

**EPA Superfund
Record of Decision:**

**FCX, INC. (STATESVILLE PLANT)
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STATESVILLE, NC
09/27/1993**

FCX-STATESVILLE SUPERFUND SITE

RECORD OF DECISION
OPERABLE UNIT ONE

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ATLANTA, GEORGIA

SEPTEMBER 1993

DECLARATION
FOR
THE RECORD OF DECISION

SITE NAME AND LOCATION

FCX-Statesville
Statesville, Iredell County, North Carolina

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Operable Unit One Remedial Action for the FCX-Statesville Superfund Site (the "Site") in Iredell County, North Carolina, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record file for this Site.

The State of North Carolina concurs with the selected remedy for Operable Unit One. State comments on this Record of Decision, as well as EPA's responses to those comments, can be found in Appendix A of this document.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The Operable Unit One Remedial Action addresses a portion of the groundwater contamination at the Site. The major threat is the contaminated groundwater emanating from beneath the Site. The next two phases of cleanup, known as Operable Units Two and Three, will address contaminated soil at the Site and all other soil, surface water/sediment, and groundwater identified during the Operable Unit Three Remedial Investigation/Feasibility Study. The major components of the Operable Unit One Remedial Action include:

GROUNDWATER

Extraction of groundwater at the FCX property and to the south of the FCX property that is contaminated above Federal Maximum Contaminant Levels (MCLs) or the North Carolina Groundwater Standards, whichever are more protective;

On-site treatment of extracted groundwater via Chemical Precipitation/Filtration and Carbon Adsorption;

Discharge of treated groundwater either to the local POTW or nearby surface water pathway; Monitoring of groundwater entering and exiting the treatment system, as well as monitoring of the groundwater quality across the Site for an estimated 30 years; and the use of deed restrictions in the affected area to prohibit the consumption of contaminated groundwater.

ADDITIONAL SAMPLING AND MONITORING

The installation of additional monitoring wells may be required during the Remedial Design to further characterize the nature and extent of groundwater contamination. Additional aquifer tests may also be needed in order to properly design the selected remedy.

In order to establish a broader database on groundwater quality and to maintain a level of protection for private well users living downgradient from the Site, samples will be collected and analyzed on a regular basis prior to implementation of the Remedial Action.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the Remedial Action, and is cost-effective.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume of Site contaminants as a principal element.

Since this remedy may result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of the Operable Unit One Remedial Action to ensure that the remedy continues to provide adequate protection of human health and the environment.

FCX-STATESVILLE
OPERABLE UNIT ONE
RECORD OF DECISION

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DECISION SUMMARY

I. SITE NAME, LOCATION, AND DESCRIPTION

A. Introduction

The FCX-Statesville property is located at the intersection of Phoenix Street and West Front Street (Highway 90) approximately 1.5 miles west of downtown Statesville. Beginning around 1940, Farmers Cooperative Exchange (FCX) began operations as an agricultural distribution center. These operations included the formulation, repackaging, warehousing, and distribution of farm chemicals, primarily pesticides and fertilizers, along with the milling and sale of feed grains. The repackaging of liquid pesticides was discontinued in 1966 and dust repackaging in 1969. Testimony from previous employees indicates that 5,000-10,000 pounds of DDT, DDE, and possibly liquid chlordane were disposed of on-site in two trenches, buried with six feet of soil, and later covered with a reinforced 8"-thick concrete slab and warehouse. Pesticide contamination in the soil as well as pesticide and volatile organic compound (VOC) contamination in the groundwater have been documented at the Site since 1986. FCX filed for bankruptcy in September 1986.

B. Site Description

The Site is approximately 5.5 acres in size. The coordinates of the Site are latitude 35 47' 11" north, longitude 80 54' 58" west. The Site is bounded to the north by the Norfolk-Southern Railroad and Burlington Industries (formerly Beaunit Mills), the Carnation Milk Company property to the west, residential/small business property along the south side of West Front Street, and a pre-fabricated utility and sales lot on the east side of Phoenix Street. Figure 1-1 shows a Site diagram.

Prior to 1950-51, the main structures at the Site included a U-shaped building located on the western half of the property used for pesticide operations, and several buildings on the eastern half of the property used for the milling and bagging of feed grains. A small office building was also present near the southeastern corner of the property.

Between 1950 and 1969, most of the buildings on the property were demolished (with the exception of the small office building). Two warehouses have been constructed at the Site since the demolition. A large brick warehouse was constructed in 1969-70, and a smaller, metal warehouse painted blue was constructed in 1982. An asphalt parking lot is present between the warehouses and West Front Street.

The majority of the Site to the east of the two warehouses is a graveled area, and contains a large reinforced concrete slab and smaller concrete tractor trailer pads.

C. Topography

The Site is situated in the Piedmont physiographic province in western-central North Carolina. The Piedmont physiographic province surrounding the Site is characterized as gently rolling and sloping, with slopes on-site ranging up to 1.5 percent. Slopes in the immediate vicinity of the Site range from 2 to 6 percent. Elevations within a four-mile radius of the Site range from 740 to 970 feet above mean sea level.

D. Geology/Hydrogeology

The Site lies within the geologic belt known as the Blue Ridge Inner Piedmont Belt. The Blue Ridge-Inner Piedmont Belt generally consists of metamorphic rocks including gneisses and

schists, as well as gradations of the 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 15-40 feet at the Site, and consists of saprolite and residual soils interspersed with unweathered gneiss/schist, and to a lesser extent, alluvium. Granitic intrusions are also common in the area of the Site. Soils in the general area of the Site belong to the Lloyd Association. These soils, located along broad ridges with short side slopes, 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 in the vicinity of the Site generally ranges from 27 to 30 feet below land surface. During the wetter periods of the year, groundwater may intersect the ground surface and become overland or surface water flow.

E. Surface Water

On-site surface water drainage and flow patterns are generally controlled by topography and several man-made drainage structures constructed along West Front Street and Phoenix Street. Surface water flow is generally to the south into Free Nancy Creek, which converges with Third Creek approximately 1.5 miles southeast of the Site (two miles stream distance).

Third Creek flows in an easterly direction for approximately 15 miles, where it empties into the South Yadkin River.

F. Meteorology

The climate in Iredell County is classified as fairly mild, and is influenced by the mountain ranges to the northeast, and the Atlantic Ocean to the southeast. Prevailing winds are from the southwest, although northeast winds do frequently occur in the autumn. Relative humidity averages about 70 percent throughout the year. Monthly total precipitation generally ranges from about 3 inches during October and November to about 5 inches during July and August.

G. Demography and Land Use

The Site is located along an industrial corridor which stretches along West Front Street. The area around the Site is characterized by a combination of light/heavy industry, commercial, residential, and institutional. The estimated population within the five-mile radius of the Site includes all of Statesville (18,622 in the 1980 census) and an estimated 9,500 living in Iredell County outside the city limits. The population within the three-mile radius of the Site includes about 90% of the city's population (about 17,000 people) and 2,440 county residents.

H. Utilities

Electricity, telephone, as well as water and sewage connections have been terminated since FCX declared bankruptcy in 1986. Nevertheless, these utilities are available upon request.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Site History

FCX began operating the Site as an agricultural supply distribution center about 1940 and

continued to operate the Site until declaring bankruptcy in 1986. The Site served as a formulating, repackaging, warehousing, and distribution center for pesticides, fertilizers, and feed grains. The repackaging of liquid pesticides was discontinued in 1966 and dust repackaging in 1969. Testimony from previous employees indicates that 5,000-10,000 pounds of DDT, DDE, and possibly liquid chlordane were disposed of on-site in two trenches, buried under six feet of soil, and later covered with a reinforced, 8"-thick concrete slab and warehouse.

Previous investigations conducted prior to the Remedial Investigation at the FCX Site have been conducted by Fred C. Hart for Southern States Cooperative, by the North Carolina Department of Human Resources (NCDHR) (now known as the North Carolina Department of Environment, Health, and Natural Resources Superfund Section (NCDEHNR)), and by EPA-Region IV Emergency Response.

The Fred C. Hart investigation in February 1986 resulted from a pre-purchase environmental evaluation on behalf of Southern States Cooperative. Five composite soil samples were collected to investigate the soil for reported pesticide contamination. Four permanent monitoring wells were installed on-site to investigate the groundwater for reported pesticide contamination. Analytical results of the soil samples indicated the presence of nine pesticides, most notably chlordane and DDT. Pesticides and volatile organic compounds (VOCs) were detected in the groundwater, most notably the pesticide gammaBHC (lindane) and the VOCs tetrachloroethylene and trichloroethylene. Figure 2-1 shows the concentrations of pesticides identified in the groundwater during the Fred C. Hart study in 1986. Figure 2-2 shows the concentrations of volatile organic compounds (VOCs) identified in the groundwater during the same study.

The NCDHR conducted a Site Inspection in May 1986. Soil samples were collected both on-site and off-site in the front yard of an adjacent residence. Groundwater samples were collected and analyzed from the four existing wells, as well as a water supply well on the Carnation Milk Company property located approximately 800 feet to the west of the FCX property boundary. Analytical results of the soil samples indicated the presence of pesticides both on the FCX property as well as on adjacent properties. Lindane, fluorocarbons, VOCs, and caprolactum were identified in the groundwater samples.

EPA-Region IV Emergency Response conducted an emergency sampling investigations at the Site in January 1989 and again in January 1990. Extensive exploratory borings were drilled through the main warehouse concrete floor in an attempt to locate the alleged pesticide trenches. Efforts to locate the pesticide trenches were unsuccessful. Four monitoring wells were installed at two locations on-site, two wells screened in the overburden portion of the aquifer and two wells screened in the bedrock portion of the aquifer. Pesticides and VOCs were once again identified in the groundwater.

B. Enforcement Activities

On September 17, 1986, FCX filed a voluntary petition under the provisions of Chapter 11 of the United States Bankruptcy Code. The EPA, NCDEHNR, and FCX entered into a settlement agreement, whereby FCX established a trust to be used to remediate the Site. Groundwater monitoring at the Site since the Fred C. Hart study in 1986 has consistently shown the presence of VOC contamination. EPA has signed an Administrative Order of Consent with Burlington Industries and El Paso Natural Gas Company to perform an RI/FS to determine the nature and extent of the VOC contamination at portions of the Site.

The FCX-Statesville Site was evaluated using the Hazard Ranking System (HRS). The Site was proposed for inclusion on the National Priorities List (NPL) on June 24, 1988, and was finalized on the NPL on February 21, 1990. EPA-Region IV initiated an RI/FS at the Site in September 1990 with the aid of EPA's Environmental Services Division, and EPA's Alternative Remedial Contract (ARCs) contractor, Roy F. Weston.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Pursuant to Section 113(K)(2)(B)(i-v) and Section 117 of CERCLA 42 U.S.C. 9613 (K)(2)(B)(i-j), and 42 U.S.C. 9617, the Community Relations Plan and the RI/FS Reports were made available to the public in the Administrative Record located both in the Information Repository maintained at the EPA Docket Room in Region IV and at the Iredell County Library in Statesville, North Carolina. Fact sheets notifying local citizens about the availability of these documents, explaining the RI/FS process, and summarizing site-related activities were sent out in May 1991 and April 1993. A public meeting was held on May 31, 1991 to inform citizens about upcoming RI activities. Notices of the Proposed Plan public meeting were published in the Record and Landmark, the Iredell County News, the Charlotte Observer, and the Challenger Newspaper on May 6, 1993. A 30-day public comment period was held from May 6, 1993 to June 5, 1993. The Proposed Plan public meeting was held on May 20, 1993 where representatives from EPA answered questions about the Site and the remedial alternatives under consideration. The public requested an extension of the comment period during the meeting. Based on this request, EPA extended the comment period to August 2, 1993. Representatives from EPA have met with individual citizens and citizen groups on numerous occasions over the past several years to obtain their input and to keep them informed. The local citizens group "Citizens for a Clean Environment" applied for and were awarded a Technical Assistance Grant (TAG) on March 23, 1992.

IV. SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

As with many Superfund sites, the FCX-Statesville Site is complex. For this reason, EPA currently believes that the remediation of the Site will be accomplished most effectively by implementing three phases of cleanup, referred to as "operable units".

Each operable unit requires a separate RI/FS, a separate Proposed Plan, and separate ROD. The objectives of the three operable units (OUs) at the Site are:

- OU One: Address the groundwater contamination beneath the FCX property and to the south of the FCX property
- OU Two: Address the soil contamination (mainly pesticides, polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol, and dioxin) at the Site
- OU Three: Address all other contamination which was not characterized during the initial RI/FS (mainly soil, groundwater, and surface water/sediment contaminated with volatile organic compounds)

The ROD for Operable Unit One is expected to be signed in September 1993. The intent of the Operable Unit One Remedial Action contained in this ROD is to reduce the risk at the Site by reducing the threat posed by groundwater contamination, as well as to restore the groundwater aquifer to its beneficial use(s).

The Operable Unit One Remedial Action will achieve these objectives by containing the off-site movement or migration of contaminated groundwater located beneath the FCX property and to the south of the Site, as well as treating the groundwater to meet all Federal and State requirements.

V. SUMMARY OF SITE CHARACTERISTICS

The purpose of the RI at the Site was to characterize the nature and extent of groundwater, soil, surface water, and sediment contamination.

A. Groundwater Contamination

The groundwater investigation was conducted in two phases; phase I was conducted in June 1991 and sampling for phase II was conducted in June and October 1992. In the first phase, samples were collected from twelve (12) on-site monitoring wells, one of which is an upgradient well (MW-04).

Groundwater samples were also collected from the Carnation well located approximately 800 feet west of the Site, as well as from three (3) private wells located south of the Site. Table 5-1 contain the phase I groundwater sample results, including the number of detects, the range of concentrations, and the mean concentration for each of the metals or compounds detected. The units of measure for the groundwater samples are micrograms per liter (ug/l), commonly referred to as parts per billion.

Phase I Results

A number of pesticides were identified in the on-site monitoring wells. All of the pesticide compounds detected in on-site monitoring wells (with the exception of endrin ketone in well MW-6S), were detected in samples from shallow wells MW-3, MW-5S, MW-1, MW-2 and one deep well, MW-5D. The pesticides with relatively high water solubility constants, such as the individual BHC compounds and endrin ketone, were the only pesticide compounds detected at concentrations exceeding 1 ug/l. On the other hand, the pesticides with relatively low water solubility constants, such as the DDT compounds, were not detected at appreciable concentrations at the monitored locations. Figure 5-1 shows the pesticide groundwater contamination identified during the phase I RI.

Nine (9) identified and four (4) unidentified extractable organic compounds, as well as fourteen (14) purgeable organic compounds were detected in samples from a number of the on-site monitoring wells across the Site at concentrations of 100 ug/l or less. With the exception of diisopropyl ether and xylene, all of the detected compounds were chlorinated hydrocarbons. The most significant purgeable organic compound contamination observed on-site in the monitoring wells was that due to the presence of tetrachloroethene and its associated degradation products, including cis-1, 2-dichloroethene, trichloroethene, 1,1,1-trichloroethane, 1,1-dichloroethene, and 1,1-dichloroethane. On-site tetrachloroethene concentrations ranged from .65J ug/l to 270 ug/l. Chloroform was also detected in 7 of 12 monitoring wells at low concentrations. Trichlorofluoromethane, carbon tetrachloride, and butylidene-bis ((dimethylethyl)methyl) phenol were also identified in the upgradient on-site monitoring well MW-04. Figure 5-2 shows the volatile organic compound groundwater contamination identified during the phase I RI.

The sample collected and analyzed from the Carnation well indicated the presence of the purgeable organic compounds tetrachloroethene and its degradation product cis-1,2-dichloroethene at concentrations of 26 ug/l and 4.2 ug/l, respectively. It also contained trichloroethene and 1,2-dichloropropane at concentrations of 8.8 ug/l and 2.9 ug/l, respectively.

Burlington Industries (located to the north of the FCX property) conducted an environmental assessment of the property it currently owns. The analytical results from the assessment indicate that VOC contamination is also present in the soil and groundwater on the Burlington property at concentrations which exceed current North Carolina Class GA standards. A separate Operable Unit Three RI/FS will be performed to characterize the nature and extent of the

contamination associated with this property.

A number of metals were identified in the on-site monitoring wells. Most notably, chromium was detected in two samples at concentrations above the drinking water standard of 50 (ug/l). Lead was also identified in five (5) monitoring wells at concentrations exceeding the Maximum Contaminant Level (MCL) of 15 ug/l or the MCL Goal (MCLG) of 10 ug/l.

Phase II Results

There were several objectives in collecting and analyzing the groundwater samples during the Phase II RI. The first objective was to provide a second round of sampling data from the twelve on-site, permanent monitoring wells. The second objective was to determine the nature and extent of pesticide, VOC, and potential dioxin groundwater migration from the FCX property in both the overburden and bedrock portions of the aquifer. This was accomplished by installing and sampling twelve (12) temporary wells and one (1) permanent bedrock well.

With the exception of a single occurrence of endrin ketone at a concentration of 0.27 ug/l from well MW-10, all pesticides detected in samples from the permanent on-site wells were detected in wells MW-3, MW-5S, MW-5D, MW-1, and MW-2. Pesticides were identified in MW-3 at the following concentrations, gamma-BHC or lindane (7.7 ug/l), beta-BHC (4.5 ug/l), alpha-BHC (2.8 ug/l), endrin ketone (2.2 ug/l), delta-BHC (1.9 ug/l), and total chlordane (0.229 ug/l). Sample MW-5D contained lindane at a concentration of 3.7 ug/l. All but one of the concentrations reported for lindane, for both the permanent wells screened in both the overburden and bedrock portions of the aquifer, exceeded its MCL of 0.2 mg/l. Figure 5-3 shows the pesticide concentrations identified in the permanent monitoring wells during the Phase II RI.

Bromacil, an herbicide, was the most notable, extractable organic compound identified in the on-site monitoring wells MW-9 and MW-7 at concentrations of 4JN ug/l and 50 JN ug/l, respectively. The analytical qualifier "JN" refers to an estimated value based on presumptive evidence. Tetrachloroethene was identified in the on-site monitoring wells MW-1, MW-2, and MW-9 at concentrations ranging from 58 to 220 ug/l.

Other compounds identified in these wells, as well as in the permanent monitoring wells, included 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, chloroform, cis-1,2-dichloroethene, and trichloroethene. MCLs for three compounds were exceeded in samples collected from five of the wells. The MCL of 7 ug/l for 1,1-dichloroethene was exceeded at wells MW-1 (21Jug/l), MW-2 (11J ug/l), MW-9 (7.4 ug/l), MW-5D (23J ug/l), and MW-11 (7.4 ug/l). The MCL of 5 ug/l for tetrachloroethene was exceeded at wells MW-1 (220 ug/l), MW-2 (58 ug/l), MW-9 (75 ug/l), MW-5D (130 ug/l), and MW-11 (42 ug/l). The MCL of 5 ug/l for trichloroethene was exceeded at wells MW-1 (6.1 ug/l) and MW-5D (11J ug/l). Figure 5-4 shows the volatile organic compound concentrations identified in the permanent monitoring wells during the Phase II RI.

Based on presumptive evidence of the compounds dioxin and furan identified in the soil during the phase I RI, EPA sampled monitoring wells MW-1, MW-3, MW-5S, and MW-5D to investigate if these compounds had leached into the groundwater. No dioxins or furans were identified in any of these samples.

Of the twelve temporary monitoring wells sampled during Phase II, pesticides were identified in four wells, three of which are located on the FCX property and one of which is located south of West Front Street. Figure 5-5 shows the location of the twelve temporary wells and the pesticide concentrations identified during the Phase II RI. The sample from temporary well T-11 indicated the presence of eleven (11) pesticides (including DDT and DDD) at the highest concentrations of any of the temporary wells installed during the Phase II RI. DDT and DDD had not been detected previously in any groundwater samples collected and analyzed during the Phase

I or Phase II RI.

Of the twelve temporary monitoring wells sampled during the Phase II RI, tetrachloroethene was the most frequently identified purgeable organic compound identified in the temporary monitoring wells. Tetrachloroethene was identified in five samples at concentrations ranging from 0.60 ug/l in sample T-7 to 340 ug/l in sample T-12. The MCL was exceeded in samples from wells T3, T-9, and T-12. Trichloroethene also exceeded its MCL value of 5 ug/l in sample T-12 with a concentration of 13 ug/l. Figure 5-6 shows the volatile organic compound contamination in the groundwater as identified during the Phase I and Phase II RI. This figure indicates that tetrachloroethene (among other VOCs), has migrated several hundred feet to the south of the Site (T-3) in the overburden portion of the aquifer. Tetrachloroethene was also identified in MW-11, the permanent monitoring well located south of West Front Street. The only notable extractable organic compound revealed in any of the temporary monitoring wells was bis (2-ethylhexyl) phthalate. Bis (2-ethylhexyl)phthalate was identified in T-2 at a concentration of 52 ug/l.

B. Soil Contamination

Although the purpose of this document is to address groundwater contamination on the FCX property and to the south of the FCX property, a description of the soil contamination is provided below to indicate where the source of the pesticide groundwater contamination has been identified. As stated in Section IV, the soil contamination will be addressed in Operable Unit two.

The soil investigation was conducted in two phases; phase I was conducted in June 1991 and sampling for the phase II was conducted in June and October 1992. During the Phase I RI, one hundred and eighty-seven (187) surface and subsurface soil samples were collected and analyzed from on-site and off-site areas to characterize the nature and extent of contamination at the Site. Included in these samples were three background soil samples collected from station FS-127; one sample was collected and analyzed at the surface, one at a depth of 24 inches below the surface, and one sample 48 inches below the surface. During the Phase II RI, nine (9) soil samples were collected and analyzed to provide additional information regarding surface and subsurface soil contamination at the Site.

All samples were analyzed for Target Analyte List (TAL) metals, cyanide, Target Compound List (TCL) VOCs, Semi-Volatile Organic Compounds (SVOCs), poly-chlorinated biphenyls (PCBs), and pesticides. Numerous exploratory borings were also drilled during both Phases of the RI in an attempt to locate the alleged pesticide burial trenches.

Phase I Results

A number of metals were detected in the soil samples during the Phase I RI, most commonly aluminum, iron, chromium, lead, vanadium, barium, magnesium, potassium, nickel, calcium, zinc, copper, and cobalt. Most of the metal concentrations, based on their widespread occurrence and geological/mineralogical associations, are probably present at naturally-occurring concentrations. However, chromium and lead were detected in a number of samples at concentrations greater than an order of magnitude higher than the mean concentration calculated for all soil samples.

Thirteen pesticides were identified in soil samples collected and analyzed during the Phase I RI. These pesticides include DDT, DDD, DDE, alpha-chlordane, gamma-chlordane, dieldrin, endrin, heptachlor, heptachlor epoxide, alpha-BHC, gamma-BHC (lindane), and aldrin. The most significant pesticide compounds detected were the compounds of the DDT family (4,4'-DDT and its degradation or transformation products, 4,4'-DDD and 4,4'-DDE). DDT (4,4'-DDT) was detected in the greatest number of samples (57 out of 187 total samples) and at the highest concentrations.

The highest concentrations of DDT were detected in samples collected at locations under the eastern half of the warehouse; a concentration of 830,000 ug/kg was detected in sample FS-319-SLB at a depth interval of 12 to 16 inches below the concrete slab.

The highest concentrations of DDD and DDE were identified at sampling locations FS-302-SLA and FS-224-SLA at levels of 160,000 ug/kg and 1,800 ug/kg, respectively. Alpha- and gamma-chlordane were detected in the soil samples at concentrations up to 1,400 ug/kg and 1,800 ug/kg, respectively.

Dieldrin was also detected in a number of soil samples; the highest concentration, 40,000 ug/kg, was identified in sample FS-226-SLB at a depth of 24 inches below the concrete pad. Endrin, heptachlor, heptachlor epoxide, alpha-BHC, beta-BHC, gamma-BHC (lindane), and aldrin were also identified in soil samples collected and analyzed during the phase I RI.

Based on presumptive evidence of the compounds dioxin and furan identified during the phase I RI, EPA collected and analyzed five soil samples for the presence of these compounds. Three of the samples were collected from location FS-307 from three separate depth intervals, while the remaining two samples were collected from locations FS-312 and FS-318. The samples from locations FS-307 and FS-318 indicated the highest concentrations of dioxin and furan compounds. Additional samples will be collected and analyzed during the summer of 1993 prior to evaluating the potential remedial alternatives for the Operable Unit Two Remedial Action.

A number of extractable organic compounds were identified in the soil samples during the Phase I RI. Nineteen (19) of the twenty-one (21) extractable organic compounds were polycyclic aromatic hydrocarbons (PAHs). The principal carcinogenic (cancer-causing) PAH compounds identified in the soil during the RI, along with the maximum concentration for each, include benzo-(b/k)fluoranthene (14,000 ug/kg), chrysene (11,000 ug/kg), benzo (a)anthracene (11,000 ug/kg), benzo(a)pyrene (7,500 ug/kg), indeno(1,2,3-CD)pyrene (5,400 ug/kg), dibenzo(A,H)-anthracene (2,300 ug/kg). The unit of measure micrograms per kilogram (ug/kg) is equivalent to parts per billion.

The principal noncarcinogenic PAHs identified in the soil during the Phase I RI, along with their maximum concentrations, include pyrene (170,000 ug/kg), fluoranthene (170,000 ug/kg), and anthracene (5,200 ug/kg). Perylene, phenanthrene, and pentachlorophenol were also identified in the soil during the RI.

In addition to the extractable organic compounds mentioned in the previous paragraphs, forty (40) other extractable compounds were detected during the Phase I RI.

Twelve (12) purgeable organic compounds were detected in soil samples collected and analyzed during the Phase I RI. Trichloroethylene and tetrachloroethylene were the most frequently detected purgeable organic compounds in the soil.

The distribution of these two compounds in the soil appears to coincide with the plume of trichloroethylene and tetrachloroethylene in the groundwater. Other purgeable organic compounds identified in the soil during the RI include acetone, 1,2-dichloroethene, tetrahydrofuran, chloroform, total xylene, ethyl benzene, chlorobenzene, pinene, trimethylcyclohexane, and ethylmethylcyclohexane.

Phase II Results

Six of the nine soil samples in the Phase II RI were collected to provide total total organic carbon (TOC) values for the computer modeling of fate and transport of the Site contaminants shown in the Phase II RI Report.

Two soil samples, FS2-T11-SLA and FS2-T11-SLB, were collected from the 20-25 foot depth interval and the 30-35 foot interval, respectively. Both samples contained DDT, DDD, DDE, and gamma-chlordane at concentrations up to 20 ug/kg, as well as smaller concentrations of several BHC isomers, endrin, and heptachlor.

C. Surface Water/Sediment Contamination

Phase I Results

Eleven surface water samples were collected and analyzed during the Phase I RI. Pesticides were detected in one surface water sample, FS-020, located immediately south of the Site. Alpha-chlordane, gamma-chlordane, dieldrin, and trans-nonachlor were all detected or estimated to be present at concentrations less than 0.05 ug/l.

Two extractable organic compounds were detected in the surface water samples collected during the Phase I RI. Cyclodecanol and hexadecanoic acid were both identified at location FS-407, based on presumptive evidence, at concentrations of 10 ug/l and 4 ug/l, respectively.

Purgeable organic compounds were identified in seven (7) out of eight (8) surface water samples collected during the Phase I RI. The significant VOC contamination was identified in sample FS-408. Tetrachloroethene, trichloroethene, and cis-1,2-dichloroethene were detected at concentrations of 98 ug/l, 63 ug/l, and 45 ug/l, respectively. Trans-1,2-dichloroethene and 1,2-dichloropropane were also detected in sample FS-408 at concentrations of 3.3J ug/l and 7.2 ug/l. The other purgeable organic compounds identified in the surface water samples included carbon disulfide, benzene, and chloromethane.

Eight sediment samples were collected and analyzed during the Phase I RI. The eleven metals identified in each of the eight samples included, in order of decreasing concentration, iron, aluminum, calcium, magnesium, potassium, manganese, vanadium, barium, lead, chromium, and nickel. Other metals identified in the sediment samples included selenium, zinc, cobalt, arsenic, sodium, mercury, titanium, strontium, and yttrium.

Of the eleven sediment samples analyzed, two samples revealed the presence of pesticides, FS-409-SD and FS-401-SD. DDT, DDD, DDE, dieldrin, and endrin were the pesticides identified in the two samples. The pesticides DDT, dieldrin, and endrin were identified in the sediment samples up to concentrations of 760 ug/kg, 150 ug/kg, and 370 ug/kg, respectively.

Extractable organic compounds were identified in three out of the eleven sediment samples. Sample FS-400-SD, collected from a ditch located between the railroad tracks and the Burlington Industries property, contained bis (2-ethylhexyl) phthalate at a concentration of 34,000 ug/kg. Three PAH compounds (fluoranthene, phenanthrene, and pyrene) were also identified in sample FS-400-SD at concentrations of 790 ug/kg, 590 ug/kg, and 530 ug/kg, respectively.

Sample FS-020-SD, collected at the head of the unnamed tributary to Third Creek contained benzo (B and/or K) fluoranthene, fluoranthene, and pyrene at concentrations of 190 ug/kg, 250 ug/kg, and 200 ug/kg, respectively. Five PAH compounds were also identified in sample FS-410-SD located just below the confluence of Third Creek and the unnamed tributary sampled during the Remedial Investigation. An asphalt plant is located immediately upstream from the confluence with the unnamed tributary.

Two purgeable organic compounds were identified in sediment sample FS-408-SD, collected near a spring located immediately to the north of Burlington Industries. 1,2-dichloroethene and trichloroethene were detected at concentrations of 24 ug/kg and 44 ug/kg, respectively.

Phase II Results

Two sediment samples, FS2-03SD and FS2-04-SD, were collected from ditches located adjacent to the railroad tracks in the vicinity of the Carnation Milk Company property. These sediment samples are not located along either intermittent or perennial streams.

The rationale for collecting and analyzing these samples was to evaluate the presence of arsenic and PAHs detected in samples collected from this area during the Phase I RI. Nine PAHs were identified in these samples, five of which are known carcinogens. Benzo (B and/or K) fluoranthene was detected in both samples at concentrations of 2,400J ug/kg and 1,500J ug/kg, respectively.

Benzo(a) - anthracene, benzo-a-pyrene, chrysene, and indeno(1,2,3CD) pyrene were also identified at concentrations ranging from an estimated value of 450 ug/kg to 1,500 ug/kg. The presence of the PAHs in samples collected adjacent to the railroad tracks appears to be associated with the railroad crossties and not to former Site activities.

VI. SUMMARY OF SITE RISKS

The Baseline Risk Assessment Report presents the results of a comprehensive risk assessment that addresses the potential threats to public health and the environment posed by the Site under current and future conditions, assuming that no remedial actions take place, and that no restrictions are placed on future use of the Site. Actual or threatened releases from the Site, if not addressed, may present an imminent and substantial endangerment to public health, welfare, or the environment. The Baseline Risk Assessment evaluated the potential risk from exposure to contaminated groundwater, soil, surface water, and sediment. Contaminated groundwater is the medium of concern addressed in this Record of Decision as the Operable Unit One Remedial Action. The Operable Unit Two Remedial Action will address the contaminated soil described in Section V. Following the Operable Unit Three RI/FS, the Operable Unit Three Remedial Action will address the contamination associated with the property currently owned and operated by Burlington Industries.

The Baseline Risk Assessment consists of the following sections: identification of chemicals of potential concern; toxicity assessment; human exposure assessment; risk characterization; and environmental assessment. All sections are summarized below.

A. Contaminants of Concern

Chemicals were included in the discussion of the Site risks if the results of the Risk Assessment indicated that a contaminant identified in the groundwater during the RI might pose a significant current or future risk or contribute to a risk which is significant. The criteria for including chemicals in the Summary of Site Risks Section was a carcinogenic risk level which exceeded the acceptable range, i.e., $1E-4$ to $1E-6$, or a hazard quotient (HQ) greater than 0.1. Chemicals were also included if they exceeded either the State or Federal ARARs. Table 6-1 shows the contaminants of concern identified during the Operable Unit One RI/FS with the exposure point concentrations.

B. Exposure Assessment

The exposure assessment evaluates and identifies complete pathways of exposure to human population on or near the Site. Current exposure scenarios include the ingestion and dermal contact of soils, surface water, and sediment. Current land use assumptions include off-site residential and on-site child trespasser scenarios. Groundwater usage was not evaluated using the current land use assumptions because the groundwater plume has not migrated into existing

private wells located south of the Site; however, groundwater usage was evaluated under the future land use scenario.

Future exposure scenarios consider construction of water supply wells within the groundwater contaminant plume, as well as the incidental ingestion and dermal contact of soils, surface water, and sediment as worst case scenarios. Possible exposure scenarios for groundwater include exposure to contaminants of concern from the groundwater plume in drinking water and through inhalation of volatile organic compounds evolved from water through household use. Inhalation from showering was evaluated to account for doses of VOCs received from non-ingestion uses of water. The dose from inhalation of VOCs from showering was assumed to be equivalent to the ingestion of 2 liters of water. Once these contaminants of concern were identified, exposure concentrations in the groundwater were estimated. The maximum concentrations detected were compared to the calculated 95% confidence level of the arithmetic average of all samples, and the lower of these values was chosen as the estimated exposure concentration.

Table 6-2 shows the model used for calculating doses from the ingestion of contaminated groundwater, including the exposure assumptions associated with groundwater usage at the Site. Further detail and mathematical calculations can be viewed in the Baseline Risk Assessment.

The commercial/industrial land use assumption was not evaluated for current land use due to the fact that the Site is abandoned and not currently being used. However, the commercial/industrial land use assumption was evaluated for future land use.

C. Toxicity Assessment

Under current EPA guidelines, the likelihood of adverse health effects occurring in humans from carcinogens and noncarcinogens are considered separately. These are discussed below. Table 6-3 summarizes the carcinogenic and noncarcinogenic toxicity criteria for the contaminants of concern.

Cancer slope factors have been developed by EPA for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. Slope factors, which are expressed in units of (kg-day/mg), are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upperbound" reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal -to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals that are likely to be without risk of adverse effect. Estimated intakes of chemicals from environmental media can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

D. Risk Characterization

The risk characterization step of the risk assessment process integrates the toxicity and exposure assessments into quantitative and qualitative expressions of risk. The output of this process is a characterization of the Site-related, potential carcinogenic and noncarcinogenic

health effects. Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ), or the ratio of the chronic daily intake (CDI) derived from the contaminant concentration in a given medium to the contaminant's Reference Dose (RfD).

By adding the HQs for all contaminants within a medium or across all media to which a given population may be reasonably exposed, the Hazard Index (HI) can be generated. Calculation of an HI in excess of unity indicates the potential for adverse health effects. Indices greater than unity will be generated any time intake for any of the chemicals of concern exceeds its Reference Dose (RfD). However, given a sufficient number of chemicals under consideration, it is also possible to generate a HI greater than one even if none of the individual intakes exceeds their respective RfDs.

For carcinogens, risks are expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. These probabilities are generally expressed in scientific notation (e.g., 1×10^{-6} or $1E[-6]$). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a reasonable maximum estimate, an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Current Land Use

For the current residents living in close proximity to the Site, no carcinogenic or noncarcinogenic risks were identified at levels greater than $1E4$ or with an HI greater than 1.0. This means that the probability of a current resident (child or adult) having adverse health effects from cancer-causing or non-cancer-causing contamination at the Site is less than one-in-ten-thousand ($1E-4$).

Carcinogenic risks for current off-site residents were determined from potential exposure to off-site surface soil, surface water, sediment, as well as on-site surface soil (for child trespasser). The total carcinogenic risk for a child aged 1-6 was $2E-5$ (2-in-100,000), while the total carcinogenic risk was $1E-5$ (one-in-100,000) for a child aged 7-12 as well as for the adult off-site resident. Therefore, the total carcinogenic risks for the off-site resident fall within the acceptable risk range.

Future Land Use

Carcinogenic risks for future residents living on-site were determined from potential exposure due to the ingestion and inhalation of contaminated groundwater. The total carcinogenic risk due to the ingestion and inhalation of volatile organic compounds present in groundwater for a hypothetical future child aged 1-6, child 7-12, and adult residents is $5E-4$, or 5 in 10,000 residents. Forty-five percent of these risks are associated with the compounds 1,1-Dichloroethene, 1,1-Dichloroethane, and tetrachloroethene.

Approximately 35% of the risk is attributed to beryllium, which was detected in five groundwater monitoring well samples. The remaining 20% of the risk is associated with the various pesticides identified in the groundwater.

In evaluating potential risks to future on-site workers, air monitoring was conducted in the FCX facility in three locations during two consecutive 24-hour periods. The results were evaluated against the Occupational Safety and Health Administration (OSHA) established limits. These federal limits are referred to as permissible exposure limits (PELs) determined with the time weighted average (40 hr/week, 8 hr/day scenario), which are referenced criteria for any EPA remedial activity. None of the air sample data exceeded the PELs. Further evaluation regarding

the risk to future on-site workers will be performed as part of the Operable Unit Two Risk Assessment.

Noncarcinogenic risk exceeded a Hazard Quotient (HQ) value of 1.0 for the future child resident age 1-6 due to the ingestion of contaminated groundwater (4E+00). Noncarcinogenic risks exceeded a HQ value of 1.0 for the future child resident age 7-12 due to the ingestion of contaminated groundwater (5E+00). Noncarcinogenic risk also exceeded an HQ value of 1.0 for the future adult resident due to the ingestion of contaminated groundwater (2E+00).

E. Environmental (Ecological) Assessment

Potential risks to environmental receptors at or near the Site were evaluated based on Site sampling data and a review of the toxicity of the chemicals of potential concern to ecological receptors. Use of the Site by terrestrial receptors such as birds and small mammals, particularly the area presently covered by the brick warehouses and paved parking lot, was considered unlikely given the lack of trees or other vegetative cover at the Site. Based on a qualitative analysis, terrestrial wildlife communities in the lowlying and wooded areas near the Site are not likely to be significantly impacted.

In order to evaluate the potential risks to aquatic receptors at the Site, the surface water concentrations were compared with North Carolina Surface Water Quality Standards and Ambient Water Quality Criteria used by EPA Region IV as chronic screening values. The National Oceanic and Atmospheric Administration's (NOAA) Effects Range concentrations were also used by EPA-Region IV as sediment screening values. The pesticides Dieldrin and Alpha Chlordane were identified in the surface water at concentrations which exceed the State Standards and the chronic screening values; therefore, the potential exists for adverse effects to aquatic biota due to pesticide contamination in surface water. Pesticide concentrations in the sediment also exceeded the NOAA Effects Range concentrations; therefore, the potential exists for adverse effects on aquatic biota due to sediment contamination.

Additional investigation of the surface water pathways located both to the north and south of the Site may be needed during Operable Unit Two and Operable Unit Three to determine if remedial action is warranted.

VII. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(D) of CERCLA, as amended by SARA, requires that remedial actions comply with requirements or standards set forth under Federal and State environmental laws. The applicable or relevant and appropriate requirements (ARARs) that must be complied with are those are (A) action-specific, (B) location-specific, or (C) chemical-specific at the Site. Potential Federal action-, location-, and chemical-specific ARARs are shown in Table 7-1. Potential State action-, location-, and chemical-specific ARARs are shown in Table 7-2.

ARARs are used to determine the appropriate extent of Site cleanup, to scope and formulate remedial action alternatives, and to govern the implementation and operation of the selected action. "To be considered" materials (TBCs) are non-promulgated, non-enforceable advisories, guidelines, or criteria issued by federal or state governments (e.g., reference doses and carcinogenic potency factors) that may be useful for developing remedial action alternatives or for determining what is protective to human health and the environment.

This section examines the cleanup criteria associated with the contaminants identified during the RI/FS and the environmental media contaminated.

A. Action-Specific ARARs

Action-specific requirements set controls or restrictions on the design, performance, and other aspects of implementation of specific remedial activities. A retained alternative must conform with all ARARs unless a statutory waiver is invoked.

B. Location-Specific ARARs

Location-specific ARARs are design requirements or activity restrictions based on the geographical or physical positions of the Site and its surrounding area.

C. Chemical-Specific ARARs

Chemical-specific ARARs include those laws and regulations governing the release of materials possessing certain chemical or physical characteristics, or containing specified chemical compounds. These requirements generally set health or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, contaminants, and pollutants.

VIII. REMEDIAL ACTION OBJECTIVES

Based on the results of the RI/FS and the Baseline Risk Assessment, the FCX-Statesville Superfund Site is comprised of several contaminated media. One contaminated medium consists of soil contaminated primarily with pesticides, PAHs, and dioxin/furan. The second medium consists of groundwater contaminated primarily with pesticides and volatile organic compounds. The third and fourth media to show minor contamination are nearby surface water and sediment.

Due to the complexity of the contamination at the Site, EPA currently believes that the remediation of the Site can be accomplished most effectively by implementing three phases of cleanup, or Operable Units. The Operable Unit One Remedial Action has several objectives. One of the objectives of Operable Unit One will be to contain the off-site migration of contaminated groundwater from the FCX property and to the south of the FCX property. The second objective of Operable Unit One will be to restore the aquifer to its unlimited use(s) by pumping and treating the contaminated groundwater.

A. Soil Contamination

The analytical results of the Phase I and Phase II RI soil samples indicate that elevated levels of several contaminants, including pesticides, PAHs, and dioxin, are present in the shallow and intermediate depth soil at the Site. However, EPA believes that further sampling beneath the warehouse at deep depths is needed in order to fully characterize the extent of pesticide contamination. Likewise, further soil sampling is also warranted at the Site to characterize the extent of dioxin/furan contamination in the soil.

Following further characterization of the soil on the FCX property during the Summer of 1993, a Baseline Risk Assessment will be generated to evaluate the potential impacts to human health and the environment which could result if no remedial action were taken on the soil contamination. Once EPA has selected a preferred alternative for Operable Unit Two and the public has commented on EPA's preferred alternative, EPA will select the Operable Unit Two Remedial Action to address the soil contamination at the Site.

B. Groundwater Contamination

Table 8-1 contains the groundwater cleanup levels or chemicalspecific ARARs for the groundwater contaminants of concern. These cleanup levels represent the most stringent groundwater remediation level required by Federal and State law.

The estimated total extent of pesticide groundwater contamination beneath the FCX property and to the south of the FCX property is shown on Figure 8-1. The estimated total extent of VOC groundwater contamination beneath the FCX property is shown on Figure 8-2. The vertical extent of VOC contamination is assumed to extend through the overburden portion of the aquifer into the fractured bedrock.

IX. DESCRIPTION OF ALTERNATIVES

Table 9-1 summarizes the technologies considered for remediating the groundwater contamination beneath the FCX property and to the south of the FCX property. This table also provides the rationale as to why certain technologies were not retained for further consideration after the initial screening.

The following alternatives were developed to address groundwater contamination at the Site:

Alternative 1: No Action

Alternative 2: Limited Action

Alternative 3: Groundwater Extraction and Treatment With Chemical Precipitation/Filtration, Carbon Adsorption, and Discharge

Alternative 4: Groundwater Extraction and Treatment With Chemical Precipitation/Filtration, Air Stripping, Carbon Adsorption, and Discharge

The remedial response actions to address groundwater contamination are discussed below.

Alternative 1: No Action

By law, EPA is required to evaluate a No Action Alternative to serve as a basis against which other alternatives can be compared. No remedial action would be implemented under the No Action Alternative. There are no capital costs or operation and maintenance (O & M) costs associated with Alternative 1.

Total Capital Costs	\$ 0
Present Worth O & M Costs	\$ 0
Total Present Worth Costs	\$ 0

Alternative 2: Limited Action

As with the No Action Alternative, no active remedial action would be conducted under the Limited Action Alternative; however, institutional controls would be taken to prevent exposure to contaminated groundwater. The institutional controls would include deed restrictions and long-term monitoring.

Implementing deed restrictions would require amending property deeds to prohibit the use of groundwater as a potable water source both on-site and downgradient of the Site where the plume extends or may extend in the future. Groundwater monitoring would be conducted semi-annually for 30 years.

Groundwater samples would be collected and analyzed for VOCs (EPA method 8240), pesticides (EPA method 8080), and metals (EPA method 6010). A phthalate scan (EPA method 8270) would also be conducted to evaluate the concentrations of bis (2-ethylhexyl) phthalate.

The Limited Action Alternative would not remediate groundwater to either State Standards or Federal Maximum Contaminant Levels (MCLs). The capital costs as well as the operation and maintenance costs associated with Alternative Two are shown below.

Total Capital Costs	\$ 7,500
Present Worth O & M Costs	\$1,100,446
Total Present Worth Costs	\$1,107,946

Alternative 3: Groundwater Extraction and Treatment with Chemical Precipitation/Filtration and Carbon Adsorption

Alternative 3 would have two main objectives. One objective would be to prevent off-site migration of contaminated groundwater from reaching potential private well users located near the Site. Another objective would be to reduce the contaminant levels to meet all ARARs (e.g., the North Carolina Drinking Water Standards, North Carolina Groundwater Standards, and the Federal Maximum Contaminant Levels).

This would be achieved by pumping and treating the groundwater for an estimated period of 20 years. Extraction wells would be used to pump contaminated groundwater from the shallow and deep portions of the aquifer, through a piping system, to the treatment equipment located on-site.

The initial type of treatment, Chemical Precipitation/Filtration, would be used for reducing the levels of metals (e.g., beryllium, chromium, copper, manganese, mercury, and zinc) in the groundwater to meet all ARARs. Reducing the levels of metals would also help to prevent inorganic fouling of the Granular Activated Carbon (GAC) System. The GAC System would be used to reduce the levels of organic compounds in the groundwater to meet all ARARs.

Once the treated groundwater has met all treatment and discharge requirements, it would be discharged to either the local publicly owned treatment works (POTW) or a nearby surface water pathway. Following installation of the treatment system, aquifer tests would be needed to evaluate the system's effectiveness in controlling the off-site migration of the contaminants.

Groundwater quality would be monitored before and after treatment to ensure that the system was reducing the contaminants to the required levels. Deed restrictions would also be used to prohibit the use of groundwater as a potable water source both on-site and downgradient of the Site where the plume extends or may extend in the future.

Total Capital Costs	\$745,975
Present Worth O & M Costs	\$3,415,550
Total Present Worth Costs	\$4,161,525

Alternative 4: Groundwater Extraction and Treatment With Chemical Precipitation/Filtration, Air Stripping, Carbon Adsorption

The objectives of Alternative 4 would be the same as Alternative 3. These include preventing the off-site migration of contaminated groundwater from reaching private well users, and reducing the levels of contaminants to meet all ARARs.

Extraction wells would be used to pump the contaminated groundwater from the shallow and deep portion of the aquifer, through a piping system, to the treatment equipment located on-site. Chemical Precipitation/Filtration would be used to reduce the levels of metals to meet all State Standards and Federal MCLs, as well as reducing the possibility of inorganic fouling of the GAC System. Air stripping and Carbon Adsorption would be used to reduce the levels of organic

compounds to meet all State Standards and Federal MCLs.

Once the treated groundwater meets all treatment and discharge requirements, it would be discharged to either the local POTW or nearby surface water pathway. Groundwater quality would be monitored before and after treatment to ensure the system was reducing the levels of contaminants to meet all ARARs. The capital costs and the operation and maintenance costs for Alternative Four are shown below.

Total Capital Costs	\$766,265
Present Worth O & M Costs	\$3,307,783
Total Present Worth Costs	\$4,074,048

Implementation: Estimated 20 years

X. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives to address groundwater contamination using the nine evaluation criteria as set forth in the NCP, 40 CFR 300.430(e)(9). A brief description of each of the nine evaluation criteria is provided below.

THRESHOLD CRITERIA

Overall Protection of Human Health and the Environment addresses how an alternative as a whole will protect human health and the environment. This includes an assessment of how the public health and the environment risks are properly eliminated, reduced, or controlled through the treatment, engineering controls, or controls placed on the property to restrict access and (future) development. Deed restrictions are examples of controls to restrict development.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy complies with all state and federal environmental and public health laws and requirements that apply or are relevant and appropriate to the conditions and cleanup options at a specific site.

If an ARAR cannot be met, the analysis of the alternative must provide the grounds for invoking a statutory waiver.

PRIMARY BALANCING CRITERIA

Long-term Effectiveness and Permanence refers to the ability of an alternative to maintain reliable protection of human health and the environment over time once the cleanup levels have been met.

Reduction of Toxicity, Mobility, or Volume are the three principal measures of the overall performance of an alternative.

The 1986 amendments to the Superfund emphasize that, whenever possible, EPA should select a remedy that uses a treatment process to permanently reduce the level of toxicity of contaminants at the site; the spread of contaminants away from the source of contaminants; and the volume, or amount, of contamination at the site.

Short-term Effectiveness refers to the likelihood of adverse impacts on human health or the environment that may be posed during the construction and implementation of an alternative until cleanup levels are achieved.

Implementability refers to the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the alternative.

Cost includes the capital (up-front) cost of implementing an alternative, as well as the cost of operating and maintaining the alternative over the long-term, and the net present worth of both the capital and operation and maintenance costs.

MODIFYING CRITERIA

State Acceptance addresses whether, based on its review of the RI/FS and Proposed Plan, the State concurs with, opposes, or has no comments on the alternative EPA is proposing as the remedy for the Site.

Community Acceptance addresses whether the public concurs with EPA's Proposed Plan. Community acceptance of the Proposed Plan were be evaluated based on verbal comments received at the public meetings and those written comments received during the public comment period.

These evaluation criteria relate directly to requirements in Section 121 of CERCLA, 42 U.S.C. 9621, which determine the feasibility and acceptability of the remedy. Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. State and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan. The evaluation of the potential remedial alternatives to address groundwater were developed as follows.

Groundwater Remediation

The following alternatives were subjected to detailed analysis for groundwater remediation:

Alternative 1: No Action

Alternative 2: Limited Action - Deed Restrictions and Long-term Groundwater Monitoring

Alternative 3: Groundwater Extraction and Treatment with Chemical
Precipitation/Filtration and Carbon Adsorption

Alternative 4: Groundwater Extraction and Treatment with Chemical
Precipitation/Filtration, Air Stripping, and Carbon Adsorption

Overall Protection of Human Health and the Environment

Each alternative was evaluated to determine whether it is likely to effectively mitigate and minimize the long-term risk of harm to public health and the environment currently presented at the Site.

Alternative 1 would not be protective of human health or the environment since no restrictions would be placed on future land use at the Site; therefore, alternative 1 would not eliminate any exposure pathways or reduce the level of risk. Alternative 2 would be protective of human health and the environment only if the deed restrictions were effectively implemented.

Alternatives 3 and 4 would both be protective of human health and the environment by reducing levels of all site-related contaminants to meet all State and federal requirements.

Compliance with ARARs

Alternatives 1 and 2 would not reduce contaminant levels; therefore, they would not meet the State Standards and Federal MCLs. EPA believes Alternatives 3 and 4 would reduce contaminant levels to meet all State and Federal ARARs. Table 10-1 identifies the Federal and State regulations applicable to the groundwater alternatives.

Short-term Effectiveness

Alternatives 1 and 2 would not reduce the site-related contamination on a short-term basis. Alternatives 3 and 4 could be implemented without significant risks to on-site workers or the community, and without adverse environmental impacts.

Long-term Effectiveness and Permanence

Alternatives 1 and 2 would have no effect on the contaminant concentrations contributing to the risks identified in the Baseline Risk Assessment. Therefore, any reduction in contaminant concentrations in the long term would be due to natural dispersion, attenuation, and degradation processes. It is questionable whether remedial action objectives can be met through natural processes in the foreseeable future. Groundwater contamination would continue to be of potential risk to human health and the environment.

Contaminants would be permanently reduced through groundwater extraction and treatment in Alternatives 3 and 4. Air stripping and Carbon Adsorption are both proven technologies for the removal of organic compounds in groundwater.

Metals would also be permanently reduced in Alternatives 3 and 4 with the use of Chemical Precipitation.

EPA would conduct 5-year reviews of any remedial alternative selected to determine whether complete aquifer restoration is feasible and to ensure that the surface water and sediment in nearby streams do not contain unacceptable levels of site-related contaminants.

Reduction of Toxicity, Mobility, or Volume

Since Alternatives 1 and 2 provide no active treatment process, contaminants would degrade only by passive, natural processes. The toxicity and mobility of the contaminated groundwater may remain at current levels for an extended period of time.

The extraction and treatment of contaminated groundwater for an estimated period of 20 years in Alternatives 3 and 4 would effectively reduce the toxicity, mobility, and volume of the contaminant plume.

Implementability

No implementation of Alternative 1 is needed. However, Alternatives 2, 3, and 4 would require extensive coordination between State and local agencies in order to implement the deed restrictions effectively. Alternatives 3 and 4 would also require detailed planning as well as coordination with local agencies to determine the most viable discharge option.

Aquifer tests and additional characterization of the aquifer may be needed prior to implementation of the system. Alternatives 3 and 4 are technically feasible, but following installation of the system, would require monitoring of the influent and effluent to determine the effectiveness of the system.

Cost

Estimated total present worth costs for the four groundwater alternatives are presented below:

Alternative 1: none
Alternative 2: \$1,107,946
Alternative 3: \$4,161,525
Alternative 4: \$4,074,048

The duration of the groundwater extraction and treatment systems for Alternatives 3 and 4 is estimated to be 20 years. Long-term monitoring of the treatment system is anticipated for 30 years. The cost estimates also assume a 5% interest rate.

State Acceptance

The NCDEHNR has reviewed and provided EPA-Region IV with comments on the Remedial Investigation and Feasibility Study reports. The NCDEHNR also reviewed this Record of Decision and EPA's preferred alternative and concurs with EPA's selection.

Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the comment period ends and a response to each comment will be included in the Responsiveness Summary, which is included as Appendix B of the Record of Decision (ROD) for the Site.

XI. THE SELECTED REMEDY

Based on consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected Alternative 3 for the Operable Unit One groundwater remedy at the FCX-Statesville Superfund Site. At the completion of this remedy, the risk associated with the Site is projected to be within 10E-4 to 10E-6, the risk range generally accepted by EPA to be protective of human health and the environment. The total present worth cost of Alternative Three for an estimated 20 years of groundwater extraction and treatment (assuming a 5% interest rate) is \$3,415,600. Table 11-1 shows the capital costs associated with Alternative 3 and Table 11-2 shows the annual operating and maintenance costs associated with Alternative 3.

Groundwater Remediation

Groundwater remediation will address the contaminated groundwater at the Site. Groundwater remediation will include designing and constructing a network of an estimated 19 extraction wells both on-site and immediately to the south of the Site. Figure 11-1 shows the proposed extraction or recovery well location map. The wells will be designed to extract contaminated groundwater from the saprolite and bedrock portions of the aquifer. The installation of a piping system will be necessary to transport the contaminated groundwater from the extraction wells to the treatment system located on-site.

Treatment of the contaminated groundwater will include Precipitation/Filtration and Carbon Adsorption, and final discharge of the groundwater following treatment will be to the local POTW or to a nearby surface water pathway. The system will operate 24 hours a day. System controls will allow complete automatic operation with minimal operator attention.

The groundwater treatment system will require monitoring and maintenance. Monitoring of the treatment system will be achieved by comparing the quality of the groundwater entering the system with the quality of the groundwater exiting the system. The groundwater quality exiting the system must comply with all treatment requirements as well as permit requirements for discharge to the local POTW or surface water. Long-term groundwater monitoring will include sampling and analysis of the groundwater from the permanent monitoring wells for an estimated 30 years. Long-term groundwater monitoring will also be used to track contaminant plume migration.

Monitoring of the treatment system will include periodic sampling of the influent and effluent from the treatment system and analysis to ensure compliance with all treatment and discharge permit requirements for the POTW or for surface water discharge.

Extraction and Performance Standards

Groundwater will be extracted from the contaminant plume identified at the FCX property and the area to the south of the FCX property. The exact locations of the extraction wells and pumping rates will be determined during the Remedial Design and Remedial Action. Discharge of the treated groundwater will either be to the local publicly owned treatment works (POTW) or to a nearby surface water pathway. This determination will be made during the Remedial Design.

The goal of this remedial action is to restore the groundwater to its beneficial uses as defined in Section 6.0. Based on information obtained during the RI, and the analysis of all remedial alternatives, EPA and the State of North Carolina believe that the selected remedy may be able to achieve this goal.

Groundwater contamination may be especially persistent in the immediate vicinity of the contaminants' source where concentrations are relatively high. The ability to achieve the remediation levels throughout the area of attainment, or the groundwater contamination plume, cannot be determined until the extraction system has been implemented, modified, as necessary, and plume response monitored over time.

If the selected remedy cannot meet the specified performance standards, at any or all of the monitoring points during implementation, the contingency measures and goals described in this section may replace the selected remedy and goals for these portions of the plume.

Such contingency measures will, at a minimum, prevent further migration of the plume and include a combination of containment technologies and institutional controls. These measures are considered to be protective of human health and the environment, and are technically practicable under the corresponding circumstances.

The selected remedy will include groundwater extraction for an estimated period of 20 years, during which time the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation.

Modifications may include any or all of the following:

- a) at individual wells where remediation levels have been attained, pumping may be discontinued;
- b) alternating pumping at wells to eliminate stagnation points;
- c) pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater; and/or

d) installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that cleanup continues to be maintained, the aquifer will be monitored at those wells where pumping has ceased on an occurrence of at least 2 years following discontinuation of groundwater extraction.

If it is determined, on the basis of the preceding criteria and the system performance data, that certain portions of the aquifer cannot be restored to its beneficial use(s), any or all of the following measures involving long-term management may occur, for an indefinite period of time, as a modification of the existing system: a) engineering controls such as physical barriers, or long-term control provided by low level pumping, as a containment measure;

b) chemical-specific ARARs may be waived for the cleanup of those portions of the aquifer based on the technical impracticability of achieving further contaminant reduction;

c) institutional controls may be provided/maintained to restrict access to those portions of the aquifer which remain above remediation levels; and/or

d) continued re-evaluation of remedial technologies for groundwater restoration.

The decision to invoke any or all of these measures may be made during a periodic review of the remedial action, which will occur at least every 5 years, in accordance with CERCLA Section 121(c).

The Remedial Action shall comply with all ARARs as identified in Table 7-1 and 7-2. The presence of contamination in the groundwater will require deed restrictions to document their presence and could limit future use of the area known to be affected by the contaminated groundwater.

XII. STATUTORY DETERMINATION

Based on available information, the selected remedy satisfies the remedy selection requirements under CERCLA, as amended by SARA, and the NCP. The selected remedy provides protection of human health and the environment, is cost-effective, utilizes permanent solutions to the maximum extent practicable, and satisfies the statutory preference for remedies involving treatment technologies.

Protection of Human Health and the Environment

The selected remedy will permanently treat the groundwater and remove the potential risk associated with the contamination. The ingestion and inhalation contact with Site contaminants would be eliminated. Compliance with ARARs

The selected remedy will comply with all Federal and State ARARs. No waivers of Federal or State requirements are anticipated for this Site.

Cost Effectiveness

The selected groundwater technologies are more cost-effective than the other acceptable alternatives considered. The selected remedies provide greater benefit for the cost because they permanently treat the waste.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized for this Remedial Action.

Of the alternatives that are protective of human health and the environment and comply with ARARs, EPA and the State have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness, implementability, and cost; State and community acceptance, and the statutory preference for treatment as a principal element.

Preference for Treatment as a Principal Element

The preference for treatment is satisfied by the use of Precipitation/Filtration and Carbon Adsorption on the contaminated groundwater. The principal threats at the Site will be mitigated by the use of these treatment technologies.

XIII. DOCUMENTATION OF SIGNIFICANT CHANGE

CERCLA Section 117(b) requires an explanation of any significant change from the preferred alternative presented in the Proposed Plan. In the Proposed Plan, Alternative 4 was chosen for the groundwater remediation. This alternative consists of groundwater extraction and on-site treatment with chemical precipitation/filtration, air stripping, and carbon adsorption.

However, comments received during a public meeting held on May 20, 1993, overwhelmingly favored Alternative 3 over Alternative 4. The public voiced their opposition to the use of air stripping as a treatment technology for the contaminated groundwater. The public favored the use of chemical precipitation/filtration and carbon adsorption as the treatment technologies for the contaminated groundwater.

EPA selected Alternative 4 for the treatment of the contaminated groundwater at the Site based on data which shows groundwater treatment systems using both air stripping and carbon adsorption as an effective means of reducing organic contaminants. Residents and area citizens, however, preferred groundwater treatment using only carbon adsorption instead of using both air stripping and carbon adsorption.

The remedy documented in this Record of Decision is in accord with the concern expressed during the comment period by the affected community.