPDES rather than discharging to the POTW

(potential net savings of more than $1 M over 30-years, non-discounted).

- Removing the sand filter and appurtenant backwashing equipment (potential net savings of more than $0.2 M over 30 years).

- Eliminating or reducing monitoring frequency for non-essential compounds (potential net savings of more than $0.4 M over 30 years, non-discounted).

- Suspending recovery pumping entirely if monitored natural attenuation is suitable for the pesticide plume as it is (OU3 ROD) for the VOC plume (potential net savings of more than $3 M over 30 years, non-discounted).

Estimated capital and annual costs (and savings) associated with recommendations are summarized in a table at the end of the report.

PREFACE

This report was prepared within the context of a demonstration project conducted by the United States Environmental Protection Agency's (USEPA) Technology Innovation Office (TIO). The objective of the overall project is to demonstrate the application of optimization techniques to Pump-and-Treat (P&T) systems at Superfund sites that are "Fund-lead" (i.e., financed by USEPA). The demonstration project was conducted in USEPA Regions 4 and 5.

The demonstration project has been carried out as a cooperative effort by the following organizations:

Organization	Key Contact	Contact Information
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Army Corp of Engineers: Hazardous, Toxic, and Radioactive Waste Center of Expertise (USACE HTRW CX)	Dave Becker	12565 W. Center Road Omaha, NE 68144-3869 (402) 697-2655 Fax: (402) 691-2673 dave.j.becker@nwd02.usace.army.mil

The project team is grateful for the help provided by an EPA Project Liaison in each Region.

Region 1	Darryl Luce and Larry Brill	**Region 6**	Vincent Malott
Region 2	Diana Cutt	**Region 7**	Mary Peterson
Region 3	Kathy Davies	**Region 8**	Armando Saenz and Richard Muza
Region 4	Kay Wischkaemper	**Region 9**	Herb Levine
Region 5	Dion Novak	**Region 10**	Bernie Zavala

They were vital in selecting the Fund-lead P&T systems to be evaluated and facilitating communication between the project team and the Remedial Project Managers (RPMs).

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1.0 INTRODUCTION

1.1 PURPOSE

The US Environmental Protection Agency's (USEPA) Technology Innovation Office (TIO) and the US Army Corps of Engineers (USACE) Hazardous, Toxic, and Radioactive Waste Center of Expertise (HTRW CX) are cooperating in the demonstration of the USACE Remediation System Evaluation (RSE) process at Superfund sites. The demonstration of the RSE's is part of a larger effort by TIO to provide USEPA Regions with various means for optimization, including screening tools for identifying sites likely to benefit from optimization and computer modeling optimization tools for pump and treat systems, such as the MODMAN code.

The FCX-Statesville site was chosen based on initial screening of pump and treat systems managed by USEPA Region 4 and represented a site with relatively high operation cost and a long projected operating life. Two sites in Regions 4 and 5 are being evaluated with RSE's in this demonstration project. A report on the overall results from these demonstration sites will also be prepared and will identify lessons learned, typical costs savings, and a process for screening sites in the USEPA Regions for potential optimization savings.

The RSE process is meant to identify cost savings through changes in operation and technology, to evaluate performance and protectiveness (as required under the NCP, i.e., and "five-year" review), assure clear and realistic remediation goals and exit strategy, and verify adequate maintenance of Government owned equipment. This report provides a brief background on the site and current operations, a summary of the observations made during a site visit, and recommendations for changes and additional studies. The cost impacts of the recommendations are also discussed.

1.2 TEAM COMPOSITION

The team conducting the RSE included:

Kathy Yager, HQ EPA TIO
Peter Rich, Engineer, GeoTrans, Inc. (EPA TIO's contractor)
Bob Briggs, Engineer, GeoTrans, Inc. (EPA TIO's contractor)
Lindsey Lien, Engineer, USACE HTRW CX
Dave Becker, Geologist, USACE HTRW CX
Kay Wischkaemper, Hydrogeologist, EPA Region 4

1.3 DOCUMENTS REVIEWED

The following documents were reviewed as part of the RSE evaluation:

Author	Date	Title/Description
EPA	9/27/93	ROD OU1
Roy F. Weston, Inc. (Weston)	6/94	Risk Assessment Report, OU2
EPA	11/22/94	ROD OU2
EPA	9/30/96	ROD OU3
Westinghouse Remediation Services, Inc. (WRS)	12/22/97	Remedial Action Work Plan, OU1
Weston	1/99	Remedial Action Report, OU1
WRS	2/16/99	Initial Startup and First Quarter Sampling Event Report
WRS	2/99	2nd Quarter Sampling Event Report
WRS	5/5/99	3rd Quarter Sampling Event Report
WRS	8/26/99	4th Quarter Sampling Event Report
Brown & Caldwell	7/12/00	Remedial Action Work Plan, OU3
Brown & Caldwell	6/14/00	Results of 12/99 Sampling for Monitored Natural Attenuation at OU3
Weston	7/00	Long Term Response Action - First Quarter Sampling Event Report

1.4 PERSONS CONTACTED

The following individuals were present during the site visit:

McKenzie Mallary, EPA RPM, Region IV
Nile Testerman, North Carolina Department of Environment and Natural Resources (NCDENR)
Joseph Ferentz, Roy F. Weston, Inc. Norcross, GA
Matt Brennan, Applied Earth Sciences, Inc., Charlotte, NC

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

This RSE pertains to OU1 at the FCX-Statesville Superfund Site (also referred to as "the site"). The FCX-Statesville Superfund site includes the former FCX property and an adjacent property. This adjacent property was at the time of the OU3 ROD owned and operated by Burlington Industries.

The FCX-Statesville property was an agricultural distribution center that is no longer active. The adjacent property was a textile facility that is also no longer active. USEPA has divided the site into three operable units (see Figure 1):

OU1: The groundwater contamination beneath the FCX property and to the south of the FCX property.

OU2: The soil contamination (mainly pesticides, polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol, and dioxin) at the FCX property.

OU3: All other contamination which was not characterized during the initial RI/FS (mainly soil, groundwater, and surface water/sediment contaminated with volatile organic compounds centered at the former textile facility).

This RSE only pertains to the ongoing groundwater remediation of OU1. OU1 and OU2 are being remediated by USEPA, while OU3 is being remediated separately by PRPs.

1.5.1 LOCATION

The site is located in a mixed residential and commercial area in Statesville, North Carolina. The site is located in Iredell County, and is approximately 60 miles north of Charlotte.

The site generally slopes to the south. The site is fenced except for the paved loading dock area along West Front Street where four (4) of the ten (10) recovery wells are located (see Figure 1). Approximately one half of the site is covered by the former FCX warehouse. OU2 soil excavation and treatment operations are currently taking place within the warehouse building and on a concrete pad in the northeast corner of the site. The 10 OU1 recovery wells are all onsite running in a line from the southwest to northeast corners of the site on approximately 50 feet centers (see Figure 1). The treatment system is housed in a prefabricated metal structure in the southeast corner of the site. The former Burlington Industries facility is located across railroad tracks immediately north of the FCX property.

1.5.2 POTENTIAL SOURCES

Beginning around 1940, Farmer Cooperative Exchange (FCX) began operations at the site as an agricultural distribution center. Activities included the formulation, repackaging, warehousing, and distribution of farm chemicals. These chemicals consisted primarily of pesticides and fertilizers. Repackaging of liquid pesticides was discontinued in 1966 and pesticide dust repackaging was discontinued in 1969.

Testimony from previous employees indicates that 5,000 to 10,000 pounds of DDT, DDE, and

possibly liquid chlordane were buried in two trenches which were subsequently covered by a concrete warehouse floor. Pesticide contamination in the soil as well as pesticide and volatile organic compound (VOC) contamination of the groundwater has been documented at the FCX site. Pesticides in soil are being excavated and treated by thermal desorption prior to backfilling the remediated material (OU2). The VOC contamination in the groundwater appears to be emanating from the former Burlington Industries facility.

1.5.3 HYDROGEOLOGIC SETTING

The FCX site lies within the Blue Ridge - Inner Piedmont Geologic Belt. This Belt generally consists of metamorphic rocks including gneisses and schists, as well as gradations of these two types. Most of these rocks near the surface have weathered into a layer of "overburden" overlying the fractured but relatively unweathered bedrock. The overburden ranges in thickness from 15 to 65 feet at the site, and consists of saprolite and residual soils interspersed with unweathered gneiss/schist, and to a lesser degree, alluvium. Granitic intrusions are also common in the area of the site. Soils in the general area belong to the Lloyd Association. These soils are characterized as deep, well-drained soils with a subsoil of dark red clay.

Groundwater at the site occurs in an unconfined to semiconfined aquifer consisting of the overburden hydraulically interconnected with the underlying fractured bedrock. The saturated overburden serves as a groundwater reservoir which supplies water to the fractures, faults, and other secondary permeability features in the bedrock. Approximate depth to groundwater in the saturated overburden generally ranges from 27 to 35 feet below land surface (bls). During wetter periods of the year, groundwater may intersect the ground surface south of the site and become overland or surface water flow.

The regional geology and hydrogeology was verified during installation of recovery well 1 (RW-1). The depth to bedrock was determined to be 65 feet. The lithology consisted of approximately 20 feet of clay, 40 feet of saprolite and saprolitic gneiss, and 5 feet of highly altered granite.

The direction of shallow groundwater flow is to the southeast with a gradient (i) of approximately 0.016.

1.5.4 DESCRIPTION OF GROUNDWATER PLUME

The remediation system that is the focus of this RSE includes recovery wells screened in saprolite to a depth of 56.5 to 65 feet. Contaminants present in groundwater in the saprolite and bedrock beneath it include:

> Pesticides: Alpha-BHC, Beta-BHC, Delta-BHC, Gamma-BHC (lindane), Dieldrin, Engrin Ketone, Chlordane, and Endrine.
>
> VOCs: Tetrachloroethylene, Trichloroethylene, 1,1,1-trichloroethane, 1,1-dichloroethane, chloroform, 1,1-dichloroethylene, and cis-1,2-dichloroethylene.

A groundwater divide under the former Burlington Industries site and the pumping of an industrial well to the west (Carnation) has resulted in several dissolved contaminant plumes extending from the

site. PCE and its breakdown VOC products, defined by a 1 Fg/L contour, extend approximately 800 feet south, north, and west of the source areas on the former Burlington property. The separate pesticide plume extends south from the FCX property with the VOC plume (see Table 1).

Pesticides strongly sorb onto soils, and thus migrate very slowly with respect to groundwater velocity, while chlorinated VOCs are much more mobile. However, pesticides have been detected in a bedrock well 500 feet south of the FCX property.

2.0 SYSTEM DESCRIPTION

2.1 SYSTEM OVERVIEW

The remediation system consists of 10 extraction wells in areas of dissolved contamination located on-site. The treatment system consists of a 300 gallon influent equalization tank, a 1200 gallon baffled tank (clarifier), two sand filters with a backwash trickle tank, and two GAC units. Potassium permanganate and polymer were formerly added into the groundwater prior to the baffled tank, but that chemical addition has been suspended. Water is discharged from the treatment plant to the sanitary sewer.

2.2 EXTRACTION SYSTEM

The ten (10) OU1 extraction wells have pneumatic total fluids submersible pumps that maintain a drawdown at the pump level. The wells are operated with drawdowns of 20 to 30 feet in the 56.5 to 65 feet deep 4-inch diameter PVC saprolite recovery wells. Design phase capture zone calculations indicated that this drawdown with 50 gpm pumping would prevent further migration offsite. The system began pumping in May 1998 and was operated for 12 ½ months by WRS prior to shutdown due to contracting issues. Pumping was restarted in April 2000 by Weston, but suspended in July 2000 due to exceedances of discharge levels for chloroform. The extraction rate was intended to be 30 to 50 gpm based on a 72 hour pump test conducted in 1997. Approximately 12 gpm of pumping was averaged during the 12 ½ months of system operation by WRS.

2.3 TREATMENT SYSTEM

All equipment was provided by Envirosys International, Inc.

The OU1 treatment system, designed for 50 gpm, consists of the following:

- A 15 HP air compressor and 1-inch PVC air line to supply air to the pneumatic pump;
- 2-inch PVC underground header pipe from the extraction wells;
- 300 gallon influent holding tank;
- Polymer and potassium permanganate injection systems with appurtenant static mixers (inactive);
- A baffled 1200 gallon tank;

- Two sand filters with a backwash system including a 350 gallon backwash influent tank and 250 gallon backwash effluent trickling filter sump; and,

- Two 2000-pound liquid phase granular activated carbon (GAC) units.

The flow rate during April 2000 was approximately 16 gpm, with influent VOC levels of 200 Fg/L and influent pesticide concentrations of less than 3 Fg/L. The two liquid phase carbon units are operated in series and adsorb VOCs and pesticides prior to discharge to the POTW. Carbon has not been changed out to date. However, carbon is scheduled to be replaced due to the exceedance of the discharge limit for chloroform.

The treatment system enclosure lacks sufficient space to access and make repairs to equipment. In addition, it does not have spill control or alarm capability.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

The OU1 ROD indicates that the goal of the system is to : (1) contain offsite migration of groundwater from the FCX property with extraction wells in saprolite and bedrock onsite and immediately south of the site, and (2) restore the aquifer to its unlimited use by pumping and treating.

The January 1999 Remedial Action Reports states that "based on a meeting between EPA and Weston on January 17, 1996, groundwater remedial objectives were changed from cleanup of contaminated groundwater in the overburden and bedrock beneath and downgradient ...to cleanup of the contaminated groundwater in the overburden beneath the FCX property." The bedrock and downgradient portions of the plume were to be addressed in OU3 (monitored natural attenuation was chosen in the OU3 ROD for this area).

In practice, the OU1 system is being managed as a overburden contaminant mass removal system as VOCs and pesticides are present in wells significantly downgradient of the site. It is unlikely that the saprolite pumping is containing groundwater migration in bedrock and no available information suggests otherwise. The system, when operational, removes approximately 17 grams/day VOCs and 0.3 grams/day of pesticides.

3.2 TREATMENT PLANT OPERATION GOALS

This is a continuously operating system, checked weekly. Groundwater is extracted from wells for treatment and discharged to the POTW sanitary sewer system. Effluent water discharged to this sewer must meet discharge requirements.

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The observations and recommendations given below are not intended to imply a deficiency in the work of either the designers or operators, but are offered as constructive suggestions in the best interest of the EPA and the public. These recommendations obviously have the benefit of the operational data unavailable to the original designers.

4.2 SUBSURFACE PERFORMANCE AND RESPONSE

4.2.1 WATER LEVELS

Although water levels are routinely monitored weekly, it is unclear whether they have been used to demonstrate a capture zone or calibrate the groundwater model. Quickflow model results indicated that the recovery system was not capturing the entire plume in the July 2000 quarterly report.

4.2.2 CONTAMINANT LEVELS

A clear summary was not presented detailing whether or not contaminant concentrations have increased or declined in the aquifer. A review of select monitor wells does not indicate a trend (see Table 1). It should be noted, however, that this is a relatively recent system, it has operated for less than 18 months total.

4.3 TREATMENT SYSTEM DOWN-TIME

There have been problems with system down-time. The sand filter backwash system float switches in particular have required several replacement and frequent cleaning.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF COSTS

A cost breakdown was provided for the first year of OU1 system operation. This totaled $219, 250 (no laboratory analytical costs are included as EPA conducts that analysis internally). Expected future O&M costs are about $150,000 per year.

4.4.1 UTILITIES

Annual electric costs are expected to be $6,000 based on information from Roy F. Weston. Electricity powers the compressor, transfer pumps, and building heat.

POTW discharge fees are expected to be about $40,000 per year based chiefly on volume rates which we assume are about $5.00 per 1000 gallons.

4.4.2 NON-UTILITY CONSUMABLES AND DISPOSAL

The following items and approximate expected annual cost are included in this category:

Replace Liquid Phase GAC	$8,400
Potassium Permanganate	$ 0
Polymer	$ 0
TOTAL	$8,400

4.4.3 LABOR

AES technicians are responsible for weekly treatment system operation and water level measurements. This function costs about $12,000 per year. Additional labor required for sampling and analysis and maintenance is discussed below.

Non routine O&M is expected to total $12,000 per year. This consists mainly of equipment repairs and replacements.

General consulting/project management costs are expected to total about $30,000 per year.

4.4.4 SAMPLING AND REPORTING

Monthly influent and effluent sampling and quarterly well sampling at 18 wells is conducted. Analysis for VOCs, pesticides and metals is done for 14 well samples; pesticides only are done for the other four wells. Quarterly reports are produced detailing the results. The sampling and reporting totals about $40,000 per year.

4.4.5 SUMMARY OF TOTAL COSTS

An estimate of total costs for the system is as follows (these are approximations based on somewhat limited data):

Item	Estimated Annual Cost
Consulting	$ 30 K/yr
Labor (O&M)	$ 24 K/yr
Utilities	$ 46 K/yr
Consumables	$ 9 K/yr
Sampling/Reporting	$ 40 K/yr
TOTAL (no analytical costs)	$149 K/yr

4.5 RECURRING PROBLEMS OR ISSUES

4.5.1 SAND FILTERS

The original system design included metals precipitation with a baffled tank and sand filtration system to capture oxidized metals and other particulate. During WRS's system operation, these filters and appurtenant equipment required significant non-routine maintenance, labor, and materials. With metal precipitation no longer being conducted, the baffle tank contains clear water. Elimination or conversion of the sand filter system to a lesser maintenance bag filter system should be considered. An additional benefit would be the increased space in the treatment enclosure.

4.5.2 SAND IN INFLUENT TANK

During the RSE visit coarse sand was present in the bottom of the influent tank indicating the possible failure of a well screen. Individual well discharges should be checked to identify the problem well, if any. Pump internals could be damaged by excessive sand in a well(s). Historic pump performance records may indicate the problem well(s).

4.5.3 PIPING LEAKS

Leaks in the Schedule 80 PVC airline and at least one leak in the Schedule 40 PVC groundwater influent line were reported. Replacing the underground PVC with a pipe such as HDPE which seems to be much less susceptible to leaks and damage should be considered. Additionally, adding secondary containment and alarm capabilities in the treatment enclosure should be considered.

4.5.4 OPEN MONITORING WELLS

During the RSE visit monitoring wells at the site were found open. Some of these wells had bailers and twine hanging in them. Although such practices may facilitate sampling, it provides a potential exposure route to groundwater contamination and potential for further contamination of the subsurface.

4.6 REGULATORY COMPLIANCE

The treatment requirements for discharge to the POTW are unusually stringent as shown in Table 2. A recent exceedance of the limit for chloroform (0.19 Fg/L) has led to suspension of treatment system operation until GAC can be replaced. GAC adsorbs chloroform poorly so this may present continuing problems. Consideration of aeration prior to the GAC may be warranted.

4.7 TREATMENT PROCESS EXCURSIONS AND UPSETS, ACCIDENTAL CONTAMINANT/REAGENT RELEASES

The reported pipe leak discussed above and the lack of secondary containment and leak alarms is an issue. Pipe breakage due to damage in the constricted treatment system is a possibility.

4.8 SAFETY RECORD

The plant appears to have had an excellent safety record.

5.0 EFFECTIVENESS OF THE SYSTEM TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT

5.1 GROUNDWATER

It is not clear whether or not the FCX property plume is being effectively captured by the current extraction system. Recent modeling after eight (8) days of pumping did not demonstrate capture at the southwest part of the site. Additionally pesticides and VOCs are present in bedrock wells 500 feet downgradient of the site. The effectiveness of the system for VOC remediation is minimal and seems out of context with monitored natural attenuation being applied for the VOC plume away from the Burlington Industries source area. However, the recovery wells (RW-1, RW-2, RW-3, and RW-4 specifically) are located in the main area of pesticide impact and could potentially be part of a system to meet OU1 ROD goals for pesticides. Additional pumping from one or more bedrock wells in this area would likely increase capture effectiveness as the saprolite and bedrock system are clearly connected and have allowed significantly faster contaminant migration than expected based on modeling. As the eastern recovery wells do not have pesticide impacts, pumping from them could be suspended. This revised pumping scheme may also solve the chloroform exceedance issue.

5.2 SURFACE WATER

As the offsite plume is not being effectively captured, there is a potential threat to streams, wetlands, and ponds. VOC discharges to surface water south of the site have been detected.

Improved sediment control at the FCX site should be implemented to prevent discharge of pesticide impacted soil to the storm sewer.

The OU3 ROD and risk assessment work have indicated that VOC impacts in the surface water do not present a significant risk to human health and the environment.

5.3 SOILS

Not a focus of this RSE. The excavation and treatment being conducted as OU2 should remove a large portion of the source of pesticide impacts in groundwater.

5.4 OTHER

The site appearance could be considerably improved by cleanup of debris and simple landscaping efforts.

6.0 RECOMMENDATIONS

6.1 RECOMMENDED STUDIES TO ENSURE PROTECTIVENESS

6.1.1 UPDATE TARGET CONTAINMENT ZONE

The stated goal of the OU1 recovery system to cleanup contaminated groundwater in the overburden beneath the FCX property should be reconsidered for the following reasons:

- The overburden (saprolite) and bedrock are not separate systems as indicated by the migration of pesticides in groundwater many times further from the site than predicted based on overburden properties.
- Despite soil remedies for OU3 VOC contamination, the VOC plume will continue to enter the site from the north for some time as OU3 does not include containment of VOC groundwater contamination. Chloroform concentrations will likely continue to cause GAC replacement and POTW discharge issues.
- The VOC plume outside of the former Burlington Industries facility is being remediated by monitored natural attenuation per the OU3 ROD.
- The east recovery wells RW-6, 7, 8, 9, and 10 are removing VOCs but little or no pesticide mass from the aquifer.
- VOCs and pesticides are migrating downgradient of the site in bedrock.

The existing system provides minimal cleanup of the large VOC plume and does not contain either the VOC or pesticide plume. If the system goal is refined, for example to containment and cleanup for the pesticide groundwater plume, then studies can be conducted so that containment of the plume can be accomplished. Bedrock well pumping tests will be necessary and will likely lead to a revised recovery system consisting of saprolite and bedrock wells on the west side of the existing recovery network. Existing treatment equipment could be used for this revised recovery system. The estimated capital cost for pumping tests, well installation, and adding about three bedrock wells to the recovery system is $100,000.

6.1.2 SITE CLEANUP

There is debris on the site, the site is overgrown and there is no control of sediment flowing offsite. Site cleanup, landscaping and installation of silt fence at the south side of the site should be accomplished. The estimated initial cost is $10,000 with $5,000 per year for continuing upkeep.

6.1.3 IMPROVED TREATMENT SYSTEM ENCLOSURE AND HEADER PIPING

The existing treatment system trailer is cramped, in poor condition, and has no secondary containment or leak alarm system. PVC groundwater and air piping has had leaks. The equipment should be relocated in a structure with a concrete floor, containment wall, sump with level alarm, and adequate room to access and maintain equipment. An area within the warehouse would be ideal to construct a treatment pad as the warehouse will provide a weather enclosure. The estimated capital cost to build the pad, relocate equipment, heat and insulate equipment as necessary and replace air and groundwater piping is $70,000.

6.2 RECOMMENDED CHANGES TO REDUCE COSTS

6.2.1 DISCHARGE TO SURFACE WATER (NPDES)

A large portion of annual O&M costs are spent paying the POTW to accept water that meets extremely stringent (potable water) standards. Although obtaining NPDES permits is time consuming and the biomonitoring tests may be difficult to pass, a continuing savings of about $40,000 per year could result from a capital expenditure (pre-application bio-testing, application, discharge line installation) of $20,000 to $30,000 (dependent on discharge location). Alternatively, renegotiating the unusually stringent discharge levels with the POTW should be considered.

6.2.2 REMOVE THE SAND FILTER

It is likely that the sand filter system can be removed or replaced with bag filters with no detrimental effect of GAC fouling. The sand filters could be bypassed and bag filters used temporarily to confirm this prior to removing the sand filters. Replacement and disposal of the filters will cost about $15,000 ($10,000 would have to be spent eventually on sand filter disposal) and will save an estimated $8,000 per year in non-routine O&M costs. The integrity of each recovery well screen should be checked to ensure that well sand pack from damaged well screens is not being pumped to the treatment system prior to this work.

6.2.3 ELIMINATE SVOC AND METALS IN QUARTERLY WELL SAMPLING ANALYSIS

Metals are currently analyzed from 14 wells on a quarterly basis. Metals do not appear to be primary contaminants of concern at the site, and the monitoring program could be modified accordingly. If sufficient monitoring of natural attenuation parameters is not conducted as part of the OU3 remedy, monitoring should continue for iron, manganese, arsenic, and other metals or major ions relevant to natural attenuation of pesticides. Monitoring for other metals, however, could likely be reduced or even eliminated. For metals with concentrations that exceed MCLs, the background concentrations should be determined to confirm that cleanup of these metals is required. Elimination of analysis for metals could save up to$8,000 per year based on commercial lab prices (EPA analyzes these samples, so the costs are not included in the annual O&M). If elimination of the parameters is not feasible, reducing the frequency of the analysis to annually could save up to $6,000 per year. Similarly, reducing BNA analysis to an annual frequency would save about $9,000 per year. Bis(2-ethylhexyl) phthalate is the only BNA that is potentially an issue at the site; it has been detected sporadically in a few wells. Additionally, the RSE team agrees with the site managers and contractor that reducing the

frequency of sampling on-site wells for VOCs and pesticides should be considered.

6.2.4 CONCENTRATE SYSTEM ON PESTICIDES

Suspending pumping from recovery wells on the east side of the site and possibly replacing the system flow with additional (bedrock) wells in the pesticide impacted area will likely reduce the influent chloroform concentration so that GAC replacement can be reduced form yearly or more frequent changeouts to every two years. This is a potential savings of about $4,000 per year.

6.2.5 SUSPENSION OF PUMP AND TREAT

If in reconsidering the system goals, monitored natural attenuation is deemed suitable for the pesticide plume (following source removal) as it has been for the VOC plume, recovering and treating groundwater could be suspended. Sampling for parameters relevant to natural attenuation of pesticides may be collected as part of the OU3 remedy, and review of this data, if it exists, may help in evaluating the potential for natural attenuation for pesticides. If this data does not exist, limited sampling could be conducted as part of OU1 to aid in evaluating natural attenuation. The current system requires a significant expenditure for removal of a very small mass of contamination in an area that apparently has minimal risk to human health and the environment. Suspension of the system operation would save an estimated $103,000 per year.

7.0 SUMMARY

In general, the RSE team found the system to be well operated and maintained. There are several protectiveness issues that should be addressed, most notably reexamining the system goals and improving the system enclosure. The anticipated costs of implementing these and other recommendations related to protectiveness are summarized on the following "Cost Summary Table."

Several recommendations are also made to potentially reduce future operations and maintenance costs. These opportunities to reduce cost arise from the fact that metals removal is not necessary and the OU3 ROD impacts the context of OU1. Not considering the possibility of shutting the system down completely, the recommendations below represent a reduction of $63,000 in annual O&M costs for a potential net savings of more than $1.6 M over 30 years. The anticipated costs and potential savings of implementing these and other recommendations to reduce costs are also summarized on the following "Cost Summary Table."

Cost Summary Table

Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change in Lifecycle Costs ($)*
Update target capture zone	Effectiveness	$100,000	($4,000)	($20,000)
Site cleanup	Effectiveness	$10,000	$5,000	$160,000
Improve enclosure and piping	Effectiveness	$70,000	$0	$70,000
NPDES discharge	Cost reduction	$30,000	($40,000)	($1,170,000)
Eliminate sand filter	Cost reduction	$15,000	($8,000)	($225,000)
Reduce analysis frequency	Cost reduction	$0	($15,000)	($450,000)

*Estimated change in life-cycle costs assumes 30 years, no discount rate
(1) Costs in parentheses imply a cost reduction

TABLES

Table 1. Total VOCs and total pesticides at select wells.

Date	Well				
	MW-2	MW-3	MW-5S	MW-5D	W-24
2/86	113/0.48	60/113.6	NS/NS	NS/NS	NS/NS
6/91	64/0.19	0.65/33.43	99.7/4.16	174.9/4.34	NS/NS
4/30/98	NS/0.11	NS/31.95	0/6.31	29/8.12	203/0.011
8/5/98	NS/0.07	NS/13	0/1.17	97/8.96	147/0.189
11/11/98	115/0.09	0/>3.93	0/7.1	72/>3.19	2/0
2/9/99	NS/0.1	NS/12.07	0/6.11	58/11.3	45/0.041
5/10/99	NS/0.11	NS/>6.04	0/9.1	95/0.57	0/ND
4/2000	NS/0.16	NS/41.94	0/4.71	30/6.54	51/0.075

Total VOC/Total Pesticides (Fg/L)
U = 0
NS – Not Sampling (W-24 was not installed in 1992, MW-5S, 5D, and 9 were not installed in 1986)

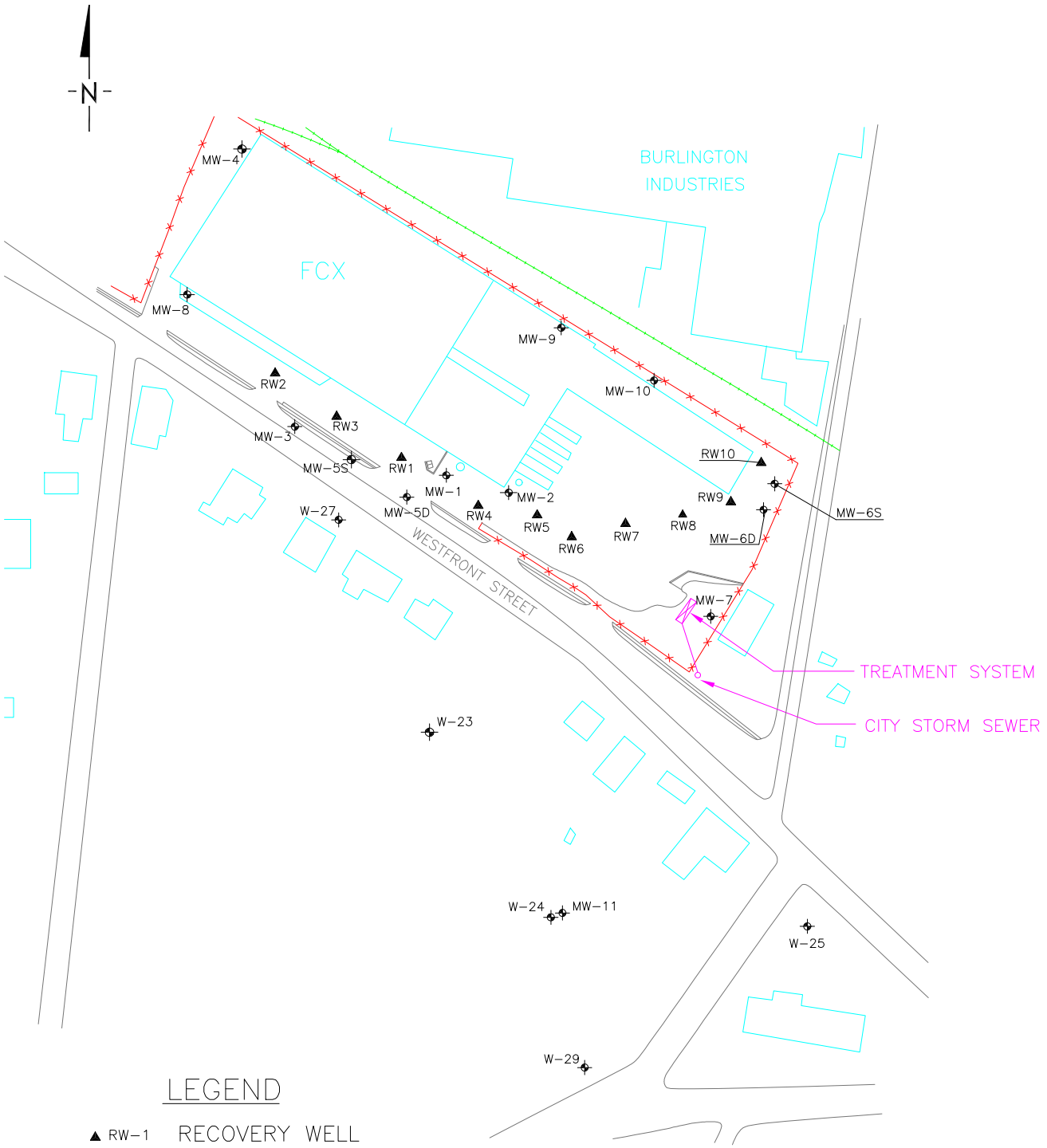
Table 2. Groundwater remediation goals and POTW discharge limits.

Chemical	MCL	NC GW Standard	Remediation Goal (a) (Fg/L)	Discharge Limit (Fg/L)
Barium	2,000	1,000	988	--
Beryllium	4	(c)	0.013	--
Chromium	100	50	50	--
Manganese	200 (b)	50	50	--
Vanadium	--	--	98	--
Alpha-Chlordane	2	0.027	0.027	1
Gamma-Chlordane	2	0.027	0.027	1
Dieldrin	--	--	0.0034	1
Heptachlor Epoxide	0.2	0.038	0.006	1
Alpha-BHC	--	--	0.0086	1
Beta-BHC	--	--	0.03	1
Lindane	0.2	0.0265	0.027	1
Bromodichloromethane	100	--	0.41	<DL
Chloroform	100	0.19	0.19	0.19
Chloromethane	--	--	2.9	<DL
1,1-Dichloroethane	--	--	0.71	<DL
1,1-Dichloroethene	7	7	0.07	7
PCE	5	0.7	0.7	0.7
Trichloroethene	5	2.8	2.8	2.8
Bis(2-ethylhexyl)phthalate	6	--	3.9	<DL

Notes: (a) = If remediation goal is below detection limit, the detection limit will be used as remediation goal.
(b) = No MCL established. Value provided is MCL Goal.
(c) = No standard promulgated.
"–" = Means no standard has been established.
"<DL" = Means less than detection limit.

Table adapted from Roy F. Weston, Inc., Remedial Action Report, 1999.

FIGURES



LEGEND

- ▲ RW-1 RECOVERY WELL
- ⊕ MW-1 MONITORING WELL
- ⊕ W-23 MONITORING WELL

NOTE:
FIGURE FROM ROY F. WESTON

0 150 300
SCALE IN FEET

TITLE:	FCX-OU1 SITE MAP
LOCATION:	Statesville, Iredell County, NC

CHECKED:	PR	FIGURE:
DRAFTED:	FM	1
FILE:	H016003A.DWG	
DATE:	11-17-00	

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