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RECORD OF DECISION FOR OPERABLE UNIT 4 (OU 4) ABL ROCKET CENTER WV

9/1/2001

FIKE CHEMICAL, INC.

EPA/ROD/R03-01/033
2001

EPA Superfund
Record of Decision:

FIKE CHEMICAL, INC.
EPA ID: WVD047989207
OU 04
NITRO, WV
09/28/2001

U.S. Environmental Protection Agency
Region III Superfund Program

Record of Decision
Operable Unit 4

Fike/Artel Superfund Site
Nitro, West Virginia

September 2001

Record of Decision for Fike/Artel Superfund Site OU4

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Record of Decision

Operable Unit 4

Fike/Artel Superfund Site
Nitro, West Virginia

I. THE DECLARATION

A. Site Name and Location

Fike/Artel Superfund Site
Nitro, West Virginia
Operable Unit 4 ("OU4")
CERCLIS Identification No. WVD047989207

The Fike/Artel Superfund Site is a former small volume chemical manufacturer located approximately 1.1 miles south-southwest of the intersection of Interstate 64 and State Route 25, in the town of Nitro, West Virginia. The Site includes an 11.9 acre former batch chemical production plant (referred to as the Chemical Plant) and a 0.9 acre former Cooperative Sewage Treatment Plant (referred to as the CST), located approximately 500 feet west of the Chemical Plant. The remedial actions for OU1, OU2, and OU3 have already been completed.

B. Statement of Basis of Purpose

This Decision Document presents the selected remedial action for soils, ground water, World War I-era and other sewers for the Fike/Artel Superfund Site located in the town of Nitro, West Virginia. This Record of Decision ("ROD") has been developed in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") of 1980, 42 U.S.C.§§ 9601-9675, as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300. This decision is based on the Administrative Record for the Site.

The remedy for the Site was selected by the U.S. Environmental Protection Agency. The State of West Virginia concurs with the selected remedy.

C. Assessment of Site

The response action selected in this Record of Decision ("ROD") is necessary to protect

the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

D. Description of Selected Remedy

This ROD sets forth the selected remedy for Operable Unit 4 ("OU4") at the Site, which includes soil, ground water, and World War I-era and other sewers. This action will be the final action for this Site. The selected remedy for OU4 is divided into five (5) components: CST; Chemical Plant and Lagoon 3; Ground Water; World War I-era and other sewers; and Institutional Controls.

Cooperative Sewage Treatment Plant (CST)

Currently, the CST consists of a flat and gently sloped 0.9 acre lot which is fenced, graded and vegetated with grass. The selected remedy for the CST is an asphalt cap to prevent human exposure to subsurface soils.

Chemical Plant and Lagoon 3

The chemical plant area is a flat 11.9 acre lot which is fenced, graded, and vegetated with grass. The only above ground structure at the Chemical Plant is a waste water treatment plant. There is a former lagoon (Lagoon 3) which was dewatered, stabilized and capped with soil in 1989. Lagoon 3 which contains approximately 5,500 cubic yards of stabilized sludge, is located on the southern portion of the Chemical Plant and is situated partially above the existing grade. The selected remedy for the Chemical Plant includes excavating Lagoon 3 and backfilling with clean fill and placing an asphalt cap over the entire surface (11.9 acres) of the Chemical Plant. The excavated stabilized sludge will be disposed off-site at either a RCRA Subtitle C or Subtitle D disposal facility as appropriate. The results of the waste analysis indicate that 300 cubic yards or less of the lagoon material would be managed as a hazardous waste.

Ground Water

The selected remedy for ground water is a pump and treat system to reduce the concentration of contaminants of concern to risk based drinking water levels. The operation of the pump and treat system will be delayed for five years to conduct additional investigation activities for data collection and remedial design activities. Currently, ground water in the vicinity of the Site is not a drinking water source, and therefore there is no immediate threat to human health. While the data collection and design activities are taking place for the ground water pump and treat system, the

Potentially Responsible Parties ("PRPs") may pursue other data collection activities to demonstrate whether natural attenuation is taking place to a degree such that all chemicals of concern will be reduced to acceptable levels within the same time frame as a pump and treat system.

World War I - era and other Sewers

A 12-inch sewer line runs from the CST to the Kanawha River. This line will be flushed. The material flushed from the line will be collected and sampled for disposal. The material flushed from the line will be disposed at an appropriate off-site disposal facility. World War I-era sewers that originate northwest of the Chemical Plant and in the vicinity of the CST and ultimately discharge into the Kanawha River will be investigated to determine if they contain contaminated sediments.

Institutional Controls

Institutional controls are warranted to ensure that the future use of the CST and the Chemical Plant remains industrial only. Appropriate institutional controls may include an attachment or notice to the deed restricting future land use. Existing institutional controls for the CST and the Chemical Plant include attachments or notices to the deeds restricting future land use to industrial use. In addition, institutional controls are also needed to ensure that no one is exposed to the contaminated ground water. Although EPA knows of no residential, commercial, or industrial use of ground water in the vicinity of the Site, additional institutional controls are warranted to prevent the use of the ground water in the vicinity of the Site until clean-up levels are achieved.

E. Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions to the maximum extent practicable. The remedy for soils at the CST and Chemical Plant does not satisfy the statutory preference for treatment as a principal element of the remedy because the low concentration, as well as the wide variety of contaminants in soil, makes the soils ill-suited to treatment. Although the remedy for ground water includes treatment, there are no principal threats in the ground water.

Because the Selected Remedy will result in hazardous substances, pollutants or contaminants remaining on-site above levels that would allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years from initiation of the remedial action at the Site, to ensure that the remedy is, or will be, protective of human health and the environment. The second five-year review for the Site

is scheduled for October 2001.

F. Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

- Chemicals of concern and their respective concentrations;
- Baseline risk represented by the chemicals of concern;
- Cleanup levels established for chemicals of concern and the basis of the levels;
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water use used in the baseline risk assessment and ROD;
- Potential land and ground water use that will be available at the Site as a result of the selected remedy;
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected;
- Key factor(s) that led to selecting the remedy

G. Authorizing Signature

Abraham Ferdas, Director
Hazardous Site Clean-up Division
Region III

9/28/01
Date

II. THE DECISION SUMMARY

A. Site Name, Location, and Description

The Fike/Artel Superfund Site is a former small volume chemical manufacturer (CERCLIS ID WVD047989207) located approximately 1.1. miles south-southwest of the intersection of Interstate 64 and State Route 25, in the town of Nitro, West Virginia (see Figure 1). The Site consists of an 11.9 acre former batch chemical production plant (referred to as the Chemical Plant) and a 0.9 acre former Cooperative Sewage Treatment Plant (referred to as the CST), located approximately 500 feet west of the Chemical Plant (collectively referred to herein as the "Property"), as well as all areas included within the definition of "on-site" at 40 C.F.R. § 300.5[1]. EPA is the lead agency and West Virginia is the support agency for the Site.

Between 1990 and 1997, EPA entered into several legal agreements with numerous Potentially Responsible Parties ("PRPs") requiring investigation and cleanup of the Site. Under these agreements and settlements, the PRPs have agreed to perform, pay for and implement the OU4 remedy.

The Chemical Plant, constructed over the razed remains of a World War I gun powder plant, was a batch chemical production plant that specialized in the development of new chemicals, custom chemical processing, and specialty chemicals. A feature known as Lagoon 3 exists at the southern end of the Chemical Plant. Lagoon 3 contains stabilized sludge and soils in a clay-lined and soil capped cell. The CST was a waste water treatment plant that treated industrial waste water and storm water runoff.

B. Site History and Enforcement Activities

The Chemical Plant, constructed over the razed remains of a World War I gunpowder plant, began operations in 1953 under ownership of Roberts Chemical Company. In 1971 the name

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[1]The NCP (40 C.F.R. § 300.5) defines "on-site" as "the areal extent of contamination and suitable areas in very close proximity to the contamination necessary for implementation of response action." As of the date of the Remedial Investigation, ground water sampling showed contamination had migrated at least to 300 feet off the Property to encompass monitoring well designated as "MW-120S". For purposes of implementation of the remedial action as detailed in this Record of Decision, the term "Site" includes the areal extent of contamination. The area so included may be modified as further information becomes available and additional investigations beyond the Property are conducted. By way of clarification, the terms "on-site" and "off-site" have been used previously throughout the Administrative Record to refer to areas "within the Property boundary," and "outside the Property boundary," respectively. However, as set forth above, this Site actually includes the full areal extent of contamination.

was changed to Fike Chemicals Inc. and later to Artel Chemical Company. More than 60 different chemicals were produced by batch reaction processes throughout the operational history of the plant. The Chemical Plant consisted of chemical production areas, office and laboratory buildings, three waste lagoons, and drum and waste burial areas.

The CST was constructed between 1966 and 1968 to treat sanitary and industrial wastewater and storm water runoff from the Fike Chemical Plant and an adjacent trucking terminal. Storm water and wastewater were directed from the Chemical Plant to the CST using the World War I-era gravity-flow sewer system. Lagoon 3 was a waste evaporation lagoon, located in the south end of the Chemical Plant.

The Fike/Artel Site was placed on the National Priorities List ("NPL") on September 1, 1983. The facility continued chemical production until June 1988. Conditions at the Fike/Artel Site prompted the West Virginia Department of Natural Resources ("WVDNR"), Kanawha County and Putnam County emergency services officials to request U.S. EPA emergency assistance following a facility inspection on June 10, 1988. EPA initiated a CERCLA Removal Action pursuant to Delegation 14-1-A on June 11, 1988. The size and complexity of the Site required additional funds. EPA organized the long term clean-up activities into several operable units (OUs). The combined efforts of EPA's Removal, Enforcement and Remedial programs have been used to address the many environmental problems at the Site.

1. Pre-remedial investigation and enforcement activities

In 1974, EPA issued a National Pollutant Discharge Elimination System ("NPDES") permit for wastewater discharges from the CST.

In 1978, West Virginia entered into a consent decree with Fike, Coastal Tank Lines and CST requiring the defendants to line the treatment basins at the CST facility. Subsequently, the court determined that the defendants did not complete the actions required by the consent decree.

In 1980, EPA filed a civil action against Fike, pursuant to the Clean Water Act ("CWA") and the Resource Conservation and Recovery Act ("RCRA") for Fike's discharges to the Kanawha River and disposal of hazardous waste at the Site, resulting in a Consent Decree entered into in November of 1982 between the United States, Fike, and the now defunct Coastal Tank Lines, Inc. This Consent Decree required the defendants to perform diking and paving of process areas, covering of principal waste disposal sites, and the pumping and treating of contaminated ground water. Fike did not comply with the terms of the Consent Decree.

In 1983, the West Virginia Department of Natural Resources issued an Administrative Order, directing Fike to stop placing waste in Lagoon 3.

In June 1983, an EPA Region III Field Investigation Team ("FIT") sampling survey was conducted to collect soil samples for dioxin analysis (2,3,7,8-TCDD). Based on the results of

this initial screening, additional dioxin sampling and analysis was required. In March 1984, EPA issued an order requiring dioxin sampling and analysis to determine the nature and extent of contamination at the Site. Fike claimed to be unable to afford this work. As a result, EPA FIT performed the sampling.

In May of 1984, EPA issued a Complaint, Compliance Order and Notice of Opportunity for Hearing for Fike. The Complaint cited violations of RCRA and specifically required Fike cease acceptance and storage of containers of hazardous waste not included in the RCRA Part A Permit Application; remove hazardous wastes not specified in the Part A Application; comply with operating record requirements; and obtain a certificate of liability insurance.

In November 1985, EPA denied a RCRA hazardous waste permit for the CST.

In January 1987, the West Virginia Department of Natural Resources issued an Order to Artel to describe materials accepted by the plant as RCRA hazardous wastes: manage containers properly; submit site plans; develop a plan to mark containers for identification purposes and submit an amended Part A Hazardous Waste Permit Application.

In June of 1988, Artel abandoned the facility.

2. Remedial/Removal Activities

In June 1988, due to the poor condition of storage vessels, incompatible materials storage, and large quantities of high hazard materials at the Fike/Artel Site, the West Virginia Department of Natural Resources, Kanawha County and Putnam County emergency services officials requested EPA assistance. On June 11, 1988, using federal funds and pursuant to Delegation 14-1-A, EPA initiated a CERCLA removal action to mitigate the threats to public health and the environment posed by the Fike/Artel Site.

The size and the complexity of the Site required additional funds in excess of the initial activation. On September 29, 1988, a Record of Decision for the Site was signed, authorizing EPA to utilize remedial funds to control stabilize, and/or eliminate hazards ("OU1"). The scope of work with an estimated total project cost of $20,250,000 was approved by EPA Headquarters through the Regional Administrator. From 1988 to 1992, EPA conducted these emergency response actions to address threats posed by the Site including leaking tanks and drums; laboratory containers, a hydrogen cyanide cylinder, and other hazardous materials.

On September 28, 1990, EPA issued a second Record of Decision ("OU2") calling for the dismantling and decontamination of all tanks, equipment, and buildings. Between 1990 and 1996 all buildings and tanks with associated piping were decontaminated, demolished and disposed of at an off-site location.

On March 31, 1992 EPA issued a third Record of Decision ("OU3") to excavate buried drums

and containers on the southern portion of the Site. The excavated materials were disposed off-site. This ROD was subsequently modified with two Explanation of Significant Differences ("ESDs") on May 13, 1993 and January 30, 1996. The first ESD eliminated the requirement for a dome during the drum excavation. The second ESD required the construction of a wastewater treatment plant to treat surface water.

In March 1997, EPA approved a response action plan to remediate the CST. The buildings and tanks at the CST were dismantled. The three lagoons were dewatered and the sludge and underlying soils were excavated. All the materials generated during this removal action were disposed off-site. The lagoons were backfilled with clean material. This work was completed in 1997.

Currently both the Chemical Plant and the CST are fenced, graded and vegetated with grass. The only remaining above ground structure is the wastewater treatment plant. The remaining items to be addressed at the Site include the soils, ground water and World War I-era and other sewers.

3. CERCLA Enforcement Activities

In February 1992, EPA entered into a Consent Decree with thirteen Potentially Responsible Parties to conduct the Remedial Design and Remedial Action for OU2.

In June 1993, EPA issued a Unilateral Order to twenty Potentially Responsible Parties to implement the OU3 ROD.

EPA entered into an Administrative Order on Consent ("AOC") (Docket No. III-94-36-DC) on September 30, 1994 with thirteen Potentially Responsible Parties ("PRPs") to conduct a Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit 4 (OU4). On May 3, 1996, EPA issued a removal order to 51 PRPs to dismantle the buildings and equipment at the CST facility. EPA and West Virginia subsequently entered into a Consent Decree (Civil Action No. 2:93-0654) on February 19, 1997 with fifty-four PRPs which requires, among other things, that the PRPs perform, pay for and implement the remedial/removal actions associated with OU3, OU4 and the CST.

C. Community Participation

The RI Report, the FS Report, the Proposed Plan for OU4 and other relevant documents for the Fike/Artel Site were made available to the public in July 2001. They can be found in the Administrative Record file and information repository maintained in the EPA Docket Room in Region 3 and the Nitro Public Library. The notice of the availability of these documents was

published in the Charleston Gazette and the Charleston Daily Mail on July 9, 2001. In addition, a public meeting was held on July 18, 2001 to present the Proposed Plan to the public. A public comment period was held from July 6 to August 5, 2001.

The PRPs organized a Fike/Artel Trust Community Liason Panel in 1994 to create a forum where citizens could gain knowledge about the project. The panel members include Fike/Artel Trust representatives, EPA and WVDEP representatives, local residents and community leaders. The panel meets three to four times a year depending on the level of activity at the Site.

A summary of comments received during the public comment period, including those discussed at the public meeting on July 18, 2001, are included in the Responsiveness Summary (Section III) of this ROD.

D. Scope and Role of Operable Unit or Response Action

Due to the complexity and magnitude of the issues associated with the Site, EPA organized the clean-up into several operable units (OUs).

OU1 consisted of an emergency response action to mitigate threats to public health and the environment. The primary threats posed by the Site included a methyl mercaptan storage tank, an estimated 10,000 drums of labeled and unlabeled hazardous materials, approximately 300 above ground tanks and reactor vessels with associated piping, about 200 drums containing sodium metal in a nitrogen-purged building, numerous laboratory containers, on-site lagoons, and the CST. Waste material removed and or treated included all classes of materials: explosives, flammable and poisonous gases, flammable liquids, pyrophoric materials, water reactive flammable solids, oxidizers and organic peroxides, poisons, reactives, and corrosives. EPA removed and/or treated 744,000, gallons, 34,000 pounds, and 1,000 cubic yards of material. In June 1989, the wastewater in Lagoon 3 was pumped and the remaining solids were stabilized with kiln dust. The lagoon was capped with clay. The capping was completed on June 24, 1989. Removal/Remedial activities for OU1 were completed in 1992.

OU2 consisted of the dismantling and decontamination of all tanks, equipment, and the majority of the buildings located on-site with subsequent disposal off-site. The scope of work for OU2 originally excluded two areas containing materials in above ground storage: 14 roll-off containers holding 722 drums of OU1 waste; and above ground tanks containing sludges and contaminated wastewater. This supplemental work to OU2 is referred to as OU7. The work associated with both OU2 and OU7 was completed in 1996.

OU3 consisted of the design and implementation of a removal program for buried drums and containers. The remedial action included the off-site disposal of 1,310 overpacked drums, 311 intermodal boxes with drum shards and soil, roll-off containers containing 616 cubic yards of

soil impacted by drum contents, and five cylinders. OU3 was completed in 1997.

OU4, the subject of this ROD, consists of the soils, ground water and WW1-era sewers. An RI/FS for OU4 was completed in 2001.

OU5 does not exist for the Fike/Artel Site. Due to the complexity of the Site, it was carved into several Operable Units but OU 5 was never assigned specific work.

OU6 consists of the design, construction, and operation of a new wastewater treatment plant to treat surface water. This work was completed in 1997.

OU7 is described under OU2.

E. Site Characteristics

1. Conceptual Site Model

a. Potential Migration Pathways

Historical sources of contaminants at the Site are related to former chemical production processes and product spills in the northern portion of the Site, and waste management practices in the southern portion of the Site. These sources have been removed during implementation of the various removal and remedial actions performed at the Site. At this point only residual contaminants remain. Evaluation of the residual contaminants in the soils indicates that the soils do not present a source capable of producing groundwater concentrations in excess of the Maximum Contaminant Levels (MCLs).

Other wastewater management practices which may have contributed to ground water contamination at the Site was the use of the former World War I-era sewer system and the treatment of stormwater and wastewater from Fike Chemical and Coastal Tank Lines Inc. Prior to the construction of the CST, the World War I-era sewers were used to discharge process and industrial wastewater to the Kanawha River. In 1968,wastewaters were directed via a World War I-era sewer to the three former CST lagoons for treatment prior to discharging to the Kanawha River. Wastewater and sediment samples collected in 1988 from the CST basins contained a variety of volatile organic compounds ("VOCs"), semi-volatile organic compounds ("SVOCs"), poly aromatic hydrocarbons ("PAHs"), dioxin, and metals. It is likely these basins could have contributed to ground water contamination. The CST was decommissioned, demolished and closed in 1996. The lagoons were dewatered, visibly contaminated soils were excavated and disposed off-site. The lagoons were backfilled with clean material and the CST was graded, seeded and fenced.

The historical releases, upon entering the soil, likely migrated downward to the ground water

surface. The rate of migration would be dependent on the amount and the chemical-physical properties of the constituents released. Once the constituents entered the ground water system, they would be transported downgradient in the ground water. Chemical data collected from the Site indicate that constituents that have migrated to ground water tend to be confined to the shallow portion of the aquifer. While some constituents have been identified in the deeper portion of the aquifer, the concentrations are significantly lower than those in the upper portion.

b. Current and Future Land Use

Currently, the Chemical Plant and the CST are vacant. Future land use at the Chemical Plant and the CST will remain industrial, consistent with the terms of the 1997 Consent Decree and attachments to the Deed. The area in the vicinity of the Site is primarily industrial and is unlikely to become residential since much of the surrounding property is within the 100-year floodplain of the Kanawha River. Figure 2 shows the surrounding land use.

c. Potential Receptors

Soil

At the Site, the on-site potential exposure pathways include direct contact with soils. This exposure scenario is a future case, because currently access to the Chemical Plant and the CST is controlled by a fence and a combination of on-site security and police patrol. Since future use of the Chemical Plant and CST will be industrial, the potential receptors include construction worker, industrial worker, and trespasser. Ecological receptors could also be exposed to contaminants present in the shallow soil.

Ground Water

There are no current receptors for ground water exposure scenarios at or near the Site since there is no known residential, commercial, or industrial use of ground water. Drinking water in the City of Nitro is obtained from a public water supply on the Elk River, approximately 15 miles to the east. There could potentially be industrial users of the shallow aquifer, however, none are known to exist. There is the possibility that the ground water could be used as a drinking water source in the future. In turn, the future resident using ground water as a drinking water source is the potential exposure pathway of concern for ground water.

2. Site Overview

The Site encompasses an 11.9 acre former Chemical Plant and a 0.9 acre former wastewater treatment plant (CST), which are located in the Nitro Industrial Complex, as well as all areas included within the NCP definition of "on-site," referenced in Footnote 1, above. Industrial facilities or operations surround the Chemical Plant and the CST. The CST is located about 500

feet west of the Chemical Plant and is not contiguous with the Chemical Plant property. The Kanawha River is 2,000 feet west of the Chemical Plant.

Land use adjacent to the Chemical Plant includes a railroad yard to the east; a lumber repackaging facility to the south, three chemical tank wagon depots and washing facilities to the west; and a chemical manufacturing facility and industrial park to the north. Industrial facilities or operations also surround the CST. A tank wagon washing and maintenance facility lies to the east; a small volume speciality chemical manufacturing facility lies to the south; an industrial park lies immediately to the north; and an industrial park, landfill, and chemical manufacturing facility lie to the west between the CST and the Kanawha River. Figure 2 shows the surrounding land use of the Chemical Plant and the CST.

The Chemical Plant and CST are accessible by an unpaved road connected to Viscose Road. The only above ground structure on the Chemical Plant is the storm water treatment plant. A feature known as Lagoon 3 exists at the southern end of the Chemical Plant. Lagoon 3 occupies approximately one acre and contains approximately 5,500 cubic yards of stabilized sludge and soils in a clay lined and soil capped cell. There are no above ground structures at the CST. Both the Chemical Plant and the CST are flat and surrounded by a chain link fence.

3. Sampling Strategy

a. Soil

Random and directed samples were collected from the surface and subsurface soil. Directed soil sample locations were selected based on historical activities at the facility such as former tank storage and disposal areas. Surface soil samples for evaluation of exposure to trespasser, construction and industrial worker were collected at the zero to two foot interval. Subsurface soils samples for evaluation of exposure to a future worker were collected at the two to eight foot interval. In addition, subsurface soil samples were collected to evaluate the impact of soil contamination to ground water. Seventy-seven locations were sampled at the Chemical Plant and 29 locations at the CST.

b. Lagoon 3

Thirty-eight (38) samples were collected from the material inside the lagoon for the purpose of classifying the waste for potential off-site disposal.

c. Ground Water

In 1998, 34 monitoring wells were installed at 17 locations within the property boundaries. In 1999, 15 monitoring wells were installed at nine locations outside the property boundaries. Well locations were selected based on ground water data collected by EPA's contractor during previous removal and remedial activities. In December 2000, the Fike/Artel Trust conducted

field investigation of ground water outside the property boundaries using Cone Penetrometer Testing (CPT). See Figure 3 for the location of the monitoring wells, piezometers, and CPT well points.

4. Types of Contamination

a. Soil

There are a wide range of contaminants at various concentrations throughout the Chemical Plant and the CST including volatile organic compounds, metals, pesticides, herbicides and dioxin. The most frequently detected volatile organic compounds in both the surface soil (0 to 2 feet) and the subsurface soil (2 to 8 feet) were benzene, toluene, ethylbenzene, and xylene. Concentrations of benzene ranged from non-detectable to 15 mg/kg (milligram per kilogram or parts per million). The highest concentration of toluene, ethylbenzene, and xylene was 780 mg/kg, 110 mg/kg, and 470 mg/kg respectively.

The compounds which present the greatest risk from direct contact with soils are arsenic and dioxin. Background soil samples were not collected and therefore it is not possible to confirm whether arsenic is present as a result of naturally occurring conditions in the area. Arsenic was detected in every soil sample. The average concentration of arsenic was approximately 16 mg/kg with the exception of one location that contained an elevated concentration of 1,100 mg/kg. The risks to human health from exposure to these contaminants is discussed in Section G of this Record of Decision.

In 1998, as part of the Remedial Investigation, 7 soil samples from the CST and 37 soil samples from the Chemical Plant were analyzed for dioxin (2,3,7,8-TCDD equivalent or TEQ[2]). Concentrations ranged from non-detect up to 12 ug/kg (microgram per kilogram or parts per billion) of 2,3,7,8-TCDD equivalents. In October 1999, EPA's Removal Program collected 20 on-site soil sample for dioxin analysis. Concentrations were less than 5 ug/kg for all samples.

In 1983, EPA's contractor collected soil samples from three locations that contained approximately 500 ug/kg. In March 2000, confirmation sampling was conducted at these same locations which were approximately three feet below the existing grade. The results from the March sampling event ranged from 2 ug/kg TEQ to 45 TEQ.

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[2]Dioxin refers to a group of chemical compounds sharing certain similar chemical structures and toxic characteristics. The dioxin compound which is the most toxic is 2,3,7,8-TCDD. In evaluating risk due to dioxin compounds, EPA has developed a Toxic Equivalence (TEQ). The concentration of each dioxin compound is multiplied by a factor called the Toxic Equivalency Factor (TEF). The TEQ is obtained by adding up the results as follows:

$$TEQ = (diox_1 \times TEF_1) + (diox_2 \times TEF_2) + ...$$

The dioxin concentrations are reported as TCDD equivalents which equals the TEQ.

b. Lagoon 3

In December 1999 and January 2000, 20 samples were collected from Lagoon 3. In August 2001, an additional 18 samples were collected from Lagoon 3. All of these samples were analyzed for hazardous waste characteristics. Of the 38 samples analyzed for TCLP characteristics, one sample failed for tetrachloroethylene and another sample failed for arsenic. None of the samples failed the reactivity, ignitability, or corrosivity hazardous waste characteristic criteria.

c. Ground Water

The earth materials beneath the surface of the Site consist of locally derived fill, unconsolidated alluvium associated with the Kanawha River, and competent claystone/shale bedrock. The alluvial aquifer is the main conduit for ground water flow beneath the Chemical Plant, and is hydraulically connected to the Kanawha River, which flows northerly at a distance of about 2000 feet west of the Chemical Plant, and eventually bends easterly at a distance of about 10,000 feet north of the Chemical Plant. Major components of ground water flow are to the north and the northwest beneath the Chemical Plant and CST, both of which are toward the Kanawha River, which is the ultimate ground water discharge zone.

The unconsolidated alluvium can be segregated into four hydrostratigraphic zones.

- Zone 1 is comprised of fine-grained sediments, clays, silts and silty-fine-grained sands. This zone is comprised of fill and flood plain sediments. These sediments generally extend to depths of 20 feet, but in places can reach depths of 25 feet or more. Most of Zone 1 occurs in the unsaturated zone.

- Zone 2 is a fairly massive, laterally continuous and coarse-grained unit comprised of generally well-sorted fine to medium-grained sand. This zone ranges in thickness from 15 to 25 feet beneath the Chemical Plant and occurs from10 to 20 feet below ground surface ("BGS") extending to depths of 40 to 45 feet. The water table typically occurs at depths of about 15 to 20 feet, so most of Zone 2 is saturated. Zone 2 is also referred to as the upper alluvial aquifer. Pumping test results showed that the upper alluvial aquifer has a moderately high permeability (hydraulic conductivity of about 0.07cm/s at the Chemical Plant). Data, collected during the Remedial Investigation, indicates that a paleochannel exists beneath and north of the Chemical Plant, but that less permeable overbank deposits occur to the west of the Chemical Plant. This causes a preferential pathway for groundwater flow to the north, despite the fact that the shortest path for ground water to discharge to the Kanawha River is to the west.

- Zone 3 is more fine-grained and less sorted, consisting of interstratified layers or mixtures

of clay, silt and fine sand. This zone ranges in thickness from 5 to 35 feet and typically lies at depths of 30 to 55 feet bgs.

- Zone 4 is comprised of a poorly sorted gravel (i.e., gravel is contained in a fine grained silt to clay matrix). The gravel material represents the bottom of this section immediately above bedrock, and is typically 3 to 8 feet thick. The deep wells are screened in Zone 4. Pumping test data showed that Zone 4 is at least 100 times less permeable than the upper alluvial aquifer.

The ground water is contaminated with thirty-four different compounds which will require remediation. Ground water underneath and down gradient of both the Chemical Plant and the CST is contaminated with some or all of the compounds listed on Table 1. Some of the compounds which were detected in the ground water underneath the Chemical Plant and CST were not detected in the ground water monitoring points downgradient of the Chemical Plant and the CST. At the same time, there are compounds detected downgradient of the Chemical Plant and the CST that were not detected in ground water underneath the Chemical Plant or CST. In general, the concentration of contaminants is greater underneath the Chemical Plant and the CST, than downgradient of the Chemical Plant and the CST. The concentrations of contaminants are much lower in the deep aquifer than in the shallow aquifer. See Table1 for a list of the chemicals of potential concern ("COPCs"[3]) in ground water underneath the Chemical Plant, underneath the CST, and downgradient of the Chemical Plant and the CST.

Based on the data collected during the Remedial Investigation, Site related ground water contamination appears to be moving in the direction of the Kanawha River. No one is currently using the ground water as a water supply for either residential or industrial use.

The data collected as part of the RI did not reveal an area that serves as a continuing source of ground water contamination. Previous remedial and removal actions have removed about 18.5 million pounds of waste material which has significantly reduced any potential continuing source of chemical constituents to ground water.

d. World War I-era Sewers

Since 1989, four separate investigations have been performed to provide information relevant to the World War I-era sewer system located beneath and in the vicinity of the Chemical Plant. Specifically, the investigations were designed to: identify the locations of the World War I-era

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[3]COPCs and COCs are used in USEPA RAG Part B guidance as Chemicals of Potential Concern and Chemicals of Concern respectively. The Remedial Investigation/Feasibility Study refers to the COPC and COCs as contaminants and/or constituents of concern. For consistency, COPCs or COCs in this document means Chemicals of Potential Concern or Chemicals of Concern.

manholes and sewers; determine the interconnections between the various manholes, drains, and sewers identified at the Site (including manholes and sewers outside the property boundary); characterize the physical condition of the sewer lines; and characterize the flow, if any, through the sewers. Techniques used during the investigations included visual inspection, smoke testing, dye tracing, standard excavation, and land surveying. The results of the sewer investigations indicate that the World War I-era sewers beneath the Chemical Plant were either blocked intentionally by Fike during the operating period of the plant, or blocked due to natural accumulation of sediments within the manholes and sewer lines. The only exception to this is the World War I-era gravity line extending from the northern portion of the Chemical Plant west under the adjacent property west of the Chemical Plant to the CST. However, this line was removed from service during the CST removal work.

Based on observations during the investigations, it is believed that the sewers underneath the Chemical Plant are likely partially or fully collapsed. Several sink holes have developed in an area near Lagoon 3. This may be due to collapsed sewer lines in the vicinity of Lagoon 3.

In May of 2001, the WVDEP conducted a survey of the World War I-era sewers in the vicinity of the CST. The survey included a review of historical maps and a site visit. The WVDEP prepared a trip report which suggests that the Chemical Plant may have discharged wastewater through WWI-era sewers prior to the construction of the CST plant. These World War I-era sewers located outside the property boundary are still functioning and discharge to the Kanawha River. There is a possibility that these sewers contain contaminated sediments. A further investigation of the World War I-era sewers that originate in the vicinity of the CST and discharge to the Kanawha River is warranted to determine if the sewers contain contaminated sediments. In general, two segments of the World War I-era sewer system that are of interest originate at points located northwest of the Chemical Plant and in the vicinity of the CST. One of the segments originates northwest of the Chemical Plant and the other segment originates in the vicinity in the CST. Both of these segments trend north for a distance of approximately 1320 feet where they intersect another segment of the World War I-era sewer system that trends east-west along roads No. 4 and 5. A portion of this segment trends west for distance of 400-600 feet where it intersects a 66-inch diameter trunk line. The trunk line trends in a general westerly direction over a distance of approximately 1800 feet where it discharges to the Kanawha River.

F. Current and Potential Future Land and Water Uses

Industrial facilities or operations currently surround the Chemical Plant and the CST. Land users adjacent to the Chemical Plant include a railroad yard to the east; a wholesale lumber facility to the south; three chemical tank trailer depots and washing facilities to the west; and a chemical manufacturing facility and industrial part to the north.

Land uses adjacent to the CST include a tank trailer washing facility and maintenance facility to the east; a small volume specialty chemical manufacturer to the south; an industrial park to the

north; and an industrial park, landfill, and chemical manufacturing facility to the west, between the CST and the Kanawha River.

In 1997, EPA entered into a Consent Decree with over fifty PRPs and the Department of Justice. In this Consent Decree, EPA required that the State of West Virginia file a deed restriction limiting the future use of the Chemical Plant and the CST to industrial use. In 1998, EPA entered into a Prospective Purchaser Agreement with the City of Nitro Development Authority. In this agreement, the City of Nitro agreed to restrict the future use of the Chemical Plant and the CST to industrial use and filed a Declaration of Deed Restrictions which, among other things, limits the future use of the Chemical Plant and the CST to industrial use.

There is no known residential, commercial, or industrial use of ground water in the vicinity of the Site. Drinking water in the City of Nitro is obtained from a public water supply on the Elk River, approximately 15 miles to the east. There could potentially be industrial users of the shallow aquifer, however, none are known to exist. EPA ground water classification guidelines have been used to classify the aquifer. EPA considers ground water as potentially usable as a source of drinking water, both from quality and yield standpoints (Subclass IIB), until demonstrated otherwise. The ground water in the vicinity of the Site is classified as a IIB aquifer.

G. Summary of Site Risks

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken.

A streamlined ecological risk assessment was conducted for the Site which consisted of five basic issues: 1) general environmental setting; 2) constituent fate and transport; 3) potential receptors; 4) complete exposure pathways; and 5) conclusions. While the ecological risk assessment supports a decision of no further remedial action, the results of the human health risk assessment provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action.

The human heath risk assessment followed a four step process: 1) Data evaluation and selection of Chemicals of Potential Concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment which considers the types and magnitudes of adverse effects associated with exposure to hazardous substances; and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below.

It is important to note that some soil samples were collected and analyzed for dioxin which were not included in the risk assessment. When the risk assessment was near completion, EPA located data collected in 1983 that showed elevated dioxin concentrations in soil at three locations. EPA required that the Fike/Artel Trust collect confirmation samples at these locations. Although the results of these samples were not included in the risk assessment, they support the decision for remedial action and will be discussed in greater detail under the uncertainty analysis of the human health risk assessment.

1. Human Health Risk Assessment

a. Identification of Chemicals of Concern

Soil

USEPA Region III Risk-Based Concentrations ("RBCs") for an industrial worker were used as the primary basis for constituent screening. Chemicals for which the maximum detected Site concentration was below the screening criteria were dropped from further quantitative analysis. Twenty-three COPCs were retained for quantitative risk estimation for soil at the Chemical Plant and the CST. The COPCs for soil at the Chemical Plant and CST are listed in Tables 3 and 4 respectively.

Ground Water

Although some of the monitoring wells at the Site were sampled multiple times, only analytical results for the most recent sample in which individual constituents were target analytes were used for screening and risk assessment purposes. USEPA Region III RBCs for tap water were used for constituent screening. Screening comparisons were made by comparing the maximum detected Site concentration for each chemical in the areas within the property boundary and the areas outside the property boundary to the risk-based screening criteria. Chemicals for which the maximum detected Site concentration was below the screening criteria were dropped from further quantitative analysis in the corresponding Site area. Fifty-five COPCs were retained for quantitative risk estimation. At the conclusion of the risk assessment, 34 chemicals were identified as contributing to overall ground water risks and are the Chemicals of Concern (COCs). The COPCs are listed on Table 1 and the COCs are listed on Table 2.

b. Exposure Assessment

Exposure is defined, for risk assessment purposes, as contact with constituents in environmental media at the outer boundaries of the body, such as the gastrointestinal tract (for ingestion route), skin (for dermal route), and lung (for inhalation route). Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure to an agent in the environment. The human health risk assessment evaluated both reasonable maximum exposure ("RME") and Central Tendency ("CT") exposure. The RME is the maximum exposure

that is reasonably expected to occur at a site. The CT estimate is intended to approximate the potential exposure to a typical receptor. Exposure Point Concentrations ("EPCs"), which are the concentrations of COPCs in a given medium to which a receptor may be exposed, were also calculated.

Soil

The human health risk assessment characterized risks to humans, both current and future, from exposure to contaminants at the Site. As discussed in the Conceptual Site Model, the future use of the Chemical Plant and the CST will be limited to industrial use. Exposures to trespassers, construction workers and industrial workers from contact with soil contaminants were evaluated. Risks to future receptors were calculated from potential exposure to soil by incidental ingestion, inhalation of particulate and volatiles, and direct dermal contact.

Potential exposure to constituents in the soil is dependent on the concentration of the constituent in the soil and the frequency and duration of the exposure. The exposure frequency for both the RME and CT industrial worker is 250 days per year, which assumes full-time employment; five days per week per year (i.e., 52 weeks minus 2 weeks vacation). The exposure duration for the RME industrial is 25 years, while the exposure duration for the CT receptor is 12 years, the median occupational tenure of workers age 25-64 years old.

Ground Water

A Deed of Restrictive Covenants for the Chemical Plant and CST has been proposed which will prevent the installation of wells and the use of ground water at the Chemical Plant and CST. Potential exposures pertain to ground water which is leaving the property boundaries. Although no one is currently using the ground water as a drinking water source, the risk assessment evaluated industrial worker, aggregate (child and adult) resident, and child resident for future potential exposure to ground waster through ingestion, inhalation, and dermal contact. The ground water ingestion rates of 1.26 liters/day and 1.22 liters/day were used for the RME and CT receptors, respectively. The ground water ingestion rate for the RME and CT child resident is 0.68 liters/day. In addition, EPA guidance numbers for skin surfaces areas for dermal absorption; inhalation rates; and exposure time RMEs and CT were utilized.

c. Toxicity Assessment

The toxicity assessment provides a description of the relationship between a dose of a chemical and the anticipated likelihood of an adverse health effect. The toxicity values describe the quantitative relationship between the level of exposure (dose) to a chemical and the increased likelihood of adverse impacts (response). The intake factors calculated in the exposure assessment were combined with toxicity values and chemical concentrations to estimate a cancer risk or a non-cancer risk

Key dose-response criteria are EPA cancer slope factors ("CSFs") for assessing cancer risks and EPA-verified reference dose ("RfD") values for evaluating non-cancer effects. Toxicity values are derived from either epidemiological or animal studies, to which uncertainty factors are applied. These uncertainty factors account for variability among individuals, as well as for the use of animal data to predict effects on humans. Sources of these toxicity values are the EPA online database Integrated Risk Information System ("IRIS") and EPA's Health Effects Assessment Summary Tables ("HEAST").

The CSF is multiplied by the estimated daily intake rate of a potential carcinogen to provide an upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. CSFs are expressed in units of mg/kg-day. The upper bound estimate reflects the conservative estimate of risks calculated from the CSF. This approach makes underestimation of the cancer risk unlikely. This chemical-induced risk calculated based on the CSF is in addition to the risk of developing cancer due to other causes over a lifetime. Consequently, the risk estimates in this risk assessment are referred to as incremental or excess lifetime cancer risks.

The chronic Reference Dose (RfD), expressed in units of mg/kg-day, is an estimated daily chemical intake rate for the human population, including sensitive subgroups, that appears to be without appreciable risk of non-carcinogenic effects if ingested over a lifetime. Estimated intakes of COPCs are compared with their RfDs to assess the non-carcinogenic hazards.

Soil

Tables 5 and 6 provide a summary of the non-cancer toxicity data for oral/dermal and inhalation exposure to the COPCs in soil. Tables 7 and 8 provide a summary of cancer toxicity data for oral/dermal and inhalation exposure to the COPCs in soil.

Ground water

Tables 9 and 10 provide a summary of non-cancer toxicity data for oral/dermal and inhalation exposure to the COPCs in ground water. Tables 11 and 12 provide a summary of cancer toxicity data for oral/dermal and inhalation exposure to the COPCs in ground water. The Baseline Risk Assessment considered exposure to ground water at the Chemical Plant separately from exposure to ground water at the CST because these are non-contiguous parcels characterized by separate sets of monitoring wells. Wells outside the property boundary were also considered as a separate exposure point. Although ground water data was separated in the toxicity assessment, the ground water is treated as one media for ultimate cleanup.

d. Risk Characterization

The risk characterization process was performed to estimate the likelihood, incidence, and nature of potential effects to human health that may occur as a result of exposure to COPCs at the Site. The quantitative and qualitative results of the data evaluation, exposure, and toxicity assessment

sections were combined to calculate risks for cancer and non-cancer health effects. Because of fundamental differences in the mechanisms through which carcinogens and non-carcinogens act, risks were characterized separately for cancer and non-cancer effects.

Carcinogenic Risks

The potential health risks associated with carcinogens were estimated by calculating the increased probability of an individual developing cancer during their lifetime as a result of exposure to a particular contaminant at the Site. The chemical-specific exposure estimates (i.e., average lifetime dose) were multiplied by the chemical - and route-specific slope factor, averaged over the expected duration of exposure, to arrive at a unitless measure of probability, expressed numerically (e.g., 1 x 10^{-4} or 1E-4) of an individual developing cancer as a result of chemical exposure at the Site.

A cancer risk estimate is a probability that is expressed as a fraction less than one. For example, a cancer risk of 1 x 10^{-4} (1E-4) refers to an upper bound increased chance of one in ten thousand of developing cancer as a result of site-related exposure to a carcinogen over the expected exposure duration. The National Oil and Hazardous Substances Pollution Contingency Plan recommends a target risk for excess cancer risk of 1E-4 to 1E-6 (one in ten thousand to one in a million).

Non-Carcinogenic Hazards

The potential for non-carcinogenic effects due to exposure to a particular chemical is expressed as the hazard quotient ("HQ"). An HQ was calculated by dividing the estimated intake or dose of a chemical by the chemical-specific toxicity value or non-cancer RfD. Implicit in the HQ is the assumption of a threshold level of exposure below which no adverse effects will occur. If the HQ exceeds one, Site specific exposure exceeds the RfD and the potential for non-cancer adverse effects may exist.

The Hazard Index ("HI") is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g. liver) within or across those media to which the same individual may reasonably be exposed. A HI less than or equal to one indicates that toxic noncarcinogenic effects are unlikely.

e. Results

Tables 13 and 14, as well as the discussion below, summarize the cancer and non-cancer risk characterization results for soils and ground water for each exposure scenario evaluated for the Fike/Artel Superfund Site.

Soil

The risks and hazards to the adolescent trespasser, future industrial worker and future construction worker were calculated assuming a current exposure scenario. These risks and hazards were based on combined ingestion and dermal contact exposures to surface soil and mixed soil. All of the calculations for cancer risk fell within EPA's acceptable risk range except for the future industrial worker's potential exposure to surface soil (0 to 2 feet) and mixed soil (2 to 8 feet). The carcinogenic risk is 1.3 x 10-4 (surface soil) and 3.4 x 10-4 (mixed soil) for the reasonable maximum exposure of a future industrial worker. These risk calculations fall at the least protective end of EPA's acceptable risk range. Cancer risk is primarily due to exposure to 2,3,7,8-TCDD.

All of the non-carcinogenic hazards for all exposures were less than one except for the future construction worker. The Hazard Index for the future construction worker's exposure to mixed soil was 1.3, which slightly exceeds EPA's target HI of 1.

Ground Water

The risks and hazards to the future industrial worker, the future aggregate resident (adult and child), and the future child were calculated assuming a hypothetical current exposure scenario. Carcinogenic risks for the aggregate resident included ingestion, dermal and inhalation exposures to ground water. Lifetime cancer risks for the resident was 5.0E-03 and 1.8E-03 for ground water underneath the Chemical Plant and ground water outside the property boundary respectively. The carcinogenic risk resulting from exposure to ground water is unacceptable. The Hazard Index for the resident was 190 and 25 for ground water underneath the Chemical Plant and ground water outside the property boundary respectively, which significantly exceed the target of 1.0.

f. Risk Assessment Uncertainties

The purpose of the risk assessment is not to predict the actual risk of exposure to an individual. Rather, risk assessments are management tools for developing conservative estimates of health hazards in order to be protective for the majority of the population and to compensate for uncertainties inherent in estimating exposure and toxicity. As a result, the numerical estimates in a risk assessment (risk values) have associated uncertainties reflecting the limitations in available knowledge about Site contaminant concentrations, exposure assumptions, and chemical toxicity.

Because the objective of the remedial investigation process is to define the nature and extent of contamination, samples are not all collected from random locations. Therefore, these samples may disproportionately represent more contaminated areas of the Site. This will tend to overestimate the exposure concentrations of contaminants and therefore exposures and consequently risks may be overestimated.

No characterization of Site-specific background was conducted for this risk assessment. Without this type of data, it is not possible to determine with confidence the extent to which estimated risks are related to former facility activities vs. activities in surrounding and typical regional environmental concentrations.

Some chemical-specific values were not available for all COPCs and surrogate values were used. This may result in under- or overestimation of actual risks.

While the remedial investigation for the Fike/Artel Site was underway, EPA was conducting an independent investigation of potential sources of dioxin to the Kanawha River. EPA's removal program collected soil samples on and in the vicinity of the Fike/Artel Superfund Site. All of the samples contained less than five parts per billion of 2,3,7,8-TCDD equivalent. At about the same time, EPA reviewed historical data (1983) which showed elevated levels of dioxin in soil at the Site. Confirmation samples were collected from these same locations in March 2000. Three locations at the Chemical Plant contained concentrations ranging from seven to 45 parts per billion of 2,3,7,8-TCDD equivalent. This exceeds EPA's current guidance of five parts per billion of dioxin in soil at industrial sites. Although the results of this sampling were not incorporated into the Risk Assessment, it demonstrates that a remedial action for soil is warranted.

2. Ecological Risk Assessment

A streamlined ecological risk assessment was conducted due to the industrial nature of the environment in the vicinity of the Site. As discussed in the Conceptual Site Model, the Chemical Plant and the CST are located in the middle of an industrial park. There are three ecological systems located in the vicinity of the Chemical Plant and the CST.

The first of these systems, the East Ditch, is located just outside of the fence that borders the northeastern part of the Chemical Plant. This ditch is about one meter wide. It runs for about 165 meters along the boundary of the Chemical Plant and continues north for perhaps another 35 meters along the eastern boundary of the Vimasco facility before discharging into a possibly blocked underground sewer reportedly leading to the Kanawha River. This ditch presently receives the surface runoff from the railroad tracks located to the east of the ditch. Prior to construction of the berm at the eastern boundary of the Chemical Plant, the ditch also received surface runoff from the Chemical Plant.

The second ecological system is a wooded area situated northeast of the Chemical Plant. The wooded area is about 20 acres in size. It is located across the railroad tracks from the Chemical Plant, and its southwestern boundary is approximately 45 meters from the Chemical Plant. The wooded area is a successional southern hardwood forest dominated by American elm. This type of forest is characteristic of land that has previously been cleared or otherwise disturbed.

The third ecological system is a roadside ditch located at the CST. The ditch is just outside of

the fence that borders the west part of the CST. It is approximately one meter wide and runs for about 75 meters along the boundary of the CST, crosses under a paved road through a culvert, where it connects to another approximately 75 meter long stretch of ditch before discharging into an underground sewer reportedly leading to the Kanawha River.

Threatened/endangered species are not present in the general vicinity of the Chemical Plant. The Chemical Plant and the CST, being industrial artifacts, are not a sensitive habitat or environment. The ecological assessment indicates that the Chemical Plant and CST do not represent a hazard to plant or animal life.

3. Overall Risk Assessment Conclusions - Basis for Response Action

The ecological risk assessment revealed that there is no unacceptable risk to ecological receptors.

a. Soil

Twenty-three chemicals of potential concern in the soil at the Chemical Plant and the CST were identified in the baseline risk assessment as chemicals that could present a risk to human health. These chemicals were carried through the risk assessment. The COCs are listed at the conclusion of the risk assessment because they either cause risk or contribute to overall risk as a result of multiple contaminants. The baseline human health risk assessment for soil revealed that future construction/industrial workers could be exposed to unacceptable levels of COCs in the soil. Elevated levels of dioxin and arsenic at discrete locations in the soils in the Chemical Plant require a response action.

b. Ground Water

Fifty-five chemicals of potential concern in the ground water were identified in the baseline risk assessment as chemicals that could present a risk to human health. These chemicals were carried through the risk assessment. The COCs are listed at the conclusion of the risk assessment because they either cause risk or contribute to overall risk as a result of multiple contaminants. At the conclusion of the risk assessment, 34 chemicals were identified as contributing to overall ground water risks. The baseline human health risk assessment for groundwater revealed that future residents potentially exposed to COCs in ground water via ingestion of drinking water would present an unacceptable human health risk. As such, actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

H. Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, Remedial Action Objectives (RAOs) were developed to aid in the

development and screening of alternatives. These RAOs were developed to mitigate, restore, and/or prevent existing and future potential threats to human health and the environment. The RAO for the selected remedy for soils for the Fike/Artel Superfund Site is to:

- Protect human health and the environment by reducing excess cancer risks to within the EPA target risk range for the anticipated future use of the Chemical Plant and CST properties as industrial.

- Remove soils containing elevated levels of arsenic and dioxin.

The RAO for the selected remedy for the World War I-era and other sewers for the Fike/Artel Superfund Site is to:

- Investigate World War I-era sewers that originate in the vicinity of the CST and discharge to the Kanawha River to determine if they contain contaminated sediments.

- Remove potential contaminated sediments from 12-inch sewer line from CST to Kanawha River.

The RAOs for the selected remedy for ground water for the Fike/Artel Superfund Site are to:

- Reduce concentrations of COCs in ground water to levels which result in less than or equal to a 1×10^{-5} cumulative cancer risk and a Hazard Index less than 1.0 and achieve drinking water standards (MCLs and non-zero MCLGs);

- Ensure that ground water is not used for water supply until concentration of COCs are reduced to levels which result in less than or equal to a 1×10^{-5} cumulative[4] excess cancer risk and a Hazard Index less than 1.0 and achieve drinking water standards (MCLs and non-zero MCLGs).

I. Description of Alternatives

Soil

Remedial Alternatives for OU4 of the Fike /Artel Superfund Site are presented below. The alternatives are numbered to correspond with the numbers in the Feasibility Study Report for soils. Due to the low concentration of contaminants in soil not presenting a principle threat, as

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[4]Cumulative risk is the additive sum of individual chemical risk for an individual receptor. The cumulative risk can be the additive risk sum from one media (surface soil) or it can be the additive sum of risk for all chemicals across all media (surface soil, ground water, sediment, and surface water combined).

well as the anticipated high expense and complexity of treating a wide variety of compounds, the Feasibility Study did not evaluate treatment of contaminated soil.

Common Elements. All of the alternatives for soil include the use of institutional controls which restrict the Chemical Plant and the CST to industrial use and will thereby limit soil exposure to future industrial worker receptors.

CST Alternatives for Soil

Alternative 1 - No Action Alternative

Estimated Capital Costs: $0
Estimated Annual O&M Costs: $0
Estimated Present Worth Cost: $0

Regulations governing the Superfund Program generally require that the "no action" alternative be evaluated to establish a baseline comparison. Under this alternative, EPA would take no action at the CST to prevent exposure to the soil contamination.

Alternative 2 - Asphalt Cap the CST Area

Estimated Capital Costs: $216,172
Estimated Annual O&M Costs: 18,627
Estimated Present Worth Cost: $502,522

The surface soils at the CST, encompassing 0.9 acres, would be capped with a sufficient load bearing capacity paving system for industrial reuse conditions. The cap would consist of, from top to bottom, a wearing course, a binder course, a base course, and a non-woven geotextile. Figure 4 shows a generalized cross-section of the cap.

Chemical Plant Alternatives for Soil

Alternative 1 - No Action Alternative

Estimated Capital Costs: $0
Estimated Annual O&M Costs: $0
Estimated Present Worth Cost: $0

Regulations governing the Superfund Program generally require that the "no action" alternative be evaluated to establish a baseline comparison. Under this alternative, EPA would take no action at the Chemical Plant to prevent exposure to the soil contamination.

Alternative 2- Asphalt Cap Former Process Area

Estimated Capital Costs: $445,384
Estimated Annual O&M Costs: $71,740
Estimated Present Worth Cost: $1,548,204

An area encompassing approximately 79,000 square feet would be capped with a sufficient load bearing capacity paving system for industrial reuse. Figure 5 shows a plan of the area which would be capped. This area selected to be capped was based on two samples containing elevated levels of dioxin. Figure 4 shows a generalized cross-section of the cap.

Alternative 3 - Asphalt Cap Entire Chemical Plant (excluding Lagoon #3)

Estimated Capital Costs: $2,752,537
Estimated Annual O&M Costs: $48,527
Estimated Present Worth Cost: $3,498,517

Alternatives 2 and 3 use identically designed asphalt caps. However, Alternative 3 provides for capping the entire Chemical Plant, excluding Lagoon 3. Figure 6 shows a plan of the area to be capped. In addition, this alternative would include the construction of utility corridors and dismantling of the existing waste water treatment plant. A utility corridor is a clean area that would allow for future excavation activities for the placement of water, power, or gas lines. Construction of the utility corridors will be coordinated to address isolated locations with elevated levels of arsenic and dioxin. Figure 4 shows a generalized cross section of the cap and Figure 7 shows the conceptual location of the utility corridors. The corridors will be approximately three feet wide and excavated to a depth of approximately four feet. All excavated soil will be disposed off-site. The corridors will be backfilled with clean fill and an asphalt cap will be placed on top.

Alternative 4 - Asphalt Cap Entire Chemical Plant and Regrade Lagoon 3

Estimated Capital Costs: $2,988,361
Estimated Annual O&M Costs: $50,252
Estimated Present Worth Cost: $3,760,858

Alternatives 2, 3, and 4 use identically designed asphalt caps. Under Alternative 4, the entire area of the Chemical Plant, including Lagoon 3 would be capped with asphalt. Samples were collected from various locations within the lagoon and tested for hazardous waste. One sample failed the Toxicity Characteristic Leaching Procedure for tetrachloroethylene and a separate sample failed for arsenic.

Under this alternative, the clean Lagoon 3 cover material would be excavated, stockpiled, and reused on-site as structural fill or disposed off-site as non-hazardous waste. The Lagoon 3 waste material above the existing ground surface elevations (approximately 750 cubic yards) would be excavated to eliminate the mound and facilitate capping the entire Chemical Plant (see Figure 8). Based on samples collected from the waste, it is anticipated that the waste material above grade could be disposed of off-site as non-hazardous material. The waste material would be sampled prior to off-site shipment and disposed of appropriately. This alternative would include the development of utility corridors and dismantling of the existing waste water treatment plant as described under Alternative 3.

Alternative 5a - Asphalt Cap Entire Chemical Plant and Excavate Lagoon 3 (assumes material in Lagoon 3 is hazardous)

Estimated Capital Costs: $11,908,767
Estimated Annual O&M Costs: $50,252
Estimated Present Worth Cost: $12,681,264

Alternatives 2, 3, 4, and 5a use identically designed asphalt caps. Under Alternative 5a, the entire area of the Chemical Plant, including Lagoon #3 would be capped with asphalt. All of the waste materials located above and below the existing ground elevations (approximately 5,500 cubic yards) of Lagoon 3 would be removed (See Figure 9). The excavated waste materials would be sampled prior to shipment off-site. It is anticipated that the waste material may test positive as a hazardous waste. If the waste material tests positive as a hazardous waste, the waste material will be disposed of off-site at a hazardous waste facility. This alternative would include the development of utility corridors and dismantling of the existing waste water treatment plant as described under Alternatives 3 and 4.

Alternative 5b - Asphalt Cap Entire Chemical Plant and Excavate Lagoon 3 (assumes material in Lagoon 3 is non-hazardous)

Estimated Capital Costs: $3,992,718
Estimated Annual O&M: $50,252
Estimated Present Worth Cost: $4,765,215

Same as Alternative 5A, except most of the material in Lagoon 3 would be managed as a non-hazardous waste and would be disposed off-site at a RCRA Subtitle C or Subtitle D waste facility as appropriate. Based on the waste analysis of the lagoon material, less than 300 cubic yards is expected to be managed as a hazardous waste.

Alternative 6 - Asphalt Cap Entire Chemical Plant and Place a Multi-layer Cap on Lagoon 3

Estimated Capital Costs: $3,029,941

Estimated Annual O&M Costs: $90,252
Estimated Present Worth Cost: $4,417,336

Alternative 6 uses the same design for capping the Chemical Plant as described under Alternatives 3, 4, and 5a and 5b. Under this Alternative the entire Chemical Plant would be capped with asphalt. Lagoon 3 would be excavated to existing grade as described under Alternative 4. The remaining waste in Lagoon 3 would be capped with a multi-layer RCRA Subtitle C-Equivalent Cap with a RCRA Subtitle C post-closure care monitoring program. The long term monitoring plan would be implemented to ensure that the lagoon does not provide a source of ground water contamination. This alternative would include the development of utility corridors and dismantling of the existing waste water treatment plant as described under Alternative 3. Figure 10 provides a cross section of the multi-layer cap.

Ground Water

Remedial Alternatives for ground water for the Fike /Artel Superfund Site are presented below. The RI/FS Report evaluated eight alternatives for remediation of ground water. Six of the eight alternatives included Monitored Natural Attenuation (MNA) as a component of the alternative. EPA's policy on the use of MNA at Superfund sites is documented in OSWER Directive 9200.4-17P (*Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*). This directive states:

> "In general, the level of site characterization necessary to support a comprehensive evaluation of MNA is more detailed than that needed to support active remediation. Site characterization for natural attenuation generally warrants a quantitative understanding of source mass; ground water flow (including preferential pathways); contaminant phase distribution and partitioning between soil, ground water, and soil gas; rates of biological and non-biological transformation; and an understanding of how all of these factors are likely to vary with time."

Natural attenuation processes are typically occurring to some degree at most Superfund sites. The Remedial Investigation report has a detailed discussion on the natural attenuation process occurring at the Fike/Artel Site. The Remedial Investigation report, prepared by the Fike/Artel Trust, concludes that there is sufficient evidence to show that natural attenuation processes are occurring in such a manner that MNA could be selected as the final remedy for ground water at the Site.

EPA does not agree that there are sufficient data available to support choosing MNA as an alternative. EPA has determined that there is insufficient information to conclude that natural attenuation will reduce all contaminants in ground water to acceptable levels within a reasonable time frame. In order to select MNA as the remedy or a remedy component for contaminated ground water at the Fike/Artel Site, additional data, including that collected outside of the

property boundaries, needs to be collected. These data are necessary to appropriately characterize the Site and to evaluate the natural processes affecting contaminants in the ground water in accordance with EPA guidance.

As a result, the alternatives evaluated for ground water in this Proposed Plan do not include MNA as a remedy or remedy component.

Alternative 1 - No Action Alternative

Estimated Capital Costs: $0
Estimated Annual O&M Costs: $9,000
Estimated Present Worth Cost: $147,352

Regulations governing the Superfund Program generally require that the "no action" alternative be evaluated to establish a baseline comparison. Under this alternative, EPA would take no action at the Site to prevent exposure to the ground water contamination.

Alternative 2 - Long Term Pump and Treat

Estimated Capital Costs: $3,285,932
Estimated Annual O&M Costs: $ 386,793
Estimated Present Worth Cost: $12,624,000

Under this alternative, ground water would be pumped to a treatment facility that would be constructed on-site. Due to the variety of hazardous constituents in the ground water, the treatment facility would include several treatment processes to reduce the level of contaminants. The treated ground water would be discharged to the Kanawha River and would satisfy the requirements of the National Pollutant Discharge Elimination System ("NPDES"). The treatment plant would occupy approximately two (2) acres of land along the northern perimeter of the Chemical Plant.

For costing purposes, it is anticipated that the ground water pump and treat system would consist of seven (7) extraction, wells which would be installed within and outside the property boundaries, and would operate for approximately 30 years. Additional field work is necessary to optimize the location and size of the extraction wells as well as to locate performance monitoring wells. See Figure 11 for the conceptual design of process flow for the treatment system.

Institutional controls are necessary to ensure that no one uses the ground water in the vicinity of the Site until clean-up levels are achieved. These institutional controls are expected to be implemented through tools such as notices to deeds, zoning restrictions, and/or county ordinances, etc.

J. Summary of Comparative Analysis of Alternatives

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis of the alternatives was performed using the nine evaluation criteria in order to select a Site remedy. The following is a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria. These nine criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with applicable or relevant and appropriate requirements ("ARARs") addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria and limitations, unless ARARs are waived under CERCLA § 121(d)(4).

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. Short term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the

construction and implementation period, until cleanup goals are achieved.

6. Implementability addresses the ease or difficulty of implementing the alternatives including consideration of the technical and administrative feasibility of a remedy, and the availability of materials and services needed to implement a particular option.

7. Cost includes estimated capital and operations and maintenance ("O&M") costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/FS and Proposed Plan:

8. State acceptance addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. Community acceptance addresses the public's general response to the alternatives described in the Proposed Plan and the RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. For the CST and groundwater alternatives, Tables 15 and 16 present the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis.

Threshold Criteria

1. Overall Protection of Human Health and the Environment

CST Soil

Both of the alternatives for soil at the CST area would provide adequate protection of human health and the environment by controlling risk through institutional controls including attachments to the deeds. Alternative 2 further controls the risk by the use of engineering controls (cap) to prevent future exposure to soil.

Chemical Plant Soil

Alternative 1, the "no action" alternative for the Chemical Plant soil is protective of human health and the environment based on the risk assessment. The concentration of contaminants in

the soils is at the upper end of EPA's risk range of 10^{-4}. Alternatives 2, 3, 4, 5a, 5b, and 6 would provide further protection of human health and the environment by using engineering measures and institutional controls to prevent exposure to these soils. Alternatives 1 and 2 do not address the soil locations containing elevated levels of arsenic and dioxin, Alternatives 4, 5a, 5b, and 6 include additional measures to manage the waste in Lagoon 3.

Ground Water

Alternative 1, the "no action" alternative, would not be protective of human health and the environment because it does not reduce the concentration of contaminants and does not prevent the future use of the ground water. Alternative 2 is protective because it will reduce the concentration of contaminants through the use of a pump and treat system and provides for institutional controls that will prevent the use of ground water as a drinking water source.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

ARARs are promulgated, enforceable federal environmental or public health requirements, and such state standards that are more stringent than federal standards, that a remedy must attain unless waived. Applicable requirements are those clean-up, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Superfund site. Relevant and appropriate requirements, while not legally applicable at a Superfund site, address problems or situations sufficiently similar to those encountered at the Superfund site such that their use is well suited to the particular site.

CST Soil

Both alternatives for soil at the CST area will meet their respective Federal and State ARARs.

Chemical Plant Soil

All of the alternatives for the Chemical Plant soil will meet their respective Federal and State ARARs. (See Table 21 - ARARs). The RCRA Subtitle C-Equivalent Cap in Alternative 6 will comply with RCRA cap and post closure requirements.

Ground Water

Alternative 1 will not meet Federal and State drinking water standards. With Alternative 2, EPA anticipates that the ground water will be cleaned-up to ARARs which include drinking water

standards. Discharges from the treatment facility to surface water will comply with substantive NPDES requirements. The ground water treatment plant may have air emissions which are subject to the substantive requirements of air regulations. Any control requirements would be determined through examination of state and federal regulations.

3. Long-term Effectiveness and Permanence

CST Soil

Both alternatives include institutional controls, such as attachments to the deed, and provide a degree of long term effectiveness, however, such controls may be difficult to implement over time and permanent oversight would be required. Alternative 2, the asphalt cap, provides an added degree of long-term effectiveness by establishing a physical barrier to prevent contact with soils.

Chemical Plant Soil

All of the alternatives include institutional controls to restrict activity on the Property, which provides a degree of long term effectiveness. However, such institutional controls may be difficult to implement over time and permanent oversight would be required. With the exception of Alternative 1, all the alternatives will excavate the locations containing elevated levels of dioxin and arsenic. Alternative 2 has a portion of the Chemical Plant capped with asphalt, whereas Alternative 3 provides an asphalt cap for most of the Chemical Plant, excluding Lagoon 3. Alternatives 2 and 3 leave all of the contents of Lagoon 3 on-site with the existing soil cap which minimizes the long term effectiveness. Over time, the existing clay liner could fail. Precipitation could enter and saturate the contents of the lagoon, causing the contaminants in the lagoon to migrate to the surrounding soils and ground water.

Alternative 4 provides an asphalt cap for the entire Chemical Plant including Lagoon 3 as well as regrading Lagoon 3 to the surrounding grade. This alternative provides more long term permanence and effectiveness by reducing the amount of precipitation which could enter the former lagoon.

Alternative 5a and 5b include the excavation of the contents of Lagoon 3 which is the most permanent solution and eliminates the possibility of any future migration of contaminants from the lagoon. Alternatives 5a and 5b provide the most long term effectiveness and permanence by totally excavating and removing all the waste material in Lagoon 3 and providing an asphalt cap for the entire Chemical Plant which will prevent exposure from any subsurface soils.

Alternative 6 provides a multilayer cap for Lagoon 3 and an asphalt cap for the entire Chemical Plant. The caps prevent exposure to mixed soil and minimize infiltration into Lagoon 3.

Alternative 6 includes a long term monitoring program to minimize impacts of the lagoon on the ground water. Over time, the liner of the lagoon could fail and contaminants could leak into the ground water. The long term monitoring program would detect any contamination leaving Lagoon 3.

Ground Water

Other than the institutional controls within the property boundaries which would prevent the use of ground water at the Chemical Plant and the CST, Alternative 1 does not provide any long term effectiveness or permanence. Alternative 2 will pump and treat the ground water until clean-up levels are achieved and permanently remove the contamination from the ground water. Recognizing that it will take several decades before the ground water clean-up levels are achieved, Alternative 2 also includes a provision for institutional controls to be implemented in the vicinity of the Site, which adds a degree of long-term protectiveness to this alternative. However, the long-term protectiveness of such institutional controls may be difficult to implement over time and permanent oversight would be required.

4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment

CST Soil

Neither of the alternatives for soil at the CST area will treat the soils, so there will be no reduction in toxicity, mobility or volume as a result of treatment.

Chemical Plant Soil

Alternative 5a and 5b are the only alternatives which will excavate all of the contaminated material from Lagoon 3. The material would be disposed off-site in either a RCRA Subtitle C facility or Solid Waste Subtitle D facility (as appropriate) thereby reducing the toxicity and mobility of contaminants.

Ground Water

Under Alternative 1, no treatment is provided so the toxicity, mobility, and volume of contaminants will remain essentially the same. Alternative 2 will pump and treat the ground water thereby reducing the mobility and toxicity of contaminants.

5. Short-Term Effectiveness

CST Soil

Neither the community nor workers would be affected by Alternative 1 because there would not be any earth disturbing activities. Alternative 2 presents some short term concerns through worker exposure during asphalt cap installation, but these concerns can be addressed through health and safety practices.

Chemical Plant Soil

Alternatives 2 and 3 present similar short term concerns during asphalt cap installation. Workers have the potential for greater exposure to contaminants when leveling Lagoon 3 to the surrounding grade under alternatives 4 and 6. Alternatives 5a and 5b present the greatest short-term risk because of the potential for exposure to contaminated material by excavating and trucking approximately 5,500 cubic yards of material to an off-site facility. These potential risks can be managed through the use of appropriate health and safety practices.

Ground Water

Alternative 1 would not provide any short term effectiveness. Reducing the concentration of contaminants in the ground water could take several decades using the pump and treat system called for in Alternative 2 but institutional controls will be used to control exposure to contaminated ground water during this period.

6. Implementability

CST Soil

Alternative 1, the no action alternative is easier to implement than Alternative 2 (asphalt cap). Overall, however, asphalt caps are relatively easy to install.

Chemical Plant Soil

Although Alternative l, the no action alternative is the easiest to implement, all of the alternatives are readily implementable. Alternative 2 is the next easiest to implement since it only requires placing an asphalt cap on a portion of the Chemical Plant. Alternative 3 is relatively easy to implement by placing an asphalt cap on the entire Chemical Plant with the exception of Lagoon 3. Alternative 4 is more difficult to implement because in addition to the asphalt cap, it requires excavating Lagoon 3 to grade. Alternatives 5a and 5b are more difficult to implement than Alternatives 1 through 4 because the entire contents of Lagoon 3 will be excavated. Alternative 6 is the most difficult to implement because it not only requires an asphalt cap for most of the Chemical Plant with leveling of Lagoon 3 to grade, but it also requires the

installation of a multi-layer cap over the former Lagoon 3.

Ground Water

Alternative 2, the pump and treat ground water system, is a well-proven ground water remediation technology. Access to properties for pumping wells and rights-of-way for the piping system may make implementation of Alternative 2 somewhat difficult. Due to the high iron concentration in the ground water, wells and associated piping may require additional maintenance to prevent fouling.

7. Cost

CST Soil

The net present worth of Alternative 1 is $0 and the net present worth of Alternative 2 is $502,522.

Chemical Plant Soil

Alternative 5a is the most expensive alternative at $12.7 million. Alternative 2 will cost approximately $1.5 million, whereas Alternatives 3 and 4 will cost $3.5 and $3.7 million respectively. Alternative 5b and Alternative 6 will cost $4.8 and $4.4 million respectively.

Ground Water

Alternative 1 is estimated to cost $147,000 whereas Alternative 2 is estimated to cost $12.6 million.

8. State/Support Agency Acceptance

The State of West Virginia supports the selected remedy for the remediation of CST Soil (Alternative 2), Chemical Plant Soil and Lagoon 3 (Alternative 5b), and Ground Water (Alternative 2).

9. Community Acceptance

Comments received during the public comment period were generally supportive of EPA's recommendations for remediation. Specific comments on the Proposed Plan are addressed in detail in the Responsiveness Summary which is a part of this ROD.

K. Principal Threat Wastes

There are no principal threat wastes in the soil or in the ground water at the Fike/Artel Superfund Site.

L. Selected Remedy

1. Summary of the Rationale for the Selected Remedy

Based on consideration of the CERCLA requirements and analysis of alternatives using the nine evaluation criteria, including public comments, EPA has determined that the following alternative constitutes the most appropriate remedy for OU 4 of the Fike/Artel Superfund Site. This selected remedy for OU 4 is the proposed preferred alternative that was identified in the Proposed Plan and is the final remedy for the Site. The preferred alternative identified in the Proposed Plan is: an asphalt cap for the CST; excavation of Lagoon 3 if it could be implemented at the same cost as a RCRA cap; an asphalt cap for the Chemical Plant; institutional controls for property and ground water; pumping and treating contaminated ground water and investigation of World War I-era sewers.

2. Description of Remedial Components

Performance standards for each of the remedial components are described below and summarized in Table 17.

CST

The selected remedy for soils at the CST is Alternative 2, an asphalt cap, because it is the best alternative to satisfy the remedial objectives of protecting human health and the environment for the anticipated future use of the CST property in an industrial setting. The surface soils at the CST will be capped with a sufficient load bearing capacity paving system for industrial reuse conditions. A generalized cross section of the cap is presented in Figure 4. The cap would consist of, from top to bottom, a wearing course, a binder course, a base course, and a non-woven geotextile. An asphalt cap results in protection of human health and the environment and takes into account the reality of long-term Site redevelopment plans. Figure 12 shows a plan of the approximate area to be capped.

Appropriate engineering dust control measures and health and safety procedures will be utilized during construction of the cap.

Annual inspection and routine maintenance of the cap will be performed to repair any cracks, settlement or separation of the wearing course layer due to weathering or long term heavy truck traffic use.

Chemical Plant and Lagoon 3

The selected remedy for soils at the Chemical Plant and Lagoon 3 is Alternative 5b because it is the best alternative to satisfy the remedial objectives of protecting human health and the environment for the anticipated future use of the Chemical Plant property in an industrial setting.

The surface soils will be capped with a sufficient load bearing capacity paving system for industrial reuse conditions. A generalized cross section of the cap is presented in Figure 4. The cap would consist of, from top to bottom, a wearing course, a binder course, a base course, and a non-woven geotextile. An asphalt cap results in protection of human health and the environment and takes into account the reality of long-term Site redevelopment plans. Figure 13 shows a plan of the area to be capped.

The clean Lagoon 3 cover material encountered from 0 to 2 feet will be excavated and stockpiled on-site for reuse as structural fill or disposed off-site. All of Lagoon 3 waste materials (approximately 5,500 cubic yards) will be removed. Thirty-eight samples were collected from Lagoon 3 and analyzed for hazardous waste characteristics. One sample failed TCLP for arsenic and a separate sample failed for tetrachloroethylene. Analysis will determine the ultimate disposition of material in Lagoon 3. If the analysis demonstrates the material to be a hazardous waste, then this material will be disposed at a RCRA Subtitle C facility. If the analysis demonstrates that the segregated material is non-hazardous, then the material will be disposed of at a Subtitle D facility.

Design considerations for this remedy include the development of utility corridors (see Figures 4 and 7 for location and generalized cross section of utility corridors) and dismantling of the existing stormwater treatment facility.

Appropriate engineering dust control measures and health and safety procedures will be utilized during construction of the cap.

Operation and maintenance of this alternative will include annual cap inspections and repairs to any cracks, settlement or separation of the wearing course layer due to weathering or long term heavy truck traffic use.

Ground Water

The selected remedy for ground water at the Fike/Artel Superfund Site is a long term pump and treat system consisting of extraction wells to reduce the concentration of contaminants of concern to health based clean-up levels. Additional investigation activities are necessary to not only define the extent of the ground water contamination, but also to design the ground water pump and treat system. Therefore, the operation of the pump and treat system will be delayed for five years to conduct additional investigation activities. Investigation of ground water will include an evaluation of how, where, and when ground water from the Site enters the Kanawha River.

Sampling of ground water will include analysis for dioxin at a detection limit in the parts per quadrillion range. The design of the pump and treat system will occur concurrently with other investigative activities and the pump and treat system will be in operation by October 2006. Currently, ground water in the vicinity of the Site is not being used as a drinking water source, and therefore there is no immediate threat to human health.

The PRPs have met with EPA and WVDEP to express their position that Monitored Natural Attenuation is a viable remedial alternative for restoring ground water to acceptable levels. EPA does not believe that the PRPs have collected the necessary data to demonstrate that natural attenuation is occurring to a degree such that all COCs will be reduced to acceptable levels. While the data collection and design activities are taking place for the ground water pump and treat system, the PRPs may pursue other data collection activities outside of this ROD to demonstrate to EPA's satisfaction that natural attenuation is taking place to a degree such that all COCs will be reduced to acceptable levels within the same time frame as a pump and treat system.

Additional field data will be collected to determine the number and location of extraction wells to capture the contaminated ground water and the number and location of performance monitoring wells. Figure 14 shows a conceptual plan for the location of ground water extraction wells. For cost estimation purposes, it is anticipated that the ground water pump and treat system would consist of seven (7) extraction wells that would operate for approximately 30 years. Data collection activities will be conducted to determine if the ground water beneath the Site has a known or projected point of entry into surface water.

A conceptual design configuration for the unit processes to be employed in treating the contaminated ground water is shown on Figure 11. The final selection and configuration of the processes to be used will be determined during remedial design.

Discharges from the treatment facility to surface water will comply with substantive NPDES requirements. The ground water treatment plant may have air emissions which are subject to the substantive requirement of air regulations. Any control requirements would be determined through examination of state and federal regulations.

A ground water monitoring and sampling plan will be developed for EPA's approval in conjunction with the design of the pump and treat system. The monitoring program will include among other things, sampling and analysis for dioxin from selected wells. The pump and treat system would operate until clean-up levels, as described below, are achieved. Continued monitoring will be required to assess the magnitude of "rebound", a process where COCs counter-diffuse into the ground water and in the absence of ground water extraction, the concentrations increase. The pump and treat system will be reactivated if a rebound of COCs is observed.

This remedy includes a requirement to monitor the ground water until the concentration of the

COCs, when considered cumulatively, are reduced to an acceptable risk. Cleanup levels are described in Section L.4.a of this Record of Decision.

After the clean-up levels have been met for three years and the remedy is determined to be protective, the ground water treatment system will be shut down. Post-closure ground water monitoring data will continue to be collected in accordance with an EPA approved monitoring plan to ensure that the cleanup levels have been met and the remedy is protective.

Institutional Controls

Soil exposure to future industrial worker receptors shall be prevented. Existing institutional control tools would be enforced to preclude such exposure. Future land use restrictions have been established in the Administrative Order of Consent dated October 1994 as amended by the Consent Decree in February 1997 and subsequent Deed of Restrictive Covenants executed by the property owner (City of Nitro Development Authority) in 1999. The institutional controls will have to be maintained. The existing layering of the institutional controls between the Federal Government (Consent Decree), state and local government (attachments to the Deed and deed notice) and the property owner, Nitro Development Authority (Deed of Restrictive Covenants), combined with the likelihood that the property will not change hands (City of Nitro Development Authority prefers to lease rather than sell) serve to enhance the long term effectiveness and permanence of the remedy.

The ground water under the Chemical Plant and the CST shall not be used until clean-up levels are achieved. Future land use restrictions have been established in the Consent Decree in February 1997 and subsequent Deed of Restrictive Covenants executed by the property owner (City of Nitro Development Authority) in 1999. A modification to the existing Declaration of Deed Restriction is warranted to prevent the use of ground water and the installation of any extraction wells on-site. Implementing institutional controls for ground water underneath property not owned by the City of Nitro is more difficult. The extent of ground water contamination has not been determined at this time, but EPA anticipates that ground water restrictions and possible deed notices may be warranted north and west of the Fike/Artel Site to the Kanawha River (see Figure 1). Deed notices will be warranted if the additional ground water investigation demonstrates that contaminated ground water has migrated to other properties and other institutional controls are not protective of human health and the environment. Institutional controls for ground water may consist of one or more of the following:

- deed attachments or notices to restrict ground water use of all properties that lie between the Chemical Plant and west to the Kanawha River, as well as those properties that lie from the Chemical Plant and north to the Kanawha River;

- municipal and/or county ordinances to restrict ground water use;

- the development of procedures with the State of West Virginia well permitting

program to deny extraction well permits within the area that could be impacted by contaminated ground water.

An institutional control plan will be developed. A status report of institutional controls will be prepared and submitted for EPA review on at least an annual basis.

World War I-era and other Sewers

Several sinkholes have developed in the southern portion of the Chemical Plant, approximately 60 feet north of Lagoon 3. During the excavation and cap installation of Lagoon 3, several test pits will be excavated in the area of the sinkholes to determine the cause of the sinkholes.

There is a 12-inch sewer line runs from the CST to the Kanawha River. This line was constructed as part of the CST construction in the late 1960s. This sewer line will be flushed. The debris flushed from the sewer and the associated water will be collected and temporarily stored. The collected material will be sampled for waste disposal purposes and ultimately disposed off-site in accordance with applicable regulations. This activity will be conducted in a manner that will not impact the local industries currently discharging to the sewer.

World War I-era sewers that originate northwest of the Chemical Plant and in the vicinity of the CST and ultimately discharge to the Kanawha River will be investigated to determine if they contain contaminated sediments. Samples will be collected from sediments in this line and analyzed for dioxin and other COPCs.

In May of 2001, WVDEP conducted a survey of the World War I-era sewers in the vicinity of the Chemical Plant and the CST. The survey included a review of historical maps and site visit. The WVDEP prepared a trip report which suggests that the Chemical Plant may have discharged wastewater through World War I-era sewers prior to the construction of the CST plant. These World War I-era sewers are still functioning and discharge to the Kanawha River. There is a possibility that these sewers contain contaminated sediments. A further investigation of the WWI-era sewers that originate in the vicinity of the CST and discharge to the Kanawha River is warranted to determine if the sewers contain contaminated sediments.

In general, two segments of the World War I-era sewer system that are of interest. One of the segments originates northwest of the Chemical Plant the other segment originates in the vicinity of the CST. Both of these segments trend north for a distance of approximately 1,320 feet where they intersect another segment of the World War I-era sewer system that trends east-west along roads No. 4 and 5. A portion of this segment trends west for distance of 400-600 feet where it intersects a 66-inch diameter trunk line. The trunk line trends in a general westerly direction over a distance of approximately 1,800 feet where it discharges to the Kanawha River. The investigation will include samples taken from each of the line segments described above.

Additional sewer lines may be investigated based on new or additional data that is generated or

discovered during the course of the World War I-era sewer investigation.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision will be documented in a technical memorandum in the Administrative Record for the Site, an ESD or a ROD Amendment, as appropriate.

3. Summary of the Estimated Remedy Costs

The information in this cost estimate summary is based on the best available information regarding the Anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order of magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

CST

The estimated capital costs associated with the asphalt cap remedy (Alternative 2) for the CST is $216,000. The present worth cost to cover O&M costs evaluated over 30 years with a discount rate of 5 percent is approximately $286,000. Therefore the net-present worth of this remedy is approximately $502,000. A summary of the costs for the CST remedy is provided in Table 18.

Chemical Plant and Lagoon 3

The estimated capital cost to implement the remedy which includes an asphalt cap for the Chemical Plant and excavation and off-site disposal of Lagoon 3 is $3,992,718. The present worth cost to cover O&M costs over 30 years with a discount rate of 5 percent is approximately $767,497. Therefore the net-present worth of this remedy is approximately $4,765,215. A cost summary of this remedy is provided in Table 19.

Ground Water

The estimated capital costs associated with the pump and treat remedy for the ground water is $3,285,932. The estimated annual O&M costs are $386,793. The net-present worth of this remedy is approximately $12,624,000. A cost summary of this remedy is provided in Table 20.

4. Expected Outcomes of the Selected Remedy

This section presents the expected outcomes of the selected remedy in terms of resulting land uses and risk reduction as a result of the selected response action.

CST

Following completion of the soil remedy, the CST will be able to be used for industrial purposes, which are the current and reasonably likely future land uses. While the CST is awaiting redevelopment, trespassers will not be subject to unacceptable health risks from exposure to site soil. Construction and industrial workers at the CST will be able to conduct normal working activities with proper safety measures without being exposed to unacceptable health risks due to soil contamination.

Institutional controls will provide a mechanism to ensure that property uses and activities over time will be compatible with the protectiveness of the remedy. Provisions for periodic inspections and maintenance of the asphalt cap will be necessary.

The purpose of the cap is to prevent exposure to the future industrial worker receptor. The integrity of the cap will be maintained with annual inspections and routine maintenance. It is anticipated that the asphalt cap can be designed and constructed in six months to one year. After the cap is constructed, the CST can be redeveloped for industrial use. The Nitro Development Authority is currently pursuing prospective tenants for the CST. The future tenants will generate tax revenues and income for the City of Nitro.

Chemical Plant and Lagoon 3

Following completion of the soil remedy, the Chemical Plant will be able to be used for industrial purposes, which are the current and reasonably likely future land uses. While the Chemical Plant is awaiting redevelopment, trespassers will not be subject to unacceptable health risks from exposure to site soil. Construction and industrial workers at the Chemical Plant will be able to conduct normal working activities with proper safety measures without being exposed to unacceptable health risks due to soil contamination.

Institutional controls will provide a mechanism to ensure that property uses and activities over time will be compatible with the protectiveness of the remedy. Provisions for periodic inspections and maintenance of the asphalt cap will be necessary.

The purpose of the cap is to prevent exposure to the future industrial worker receptor. The integrity of the cap will be maintained with annual inspections and routine maintenance. It is anticipated that the soil remedy for the Chemical Plant can be designed and constructed in 12 to 18 months. After the cap is constructed, the Chemical Plant can be redeveloped for industrial use. The Nitro Development Authority is currently pursuing prospective tenants for the Chemical Plant. The future tenants will generate tax revenues, rental income, and jobs for the City of Nitro.

Ground Water

Although previous removal and remedial actions have removed the primary sources of ground water contamination, it is still anticipated that it will take several decades before cleanup levels specified for the groundwater are achieved. During this period, a variety of institutional controls will prevent exposure to the contaminated ground water. The primary expected outcome of the selected remedy is that ground water will no longer present an unacceptable risk to future users of the ground water via ingestion and inhalation.

a. Cleanup levels for Ground Water

This remedy includes a requirement to monitor the ground water until the concentration of the COCs, when considered cumulatively, are reduced to an acceptable risk. The COCs are listed on Table 2. An acceptable carcinogenic risk is 1×10^{-5} and a non-carcinogenic risk is a Hazard Index of less than or equal to 1.0. In addition, for organic compounds a requirement of the selected remedy is achievement of MCLs and non-zero MCLGs in the ground water, and for inorganic compounds, a requirement of the selected remedy is achievement of MCLs and non-zero MCLGs if these values are higher than the established background levels.

There is not sufficient evidence, at this time, to determine whether the elevated levels of inorganic contaminants detected in the ground water are due to background levels or are Site-related. The goal of the selected remedy is to reduce the level of inorganic contaminants in the ground water, achieve ARARs and protect human health and the environment, given the background levels. In order to attain this standard, the background levels of inorganic contaminants must be established via additional ground water study during remedial design. Once background levels for inorganics are established, a comparison between the background and the on-site (downgradient) wells will be made. If the levels of inorganic contaminants found in the ground water at the Site are greater than the established background levels, this contamination will be considered Site-related. Therefore, the performance standard for inorganic contaminants shall be risk-based levels discussed above (cumulative carcinogenic risk of 1×10^{-5} and a cumulative hazard index of 1.0) or the established background level, whichever is higher. Additionally, for inorganic contaminants, the performance standards shall also include achievement of MCLs and non-zero MCLGs if these values are higher than the established background levels.

Cleanup levels must be met throughout the contaminated ground water plume. EPA has estimated that it will take 30 or more years to attain the cleanup levels.

World War I-era and other Sewers

Flushing the 12-inch sewer line that runs from the CST to the Kanawha River will ensure that there is no residual contamination that could contribute to contamination of the Kanawha River. Investigation of the World War I-era sewers that originate in the vicinity of the CST and

discharge to the Kanawha River will be investigated to determine if remediation is necessary. Evaluation of the area near the sink holes should identify if additional work is necessary to eliminate future sink holes.

Performance Standards are set forth in Table 17 and are incorporated by reference.

M. Statutory Determinations

The remedial action selected for implementation for OU4 at the Fike/Artel Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. The following information identifies each statutory requirement and describes how the remedy meets the requirement.

Protection of Human Health and the Environment

CST

The asphalt cap will prevent direct contact with soil, including ingestion, dermal contact and inhalation of soil particles. Institutional controls adequately protect human health and the environment by restricting future use to industrial development.

Chemical Plant and Lagoon 3

The asphalt cap will prevent direct contact with soil, including ingestion, dermal contact and inhalation of soil particles. Excavation and off-site disposal prevents future exposure to waste in Lagoon 3. Institutional controls adequately protect human health and the environment by restricting future use to industrial development.

Ground Water

The selected remedy will protect human health by controlling exposures to human receptors through treatment, engineering controls, and institutional controls. The selected remedy will pump and treat the ground water to achieve cleanup levels. Institutional controls will be implemented to prevent the use of ground water until the cleanup levels are achieved.

World War I-era and other Sewers

Flushing the 12-inch sewer line that runs from the CST to the Kanawha River will ensure that any residual contamination in the sewer is removed, eliminating any potential impacts to the Kanawha River. Investigation of the WWI-era sewer line will determine if remediation is necessary.

Compliance with Applicable or Relevant and Appropriate Requirements

CST

EPA has determined that there are no specific ARARs that need to be attained for the selected remedy for the CST.

Chemical Plant, Lagoon 3, Ground Water, and World War I-era Sewers

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the Site. In particular, the remedy will comply with the ARARs listed on Table 21.

Cost Effectiveness

CST

The asphalt cap for the CST is the most cost effective remedy. Taking no action to remediate soil would be considerably less costly than the selected remedy, but would not meet the remedial action objectives.

Chemical Plant and Lagoon 3

The selected remedy for the Chemical Plant and Lagoon 3 is mid range when compared to all the alternatives evaluated. Taking no action would be considerably less costly than the selected remedy, but would not be protective of human health.

Ground Water

The pump and treat system for the ground water is a cost-effective remedy. Taking no action to remediate ground water is considerably less costly than the selected remedy, but would not meet the remedial action objectives.

World War I-era and other sewers

Flushing the sewer is a cost effective remedy. It has not been determined that the sewer is having any impact on the Kanawha River. The Fike/Artel Trust submitted comments on the Proposed Plan stating that it would be more cost effective to flush the 12-inch sewer rather than to investigate the sewer. EPA agrees.

EPA has not made a determination that remediation of the World War I-era sewer is warranted. First, samples must be collected from sediments in the sewer line.

Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Possible

CST

The selected remedy for the CST does not employ treatment or resource recovery technologies. Due to the low concentration of contaminants and no principle threats, as well as the wide variety of compounds, the Feasibility Study did not evaluate treatment of contaminated soils. Treatment of soils is not required to achieve protection of human health and the environment. An asphalt cap, the selected remedy for the CST, provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set out in the NCP.

Chemical Plant, Lagoon 3 and WW I-era and other Sewers

The selected remedy for the Chemical Plant does not employ treatment or resource recovery technologies. Due to the low concentration of contaminants and no principle threats, as well as the wide variety of compounds, the Feasibility Study did not evaluate treatment of contaminated soils at the Chemical Plant. The remedy to totally excavate Lagoon 3 provides more long term effectiveness and permanence when compared to the other alternatives. Treatment of soils and/or treatment of the material in Lagoon 3 is not required to achieve protection of human health and the environment. Therefore, the alternative considered to be least costly while providing permanent solutions was selected. Total excavation of Lagoon 3 and an asphalt cap for the Chemical Plant provide the best balance of trade-offs among the alternatives with respect to the balancing criteria set out in the NCP.

Ground Water

The selected remedy for ground water consists of a pump and treat system which is a permanent solution. It was not feasible to utilize an alternative technology for ground water due to the wide variety of compounds in the ground water. A pump and treat system, the selected remedy for ground water, provides the best balance of trade-offs among the alternatives with respect to the balancing criteria set out in the NCP.

Preference for Treatment as a Principal Element

CST, Chemical Plant, Lagoon 3 and World War I-era and other Sewers

The statutory preference for treatment as a principle element of the selected remedy is not addressed because treatment of residual contamination in the soils is not required to achieve protection of human health and the environment. It is important to remember that a number of removal and remedial actions which did employ treatment as a principal element have been conducted at the Site. The low concentration of contaminants remaining in the soil do not

constitute a principle threat and, in turn, do not warrant treatment. The material flushed from the 12-inch sewer line will be sampled and analyzed for off-site disposal. If necessary, the material will be treated at an off-site location.

Ground Water

The principle element of the selected remedy is the extraction and treatment of contaminated ground water. The selected remedy satisfies the statutory preference for treatment as a principle element by reducing the contamination in the aquifer through extraction and treatment of the contaminated ground water.

Five-Year Reviews of the Selected Remedy are Required

The NCP requires a five-year review if the remedial action results in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. This review evaluates whether a remedy currently is, or will be, protective of human health and the environment. A statutory five-year review is required for the Fike/Artel Superfund Site because it is estimated to take 30 years to remediate the ground water. The last five-year review was conducted in October 1996. The next five-year review will be conducted in October 2001.

N. Documentation of Significant Changes

The Proposed Plan for the OU4 remedy was released for public comment on July 6, 2001. The Proposed Plan presented remedial action alternatives for the CST, the Chemical Plant and Lagoon 3, ground water, and World War I-era sewers. EPA proposed: Alternative 2, an asphalt cap for the CST; Alternative 6, a RCRA-equivalent cap for Lagoon 3 (unless sampling of Lagoon 3 material suggested that Lagoon 3 could be excavated for a similar cost as a RCRA cap) and an asphalt cap for the entire Chemical Plant; Alternative 2, pump and treat system, for ground water; removal of a portion of the World War I-era sewer line in the vicinity of the former CST sump and additional investigation of World War I-era sewers.

EPA reviewed all written and oral comments submitted during the public comment period. The comments generally expressed support for the EPA preferred alternative. The Fike/Artel Trust submitted the majority of comments, some of which are discussed below with detailed responses provided in the Responsiveness Summary, Section III of this ROD.

Ground Water

One citizen asked about the presence of dioxin in the ground water. Dioxin was detected in four monitoring wells in December 1998. Confirmation samples were collected in December 1999. The detection limits were not appropriate for the confirmation analysis. EPA is adding the

requirement to sample ground water for dioxin. The ROD specifies that ground water will be analyzed for dioxin at a detectable concentration in the parts per quadrillion range.

Lagoon 3

The Proposed Plan stated that additional samples would be collected from Lagoon 3 for waste characteristics. If the additional sampling suggested that the cost to totally excavate Lagoon 3 is equivalent to the cost of a RCRA cap, then Lagoon 3 would be excavated and disposed off-site. Additional sampling was conducted on August 29, 2001. Eighteen samples were collected from the waste material below the existing grade and analyzed for hazardous waste characteristics. In addition, 20 samples were collected from Lagoon 3 in December 1999 and January 2000. The results of the waste analysis demonstrate that most, if not all, of the material in Lagoon 3 can be excavated and shipped off-site for disposal at a Subtitle D facility. Of the 38 samples collected, one sample failed TCLP for arsenic and a separate sample failed TCLP for Tetrachloroethylene. The selected remedy requires that the Lagoon be totally excavated and the contents shipped off-site to an appropriate disposal facility. The material in Lagoon 3 which fails the TCLP will be segregated for additional waste analysis. The segregated waste material will be disposed at either a RCRA Subtitle C facility or Subtitle D facility based on the results of the waste analysis.

World War I-era Sewers

EPA proposed excavating a small portion of World War I-era sewer between Manhole #1 and the former CST sump. The Fike/Artel Trust commented that this small section of line does not require removal for several reasons. See Responsiveness Summary B.19. EPA agrees with their comments and is not requiring that this section of World War I-era sewer be removed.

There is a 12-inch sewer line that runs from the CST to the Kanawha River. The Proposed Plan recommended that samples from the sediments in this line be analyzed for dioxin. The Fike/Artel Trust commented that it would be more cost effective to flush the line. The material flushed from the line would be contained and properly disposed. EPA agrees and has selected the flushing of this line as a component to the remedy.

III. Responsiveness Summary

The public comment period on the Proposed Plan for the Fike/Artel Superfund Site OU4 was held from July 6, 2001 to August 5, 2001. Comments received during this time are summarized below. Section A address those concerns and issues generated during the public meeting on July 18, 2001. The agency also received written and electronic comments which are addressed in Section B.

A. Summary of Major Issues and Concerns Raised by the Public during the July 18, 2001 Public Meeting

A.1 A citizen asked if dioxins were detected in ground water and what the detection limits were.

EPA Response: In December 1998, ground water samples were collected and analyzed for dioxin compounds. Although none of the wells contained detectable levels of 2,3,7,8 TCDD, four wells did contain low concentrations of other dioxin compounds. For example, monitoring wells 111S, 111D and 113D contained 0.61, 0.16 and .77 micrograms per liter (parts per billion) of OCDF respectively. The detection limit of the December 1998 sampling round was in the parts per trillion detection range. In December 1999, these wells were resampled for dioxin compounds. The results were non-detect in the parts per billion range. The selected remedy will require that ground water samples be collected and analyzed for dioxin. The detection limit will be set at the parts per quadrillion range due to the toxicity of some forms of dioxin at very low concentrations.

A.2 A citizen suggested that it may be better to intercept ground water before it flows under the Fike Site so that 1) not so much water would need to be treated; and two) the flow path of the ground water could be controlled such that it would not move from the Fike Site to the Monsanto facility.

EPA Response: In the aquifer materials under and near the Fike Site, ground water is present in the spaces between the silt and clay grains. The ground water generally moves from south of the Site in a northerly and northwesterly direction past the Site. As precipitation infiltrates down through the contaminated soils and source materials, contaminants dissolve in the water, move to the watertable and into the aquifer. The contamination in the ground water then partitions into the water and sorbs onto the grains of silt and clay. As the ground water moves, the contaminants continually desorb and sorb from and onto the aquifer materials; the dissolved contamination in the ground water constitutes the plume. As the ground water moves through the spaces between the grains it is replenished from water immediately upgradient.

Because ground water up-gradient of the Site and unaffected by the Site has been shown to be free of the contaminants of concern, capturing the ground water *before* it passes under the Site will do nothing to prevent the current plumes of contamination from continuing to move or to prevent any continuing sources of contamination from adding to the plume. However, capturing the contaminated ground water at the Site will prevent it from continuing to move. Down-gradient ground water monitoring will detect any additional sources of contamination contributing to the plume.

A.3 The President of the Nitro Development Authority stated that the Nitro Development Authority supports EPA's proposal.

EPA Response: EPA acknowledges the NDA's support.

B. Summary of Major Written and Electronic Comments Received During the Public Comment Period

B.1 One nearby business owner urged EPA to select natural attenuation for the ground water remedy and to select pump and treat as a contingency remedy if natural attenuation is not successful. The citizen feels that ground water presents no meaningful hazard to employees and businesses and given the history of the area it is inconceivable that anybody would try to use the ground water for anything.

EPA Response: During the Remedial Investigation/Feasibility Study (RI/FS), the Potentially Responsible Parties (PRPs) proposed Monitored Natural Attenuation (MNA) as a component of several remedial alternatives for ground water. EPA did not consider MNA as a viable remedial alternative for ground water because the PRPs failed to demonstrate to EPA's satisfaction that natural attenuation was occurring at a sufficient rate for the Chemicals of Concern (COCs). In accordance with EPA's "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water" (EPA/600/R-98/128), EPA requires that the protocol in this publication be followed when evaluating natural attenuation at any Superfund site. The final selected remedy for ground water is being delayed for five years to allow for the collection of additional data for the design of the pump and treat system. During this time, the PRPs may collect additional data to determine if natural attenuation is occurring at a sufficient rate for all the COCs, but they must follow the protocol in the document referenced above.

B.2 A citizen commented that it is preferable to pump and treat the ground water prior to it reaching the Kanawha River. The citizen asked whether the discharge limitation for dioxin would be less than 0.013 parts per quadrillion?

EPA Response: Based on the data collected during the Remedial Investigation it does not appear that the ground water containing contaminants from the Fike/Artel Site has

reached the Kanawha River. The ROD does require that additional ground water data be collected to estimate how, where, and when ground water would reach the Kanawha River. If the treated ground water is discharged directly to the Kanawha River, the State of West Virginia would set the discharge limitations under the National Pollutant Discharge Elimination System (NPDES) program.

B.3 Two citizens commented that they are pleased with all the data that has been collected over the past several years and are eager to the see the remedy implemented so that the Site can be put back to productive use.

EPA Response: EPA appreciates their support.

B.4 The Fike/Artel Trust (Trust), on behalf of the potentially responsible parties (PRPs) at the Site, commented that the design and installation of a RCRA-equivalent cap including an asphalt surface over Lagoon 3 would be more cost effective than excavating Lagoon 3.

EPA Response: EPA prepared a cost estimate for excavating Lagoon 3 using the PRP's unit costs presented in the Feasibility Study. The cost of total excavation of Lagoon 3 (Alternative 5b in the ROD) is $4.8 million, which is comparable to a RCRA-equivalent cap (Alternative 6) of $4.5 million. In addition, Alternative 5b offers greater long term effectiveness and permanence.

B.5 The Trust supports a ground water pump and treat system with a delayed implementation of five years.

EPA Response: EPA acknowledges the Trust's support.

B.6 The Trust recommends that the language in the ROD be consistent with the language in the OU4 Consent Decree. Specifically, the Consent Decrees states that the Trust "shall perform, pay for and implement an OU4 remedy unless . . . the remedy selected in the OU4 ROD in not based on an assumption that future land use at the Site will be industrial use." In turn, the reference to commercial use (as opposed to industrial use) of the Site is inappropriate and should be eliminated.

EPA Response: EPA agrees and has eliminated the reference to commercial use in the ROD.

B.7 The Trust commented that the common goal of EPA and the Trust should be to resolve whether MNA will serve as an equivalent treatment to pump and treat, respecting the expressed desires of the Community Liaison Panel and the Nitro Development Authority.

EPA Response: EPA's goal is to select a remedy that will achieve cleanup levels. EPA has stated in the ROD that there is insufficient information to demonstrate to EPA's

satisfaction, and in accordance with EPA's September 1998 publication "Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater," that MNA is a viable remedial alternative for ground water. There is insufficient data to prove that natural attenuation is occurring at a sufficient rate for all the Chemicals of Concern (COCs). EPA's protocol for demonstrating MNA must be followed. EPA will consider and allow for the collection of additional information to resolve whether MNA will serve as effectively as pump and treat. See EPA's Response to Comment B.1.

B.8 The Trust commented that the Proposed Plan describes the groundwater impacts and remedial action objectives in terms of the constituents of potential concern (COPCs) that are identified by site assessment steps prior to risk assessment, rather than the constituents of concern (COCs) that are identified at the conclusion the comprehensive risk assessment process.

EPA Response: EPA agrees and, in accordance with EPA's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, December 1989, EPA has changed the terminology to COCs in the ROD.

B.9 The Trust commented that pursuant to EPA guidance, COPCs are to be used only as a screening tool for focusing the site assessment and risk assessment component of the process, not as the set of constituents to be specifically included in remedial actions and assigned performance measures. EPA guidance specifies that it is the role of a comprehensive Remedial Investigation (RI) including a Baseline Risk Assessment to allow initially identified lists of constituents to be evaluated to identify those constituents that actually represent a significant potential risk. COPCs are identified early in the process of site assessment to indicate those constituents warranting further evaluation of contribution to the overall risk estimation. This list is refined in the later stages of the risk assessment to identify constituents of concern, or COCs, and it is these COCs that a remedy must address, and correspondingly, for which performance levels are relevant.

EPA Response: EPA agrees and, in accordance with EPA's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, December 1989, EPA has changed the terminology to COCs in the ROD.

B.10 The Trust commented that once a COC list is established, EPA guidance requires that preliminary remediation goals (PRGs) be derived for the COCs (i.e., initial numerical values are proposed for the associated list of compounds or chemicals). It is important to bear in mind the EPA's specification that PRGs provide "*remediation design staff with long-term targets to use during analysis and selection of remedial alternatives*" (pg. l, USEPA RAGS Part B guidance [USEPA, 1991]. (This process is described in Section 7 of the Groundwater Baseline Risk Assessment (BRA) and Section 8.4 of the Groundwater RI/FS Report)

EPA Response: The Trust identified PRGs (referred to as Remedial Goal Options on Tables 12 through 15) in Section 7 of the Ground Water Baseline Risk Assessment. For clarification, the complete quoted citation (USEPA RAGS Part B, page 1) is, "In general, PRGs provide remedial design staff with long-term targets to use during analysis and selection of remedial alternatives. Ideally, such goals, if achieved, should both comply with applicable or relevant and appropriate requirements (ARARs) and result in residual risks that fully satisfy the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requirements for protection of human health and the environment. By developing PRGs early in the decision-making process (before the RI/FS and the baseline risk assessment are completed), design staff may be able to streamline the consideration of remedial alternatives." See EPA's Response to B.14.

B.11 The Trust commented that EPA guidance on transferring proposed PRGs for subsequent use as Remedial Goal Options (RGOs) in the Feasibility Study and RD/RA based on risk assessment results requires that specific consideration of other criteria (non-risk-based factors such as the availability-derived PRGs) have to be refined to enforceable numerical goals before incorporation into a ROD.

EPA Response: As indicated in EPA's Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, (Part B, Development of Risk-Based Preliminary Remediation Goals), December 1991, preliminary remediation goals are based on the site-specific final risk assessment results.

B.12 The Trust commented that "there were no PRGs identified based on the potential of constituents to represent a significant risk in groundwater. This was primarily due to the determination that the USEPA specification that future use pathways must represent a "reasonably foreseeable" exposure was not met for any identified scenarios in the BRA. At the request of the EPA project team, theoretical PRGs were calculated for comparison purposes to ARARs. However, the risk assessment clearly documents that site-specific, risk-based PRGs are not relevant for FS or RD/RA consideration, since there are no-risk-based COCs. Also, the risk assessment specifies, in accordance with EPA guidance, that regardless of the lack of risk-based cleanup requirements, any available ARARs must still be considered. Accordingly the list of constituents that are relevant for the setting of enforceable goals and performance criteria in design and monitoring are those constituents that are at the Site and have an ARAR value. The relevant ARARs, in this case, are EPA maximum contaminant levels (MCLs), making the MCL the required performance goal. And, the relevant constituents for which performance criteria should be specified are limited to those that currently exceed MCLs."

EPA Response: The "reasonably foreseeable" future groundwater use scenario was included in the baseline risk assessment because the NCP requires that "groundwater must be restored to its beneficial use" (40 CFR 300.430(iii)(D)(F)). EPA continues to

require that the potential "reasonably foreseeable" receptor(s) should remain protected. Although the Fike/Artel Trust has argued that the future land use will remain industrial and that groundwater should be separated as "on-site" (within the property boundary) and "off-site" (outside the property boundary), EPA considers groundwater as one media without boundaries, since groundwater constantly flows and moves. In addition, the potable groundwater well search was only conducted within a two-mile radius from the Property for public water and ½ mile for private wells.

Site-specific risk assessment results were used to calculate Remediation Goals (as indicated in Fike/Artel Trust, "Final Human Health Risk Assessment for Groundwater: OU-4 RI/FS," Section 7.0, Table 12). In addition, in order to calculate the presented Remediation Goals on Table 12, COCs had to exist for groundwater, as indicated by contaminants exceeding EPA target benchmark value of 1E-06. (See "Final Human Health Risk Assessment for Groundwater: OU-4 RI/FS," RAGS D Tables 9.1 through 9.9).

Although MCLs are ARARs which should assist in the development of cleanup goals, MCLs are based on many considerations, including technical feasibility, economics, and risk. Cleanup goals or remediation goals for Superfund sites should be based on risk only, as stated in 40 C.F.R. Sections 300.430(e)(2)(i)(A),(B),(C), and (D).

B.13 The Trust commented that the EPA Region III Risk-Based Concentration Table should generally not be used to set cleanup or no-action levels at CERCLA sites.

EPA Response: The Region III Risk-Based Concentration (RBC) Table should not be used by itself to establish final cleanup goals for many reasons. When calculating Remediation Goals, the risks from all pathways (ingestion, dermal, and inhalation) are summed together in the Baseline Risk Assessment and used to calculate the cleanup goal.

B.14 The Trust commented that based on EPA guidance, the remedial performance goals should be established on the basis of those constituents with existing MCLs. Further, performance goals based on COPCs (the initial listing of constituents) rather than COCs (if there had been any risk-based COCs), would necessitate extensive efforts for constituents that had already been determined not to represent significant risks. Because of the EPA specification to consider whether ARARs are available, there are COCs for this site, regardless of the risk assessment conclusions, and it is these that should be addressed in performance and monitoring criteria.

EPA Response: At the Fike/Artel site the existing MCLs (ARARs) do not offer adequate protection of human health because of the presence of multiple contaminants. Therefore, risk-based remediation goals have been established. This procedure is consistent with the expectation of the Superfund program, that selected remedies be protective of human health and the environment, ***and*** comply with ARARs.

Remediation goals for this site were calculated based on site-specific information obtained at the conclusion of the baseline risk assessment. MCLs were considered and found not to be protective of human health, because the cumulative risk at some MCLs exceeded EPA's clean-up goal.

This process is consistent with EPA's guidance, which indicates that: "the initial list of PRGs may need to be revised as new data become available during the RI/FS. Therefore, upon completion of the baseline risk assessment, it is important to review the media and chemicals of potential concern, future land use, and exposure assumptions originally identified at scoping. Chemicals may be added or dropped from the list, and risk-based PRGs may need to be recalculated using site-specific exposure factors. PRGs that are modified based on the results of the baseline risk assessment must still meet the "threshold criteria" of (1) protection of human health and the environment and (2) compliance with ARARs." See EPA responses to B.11, B.12, and B.13.

See EPA's *Human Health Evaluation Manual, Part B: "Development of Risk-Based Preliminary Remediation Goals"* (OSWER Directive 9285.7-01B), and the NCP, 40 C.F.R. Section 300.430(i)(A)(1)(2), for more information on these issues.

B.15 The Trust commented that EPA should consider a reduced list of constituents with MCLs presented as Table 1 in the Proposed Plan, due to the very low frequency of detection and maximum detected concentrations near the MCL and proposed that the following constituents be eliminated from the list of constituents: carbon tetrachloride, chromium, ethyl benzene, gamma-BHC (Lindane), gamma chlordane, heptachlor epoxide, lead, and thallium.

EPA Response: EPA's "Risk Assessment Guidance for Superfund" (RAGS Part A, 1989) suggests that a frequency of detection of 5% may be acceptable for screening purposes. With the exception of carbon tetrachloride, each of the constituents proposed by the Trust exceed 5%. Deleting this chemical from the list of COCs will not significantly impact the cleanup criteria for ground water, therefore EPA declines to eliminate any of the proposed constituents.

B.16 The Trust commented that "[i]n accordance with EPA guidance and providing information about the site specific constituents, a list of constituents for performance monitoring and corresponding remedy performance levels" should be:

Compound	MCL (ppb)
1,1,2-Trichloroethane	5
1,1,- Dichloroethene	7
1,2 - Dichlorobenzene	600
1,2 - Dichloroethane	5
1,2 - Dichloropropane	5
1,4 - Dichlorobenzene	75
Arsenic	50
Benzene	5
Chlorobenzene	100
cis-1,2- Dichloroethene	70
Heptachlor	.04
Tetrachloroethene	5
Toxaphene	3
Trichloroethene	5
Vinyl Chloride	2