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Environmental Protection
Agency

Office of
Emergency and
Remedial Response

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September 1991

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Superfund Record of Decision:

Saunders Supply, VA

50272-101

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	14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 7.3-acre Saunders Supply site is an active lumber yard facility in the Village of Chuckatuck, a rural area of the City of Suffolk, Virginia. Land use in the area is predominantly mixed residential and commercial. The site is composed of the Saunders Supply Company property and a portion of the adjacent Kelly property. Commercial establishments and residences are to the east of the facility, and a wooded area is to the west. From 1964 to 1991, the Saunders Supply Company used the site to chemically treat wood before distribution. Prior to 1984, treated wood was placed on pallets located directly on the ground near the wood treating process area. Subsequently, from 1984 to 1991 when the site ceased operations, treated wood was air-dried on a concrete drip pad. These improper treatment and disposal processes have contaminated onsite soil, sediment, and ground water. Principal site features include the treatment facilities, a former conical burn pit area, a former earthen separation pond, and a wastewater pond west of the site. Some drainage from the site discharges to storm sewers adjacent to the site boundary. After the State investigated the site, Saunders Supply was required to install monitoring wells, excavate the contaminated soil around the conical burn pit area, and install a

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Saunders Supply, VA
First Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: organics (dioxin, PCP), metals (arsenic, chromium)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
	None	69
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

recovery well. Treated water from the recovery well was recycled as the process water for the chemical treatment of lumber. EPA conducted additional investigations that revealed the presence of pentachlorophenol (PCP), arsenic, and chromium in the ground water. This Record of Decision (ROD) addresses all media impacted by site contamination as a final remedy. The primary contaminants of concern affecting soil, sediment, and ground water are organics including dioxins and PCP; and metals including arsenic and chromium.

The selected remedial action for this site includes draining the wastewater from the wastewater pond, followed by onsite or offsite treatment and discharge; excavating, treating using dechlorination, and offsite disposal of 700 tons of sediment from the wastewater pond and the former earthen separation pond; excavating, treating onsite using low-temperature thermal desorption (LTTD), and offsite disposal of 24,300 tons of soil and sediment from the storm sewer exceeding 1.46 mg/kg PCP; regenerating spent carbon from the LTTD treatment process offsite; treating ground water during the dewatering process prior to excavating the soil; discharging the treated water onsite or offsite based on remedial design studies; testing the concrete pads for RCRA characteristic hazardous wastes; scarification of the top 1 inch of the concrete pads and treating the removed material using solidification if determined to be RCRA characteristic waste, with subsequent offsite disposal along with the remainder of the concrete pads; removing and plugging preexisting wells; cleaning and sliplining the storm sewer; monitoring ground water; and implementing institutional controls including deed and ground water use restrictions. The estimated present worth cost for this remedial action is $20,485,000, which includes an annual O&M cost of $15,000.

PERFORMANCE STANDARDS OR GOALS: The chemical-specific soil clean-up level is PCP 1.46 mg/kg. If ground water is discharged onsite, treated effluent must meet State permit limits; or if discharged offsite, treated effluent must meet levels set by the receiving facility.

RECORD OF DECISION
SAUNDERS SUPPLY COMPANY

DECLARATION

SITE NAME AND LOCATION

Saunders Supply Company
Chuckatuck, Virginia

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Saunders Supply Company Site (the Site) in Chuckatuck, Virginia which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 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). This decision document explains the factual and legal basis for selecting the remedy for this Site. The information supporting this remedial action decision is contained in the Administrative Record for this Site.

The Virginia Department of Waste Management concurs with the selected remedy.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE REMEDY

This remedy will address all of the media impacted by the contamination at the Site. It is not warranted at this time to split the Site into smaller components called operable units to address individual media. Based on the information derived through the Remedial Investigation, the Site soils pose a principal threat to human health. Since wastes will be left in place, long-term monitoring of the ground water must be performed. The ground water monitoring must test for the presence of pentachlorophenol (PCP), arsenic, and chromium because these contaminants have been detected at elevated levels in the ground water to date.

The selected remedy includes the following major components:

- Excavation, dechlorination treatment, and offsite disposal of the K001 sediments from the wastewater pond and the former earthen separation pond.

- Excavation, low temperature thermal desorption treatment and offsite disposal of the Site soils and the sediments from the storm sewer.

- Treatment of the ground water during the dewatering process prior to excavating the soil.

- Scarification of the top one inch of the concrete pads, solidification treatment of the removed material, and offsite disposal of the solidified material and the remainder of the concrete pads.

- Cleaning and sliplining of the storm sewer.

- Ground water monitoring.

- Institutional controls.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and it satisfies the statutory preference for a remedy that employs treatments that reduce toxicity, mobility, or volume as their principal element.

Because this remedy will result in hazardous substances remaining onsite, a review will be conducted no less often than each five years after initiation of remedial action to ensure that human health and the environment are being protected by the remedial action being implemented.

Edwin B. Erickson — 9-30-91
for Regional Administrator — Date
Region III

DECISION SUMMARY for the RECORD OF DECISION

SAUNDERS SUPPLY COMPANY

A. Site Name, Location, and Description

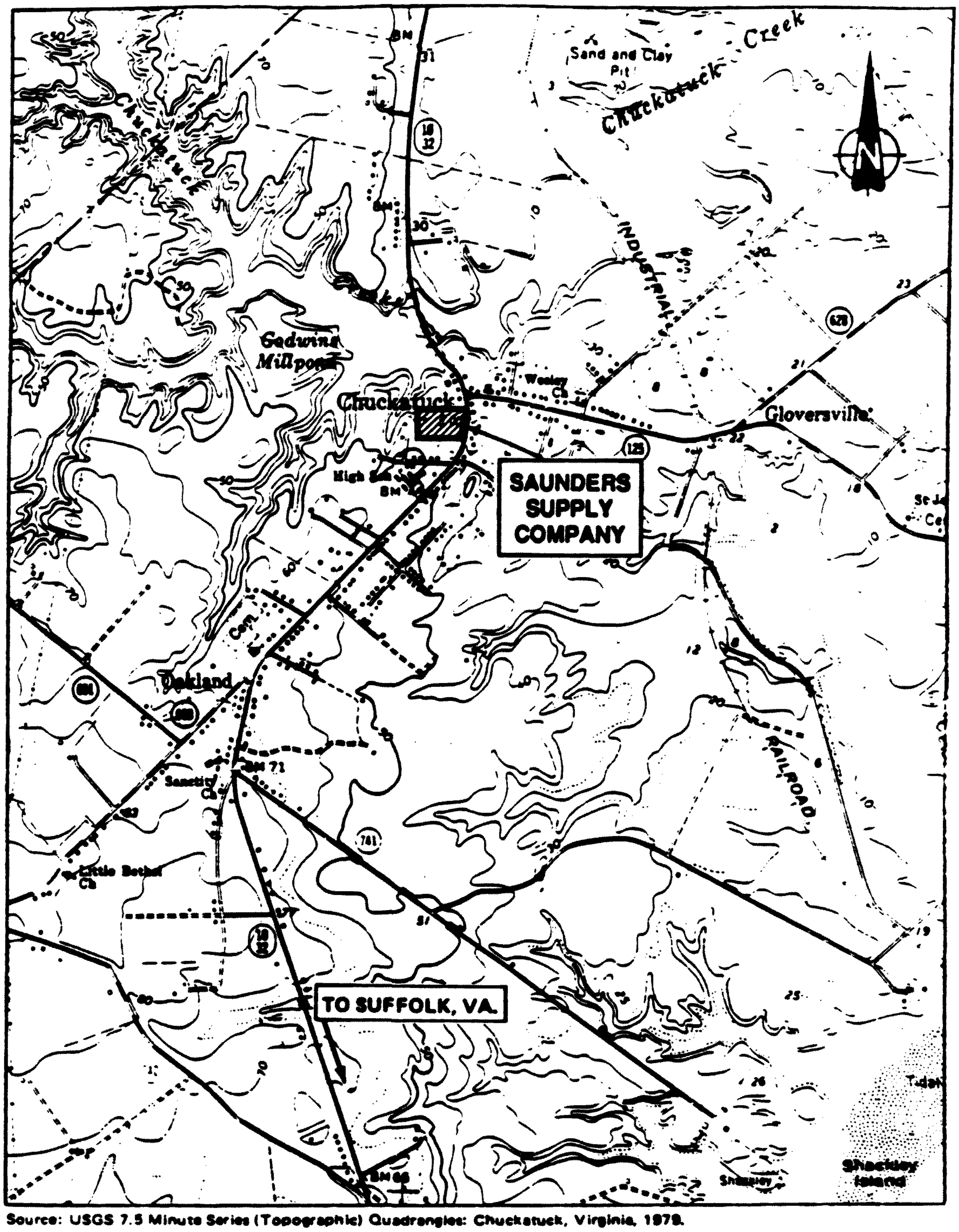
The Saunders Supply Company site (the Site) is located in the village of Chuckatuck, a rural area of the city of Suffolk, Virginia (see Figure 1). The Site is comprised of the Saunders Supply Company property and a portion of the Kelly property adjacent to the Saunders property. The Saunders property occupies approximately 7.3 acres along State Route 10/32, which defines the eastern boundary of the property. The Saunders Supply Company is an active lumber yard which previously chemically treated wood before distribution. The Saunders Supply Company also has a hardware store but that facility is located several hundred feet south and upgradient of the wood treating facility and is therefore not part of the Site.

The Saunders Supply Company facility is located in a mixed residential and commercial area (see Figure 2). The Kelly Nursery and residence is located immediately north of the facility. A gasoline station and a residential subdivision are located south of the facility. Commercial establishments and residences are located east of the facility, and a wooded area is west of the facility, beyond which agricultural activity exists.

Buildings used primarily for retail operations are located on Godwin Boulevard (State Route 10/32) on the eastern portion of the Saunders property. Wood storage areas are located primarily on the southern portion of the Saunders property. Wood treatment facilities, the former conical burn pit area, and a former earthen separation pond are located on the north central and northwestern portions of the Saunders property. On the western portion of the Saunders property, a pond was constructed to hold water used for process cooling purposes. This pond is denoted as the wastewater pond.

The surficial slope of the property is toward a drainage ditch immediately north of the Site and an intermittent stream adjacent to and west of the Site. These surface water bodies discharge to Godwin's Millpond (also known locally as Crump's Millpond), located approximately 500 feet north of the Saunders property. Godwin's Millpond is used as a municipal water source for the city of Suffolk. Godwin's Millpond drains into Chuckatuck Creek.

Drainage from the vicinity of the Saunders wood treatment and wood storage operations is also received by storm sewers (catch basins) along Route 10/32, which discharge to a drainage swale and are ultimately received by Cedar Creek, located approximately 1 mile to the east of the Saunders property.



Source: USGS 7.5 Minute Series (Topographic) Quadrangles: Chuckatuck, Virginia, 1979.

SCALE

0 ½ 1 Mile

0 .5 1 Kilometer

Figure 1
SAUNDERS SUPPLY COMPANY LOCATION MAP

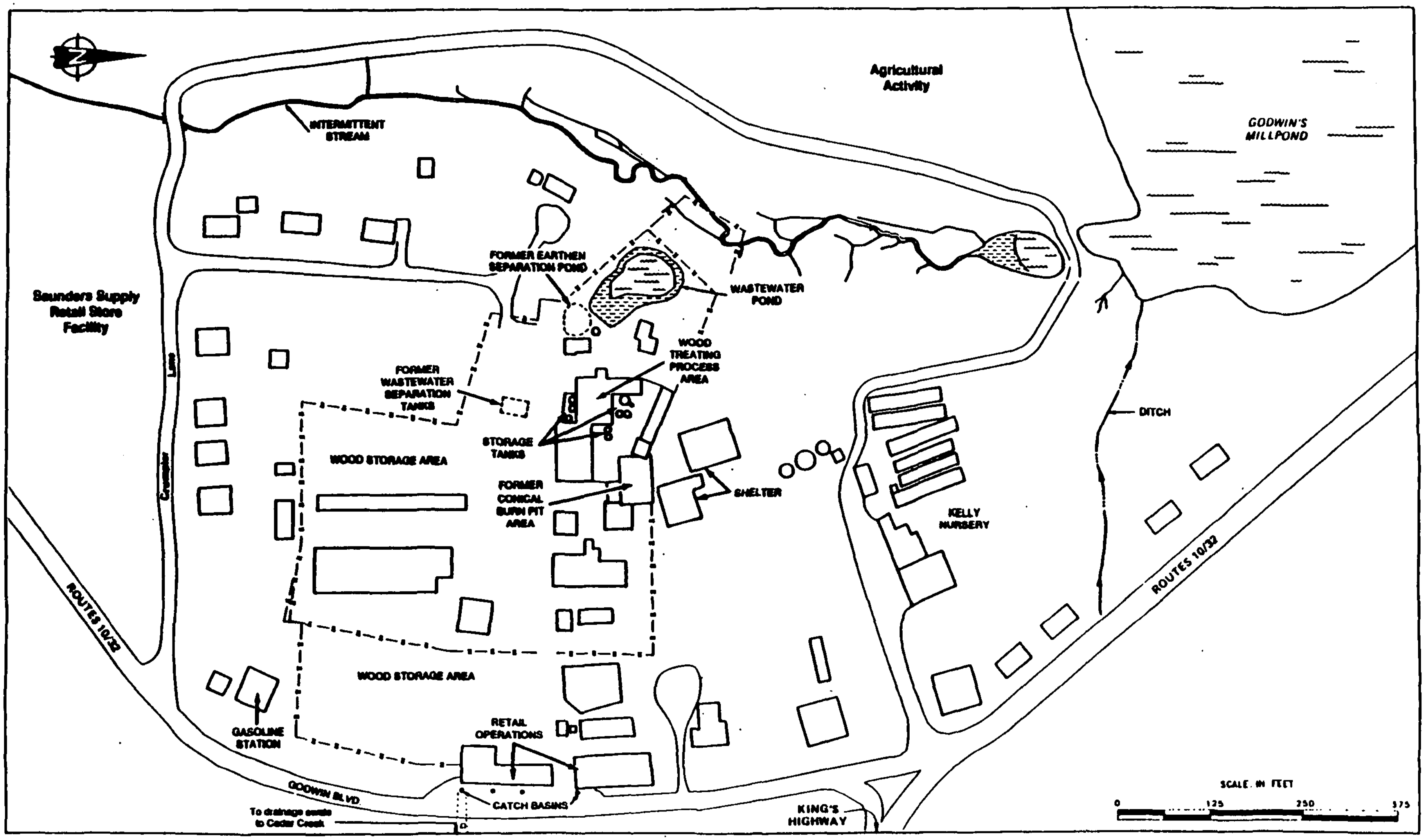


Figure 2
SAUNDERS SUPPLY COMPANY
FACILITIES MAP

B. Site History and Enforcement Activities

The eastern portion of the Saunders property, along Godwin Boulevard, was purchased in 1946 and operated as a lumber and hardware retail store by the current owners. Prior to purchase, the land was used for agricultural purposes. Onsite chemical treatment of the lumber began in 1964 on the northwestern portion of the Saunders property. During initial chemical treatment operations, a 5% pentachlorophenol (PCP) solution in No. 2 fuel oil was used in a cylinder 5 feet in diameter and 32 feet long. A second cylinder 5 feet by 50 feet, was put into operation in 1971. The second cylinder also treated lumber with a 5% PCP solution in No. 2 fuel oil. In 1974, a third cylinder, 4 feet by 36 feet, was added. The third cylinder, however, used a copper, chromium, and arsenic (CCA) solution for the wood treatment. The 5 by 50 foot cylinder was converted to the CCA process in 1981, and the 5 by 32 foot cylinder was converted to the CCA process in 1984. The Saunders Supply Company ceased all wood treating operations at the facility in June 1991.

When in use, the PCP treatment solutions were periodically drained from the cylinders into a series of oil/water separators. The third and final oil/water separator in the series was an unlined pond, located southeast of the existing wastewater pond on the Saunders property. This pond is denoted as the former earthen separation pond. A crust-like residue that formed on the surface of the former pond was occasionally burned as a training exercise for the local fire department. The pond has since been filled in and covered over by the Saunders Supply Company. The sediments which were at the bottom of the pond exist in a layer under the surface of the soil. These sediments are classified as a listed hazardous waste under the Resource Conservation and Recovery Act (RCRA) as a K001 waste, 40 C.F.R. 261.32. Similarly, the sediments at the bottom of the existing wastewater pond are also classified as a K001 listed hazardous waste.

Sludge removed during annual maintenance of the PCP treatment cylinders or associated oil/water separators was used on the roads and/or around the lumber storage areas to control dust and weeds from approximately 1966 through 1981. In 1969 a conical burner, used primarily for the disposal of lumber scraps and sawdust, was also used periodically to incinerate some of the sludges. The conical burner ceased operations in 1974 and has since been removed. Offsite removal of sludges generated by the PCP process took place from 1981 through 1985, at which time the entire wood treating process was converted to the CCA process. The burning of the PCP sludges in the conical burner and the former oil/water separation pond is the likely source of the dioxins detected on the Site.

During the past treatment operations, treated wood has been allowed to dry onsite. Prior to 1984, treated wood was placed on pallets located directly on the ground in the southern portion of the property near the wood treating process area. From 1984 to 1991, the wood was air-dried on a concrete drip pad that collected the excess chemicals. Because of the contamination resulting from the previous practice of allowing the treated wood to drip onto the ground, the soils at the Site contain F032 RCRA listed hazardous waste, Federal Register 261.31.

Based on an investigation by the Virginia Department of Health, Solid Waste Management Division and the Virginia State Water Control Board, Saunders Supply Company installed monitoring wells, excavated the contaminated soils around the conical burner area, and installed a recovery well. The water from the recovery well was used as process water for the CCA chemical treatment of the lumber, since this process is a net consumer of water.

EPA proposed that the Saunders Supply Company Site be listed on the National Priorities List (NPL) in 52 Fed. Reg. 2492, 2497, dated January 22, 1987. On July 31, 1987, Saunders was informed of EPA's intention to further investigate the Site pursuant to Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. Section 9604, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). Although Saunders initially retained an engineering firm to prepare a workplan for a Remedial Investigation/ Feasibility Study (RI/FS), the Company informed EPA that it did not have the financial ability to perform the RI/FS. As such, EPA utilized Superfund monies to perform the RI/FS. General Notice letters were sent on July 12, 1990 to each of the officers of the Saunders Supply Company.

C. Highlights of Community Participation

The RI/FS and Proposed Plan for the Saunders Supply Company site were released to the public in May, 1991. These documents were made available to the public in both the administrative record and an informational repository maintained at the EPA Docket Room in Region III and at the Morgan Memorial Library in Suffolk, Virginia. The notice of availability for these documents was published in the Virginia Pilot and the Suffolk News Herald on May 23, 1991. The purpose of the notice was to announce the beginning of a 30-day public comment period on the Proposed Plan for the Site. The public comment period was initially to be held from May 23, 1991, through June 21, 1991. However, based on a request from the Saunders Supply Company, the public comment period was extended until July 22, 1991.

In accordance with Section 117 (a)(2) of CERCLA, 42 U.S.C. Section 9617(a)(2), a public meeting was held on June 4, 1991 at the Oakland Elementary School in Chuckatuck, Virginia. At this meeting, representatives from EPA and the Virginia Department of Waste Management (VDWM) answered questions about problems at the Site and the remedial alternatives under consideration. The majority of the comments from the local citizens at the public meeting were chiefly related to offsite ground water contamination, the need to dispose of the soils offsite, and the impact of the remedy on the operations of the Saunders Supply Company. A response to comments and concerns received during the public comment period is included in the

Responsiveness Summary, which is part of this Record of Decision (ROD).

D. Scope and Role of Operable Unit or Response Action Within Site Strategy

The selected remedy will address all of the media impacted by the contamination at the Site; that is, the soils, the ground water in the Columbia aquifer, the sediments in the former earthen separation pond and the wastewater pond, the sediments in the storm sewers, and the concrete drip pad. The levels of PCP found in the soils constitute a principal threat at the Site. EPA has determined that it is not warranted to split the site remediation into operable units to address individual media.

E. Summary of Site Characteristics

The RI field activities and analytical program were designed to define the extent of contamination in the soils, sediments, surface water and ground water on and around the wood treatment facility, identify migration pathways, and provide data to support a feasibility study of potential remedial actions. The following tasks were completed at the Site (Figures 3 through 6 show the sampling locations):

- Grid surveying and topographic mapping;
- X-ray fluorescence surveying for arsenic, chromium, and copper detection on shallow surface soil;
- Geophysical surveying;
- Air monitoring;
- Combustion product deposition modeling;
- Shallow surface soil sampling on both Saunders and Kelly properties;
- Surface water, sediment and runoff sampling from surface water bodies and drainage sewers within the study area;
- Subsurface soil boring and sampling;
- Ground water well installation and sampling;
- Aquifer testing; and
- Biota sampling in selected locations of surface water bodies.

A summary of the results from the RI sampling program are shown below.

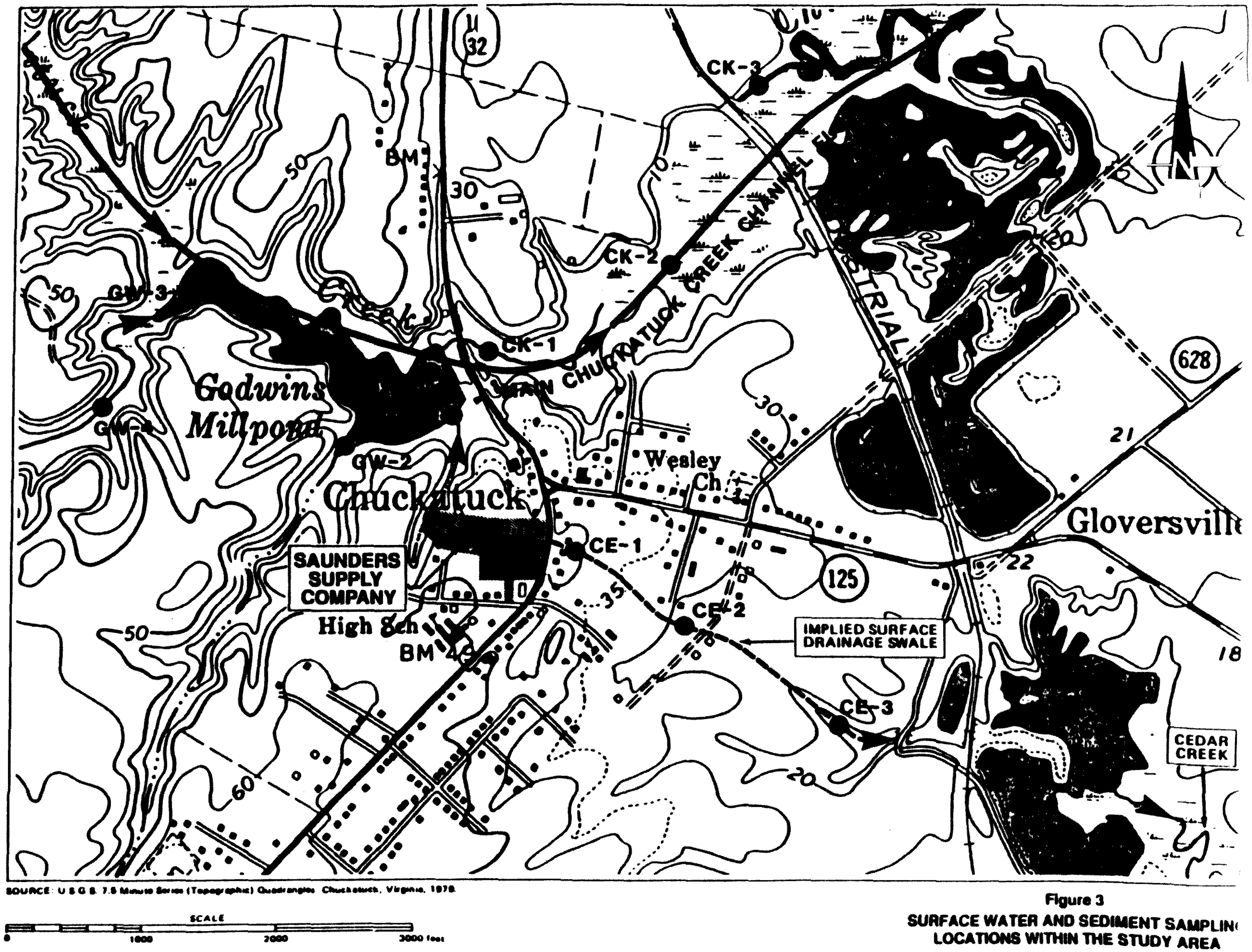


Figure 3

SURFACE WATER AND SEDIMENT SAMPLIN[G] LOCATIONS WITHIN THE STUDY AREA

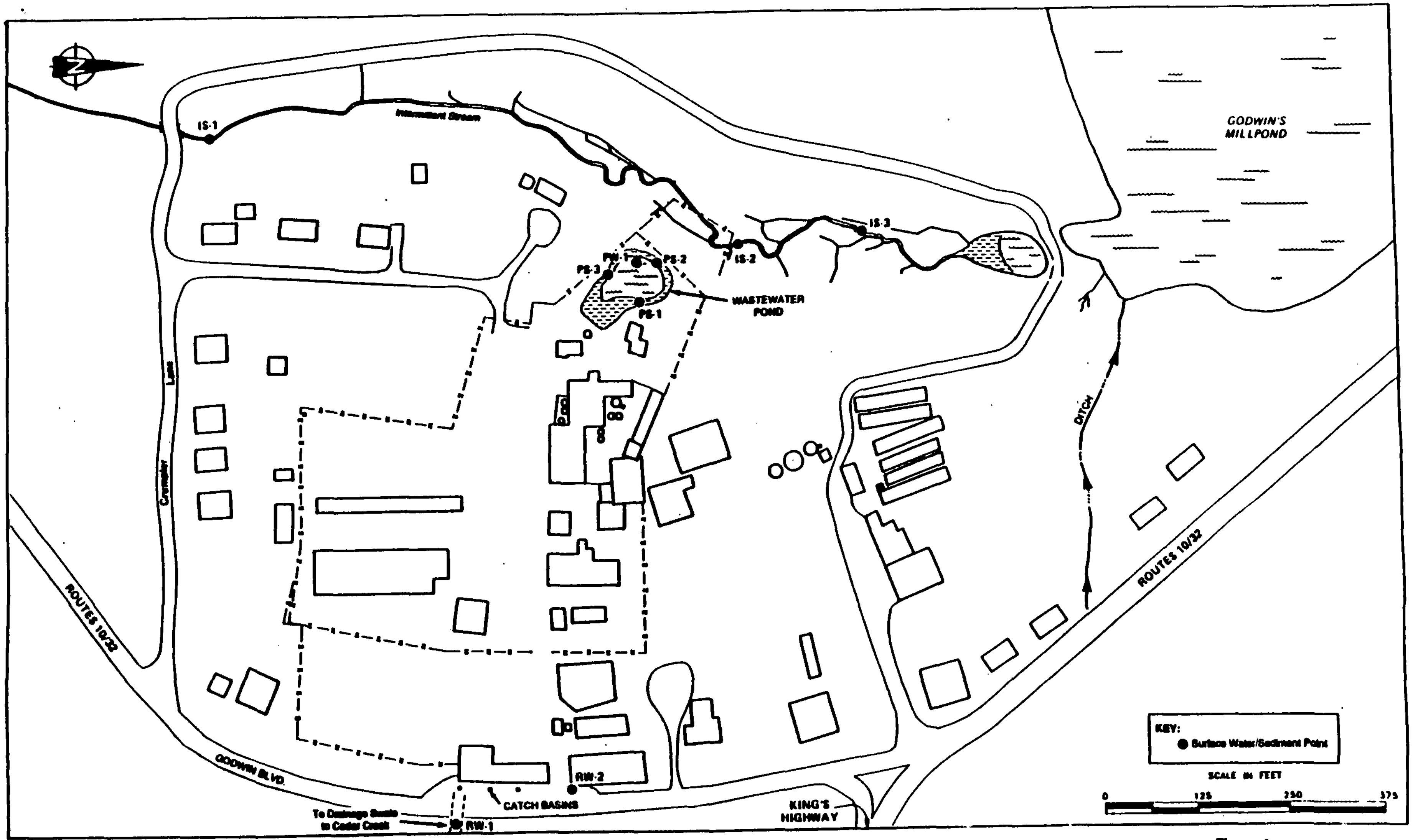


Figure 4
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS ON AND ADJACENT TO THE SAUNDERS PROPERTY

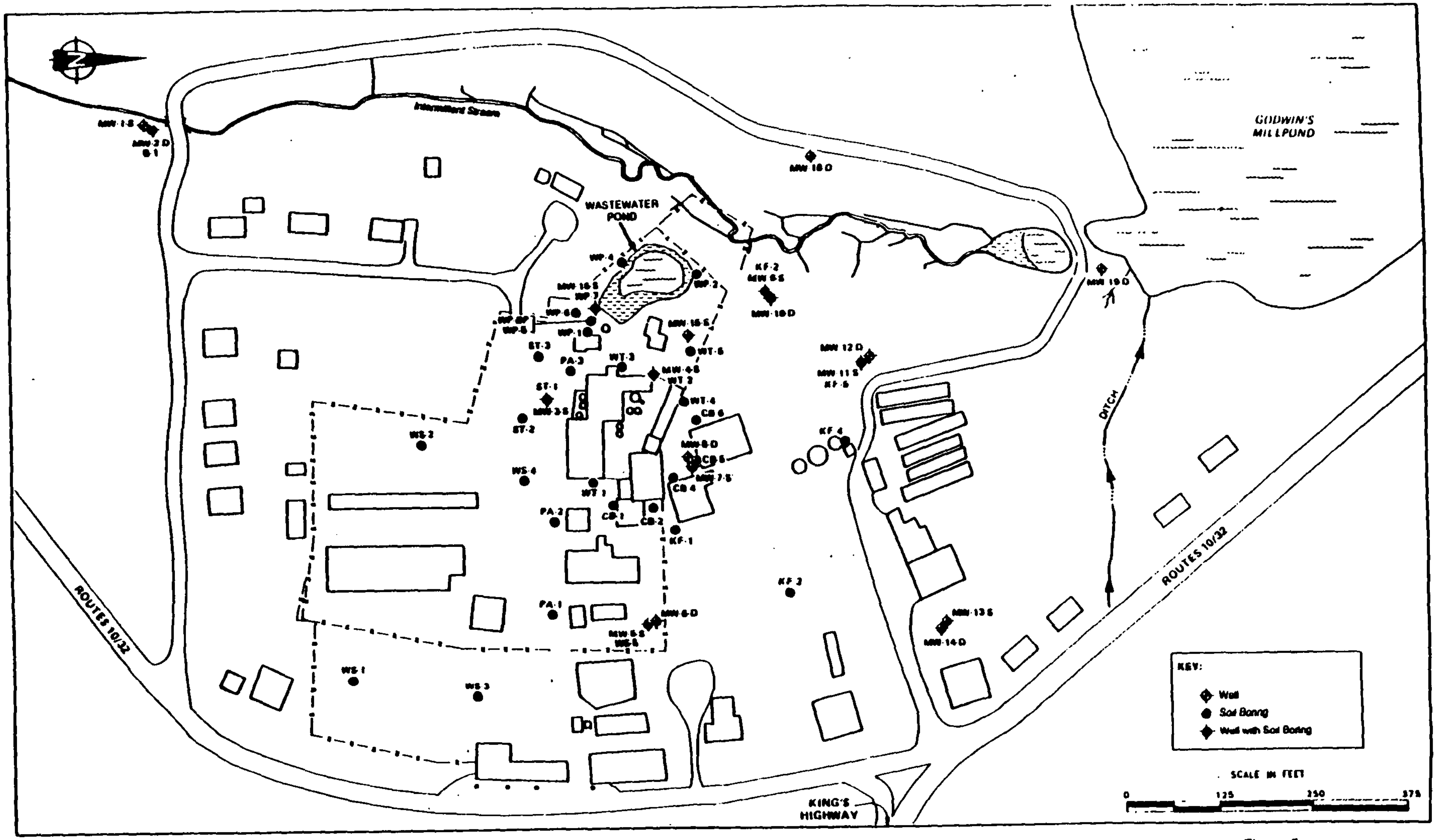


Figure 5
SUBSURFACE SOIL SAMPLING LOCATIONS

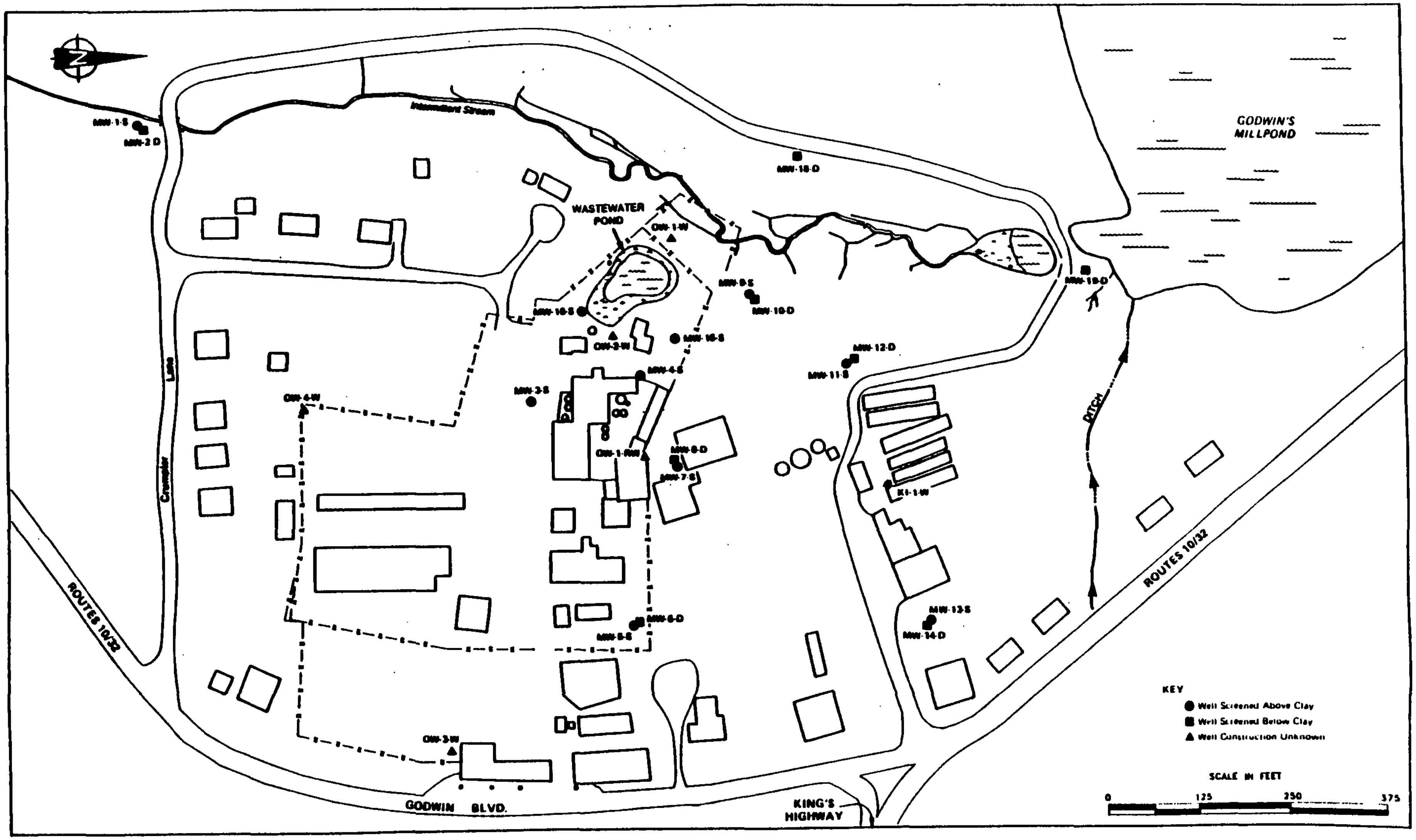


Figure 6
WELL LOCATIONS

Surface Soil

Concentrations of arsenic, total chromium, and copper above the respective background levels of 5.7 mg/kg, 14.9 mg/kg, and 10.8 mg/kg were detected across most of the Saunders property and the portion of the Kelly property adjacent to the former conical burn pit. The highest concentrations of these three analytes were found in the area surrounding the wood treating building where arsenic was detected at 266 mg/kg, total chromium at 252 mg/kg, and copper at 158 mg/kg. The maximum level of hexavalent chromium detected was 1.836 mg/kg.

EPA has classified arsenic in Group A, a human carcinogen, based on extensive evidence of human carcinogenicity through inhalation and ingestion exposure. In regards to noncarcinogenic effects, arsenic compounds have been shown to produce acute and chronic toxic effects, including irreversible systemic damage at high doses. EPA has also listed hexavalent chromium as a Group A, human, carcinogen based on positive animal studies and positive epidemiological studies. In regards to noncarcinogenic effects, hexavalent chromium is a respiratory tract irritant following inhalation and occupational exposure to chromium compounds by inhalation have resulted in changes in the kidney and liver. EPA has classified copper as a Group D carcinogen--not classified. In regards to noncarcinogenic effects, copper has toxic effects at high dose levels including gastrointestinal disturbances, hemolytic anemia, and liver damage.

PCP was not detected in the background surface soils. Detected levels of PCP in surface soils ranged from 21 μg/kg to 5100 μg/kg. The only area on the Kelly property with a detectable level of PCP (67 μg/kg) in the surface soil is located immediately north and adjacent to the former conical burn pit area. The highest levels of PCP were detected in the vicinity of the former conical burn pit area. These include where the conical burn pit was located (2600 μg/kg), and the areas adjacent and south of the burn pit (5100 μg/kg) and adjacent and west of the burn pit (3100 μg/kg).

EPA has classified PCP as a B2 carcinogen, a probable human carcinogen, because there is sufficient evidence of carcinogenicity in animals but insufficient data in humans. In regards to noncarcinogenic effects, there is a wide range of effects associated with PCP, including hepatic toxicity, kidney toxicity, and central and peripheral nervous system toxicity.

Because of the existence of many different isomers of dioxins, EPA uses the Toxicity Equivalence Factor (TEF) to compare the differing isomers to the most toxic isomer, 2,3,7,8 tetrachlorodibenzodioxin (TCDD). Background levels of dioxins ranged from 0.005 ppb TEF to 0.0150 ppb TEF. Samples from two locations on the Kelly property were consistent with background levels (0.0140 ppb TEF and 0.0110 ppb TEF). The other surface soil sample locations had levels which ranged from 0.0770 ppb TEF to 3.249 ppb TEF. The highest levels of dioxins were detected in the southern wood storage area (2.468 ppb

TEF), and in the areas around the wastewater pond and the former conical burn pit (3.249 ppb TEF, 2.100 ppb TEF, 1.294 ppb TEF and 1.164 ppb TEF).

EPA has classified TCDD-dioxin as a B2 carcinogen, a probable human carcinogen, because there is sufficient evidence of carcinogenicity in animals but insufficient data in humans. In regards to noncarcinogenic effects, there are four major toxic effects associated with exposure to TCDD: chloracne, the wasting syndrome, hepatoxicity, and immunotoxicity.

Background Total Petroleum Hydrocarbons (TPH) levels ranged from nondetectable to 69.5 mg/kg. All surface soil TPH levels were at or above background levels ranging from 64.9 mg/kg to 572 mg/kg, with most locations ranging from 100 mg/kg to 200 mg/kg. Only one location on the Kelly property had TPH levels above 200 (572 mg/kg).

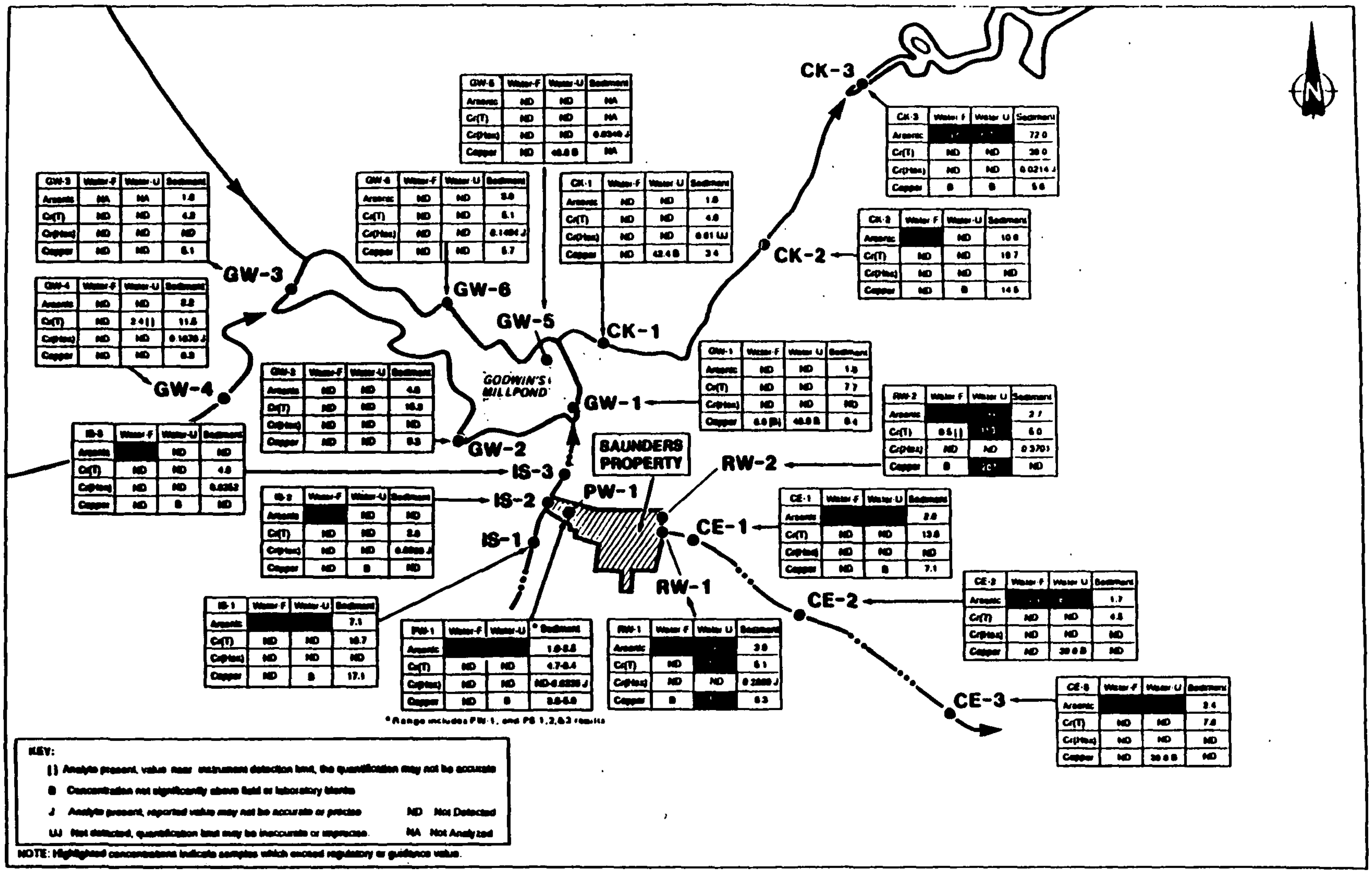
No soil samples were taken beneath the concrete pads in the wood treating area.

Surface Water and Sediment

All of the inorganics detected in the sediments in the study area were found in levels which were within either the Site background or the reported ranges of eastern United States soil metal concentrations.

Several inorganics, such as iron, lead, and manganese, were detected in surface water at elevated concentrations but were not considered related to the activities at the Site because they are not associated with the operations at the Site. Arsenic was detected in all of the sampled locations along the intermittent stream, including upstream of the Site (see Figure 7). In fact, the highest level detected in the intermittent stream was the location upstream of the Site. As such, the Site does not appear to be the source of the arsenic in the intermittent stream. Arsenic was also detected at two locations along Chuckatuck Creek discharging from Godwin's Millpond. Based on the data collected, the arsenic levels in the Chuckatuck Creek do not appear to be attributable to Saunders since no arsenic was detected in Godwin's Millpond, which is located upstream of the Chuckatuck Creek sampling locations. Arsenic was also detected in the wastewater pond and the catch basins on the Saunders property. The catch basins, which collect surface runoff from the eastern portion of the Site, discharge to a drainage swale. Samples collected from the drainage swale also had detectable levels of arsenic. Arsenic levels in unfiltered surface water samples ranged from nondetectable to 143 μg/L, and from nondetectable to 55.9 μg/L in filtered samples. The highest concentrations were detected in the catch basins on the Site. The arsenic in the sediments in the catch basins is considered to be from the Site.

The only surface water samples that contained detectable levels of total chromium and copper were those collected from the catch basins on the Site. Total chromium was detected at 135 μg/L and 153 μg/L



KEY:

- ● Monitoring Well
- ——— Stream
- Intermittent Stream
- Direction of Flow

UNITS: Soil Metals in mg/kg; Water Metals in ug/L

SCALE: 0 — 1,000 — 2,000 Feet

Figure 7

ARSENIC, CHROMIUM, AND COPPER DETECTED IN SEDIMENT AND SURFACE WATERS

in the unfiltered samples and below detection and 9.5 µg/L in the filtered sample. Copper was detected at 181 µg/L and 207 µg/L. In addition, hexavalent chromium was detected in one sample located upgradient of the Saunders property (see Figure 7).

PCP was detected in four sediment samples, all of which were collected from the wastewater pond. Detected PCP concentrations ranged from 1,200 µg/kg to 230,000 µg/kg.

Dioxins were detected in each of the 11 sediment samples, with concentrations ranging from 0.0010 ppb TEFs in the intermittent stream to 15.3 ppb TEFs in the wastewater pond sediment. Although not found in the surface water of the wastewater pond, dioxins were detected in the surface water of the catch basins at levels of 7.008 ppb TEFs and 5.851 ppb TEFs. However, it is assumed that this detection is representative of the sediment from the catch basin, not surface water runoff, because there was no runoff during sample collection and a depression had to be created in the sediments of the catch basin to pool any water there.

TPH was detected in every sampled sediment location with concentrations ranging from 8.6 mg/kg at the reference location to 797 mg/kg in the catch basin. TPH was not detected in any of the surface water samples.

Subsurface Soil

None of the subsurface soil samples had concentrations of inorganics that exceeded the published range for eastern United States soils. PCP was detected in approximately half of the soil samples with detected concentrations ranging from 45 to 1,900,000 µg/kg. The highest result was obtained from a sample collected in the vicinity of the former earthen separation pond.

Dioxin concentrations exceeded 1 ppb TEF in three isolated areas surrounding the wood treatment operation. A level of 7.691 ppb TEF was detected south of the wood treating area while 20.56 ppb TEF was detected west of the area and 11.939 ppb TEF was detected east of the area.

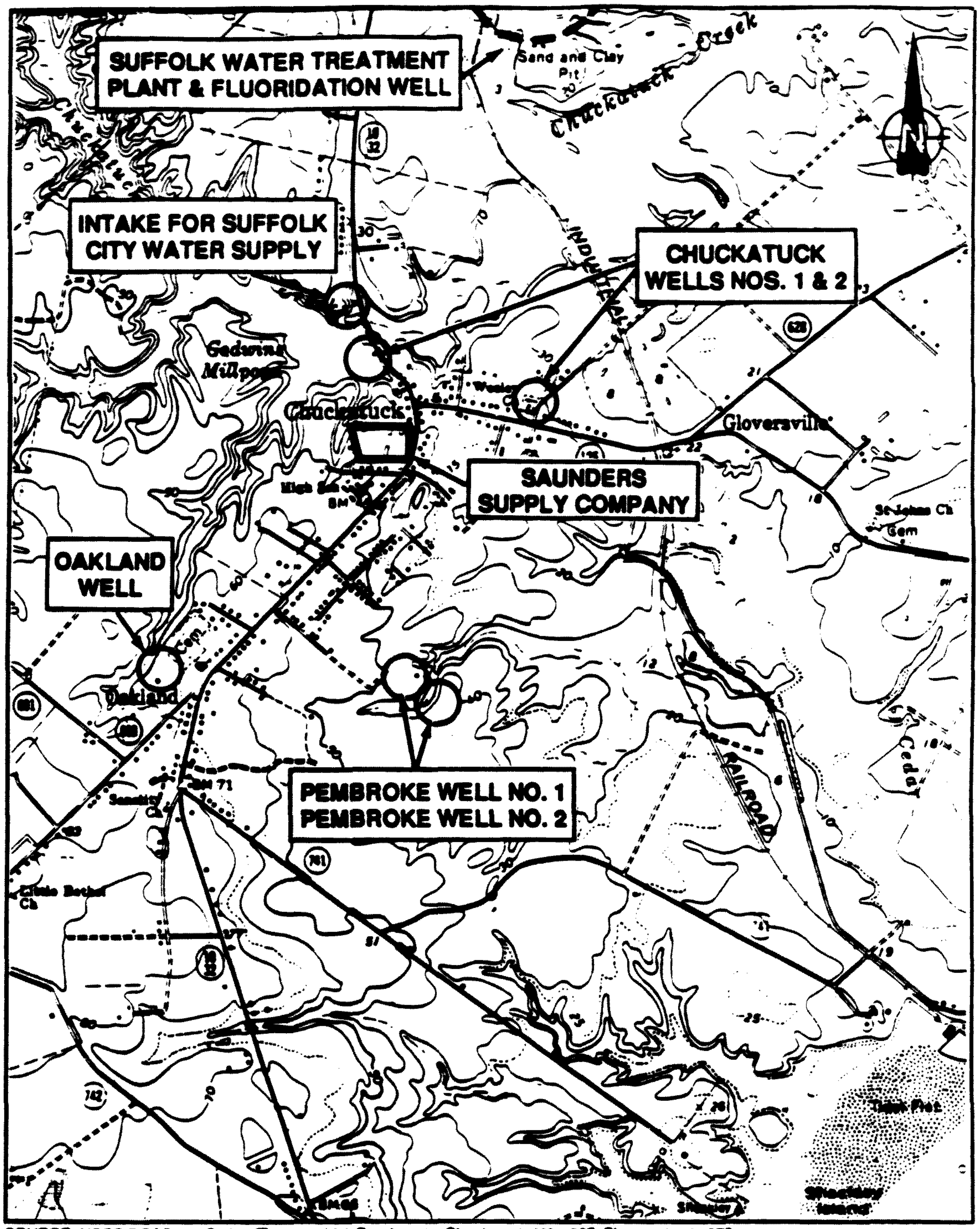
Elevated concentrations of TPH were limited to areas immediately surrounding the wood treatment building and in the vicinity of the former earthen separation pond.

Ground Water

The unconfined Columbia aquifer, with a saturated thickness of 7 feet or less, is the uppermost water bearing unit underlying the Site. No water supply wells exist in the Columbia aquifer in the vicinity of the Site. Immediately underlying the Columbia aquifer is a 2- to 7-foot thick clay unit which overlies the semi-confined Yorktown aquifer. The thickness of the Yorktown aquifer in the vicinity at the Site is unknown but is estimated to be 100 feet or greater. The general flow of both the Columbia and Yorktown aquifers is towards Godwin's Millpond and the intermittent stream. Two public water supply wells (Pembroke well numbers 1 and 2) and the Kelly irrigation well have been identified as probably withdrawing water from the Yorktown aquifer. However, the majority of the public water supply wells (Oakland, Suffolk Water Treatment Plant and Fluoridation, and the Chuckatuck wells) withdraw water from the Potomac group aquifers (Figure 8) which underlie the Yorktown aquifer.

As shown on Figure 9, the concentrations of arsenic, copper, and chromium from filtered samples did not exceed either the Virginia Groundwater Standards or the Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs). However, the unfiltered sample result for arsenic at MW-7-S, with a measured concentration of 82 μg/L, exceeded the Virginia Groundwater Standard of 50 μg/L. Unfiltered samples from MW-1-S (the background sample), MW-3-S, MW-4-S, MW-5-S, MW-7-S, and MW-13-S in the Columbia aquifer, a Class II aquifer, had concentrations of chromium which ranged from 55.2 μg/L to 238 μg/L, thus exceeding either the Virginia Groundwater Standard of 50 μg/L or the MCL of 100 μg/L. The highest detected level of total chromium in the Yorktown aquifer, a Class II aquifer, was the 61.9 μg/L detected in an unfiltered sample from MW-10-D, located on the Kelly property. Since all of the total chromium detections, both onsite and offsite, were from unfiltered samples and this one is the only sample which exceeded the Virginia Ground Water Standard of 50 μg/L, this detection is considered as an isolated instance and is not considered related to the operations at the Site.

PCP was detected in ground water samples collected from four of the monitoring wells screened in the Columbia aquifer (Figure 10). These shallow wells are located downgradient of the wood treating facility. The concentrations of PCP detected ranged from 10 μg/L to 19,000 μg/L (Figure 10). PCP was also detected in two monitoring wells screened entirely in the Yorktown aquifer. One of the two wells is located downgradient of the wood treating facility and adjacent to the former conical burn pit. This well had measured concentrations of PCP up to 160 μg/L. It should be noted that no wells were placed in the Yorktown aquifer beneath the wood treating area, or beneath the area of the Columbia aquifer where the highest levels of PCP were detected. The only other deep monitoring well that had a detectable concentration of PCP is downgradient of the Site, along Godwin's Millpond. This well had a single detection of PCP at the MCL level of 1 μg/L that was qualified as an estimated value. No PCP was detected in the Kelly irrigation well which is located approximately 300 feet north of the Site. PCP was detected in ground water collected from the recovery well which is one of the preexisting wells on the Site. This well is located in the area of the former conical burn pit. Based on well log information, the placement of the recovery well screen across the Columbia aquifer and the upper part of the Yorktown aquifer could be considered to have caused the detection of the elevated levels of PCP in the upper Yorktown aquifer. Since the exact location of the screens and the integrity of the surface seals are not known, the data from this and the other preexisting wells cannot reliably be used to qualify the

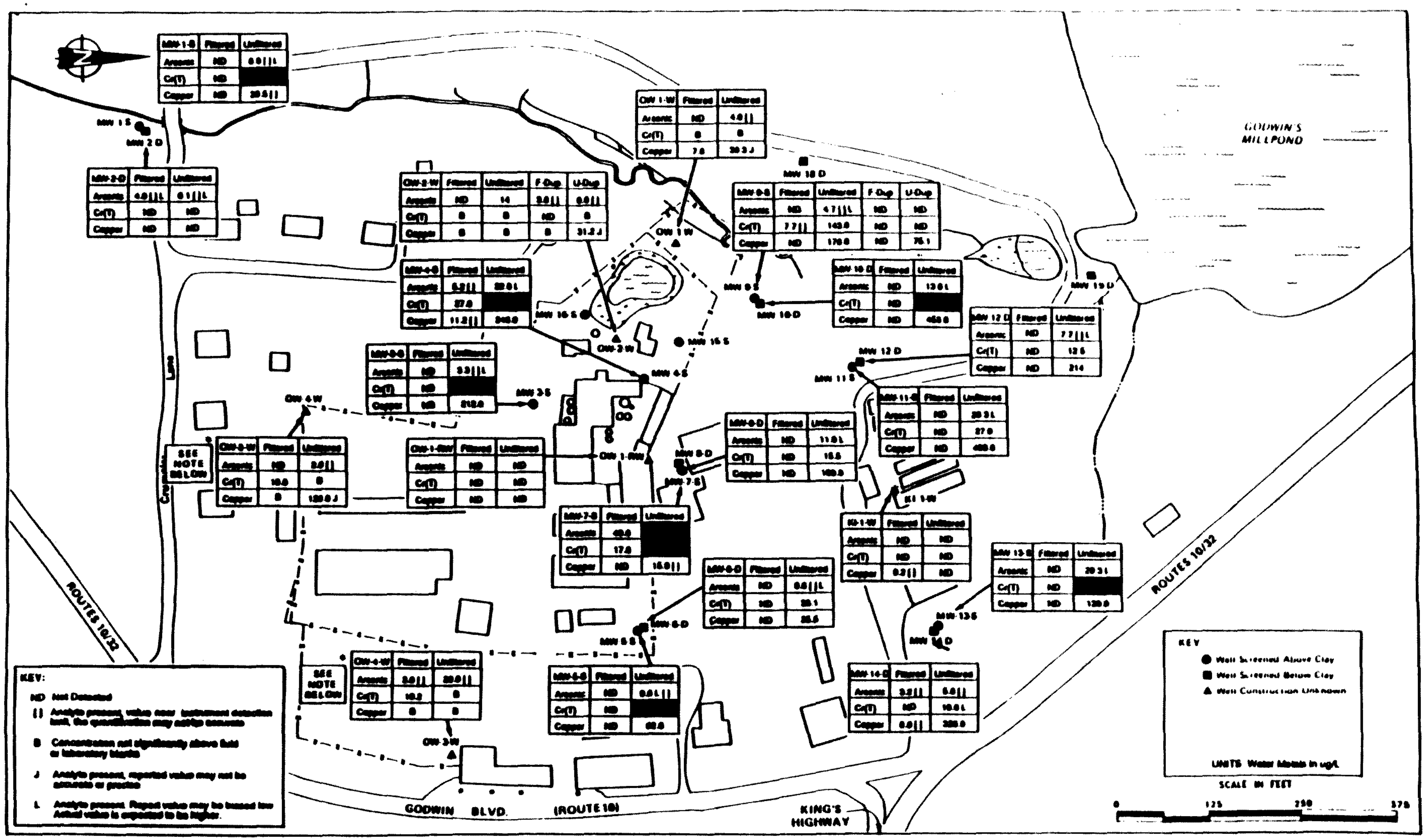


SOURCE: USGS 7.5 Minute Series (Topographic) Quadrangle, Chuckatuck, VA 1965, Photorevised 1978.

SCALE 1:24,000

0 .5 1 Mile

Figure 8
WATER SUPPLY SOURCES



NOTE *The sample collected from monitoring well OW-3-W was labeled OW-4-W. The reported sample results for sample OW-4-W actually relate to location OW 3-W, as shown on this map. Similarly, the sample results reported for sample OW-3-W correspond to monitoring well OW-4-W, as shown on this map.

Highlighted concentrations indicate samples which exceed SDWA regulatory or guidance values.

Figure 8
ARSENIC, CHROMIUM, AND COPPER DETECTED IN GROUNDWATER IN μg/L

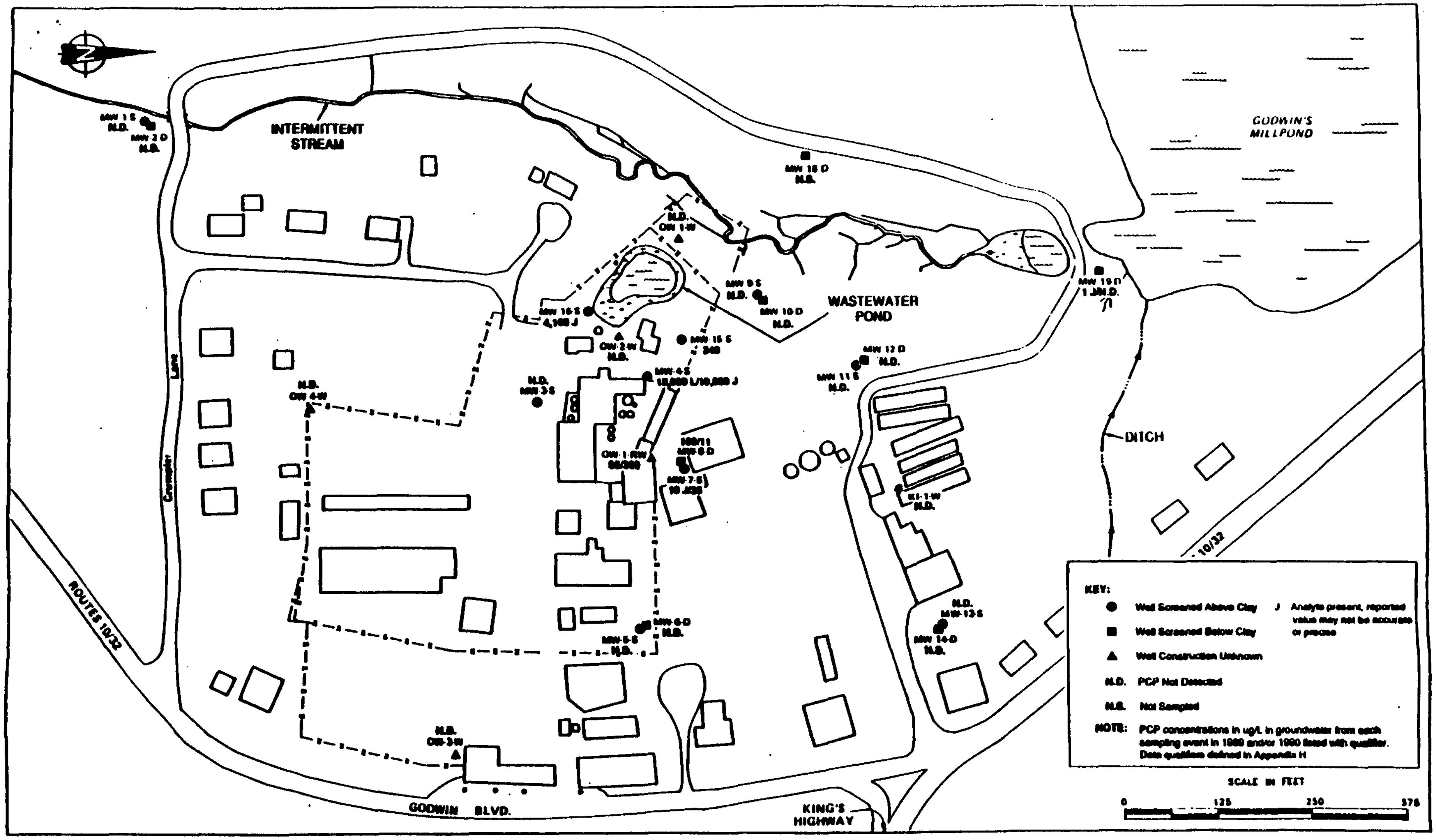


Figure 10
PENTACHLOROPHENOL CONCENTRATIONS IN GROUNDWATER

extent of ground water contamination in an individual aquifer unit.

Concrete Pads

Since the concrete pads in the wood treating area were installed after the complete conversion to the CCA process, the surface of the pads should not be contaminated with PCP. No core samples of the pad were collected for chemical analysis. Based on visual observation only, the pads appear to be contaminated with copper, chromium, and arsenic. Because the CCA is a water-based solution and the fact that the pads were only in use for seven to eight years, the contamination is considered at this time to be no deeper than one inch.

Storm Sewer Pipelines

The storm sewer pipelines that receive drainage from the Site are located along Route 10/32. The storm sewer system includes approximately 550 linear feet of 8-inch concrete pipe and five catch basins. The storm sewer discharges to a drainage swale located approximately 350 feet east of the Site. Elevated concentrations of arsenic and dioxins have been detected in the surface water or sediments collected from the two sampled catch basins along Route 10/32. The pipelines and the catch basins are both constructed of concrete. Contamination may reach the drainage swale because the contaminants which may have sorbed onto the concrete may desorb into the storm water or be carried by it. Also, the contaminants may have settled along any joints or cracks within the storm system and may migrate to the adjacent soils or reach the drainage swale.

F. Summary of Site Risks

As part of the RI/FS process, a Baseline Risk Assessment was prepared for the Site to characterize, in the absence of remedial action (i.e., the "no action" alternative), the current and potential threats to human health and the environment that may be posed by contaminants migrating in ground water or surface water, released to the air, leaching through the soil, remaining in the soil, or bioaccumulating in the food chain at the Site. Figure 11 provides a glossary of the key risk terms from the Baseline Risk Assessment that are used in this section of the ROD.

Based on the Baseline Risk Assessment discussed below, 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.

Human Health Risks

Contaminants of Concern

The initial step of the Baseline Risk Assessment was to compile a list of key indicator contaminants, those which represent the

FIGURE 11
KEY RISK TERMS

Carcinogen: A substance that increases the incidence of cancer in humans.

Chronic Daily Intake (CDI): The average amount of a chemical in contact with an individual on a daily basis over a substantial portion of a lifetime.

Chronic Exposure: A persistent, recurring, or long-term exposure. Chronic exposure may result in health effects (such as cancer) that are delayed in onset, occurring long after exposure ceased.

Chronic Reference Dose (RfD): An estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (as a Superfund program guideline, seven years to lifetime.

Exposure: The opportunity to receive a dose through direct contact with a chemical or medium containing a chemical.

Exposure Assessment: The process of describing, for a population at risk, the amounts of chemicals to which individuals are exposed, or the distribution of exposures within a population, or the average exposure of an entire population.

Hazard Index (HI): The sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways. The HI is calculated separately for chronic, subchronic, and shorter-duration exposures.

Hazard Quotient: The ratio of a single substance exposure level over a specified time period (e.g., subchronic) to a reference dose for that substance derived from a similar exposure period.

Risk: The nature and probability of occurrence of an unwanted, adverse effect on human life or health, or on the environment.

Risk Assessment: The characterization of the potential adverse effect on human life or health, or on the environment. According to the National Research Council's Committee on the Institutional Means for Assessment of Health Risk, human health risk assessment includes: description on the potential adverse health effects based on an evaluation of results of epidemiologic, clinical, toxicologic, and environmental research; extrapolation from those results to predict the types and estimate the extent of health effect in humans under given conditions of exposure; judgements as to the number and characteristics of persons exposed at various intensities and durations; summary judgements on the existence and overall magnitude of the public-health program; and characterization of the uncertainties inherent in the process of inferring risk.

Slope Factor: The statistical 95% upper confidence limit on the slope of the dose response relationship at low doses for a carcinogen. Values can range from about 0.0001 to about 100,000, in units of lifetime risk per unit dose (mg/kg-day). The larger the value, the more potent is the carcinogen, i.e., a smaller dose is sufficient to increase the risk of cancer.

Weight-of-Evidence Classification: An EPA classification system for characterizing the extent to which the available data indicate that an agent is a <u>human</u> carcinogen. Recently, EPA has developed weight-of-evidence classification systems for some other kinds of toxic effects, such as developmental effects.

highest potential risk to human health. The following six contaminants of concern were judged to represent the major potential health risks at the Site:

arsenic
copper
dioxin
PCP
hexavalent chromium
total chromium

Exposure Assessment

The goal of the exposure assessment is to determine the type and magnitude of human exposure to the contaminants present at, and migrating from, the Site. The exposure assessment was conducted to estimate the Site risks if remedial action is not taken.

To determine if human and environmental exposure to the contaminants of concern might occur in the absence of remedial action, an exposure pathway analysis was performed. An exposure pathway has four necessary elements: 1) a source and mechanism of chemical release; 2) an environmental transport medium; 3) a human or environmental exposure point; and 4) a feasible human or environmental exposure route at the exposure point. The potential for completion of exposure pathways at the Site is described in the following sections.

Transport Pathways

For any particular site, there may be a variety of potential exposure routes, with either simple or complex pathways. The simple pathways are of primary significance at the Site. Such simple exposure routes for humans generally include consumption of ground water, bathing with ground water, inhalation of volatile contaminants in ground water during showering, consumption of surface water, bathing with or playing in surface water, ingestion of soil, dermal exposure to soil, and inhalation of fugitive dust emissions. The ingestion pathways are the most important at the Site, based on Site constituents and contaminant distribution. Complex exposure routes are significantly less important at the Site than simple pathways because the primary contaminants have not been shown to bioaccumulate. Furthermore, sampling data indicate that only minimal offsite migration of contaminants has occurred in any environmental media to date.

The transport pathways evaluated at the Site include ground water, soils, sediments, and runoff water. Based on the results of the sampling performed as part of the RI, the five primary areas of contamination associated with the Site are as follows:

- Soils in the vicinity of the former location of the conical burn pit and earthen separation pond;

- Sediments in the existing wastewater pond;
- Surface soils distributed throughout the Saunders property and a portion of the adjoining Kelly property;
- A ground water plume adjacent to the conical burn pit and wood treating area; and
- Water and sediment in runoff water catch basins.

The contaminants of greatest concern with respect to potential current exposure are those in the surface soils which are distributed throughout the Saunders property and a portion of the Kelly property. Currently, exposure to sediments at the bottom of the wastewater pond and ground water is very unlikely. However, if the property is developed for residential use, future residents could potentially be exposed. Similarly, exposure to the sediments in the storm sewers also is very unlikely. However, continued flow of runoff through the sewers may move the sediments to the drainage swale or ultimately, to Cedar Creek. It should be noted that sampling downstream of the catch basins indicated that the sediments in the storm sewer posed no present risk to downstream receptors.

Exposure Scenarios

Three scenarios, encompassing the greatest potential exposure pathways, have been evaluated in the Baseline Risk Assessment using the Reasonable Maximum Exposure (RME). They are:

- Scenario 1: Worker exposure to soil contaminants;
- Scenario 2: Hypothetical future residential exposure to soil contaminants; and
- Scenario 3: Residential ground water usage exposure.

Scenario 1 addresses outdoor exposure to adult workers under existing conditions. Since the soils are contaminated with metals and relatively nonvolatile organic compounds, the worker exposure scenario addresses exposure from ingestion and dermal adsorption of contaminants in soil, and inhalation of soil contaminants entrained in airborne particulates. Exposures by these routes are most likely to occur on the Saunders property, and currently Saunders Supply Company employees are the main receptors. The key variables in the RME worker exposure scenario include a soil ingestion rate of 100 mg/day, an exposure frequency of 250 days/year, an exposure duration of 40 years, a skin surface area of 800 cm^2, an exposure time of 8 hours/day, and an inhalation rate of 2.5 m^3/day.

Scenario 2 addresses soil-related exposures that could occur if the Saunders property were to be converted to residential use at some time in the future. In this scenario, the same three exposure pathways (ingestion and dermal adsorption of contaminants in soil and inhalation of soil contaminants) have been evaluated for adult males and females, teenagers, adolescents, and young children. Key variables in the future residential scenario are a soil ingestion rate of 200 mg/day for children aged 1 to 6 and 100 mg/day for all older receptor groups, an exposure frequency of 365 days/year, an exposure duration of 30 years, a skin surface area of 1,600 cm^2 for adults and teenagers and 2,000 cm^2 for children, an outdoor exposure time of 16 hours/day, and an inhalation rate of 1.2 m^3/hour.

Scenario 3 addresses potential exposures to PCP that could occur as a result of future residential use of ground water from the Site. The exposure pathways evaluated are ingestion of ground water, dermal contact during showering, and inhalation of volatilized PCP during showering. For simplicity, only adult male receptors were evaluated in this scenario. Key variables in the residential ground water usage scenario are a water ingestion rate of 2.0 liters/day, an exposure frequency of 365 days/year, an exposure duration of 30 years, an exposure time while showering of 0.2 hours, and an inhalation rate of 0.6 m^3/hour.

Exposure Point Concentrations

Data gathered during the RI are adequate to predict potential exposure concentrations if the Site has reached steady-state conditions (i.e., when the rate of transport of contaminants is stable and in equilibrium with the environment). In the absence of an established trend in historical data indicating the contrary, the Site was considered to have reached steady-state conditions.

The upper 95% confidence limits on the arithmetic averages of surface soil concentrations were used to estimate worker exposures under the current worker exposure scenario. Since soil would be excavated prior to residential construction, upper 95% confidence limits for all surface soil, wastewater pond sediment, and soil boring samples were used to estimate exposures in the future site-use residential scenario. Table 1 presents the soil concentrations used in exposure estimation for these two scenarios.

The only ground water aquifer used as a drinking water source in the vicinity of the Site is the Yorktown aquifer. However, there appears to be hydraulic communication between the upper Columbia water-bearing zone and the Yorktown aquifer, probably by way of open boreholes through the intervening clay layer. Also, it appears that a breech in the clay confining unit exists in the vicinity of the intermittent stream, downstream of the Site. Thus, the more contaminated water in the Columbia aquifer could migrate down into the Yorktown aquifer and increase the contaminant concentration there.

Therefore, two exposure estimates were made for the residential use scenario, one for ground water from the Yorktown aquifer and one for ground water from the Columbia aquifer. Since there were only two usable data values for the Yorktown aquifer, the maximum concentration was used as the PCP exposure concentration. For the Columbia aquifer, the upper 95% confidence limit was used for the

Table 1

CONCENTRATIONS OF CONTAMINANTS USED IN ESTIMATING EXPOSURE TO SITE SOIL

Contaminant	Soil: Current Site Use (mg/kg)*	Soil: Future Site Use (mg/kg)**
Arsenic	106	16
Chromium (III)	119	25
Chromium (VI)	0.46	0.32
Copper	87	18
Pentachlorophenol	1.6	62.6
2,3,7,8-TCDD Equivalents	0.0019	0.00241

Key:

*Upper 95% confidence limit on mean concentration in surface soils collected on the Saunders property only.

**Upper 95% confidence limit on mean concentration in all surface soil and soil boring samples.

PCP exposure concentration because there were six data values. Table 2 presents the concentrations of PCP in ground water used in exposure estimation for this scenario.

Toxicity Assessment

The purpose of the toxicity assessment is to compile toxicity and carcinogenicity data for the chemicals of concern and to provide an estimate of the relationship between the extent of exposure to a contaminant and the likelihood and/or severity of adverse effects. The toxicity assessment was performed in two steps - hazard identification and dose-response relationship. Hazard identification is a qualitative description of the potential toxic properties of the chemicals of concern present at the Site. The dose-response evaluation is a process that results in a quantitative estimate or index of toxicity for each contaminant at the Site. For carcinogens, the index is the cancer potency factor and for non-carcinogens, it is the reference dose.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Risk Characterization

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1E-6). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one

Table 2

CONCENTRATIONS OF PCP
USED IN ESTIMATING EXPOSURE
TO SITE GROUNDWATER

Sample Number	PCP (μg/L)
Lower Aquifer	
MW-8-D	160
MW-8-II	11
Maximum Concentration	160
Upper Aquifer	
MW-4-II	19,000
MW-4-S	15,000
MW-7-II	25
MW-7-S	10
MW-15-II	240
MW-16-II	4,100
Upper 95% Confidence Limit	12,074

in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

In the absence of a remedial action, the total excess lifetime cancer risks determined for all exposure pathways based on the RME under the soil exposure scenarios are 3.6×10^{-4} for the current worker and 9.9×10^{-4} for the future residential exposures. In other words, without remedial action, approximately four additional people per ten thousand have an increased chance of developing cancer as a result of working at the Site and approximately one person per one thousand would have an increased risk of developing cancer as a result of living on the property.

Potential concern for non-carcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). The Hazard Index (HI) is calculated by adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed. The HI provides a reference point to gauge the potential significance of multiple contaminant exposures within a single medium or across media.

To determine the human health effects from the non-carcinogenic contaminants, EPA uses the HI. Any media with a cumulative HI equal to or greater than 1.0 is considered to pose a risk to human health. With an HI of 12, PCP would pose a human health risk through the ingestion of ground water from the Columbia aquifer. PCP concentrations in the Yorktown aquifer would not pose a risk to human health because the HI is less than 1. This evaluation is intended to provide a reference point for evaluating future ground water risks; however, it does not represent actual exposures. Although the Columbia and Yorktown aquifers have the characteristics of Class II aquifers, domestic use of the aquifers is not likely to occur since a public water source is already available.

Beside the above exposures, EPA must protect Godwin's Millpond, also known as Crump's Millpond, which is a present day drinking water source for the city of Suffolk. Although contamination has not reached the Millpond, EPA has determined that PCP contamination in the Columbia aquifer may reach the Millpond through a clay outcrop in the intermittent stream west of the Site. Also, PCP contamination in the Yorktown aquifer may reach the Millpond through discharge of the Yorktown aquifer to the Millpond.

Site media which exceed the EPA acceptable risk range of 10^{-4} to 10^{-6} or have an HI equal to or greater than 1.0 are listed on Table 3.

Significant Sources of Uncertainty

Discussion of general limitations inherent in the risk assessment process as well as the uncertainty related to some of the major assumptions made in this assessment are included below:

Table 3

SAUNDERS HUMAN HEALTH RISK ASSESSMENT
SUMMARY OF ESTIMATED EXCESS LIFETIME CANCER
RISKS UNDER CURRENT AND FUTURE LAND USE CONDITIONS

Exposure Scenario	Receptor	Exposure Route	Cancer Risk	% of Total Cancer Risk	Chemicals Primarily Responsible for Cancer Risks in Order of Importance
Current On-Site Workers					
Outdoor Soil Exposures	Adult	Soil Ingestion	2.6×10^{-4}	74%	TCDD, Arsenic
	Adult	Soil Dermal Absorption	3.1×10^{-5}	8%	TCDD, Arsenic
	Adult	Soil Particulate Inhalation	6.3×10^{-5}	18%	Arsenic, TCDD
		Total	3.6×10^{-4}	100%	
Future On-Site Residential					
Outdoor Soil Exposures	Composite Lifetime	Soil Ingestion	7.7×10^{-4}	78%	TCDD, Arsenic, Pentachlorophenol
		Soil Dermal Absorption	1.8×10^{-4}	18%	TCDD, Pentachlorophenol, Arsenic
		Soil Particulate Inhalation	3.6×10^{-5}	4%	Arsenic, TCDD, Chromium (VI)
		Total	9.9×10^{-4}	100%	

Table 3 (Cont.)

Exposure Scenario	Receptor	Exposure Route	Cancer Risk	% of Total Cancer Risk	Chemicals Primarily Responsible for Cancer Risks in Order of Importance
	Child	Soil Ingestion	3.5×10^{-4}	84%	TCDD, Arsenic, Pentachlorophenol
		Soil Dermal Absorption	5.4×10^{-5}	13%	TCDD, Pentachlorophenol, Arsenic
		Soil Particulate Inhalation	1.0×10^{-5}	3%	Arsenic, TCDD, Chromium (VI)
		Total	4.0×10^{-4}	100%	
Future On-Site Residential					
Groundwater Use Lower Aquifer	Adult	Water Ingestion	2.4×10^{-4}	97	Pentachlorophenol
		Water Dermal Absorption	9.2×10^{-7}	--	Pentachlorophenol
		Airborne Chemical Inhalation	7.0×10^{-6}	3	Pentachlorophenol
		Total	2.4×10^{-4}	100%	
Groundwater Use Upper Aquifer	Adult	Water Ingestion	1.8×10^{-2}	97	Pentachlorophenol
		Water Dermal Absorption	6.9×10^{-5}	--	Pentachlorophenol
		Airborne Chemical Inhalation	5.3×10^{-4}	3	Pentachlorophenol
		Total	1.8×10^{-2}	100%	

1. The use of the upper 95% confidence limit to estimate the soil and Columbia aquifer ground water concentrations and the use of the highest observed values to estimate the Yorktown aquifer concentrations for the RME estimates. Although only two wells in the Yorktown aquifer had detectable levels of PCP, it should be noted that EPA did not place any monitoring wells in the Yorktown aquifer beneath the area of the highest PCP contamination in the Columbia aquifer because of the possibility of PCP escaping to the lower aquifer. Therefore, the actual values of PCP in the Yorktown aquifer underlying the wood treating area are unknown.

2. The assumption that the contaminants at the Site have reached steady-state conditions.

3. The likelihood of the Saunders property being converted to residential use. Although the property has been an industrial site for about 25 years, it is presently bounded on three sides by residential areas. Therefore, development of the Site in the future for residential use is quite possible.

Environmental Risks

An ecological assessment was performed to determine if contaminants related to the Saunders wood treating facility are present in nearby surface waters and sediments in available concentrations sufficient to cause adverse ecological impacts. As with the human health assessment, the contaminants of concern for the ecological assessment are arsenic, total chromium, hexavalent chromium, copper, dioxin, and PCP.

For the purposes of the ecological assessment, a subset of environmental receptors were chosen to serve as biotic focal elements for analysis. Environmental receptors are populations and communities of organisms potentially exposed to contamination. Criteria for selection of particular species or groups of species as focal elements are as follows:

- Intrinsic importance for economic or recreational reasons, or for regulatory reasons (e.g., endangered species), or the potential for serving as vectors for human exposure;

- Ability to provide an early warning signal of potential effects, or particular and reliable sensitivity to chemical stress;

- Indicative of alterations in ecosystem processes such as energy flow or nutrient cycling or known to play a critical ecological role in the food chain; and

- Being representative of or known to occur in habitats potentially affected by contamination.

The Virginia Department of Conservation and Recreation's Division of Natural Heritage database does not contain any records of natural heritage resources, such as rare species or exemplary natural communities, in the study area. In addition, the Virginia Department of Game and Inland Fisheries reported no wilderness areas, natural areas, or scenic rivers in the immediate area of Chuckatuck, Virginia. However, because of the proximity of the Site to the Great Dismal Swamp, EPA has determined that a biological assessment must be completed and submitted for review to determine if the Dismal Swamp Southeastern Shrew or the shrew's habitat is present at the Site, in accordance with the Virginia Endangered Species Act.

The primary contaminant exposure routes to the environment are through the aquatic ecosystem. Therefore the ecological assessment detailed the exposure of aquatic species to contaminants derived from the Saunders property.

The quotient method is a standard approach for screening sample locations for potentially toxic concentrations of chemicals. On the basis of the quotient method, the levels of arsenic, total chromium, and hexavalent chromium do not appear to pose a significant risk to aquatic life in Godwin's Millpond or adjacent streams. However, it is not possible to make a determination of the risk, if any, from levels of copper and PCP in surface water.

The following were observed during the RI sampling:

- The presence of oily film and odor in sediments;
- The presence of a single tumor on one of the fish collected from Godwin's Millpond;
- The spatial pattern of chemical contamination of sediments;
- Chronic toxicity of sediments on some invertebrates as indicated in bioassays; and
- The low incidence of invertebrates collected from Godwin's Millpond.

However, the contamination from the Site does not appear to be the cause of these observed effects. The oily film and odor were noted along the intermittent stream upstream and downstream of the Site and at all sample locations on Godwin's Millpond. The presence of a tumor on a bass collected from Godwin's Millpond is a possible indication of chemical contamination. However, a definitive link of the gross pathology of the fish tumor to the contaminants of concern related to the Site cannot be made because a reasonably healthy fish population was noted in the field survey and concentrations of contaminants of concern were not found at toxic levels in the surface water of aquatic habitats. Sediment toxicity bioassays have shown chronic reproductive toxicity for Daphnia magna at all sample locations, including the reference location, which is outside the influence of the contaminants from the Site.

In summary, the ecological assessment has found evidence indicating the potential for adverse ecological impacts in sediments of Godwin's Millpond and adjacent intermittent stream aquatic habitats. The spatial extent of this contamination, however, indicates a source or sources other than Saunders and the spatial distribution of contaminants of concern in surface waters or sediments does not provide any evidence that contaminants related to the Site are the causal agent of adverse ecological impacts. Agricultural and waste disposal activities in the area may contribute to the contamination, but it is not possible to identify any source in particular from the available data.

G. Description of Alternatives

In accordance with Section 300.430 of the National Oil and Hazardous Substances Contingency Plan (NCP), 40 C.F.R. Section 300.430(e)(9), remedial response actions were identified and screened for effectiveness, implementability, and cost during the FS to meet remedial action objectives at the Site. The technologies that passed the screening were assembled to form remedial alternatives. The alternatives were then evaluated using the nine criteria required by 40 C.F.R. Section 300.430(e)(9). The FS evaluated a variety of technologies used in the development of alternatives for addressing the soils on the Saunders property and the adjoining property, the ground water in both the Columbia aquifer and the Yorktown aquifer, the sediments in the area of the former earthen separation pond and the wastewater pond, the sediments in the storm sewer along Godwin Boulevard, and the concrete pad in the wood treating area. The technologies and the approaches contained in the alternatives listed below have been determined to be the most applicable for this Site. The descriptions of the alternatives reflect the descriptions in the FS. The capital costs, the Operation and Maintenance (O&M) costs, present worth costs, and months to implement for each of the alternatives listed below are estimates based on present information.

Common Elements

Except for Alternative 1 ("No Action"), each remedial alternative for the Site includes the following elements:

Limited Action. The preexisting wells that are screened across the confining clay layer will be removed and plugged to prevent further migration of PCP from the Columbia aquifer to the Yorktown aquifer.

Institutional Controls. Institutional controls, including deed restrictions and restrictions on offsite ground water extraction, will be implemented. The deed restrictions will prevent exposure to contaminated ground water by prohibiting utilization of both the Columbia aquifer and the Yorktown aquifer as sources of ground water. The restrictions on the extraction of offsite ground water will prevent the further migration of the PCP plume.

Ground Water Monitoring. Ground water monitoring will be used to evaluate the protectiveness of the remedial action because waste will be left in place. EPA will determine the appropriate number and location of the monitoring wells during the design phase. The monitoring will include, but not be limited to, the requirements of Section 10.5.H of the Virginia Hazardous Waste Management Regulations (VHWMR), VR 672-10-1. The ground water monitoring will be performed for at least thirty years, in accordance with the VHWMR. The monitoring will test for PCP, arsenic and chromium since these were the only contaminants detected in the ground water during the RI sampling.

<u>Alternative 1</u> - No Action

Capital Cost:	$ 19,000
Annual O&M Cost:	$ 37,000
Present Worth:	$320,000
Months to Implement:	N/A

Section 300.430 of the NCP, 40 C.F.R. Part 300.430, requires that a "no action" alternative be evaluated at every NPL site in order to establish a baseline for comparison. Under this alternative, EPA would take no further action at the Site to prevent exposure to the contaminated media or to reduce risk at the Site.

<u>Alternative 2</u> - Capping With Ground Water Treatment

Capital Cost:	$1,606,000
Annual O&M Cost:	$ 201,600
Present Worth:	$3,459,000
Months to Implement:	12

Alternative 2 consists of capping of the soils and sediments, extraction and treatment of ground water from the Columbia aquifer, surface sealing of the concrete pads, and cleaning and sliplining of the storm sewers.

Because the capping would take place without any prior treatment, the Land Disposal Restrictions (LDRs) would not apply to Alternative 2. The cap would consist of approximately a 6 inch thick base course and approximately a 2- to 4-inch thick asphalt pavement covering an area of approximately 6.25 acres. The cap would require subgrade preparation to properly drain the water under the asphalt pavement and to provide a stable foundation. The cap would be sloped up to the structural foundations, compacted, and sealed with an asphalt sealer. Grading of the Site and the surrounding areas may be required to minimize lateral seepage by diverting surface runoff downgradient of the Site. A storm water management plan would be required as would a long-term maintenance plan. Maintenance, in the form of repairing cracks and recoating the surface, would be required over the life of the cap (approximately 30 years). At the end of the 30 years, the cap may have to be replaced. Since the soils would remain relatively undisturbed (grading would result in minimal soil disturbance), there would be very little physical effects on the environment.

The asphalt cap would not eliminate water seepage through the soil. As such, ground water from the Columbia aquifer, which has the characteristics of a Class II aquifer, would have to be collected and treated. Because of the limited flow in the Columbia aquifer and the fact that PCP desorbs slowly, collection of ground water would be accomplished with subsurface drainage trenches. The drainage system would consist of a main collection or interception trench along the downgradient (northern) edge of the Site with three lateral trenches extending from the main trench into the area of the wood treating operations. Two sumps would be installed in the main collection trench to remove contaminated ground water from the trench. The ground water would then be treated using granulated activated carbon and discharged to Chuckatuck Creek at a point downstream of the Millpond in accordance with the substantive requirements of a Virginia Pollution Discharge Elimination System (VPDES) permit.

The cleanup level for PCP in both the Columbia and Yorktown aquifers is 1 $\mu g/L$ at the boundary of the plume. The spent carbon from the ground water treatment system would require regeneration at an offsite facility.

The existing concrete pads in the area of the wood treating area would be sealed or coated with an impermeable material such as epoxy or polyurethane sealants. Additionally, the concrete pad joints would be fitted with chemically resistant water stops to ensure an impermeable surface.

The existing 8 inch concrete storm sewers would be sliplined with a flexible high-density polyethylene pipe of a slightly smaller diameter. Before installing the liner pipe, the existing storm sewer would have to be inspected with a closed circuit television to identify any obstructions and thoroughly cleaned. After the liner pipe is pulled into place, the service connections would have to be reconnected to the new liner pipe. The annulus between the old and new pipeline may be filled with grout.

Alternative 3A - Dechlorination with Offsite Disposal

Capital Cost:	$25,824,000
Annual O&M Cost:	$ 14,000
Present Worth:	$25,934,000
Months to Implement:	36

Alternative 3A consists of onsite chemical dechlorination treatment of approximately 25,000 tons of soils and sediments with offsite disposal of all of the treated soils and sediments in a RCRA Subtitle C permitted facility, backfilling of the area with clean soil, scarification and solidification treatment, if necessary, and offsite disposal of the treated material as directed by the Virginia Department of Waste Management (VDWM) and offsite disposal of the remainder of the concrete pads in a solid waste landfill, and cleaning and sliplining of the storm sewers.

The contaminated soils and sediments would be excavated and treated onsite with the alkaline metal hydroxide/polyethylene glycol (APEG) chemical dechlorination process within an enclosed batch reactor. Vapors generated during treatment within the reactor would be collected, condensed, and recycled through a washing process. Any vapors that are not collected or condensed would require treatment using activated carbon filters to prevent volatile organic emissions. Such volatiles would not include PCP and/or dioxins. The treated soil slurry would go from the reactor to a separator where the soil and the reagent are separated. Excess reagent would be decanted and/or removed through centrifugation and collected for reuse. Any residual agent remaining in the soil would be removed by aqueous washings with subsequent decanting or centrifugation. The washwater would be recycled, since the process is a net consumer of water.

After the treatment of all of the contaminated soils to meet the soil cleanup level of 1.46 ppm of PCP, the reagent, which has been continually recycled, would require disposal. Generally, this liquid, which is mostly organic, is incinerated offsite. Approximately 12,000 to 20,000 pounds of reagent would have to be disposed. The spent carbon would be regenerated at an offsite facility. Treated soil would be stockpiled or staged in accordance with VHWMR Part 10 and sampled to determine the level of treatment achieved.

LDRs would not apply to the soils because treatment standards have not been established for these listed wastes. However, the LDRs would apply to the K001 wastes, pursuant to 40 C.F.R. Section 268.33. Treatability tests would have to be done during the design phase to determine proper operating parameters.

Currently, the concentration of PCP in the Columbia ground water is at high levels near the source area and declines to nondetectable levels within the Site boundary. Because the contaminated ground water is limited to the Site, this alternative does not contain long-term ground water treatment. Rather, treatment of the ground water will occur as the soils are dewatered during excavation, thus substantially reducing the volume of contamination. The reduction in the mass of contaminant on the Site will reduce the contaminant available to partition or leach to the ground water.

If the concrete pads are classified as a RCRA characteristic hazardous waste by the Toxicity Characteristic Leaching Procedure (TCLP), remediation of the concrete pads would include scarifying or removing approximately the top one inch of concrete from the surface of the pads, and demolition of the remainder of the concrete pads. Scarification is accomplished using a scabbler, which is a pneumatically operated tool with piston heads. The pistons are equipped with multipoint tungsten carbide bits for cutting and chipping the concrete. Dust control measures would include pre-wetting the concrete, equipping the scabbler with a sprayer, and using a vacuum attachment for dust collection. The material generated from the scarification process would be solidified so that it no longer has the characteristics of a RCRA waste. Disposal of the treated material would be as directed by the VDWM. The remaining concrete would be cleaned of any residual soil and disposed in a solid waste landfill. If the concrete pads are not classified as a RCRA characteristic hazardous waste, all of the concrete could be disposed in a solid waste landfill without any prior treatment other than cleaning of the residual soil.

The existing 8 inch concrete storm sewers would be sliplined with a flexible high-density polyethylene pipe of a slightly smaller diameter. Before installing the liner pipe, the existing storm sewer would have to be inspected with a closed circuit television to identify any obstructions and thoroughly cleaned. After the liner pipe is pulled into place, the service connections would have to be reconnected to the new liner.

Alternative 3B - Dechlorination with Onsite Disposal

Capital Cost:	$13,977,000
Annual O&M Cost:	$ 15,000
Present Worth:	$14,097,000
Months to Implement:	48

Alternative 3B consists of the remedial action components identical to those of Alternative 3A except for the final disposal of the treated soil and storm sewer sediments. In Alternative 3B, after the soil and storm sewer sediments are treated with the chemical dechlorination process, they would be disposed onsite. In accordance with Section 2.4.c.5 of the Virginia Solid Waste Management Regulations (VSWMR), VR 672-20-10, backfilling of the treated soil can only take place if the soil is treated to background levels. If the soils cannot be treated to background levels, disposal must be in either a RCRA Subtitle C landfill or a solid waste landfill, depending on the operating guidance in effect at the time of the disposal and in accordance with Part 8 of the VSWMR. The remainder of the remedial action includes dechlorination treatment of the sediments from the wastewater pond and the former earthen separation pond with disposal in a RCRA Subtitle C facility, scarification and solidification treatment of the concrete pads (if determined to be a RCRA characteristic waste), and disposal as directed by the VDWM, cleaning and demolition of the remainder of the concrete pads and disposal offsite in a solid waste landfill, and cleaning and sliplining the storm sewers.

Alternative 4A - Low Temperature Thermal Desorption with Offsite Disposal

Capital Cost:	$20,375,000
Annual O&M Cost:	$ 15,000
Present Worth:	$20,485,000
Months to Implement:	36

Alternative 4A consists of onsite low temperature thermal desorption of the contaminated soils and storm sewer sediments to meet the soil cleanup level of 1.46 ppm of PCP, dechlorination of the sediments from the wastewater pond and the former earthen separation pond, offsite disposal of all of the treated soils and sediments in a RCRA Subtitle C facility, backfilling of the area with clean soil, scarification and solidification treatment of the concrete pads (if determined to be a RCRA characteristic waste) with disposal as directed by the VDWM, cleaning and demolition of the remainder of the concrete pads with disposal offsite in a solid waste landfill, and cleaning and sliplining of the storm sewers.

The low temperature thermal desorption unit would be a fully mobile system. The contaminated soils and sediments would be fed into a thermal processor or materials dryer where they would be heated to 400^{0} F to 800^{0} F and mixed and agitated, allowing moisture and volatiles such as PCP to escape from the soil. The processor or dryer gases, containing volatile organic compounds and dust, would be vented into a cyclone or baghouse system to remove the entrained particulate material. The airstream would then be directed into a condenser to condense the volatile organic compounds for subsequent treatment using either a carbon adsorption unit or an afterburner. The spent carbon would be regenerated at an offsite facility at which the organic contaminants would be destroyed by incineration. Treatability tests would have to be done during the design phase to determine proper operating parameters. LDRs would not apply to the soils and storm sewer sediments since these are not restricted wastes under RCRA.

The remainder of the remedial action would be identical to that under Alternative 3A, including treating the sediments from the wastewater pond and the former separation pond with the dechlorination process and disposing of these in a RCRA Subtitle C facility, scarification and treatment, if necessary, of the concrete pads and disposal offsite in a solid waste landfill, and cleaning and sliplining the storm sewers.

<u>Alternative 4B</u> - Low Temperature Thermal Desorption with Onsite Disposal

Capital Cost:	$8,528,000
Annual O&M Cost:	$ 15,000
Present Worth:	$8,648,000
Months to Implement:	48

Alternative 4B consists of the remedial action components identical to those of Alternative 4A except for the final disposal of the treated soil and storm sewer sediments. In Alternative 4B, after the soil and storm sewer sediments are treated with the low temperature thermal desorption process, they would be disposed onsite. The remainder of the remedial action would be identical to that under Alternative 3A, including dechlorination treatment of the sediments from the wastewater pond and the former separation pond with disposal in a RCRA Subtitle C facility, scarification and solidification treatment of the concrete pads (if determined to be a RCRA characteristic waste) and disposal as directed by the VDWM, cleaning and demolition of the remainder of the concrete pads and disposal offsite in a solid waste landfill, and cleaning and sliplining the storm sewers. In accordance with Section 2.4.c.5 of the VSWMR, VR 672-20-10, backfilling of the treated soil can only take place if the soil is treated to background levels. If the soils cannot be treated to background levels, disposal must be in either a RCRA Subtitle C landfill or a solid waste landfill, depending on the operating guidance in effect at the time of the disposal and in accordance with Part 8 of the VSWMR.

Alternative 5 - In-Situ Vitrification

Capital Cost:	$15,834,000
Annual O&M Cost:	$ 14,000
Present Worth:	$15,945,000
Months to Implement:	24

Alternative 5 consists of in-situ vitrification of all of the contaminated soils and sediments, scarification and solidification treatment of the concrete pads (if determined to be a RCRA characteristic waste), and disposal as directed by the VDWM, cleaning and demolition of the remainder of the concrete pads and disposal offsite in a solid waste landfill, and cleaning and sliplining the storm sewers.

The in-situ vitrification treatment process uses high voltage electricity to melt the soils at the Site to form an inert glass product. The shallow contaminated soils would have to be consolidated in the area of deep contamination because this process is not recommended for depths of less than 7 feet. Additionally, a one to two foot layer of clean fill would have to be placed over the area to be treated to minimize volatilization of the contaminants at the surface during the treatment process. Once the desired melt had been achieved, the electricity would be turned off and clean fill would be used to fill the subsidence in volume resulting from the loss of soil void volume (approximately 20% to 40%). The molten mass would cool in place, resulting in a chemically inert, stable glass residual product. Treatability tests would have to be done during the design phase to determine proper operating parameters. Because the soils and sediments would be consolidated in the same area of contamination and the treatment would be done in-situ, placement would not occur. Therefore, the LDRs under RCRA are not an ARAR.

H. Summary of Comparative Analysis of Alternatives

All of the seven remedial action alternatives described above were assessed in accordance with the nine evaluation criteria as set forth in the NCP at 40 C.F.R. Section 300.430(e)(9). These nine criteria are categorized below into three groups: threshold criteria, primary balancing criteria, and modifying criteria.

THRESHOLD CRITERIA

1. Overall protection of human health and the environment; and
2. Compliance with applicable or relevant and appropriate requirements (ARARs).

PRIMARY BALANCING CRITERIA

3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, or volume through treatment;
5. Short-term effectiveness;
6. Implementability; and
7. Cost.

MODIFYING CRITERIA

8. State acceptance; and
9. Community acceptance.

These evaluation criteria relate directly to requirements in Section 121 of CERCLA, 42 U.S.C. Section 9621, which determine the overall feasibility and acceptability of the remedy.

Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. State and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan. A summary of the relative performance of the alternatives with respect to each of the nine criteria follows. This summary provides the basis for determining which alternative provides the "best balance" of tradeoffs with respect to the nine evaluation criteria.

1. Overall Protection of Human Health and the Environment

A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. A remedy is protective if it reduces current and potential risks to acceptable levels within the established risk range posed by each exposure pathway at the Site.

Alternatives 3A, 3B, 4A, 4B, and 5 are all equally protective of human health and the environment. These alternatives achieve this protection by eliminating the contamination onsite through treatment of the soils, sediments, and existing ground water. Alternative 2 provides adequate protection of human health and the environment by controlling the risks posed by the exposure pathways through capping the soils and sediments and by treating the ground water. Additionally, in Alternatives 2 through 5, long-term ground water monitoring and institutional controls are coupled to ensure that the alternatives remain protective by monitoring ground water contaminant concentrations at the boundary of the plume, implementing deed restrictions to prevent utilization of either the

Columbia aquifer or the Yorktown aquifer as a source of ground water, and restricting the extraction of offsite ground water to prevent further migration of the PCP. If ground water sampling results were to indicate concentrations of PCP greater than 1 μg/l at the boundary of the plume, verification sampling would be conducted, and perhaps active ground water restoration may be implemented.

Alternative 1 accomplishes none of the above. Because contaminant levels already exceed health-based levels, Alternative 1 would not be protective of human health or the environment. Since protection of human health and the environment is a threshold criteria for any Superfund action, this alternative cannot be selected and thus will not be evaluated any further with regard to the nine criteria.

2. Compliance with ARARs

This criterion addresses whether a remedy will meet all of the Applicable or Relevant and Appropriate Requirements (ARARs) of other environmental statutes and/or provide grounds for invoking a waiver under the NCP at 40 C.F.R. 300.430(f)(1)(ii)(C).

Alternatives 3A, 4A, and 5 would meet all of the respective ARARs of Federal and Virginia law (see Table 4). The treated soil and storm sewer sediments in Alternatives 3A and 4A must meet the treatment standards of C.F.R. Part 268 prior to land disposal in a RCRA permitted facility. The level of treatment will determine whether disposal must be in a Subtitle C facility or in a solid waste facility, as determined by the VDWM. Although published data indicate that the treatment processes for dioxin will meet the VSWMR requirements, treatability studies will be performed during the design phase to determine the residual contaminant levels for the Site-specific soils and sediments. The treatment of the ground water from the dewatering of the excavated soils and the condensation from the low temperature thermal desorption process (if using carbon adsorption) would be treated to meet the substantive requirements of a VPDES permit to be established by the Virginia State Water Control Board.

Because the treatment process for Alternative 5 is in-situ and does not require any disposal of soil or sediments but only consolidation within the same area of contamination, the VSWMR requirements indicated above are not an ARAR. However, treatability tests will also have to be performed for Alternative 5 during the design phase to determine that the in-situ vitrification treatment process will successfully destroy the organic contaminants and bind the inorganic contaminants to meet the TCLP requirements.

Alternatives 3B and 4B would require treatment to background conditions in accordance with the VHWMR and the VSWMR to allow backfilling of the treated soil and storm sewer sediments onsite.

For Alternatives 3A, 3B, 4A, 4B, and 5, the concrete pads must be tested by the TCLP to determine if the pads are a characteristic

TABLE 4

ARARs

ACTION-SPECIFIC

Standards, Requirements, Criteria, or Limitations	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Resource Conservation and Recovery Act (RCRA) Regulations	40 C.F.R. Section 268 (Subpart D)	Land Disposal Restrictions for offsite disposal of scarified waste from concrete pads, if RCRA Characteristic waste.	yes/no	Alternatives 2-5.
RCRA Regulations	40 C.F.R. Section 268 (Subpart D)	Land Disposal Restrictions for onsite consolidation of contaminated soil.	no/yes	Alternative 5. Soil must be consolidated if depth is less than 7 feet.
Clean Water Act (CWA) Regulations	40 C.F.R. Section 122.44(a)	Discharge of ground water treatment system effluent to Chuckatuck Creek.	yes/no	Alternatives 2, 3A, 3B, 4A, and 4B. Best available technology economically achievable and best conventional pollution control technology required to control toxic and nonconventional pollutants and conventional pollutants, respectively.

TABLE 4

ARARs

ACTION-SPECIFIC

CWA Regulations	40 C.F.R. Sections 125.100, 125.104, 122.41(i), 136.1-136.4	Best Management Practices for discharge of ground water treatment system effluent to Chuckatuck Creek.	yes/no	Alternatives 2, 3, 3A, 4A, and 4B. Best Management Practice Program to prevent the release of toxic constitutents to surface waters.
CWA Regulations	40 C.F.R. Section 122.44	Ambient Water Quality Standards for discharge of ground water treatment system effluent to Chuckatuck Creek.	yes/no	Alternatives 2, 3A, 3B, 4A, and 4B.
Virginia Water Quality Standards	Virginia Regulation 680-21-03.2	State Water Quality Criteria for surface water serve as a source for the establishment of discharge limits of ground water treatment system to Chuckatuck Creek.	yes/no	Alternatives 2, 3A, 3B, 4A, and 4B.
Virginia Permit Regulation VR 680-14-01	Permit Regulation Section 2.5	Virginia State Water Control Board establishes effluent limitations on a case-by-case basis.	yes/no	Alternatives 2, 3A, 3B, 4A, and 4B.

TABLE 4

ARARs

ACTION-SPECIFIC

Virginia Toxics Management Regulation VR 680-14-03	Toxics Management Regulation Section 2	Requirements for effluent discharge and receiving stream monitoring.	yes/no	Alternatives 2, 3A, 3B, 4A, and 4B.
Virginia Erosion and Sediment Control Law	Virginia Code Sections 10.1-560 et seq.	Methods to control erosion and sedimentation.	yes/no	Alternatives 1, 2, 3A, 3B, 4A, 4B, and 5.
Virginia Hazardous Waste Management Regulations (VHWMR) VR 672-10-1	VHWMR Part 3	Hazardous Waste determination requirements.	yes/no	Alternatives 2-5. Concrete pads will undergo TCLP to determine if RCRA characteristic waste.
VHWMR	VHWMR Section 10.5.H	Ground water monitoring requirements.	no/yes	Alternatives 1, 2, 3A, 3B, 4A, 4B, and 5.
VHWMR	VHWMR Part 10	Onsite stockpiling or staging of treated soil.	yes/no	Alternatives 3A, 3B, 4A, and 4B.
VHWMR	VHWMR Parts 3 and 10	Treatment, storage, and disposal of spent carbon from the ground water treatment system.	yes/no	Alternatives 2, 3A, 3B, 4A, and 4B.

TABLE 4

ARARs

ACTION-SPECIFIC

VHWMR	VHWMR Part 7	Transportation of the treated soil and sediments and the spent carbon to an offsite facility.	yes/no	Alternatives 3A and 4A for the treated soil and all sediments and the spent carbon. Alternatives 3B and 4B for the treated K001 sediments and spent carbon.
VHWMR	VHWMR Part 3	Treated soil and sediments must meet standards in order to no longer be managed as a hazardous waste.	yes/no	Alternatives 3A and 4A for the treated soil and storm sewer sediments.
Virginia Solid Waste Management Regulations (VSWMR) VR 672-20-10	VSWMR Part 8	Treated soil and sediments must meet requirements prior to disposal in a solid waste landfill in Virginia.	yes/no	Alternatives 3A and 4A for the treated soil and storm sewer sediments.

TABLE 4

ARARs

CHEMICAL-SPECIFIC

Standards, Requirements, Criteria, or Limitations	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Safe Drinking Water Act (SDWA) Regulations	40 C.F.R. Section 141.11	Maximum Contaminant Level for discharge of ground water treatment system to Chuckatuck Creek.	yes/no	Alternatives 2, 3A, 3B, 4A and 4B.
Virginia Water Quality Standards	Virginia Regulations 680-21-03.2	Site specific limits for discharge of treatment system effluent to Chuckatuck Creek.	yes/no	Alternatives 2, 3A, 3B, 4A and 4B.

TABLE 4

ARARs

LOCATION-SPECIFIC

Standards, Requirements, Criteria, or Limitations	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
National Historic Preservation Act	16 U.S.C. Section 470 *et seq*.	Phase 1 archaelogical field survey to locate all archaelogical resources that may be impacted.	yes/no	Alternatives 1, 2, 3A, 3B, 4A, 4B and 5.
Virginia Endangered Species Act	Virginia Code Section 29.1-563 *et seq*.	Conduct biological Assessment to determine if the Dismal Swamp Southeastern Shrew or its habitat is present on the Site.	yes/no	Alternatives 1, 2, 3A, 3B, 4A, 4B and 5.

waste and if scarification and treatment are required. If the pads are determined to be a RCRA hazardous characteristic waste, they must be scarified to remove the top one inch and the removed material solidified. If the solidified material passes TCLP, the waste will be considered a special waste under VSWMR Part 8 and disposal will then be as directed by the VDWM. The remaining concrete debris would then be cleaned of any residual soil and disposed offsite in a solid waste landfill.

Since Alternative 2 includes capping the soils, the only VHWMR requirement that would be an ARAR is Section 10.5.H. The discharge of treated ground water would have to comply with the substantive requirements of a VPDES permit to be established by the Virginia State Water Control Board in accordance with VR 680-14-01.

Alternatives 2 through 5 must comply with the requirements of the National Historic Preservation Act, 16 U.S.C. Section 470 et seq., which has been determined to be an ARAR for this Site. Duė to the archaeological potential of the Site, as well as the project impacts, a Phase 1 archaeological field survey would be necessary during the design phase. The purpose of the survey is to locate all archaeological resources which may be impacted by the remedial action.

Alternatives 2 through 5 must also comply with the requirements of the Endangered Species Act because of the possible existence of the Dismal Swamp Southeastern Shrew on the Site. A biological assessment would be required to determine if the shrew or the shrew's habitat is present on or in close proximity to the Site. If so, appropriate mitigating measures would be determined and required such that the shrew and/or its critical habitat would not be affected by the remedial activities.

3. Long-Term Effectiveness and Permanence

This evaluation criterion addresses the long-term protection of human health and the environment once remedial action cleanup goals have been achieved, and focuses on residual risks that will remain after completion of the remedial action.

Alternative 4A, the selected alternative, and Alternative 3A provide the greatest degree of long-term effectiveness and permanence because they provide for treatment and offsite disposal of all of the soil and sediments.

Alternatives 3B and 4B differ only in the final disposal of the soil and storm sewer sediments. In Alternatives 3B and 4B, the treated soil and storm sewer sediments would be disposed onsite if they can be treated to background levels. Because the sediments from the wastewater pond and the former earthen separation pond are K001 listed hazardous wastes, they must be disposed in a RCRA Subtitle C facility.

For Alternatives 3A, 3B, 4A, and 4B, further degradation of the Yorktown aquifer is curtailed by plugging the preexisting wells and by substantial removal and treatment of the contaminated ground water in the Columbia aquifer during the dewatering process required for the excavation of the soils. However, levels of PCP which do not pose a direct contact risk (i.e. greater than 1.46 ppm) would remain in the soil. These levels may result in PCP concentrations above 1 ppb partitioning into the Columbia aquifer. Therefore, monitoring of the Columbia and Yorktown aquifers would be required to assure that the remedial cleanup goal of 1 ppb is not exceeded at the boundary of the plume.

For Alternative 5, treatability testing would be required to assess the effectiveness of the in-situ vitrification. Although the in-situ vitrification has the potential to eliminate the exposure risks associated with the contaminated soils and sediments, treatability tests would be required to assess the magnitude of residual risks. The contaminated ground water in the Columbia aquifer would be removed (evaporated) during treatment. However, any PCP remaining in the untreated soils may cause PCP concentrations greater than 1 ppb partitioning into the Columbia. As such, ground water monitoring would be required to assure that the remedial cleanup goals are not exceeded.

For Alternative 2, the risks posed by soil contaminants through the potential exposure pathways would be eliminated only as long as the cap was properly maintained. Alternative 2 therefore offers the least long-term protectiveness. Because the source is only contained, long-term threats remain should the remedy fail. Ground water within the boundaries of the Site would have concentrations of PCP greater than the proposed MCL of 1 ppb. However, this would pose little risk to human health. The ground water within the Site could not be used for domestic purposes since institutional controls would be implemented as part of the remedy to restrict the use of ground water onsite and to preclude development of the Site in order to protect the integrity of the cap. The 1 ppb proposed MCL for PCP would be attained at the boundary of the plume by extraction of the contaminated ground water from the Columbia aquifer via subsurface drains, and through dispersion by natural flow conditions in the Yorktown aquifer.

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

This evaluation criterion addresses the degree to which a technology or remedial alternative reduces the toxicity, mobility, or volume of a hazardous substance. Although Section 121 (b) of CERCLA, 42 U.S.C. Section 9621(b), establishes a preference for remedial actions that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances, EPA expects to use a combination of treatment and engineering controls to achieve protection of human health and the environment, as set forth in the NCP at 40 C.F.R. Section 300.430(a)(iii). EPA's expectations are that treatment should be utilized whenever principal threats occur and that containment will be considered for wastes that pose a relatively low long-term threat or where treatment is impracticable.

Based on published data, it is anticipated that Alternatives 3A, 3B, 4A, 4B, and 5 would all reduce the toxicity of the Site contaminants by removing and/or destroying the organic contaminants. However, for all of these alternatives, the actual effectiveness of the different technologies would have to be confirmed by treatability testing performed during the design phase.

The in-situ vitrification under Alternative 5 would destroy the organic contaminants and immobilize the inorganic contaminants in the soil and sediments. The PCP in the contaminated ground water within the Columbia would be substantially removed by evaporation during the treatment process. The PCP would be captured during this process and destroyed in a separate process.

In Alternatives 4A and 4B, chemical dechlorination treatment would reduce the toxicity of the K001 sediments by permanently destroying the PCP and dioxin contaminants. The PCP contamination in the soil and storm sewer sediments would be transferred from the soil phase to the air phase using the low temperature thermal desorption process. The organic-laden air would be treated by either catalytic or thermal oxidation or carbon adsorption. Oxidation would result in immediate contaminant destruction, while carbon adsorption would lead to destruction when the carbon is regenerated. The optimum operating temperature for the removal of PCP may cause the arsenic present in the soil to volatilize. If so, the soils would first be treated with lime to convert the arsenic to a less volatile form of arsenic, thus reducing the mobility of the arsenic. During the dewatering of the soils, the PCP contamination in the ground water in the Columbia aquifer would be reduced using carbon adsorption. The PCP would then be destroyed when the carbon is regenerated. Removing and plugging the preexisting wells will reduce the mobility of the PCP remaining in the soil from reaching the Yorktown aquifer.

In Alternatives 3A and 3B, chemical dechlorination treatment would reduce the toxicity of the contaminated soil and sediments by permanently destroying the PCP and dioxin contaminants. During the dewatering of the soils, the PCP contamination in the ground water in the Columbia aquifer would be reduced using carbon adsorption. The PCP would then be destroyed when the carbon is regenerated. Removing and plugging the preexisting wells will reduce the mobility of the PCP remaining in the soil from reaching the Yorktown aquifer.

Alternative 2 would not reduce the toxicity, mobility or volume of the contaminated soils or sediments since only ground water would be treated. The PCP contamination in the ground water in the Columbia aquifer would be reduced using carbon adsorption. The PCP would then be destroyed when the carbon is regenerated. Removing and plugging the preexisting wells will reduce the mobility of the PCP remaining in the soil from reaching the Yorktown aquifer.

5. <u>Short-Term Effectiveness</u>

This evaluation criterion addresses the period of time needed to achieve protection of human health and the environment, and any adverse impacts that may be posed during the construction and implementation period of a remedy, until cleanup goals are achieved. The time for completion of the remedial actions for each of the alternatives listed below does not include the time for long-term ground water monitoring, which will be required for all of the remaining alternatives. All of the timeframes listed below are estimates.

Remedial action would be implemented in the shortest amount of time under Alternative 2, approximately one year, and would present the fewest short-term effects. During the capping and excavation of the drainage trenches there would be a temporary increase in dust production, noise disturbance, and truck traffic at the Site. However, as the alternative with the least amount of excavation, the soils would remain relatively undisturbed. Grading of the Site would result in minimal soil disturbance.

It is estimated that Alternative 5 would take approximately 2 years to implement. Excavation of soils would be more extensive than that under Alternative 2 because of the need to consolidate the shallow soils to a depth of at least 7 feet. It is estimated this would entail the excavation and handling of approximately 7,200 cubic yards of contaminated soil. In addition, the concrete pads and some building structures would require removal. The structures would have to be removed because the in-situ vitrification will cause a 20% to 40% subsidence in soil volume, resulting from the loss of soil void volume.

Alternative 4A is expected to take approximately 3 years to implement. In addition to the removal of the concrete pads, the amount of soil and sediment excavation required would be much more extensive than Alternatives 2 and 5. As such, the amounts of dust production, noise disturbance, and truck traffic would also be significantly increased. However, dust-suppression techniques could substantially control any dust that would be generated to protect the workers at the Site and the residents in the area of the Site.

Although Alternative 4B is expected to take approximately 4 years to implement, it would entail less truck traffic than Alternative 4A because there would not be the offsite disposal of the treated soil and storm sewer sediments, which make up the bulk of the material to be disposed offsite.

Alternative 3A is expected to take approximately 3 years to implement. The short-term effects associated with this alternative would be similar to those indicated for Alternative 4A: significantly increased dust production, noise disturbance, and truck traffic. As with Alternative 4A, dust-suppression techniques could substantially control any dust that would be generated to protect the workers at the Site and the residents in the area of the Site.

Alternative 3B is expected to take approximately 4 years to implement. As the case with Alternative 4B, the truck traffic would be less than that associated with Alternatives 3A and 4A because there will be less material to be disposed offsite.

6. Implementability

This evaluation criterion addresses the technical and administrative feasibility of each remedy, including the availability of materials and services needed to implement the chosen remedy.

Alternatives 2, 3A, and 4A could be easily implemented. Operation of either the chemical dechlorination system under Alternative 3A or the low temperature thermal desorption and chemical dechlorination systems under Alternative 4A would be fairly straightforward once treatability tests are completed and the systems' operating parameters are established. The handling, treatment, and disposal of the 25,000 tons of contaminated soils and sediments would require a design plan sequencing remedial activities to facilitate an efficient removal. In addition, varying volumes or concentrations of soils or sediments could be easily handled and ground water treatment could be easily implemented, if required.

The cap and ground water extraction and treatment systems under Alternative 2 are both simple to construct and operate. Although the cap could be easily extended or repaired, if needed, it would preclude direct soil treatment unless it were removed.

Alternative 5 would require special equipment and trained personnel. Although the in-situ vitrification could accommodate varying volumes of contamination, it may be difficult to implement future remedial actions if the vitrified material was not protective of human health and the environment.

Operation of Alternatives 3B and 4B would be the same as that for Alternatives 3A and 4A. However, since the treatment systems are not currently expected to reduce the contaminants to background levels as required by the onsite disposal provisions of Part 8 of the VSWMR, these two alternatives are not considered implementable.

7. Cost

Section 121 of CERCLA, 42 U.S.C. Section 9621, requires selection of a cost-effective remedy that protects human health and the environment and meets the other requirements of the statute. The alternatives are compared with respect to present worth cost, which includes all capital costs and the operation and maintenance cost incurred over the life of the project. Capital costs include those expenditures necessary to implement a remedial action, including construction costs. All of the costs indicated below are estimates.

Alternative 2 has the lowest present worth cost, $3,459,000. Of the alternatives that include treatment of the contaminated soil and sediments, Alternative 4B has the lowest present worth cost, $8,648,000. Alternatives 3B and 5 have the next lowest present worth costs at $14,097,000 and $15,945,000, respectively. Of the alternatives that include offsite disposal of the treated soil and sediments, the selected alternative, Alternative 4A, has the lowest present worth cost, $20,485,000. Alternative 3A has the highest present worth cost of all of the alternatives, $25,934,000. The present worth costs for Alternatives 3A and 4A include the cost of offsite disposal in a RCRA Subtitle C facility. If it is later determined that disposal may take place in a solid waste facility, the present worth costs for these two alternatives will be reduced accordingly. It is estimated at this time that the cost reduction would be approximately $6,250,000. A breakdown of the cost of Alternative 4A is provided in Table 5.

8. <u>State Acceptance</u>

The Commonwealth of Virginia has concurred with the remedy selected in this Record of Decision.

9. <u>Community Acceptance</u>

On June 4, 1991, a public meeting was held at the Oakland Elementary School in Suffolk, Virginia to discuss EPA's preferred alternative as described in the Proposed Plan. A public comment period for the Proposed Plan was held from May 23, 1991, through July 22, 1991. The comment period was extended as requested by the Saunders Supply Company. Comments received during the public meeting and the public comment period are discussed in the Responsiveness Summary attached to this ROD.

I. <u>Selected Remedy</u>

EPA has selected Alternative 4A to remediate the contamination at the Site. Based on the RI/FS findings and the nine criteria listed in Section H of this Decision Summary, Alternative 4A represents the best balance among the evaluation criteria.

Performance Standards

The selected remedy addresses all of the contaminated media at the Site and consists primarily of the following: excavation, dechlorination treatment, and offsite disposal of the K001 sediments; excavation, low temperature thermal desorption, and offsite disposal of the contaminated soil and storm sewer sediments; scarification and solidification treatment of the top one inch of the concrete pads (if determined to be a RCRA characteristic waste) and offsite disposal of the treated material as directed by the VDWM; cleaning and offsite disposal of the remainder of the concrete pads; cleaning and sliplining of the storm sewer; implementation of institutional controls; and ground water monitoring. By instituting

Table 5
CAPITAL COSTS ALTERNATIVE 4A

REMEDIAL ALTERNATIVE ITEM	UNITS	UNIT COST	QUANTITY	TOTAL CAP. COST
SURVEYING	LS	$3,000.00	1	$3,000
SITE PREP./CLEARING & GRUBBING	LS	$3,000.00	1	$3,000
STRUCTURE REMOVAL/REPAIR	LS	$5,000.00	1	$5,000
DECON PAD	LS	$2,500.00	1	$2,500
UTILITY HOOKUP	LS	$10,000.00	1	$10,000
SOIL				
STAGING/STORAGE AREAS	LS	$15,000.00	1	$15,000
TREATABILITY STUDY	LS	$20,000.00	1	$20,000
LOW-TEMP. THERMAL DESORPTION	TON	$175.00	25000	$4,375,000
TREATMENT EQUIPMENT PAD	LS	$750.00	1	$750
EXCAVATION				
0 - 2"	MSF	$110.00	82	$9,020
0 - 1'	MSF	$220.00	167	$36,740
0 - 2'	CY	$6.50	620	$4,030
0 - CLAY	CY	$20.00	11550	$231,000
DUST CONTROL	LS	$20,000.00	1	$20,000
TREAT WATER FROM SOIL DEWATER.	GAL	$0.30	350000	$105,000
EXCAV. VERIFICATION SAMPLING	LS	$65,000.00	1	$65,000
TREAT. VERIFICATION SAMPLING	LS	$60,000.00	1	$60,000
OFF-SITE DISPOSAL AT RCRA FACILITY	TON	$280.00	25000	$7,000,000
TRANSPORT TO RCRA FACILITY	TON	$48.50	25000	$1,212,500
BACKFILL SITE WITH CLEAN FILL				
0 - 2"	MSF	$285.00	82	$23,370
0 - 1'	MSF	$800.00	167	$133,600
0 - 2'	CY	$13.00	620	$8,060
0 - CLAY	CY	$13.00	12200	$158,600
SITE RESTORATION	LS	$3,000.00	1	$3,000
STORM SEWER SEDIMENT				
STORM SEWER CLEANING	LF	$10.00	550	$5,500
FLUSH WATER TREATMENT	GAL	$0.30	5000	$1,500
DISPOSAL OF WATER @ POTW	GAL	$0.20	5000	$1,000
TRANSPORT WATER TO POTW	GAL	$0.05	5000	$250
LOW-TEMP. THERMAL DESORPTION (INCLUDED ABOVE)				
K001 SEDIMENTS				
STAGING/STORAGE AREA	LS	$5,000.00	1	$5,000
EXCAVATION				
WASTE WATER POND	CY	$20.00	450	$9,000
EARTHEN SEPARATION POND	CY	$20.00	115	$2,300
VERIFICATION SAMPLING (INCLUDED ABOVE)				
TREATABILITY STUDY	LS	$20,000.00	1	$20,000
CHEMICAL DECHLORINATION	TON	$325.00	700	$227,500
REAGENT DISPOSAL				
LOAD TANKER TRUCK	EA	$88.00	1	$88
TRANSPORTATION	MI	$5.00	1000	$5,000
INCINERATION	LB	$1.00	20000	$20,000
OFF-SITE DISPOSAL AT RCRA FACILITY	TON	$280.00	700	$196,000
TRANSPORT TO RCRA FACILITY	TON	$48.50	700	$33,950

Table 5 (Cont.)

SURFACE WATER				
DRAIN WW POND WATER	LS	$500.00	1	$500
WW POND WATER TREATMENT	GAL	$0.30	7200	$2,160
DISPOSAL OF WATER @ POTW	GAL	$0.20	7200	$1,440
TRANSPORT WATER TO POTW	GAL	$0.05	7200	$360
BACKFILL POND AREA	CY	$13.00	1300	$16,900
CONCRETE PADS				
SCARIFICATION	SF	$2.25	16850	$37,913
CONCRETE TCLP	EA	$310.00	2	$620
SOLIDIFICATION & OFF-SITE DISPOSAL AT RCRA FACILITY	TON	$280.00	100	$28,000
TRANSPORT TO RCRA FACILITY	TON	$48.50	100	$4,850
CONCRETE PAD DEMOLITION	SF	$3.75	260	$975
DISPOSAL AT OFF-SITE SOLID WASTE FACILITY	TON	$8.00	500	$4,000
TRANSPORT TO SOLID WASTE FACILITY	TON	$7.50	500	$3,750
GROUNDWATER				
LIMITED ACTION & INSTITUTIONAL CONTROLS				$0
INSTALL NEW WELLS	LS	$14,000.00	1	$14,000
PLUG WELLS	EA	$4,500.00	6	$27,000
SUBTOTAL				$14,173,726
CONTINGENCY (25%)				$3,543,431
SUBTOTAL				$17,717,157
ENGINEERING (15%)				$2,657,574
TOTAL COST				$20,374,730

all of these components, the Site risks would be reduced to within the EPA acceptable risk range. The major components of this alternative include the following:

- To reduce the risk to human health and the environment via the exposure pathways attributed to the K001 sediments, approximately 700 tons of sediments from the wastewater pond and the former earthen separation pond will be excavated and treated by the dechlorination process. Since the sediments contain RCRA K001 listed hazardous waste, the sediments must be disposed offsite in a RCRA Subtitle C facility. The excavated areas will be filled with clean soil and contoured to promote run-off.

- To reduce the risk to human health and the environment via the exposure pathways attributed to the contaminated soil and storm sewer sediments, approximately 24,300 tons of surface and subsurface soils exceeding the soil cleanup level of 1.46 mg/kg of PCP (corresponding to a 10^{-6} risk level) and the sediments from the storm sewer along Godwin Boulevard will be excavated, treated by the low temperature thermal desorption process, and disposed offsite in accordance with the operating guidance in effect at the time of disposal.

- To reduce the risk to human health and the environment via the exposure pathways attributed to the water in the wastewater pond, the pond will be drained and the water treated prior to discharge. It will be determined during the design phase whether to treat the water onsite and discharge to Chuckatuck Creek or to treat and discharge offsite. If treating onsite, the discharge to Chuckatuck Creek will meet VPDES permit limits. If treating and discharging offsite, the treatment will meet the levels as set by the receiving facility.

- To reduce the risk to human health and the environment attributed to the concrete pads, the concrete pads will be tested to determine if they are a RCRA characteristic hazardous waste, especially for arsenic and chromium, using the TCLP. If the pads are determined to be a RCRA characteristic waste, approximately the top one inch of the pads will be scarified, solidified, and disposed offsite in a landfill as directed by Part 8 of the VSWMR. During the scarification process, the following dust control techniques will be implemented to control the possible release of contaminated material: pre-wetting the concrete, equipping the scabbler with a sprayer, and using a vacuum attachment for dust collection. The remainder of the concrete pads will be cleaned of any residual soil and disposed in a solid waste facility. If the pads are not determined to be a characteristic waste, the entire pad will be cleaned of any residual soil and disposed in a solid waste facility.

- To reduce the risk to human health and the environment attributed by the existing 8 inch concrete storm sewers, the sewers will be inspected, cleaned and sliplined. The storm sewer will first be inspected with a closed circuit television camera to identify any obstructions and then thoroughly cleaned. The material cleaned out of the sewer will be collected, treated using the low temperature thermal desorption process, and then disposed offsite. After the sewers are cleaned, they will be sliplined with a flexible high-density polyethylene pipe of a slightly smaller diameter. The service connections will then be reconnected to the new liner. The annulus between the old and the new pipeline may be filled with grout.

• To reduce the risk to human health and the environment attributed to the movement of PCP from the Columbia aquifer to the Yorktown aquifer, the preexisting wells that are screened across the confining clay layer will be removed and plugged.

• To ascertain that the remedy is protective of human health and the environment, long-term ground water monitoring will be performed for thirty years. The ground water monitoring will include sampling for PCP, arsenic, and chromium as they were the only contaminants associated with the operations at the Site which were detected at elevated levels in the ground water. EPA will determine the appropriate number and location of the monitoring wells during the design phase. The monitoring will determine if the cleanup level of 1 ppb of PCP, the proposed MCL, is being met at the boundary of the plume in both the Columbia aquifer and the Yorktown aquifer.

• To restrict access to the contaminated ground water under the Site and to prevent accelerated movement of the PCP offsite, institutional controls will be implemented. The institutional controls include deed restrictions on the Site to prohibit using either the Columbia aquifer or the Yorktown aquifer as a source of ground water and restrictions on offsite ground water extraction.

EPA may modify or refine the selected remedy during the remedial design and construction. Such modifications or refinements, if any, would generally reflect results of the engineering design process. However, it may also include changing the disposal of the treated soil and storm sewer sediments to a solid waste facility, as allowed by the VDWM. The estimated present worth cost of the selected remedy is $20,485,000. The present worth cost is comprised of a capital cost of $20,375,000 and an annual operation and maintenance cost of $15,000. Details of the costs for the selected remedy are shown in Tables 5 and 6.

J. Statutory Determinations

EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA, 42 U.S.C. Section

Table 5
CAPITAL COSTS ALTERNATIVE 4A

REMEDIAL ALTERNATIVE ITEM	UNITS	UNIT COST	QUANTITY	TOTAL CAP. COST
SURVEYING	LS	$3,000.00	1	$3,000
SITE PREP./CLEARING & GRUBBING	LS	$3,000.00	1	$3,000
STRUCTURE REMOVAL/REPAIR	LS	$5,000.00	1	$5,000
DECON PAD	LS	$2,500.00	1	$2,500
UTILITY HOOKUP	LS	$10,000.00	1	$10,000
SOIL				
STAGING/STORAGE AREAS	LS	$15,000.00	1	$15,000
TREATABILITY STUDY	LS	$20,000.00	1	$20,000
LOW-TEMP. THERMAL DESORPTION	TON	$175.00	25000	$4,375,000
TREATMENT EQUIPMENT PAD	LS	$750.00	1	$750
EXCAVATION				
0 - 2"	MSF	$110.00	82	$9,020
0 - 1'	MSF	$220.00	167	$36,740
0 - 2'	CY	$6.50	620	$4,030
0 - CLAY	CY	$20.00	11550	$231,000
DUST CONTROL	LS	$20,000.00	1	$20,000
TREAT WATER FROM SOIL DEWATER.	GAL	$0.30	350000	$105,000
EXCAV. VERIFICATION SAMPLING	LS	$65,000.00	1	$65,000
TREAT. VERIFICATION SAMPLING	LS	$60,000.00	1	$60,000
OFF-SITE DISPOSAL AT RCRA FACILITY	TON	$280.00	25000	$7,000,000
TRANSPORT TO RCRA FACILITY	TON	$48.50	25000	$1,212,500
BACKFILL SITE WITH CLEAN FILL				
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SITE RESTORATION	LS	$3,000.00	1	$3,000
STORM SEWER SEDIMENT				
STORM SEWER CLEANING	LF	$10.00	550	$5,500
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DISPOSAL OF WATER @ POTW	GAL	$0.20	5000	$1,000
TRANSPORT WATER TO POTW	GAL	$0.05	5000	$250
LOW-TEMP. THERMAL DESORPTION (INCLUDED ABOVE)				
K001 SEDIMENTS				
STAGING/STORAGE AREA	LS	$5,000.00	1	$5,000
EXCAVATION				
WASTE WATER POND	CY	$20.00	450	$9,000
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VERIFICATION SAMPLING (INCLUDED ABOVE)				
TREATABILITY STUDY	LS	$20,000.00	1	$20,000
CHEMICAL DECHLORINATION	TON	$325.00	700	$227,500
REAGENT DISPOSAL				
LOAD TANKER TRUCK	EA	$88.00	1	$88
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Table 5 (Cont.)

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CONCRETE PADS				
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TRANSPORT TO SOLID WASTE FACILITY	TON	$7.50	500	$3,750
GROUNDWATER				
LIMITED ACTION & INSTITUTIONAL CONTROLS				$0
INSTALL NEW WELLS	LS	$14,000.00	1	$14,000
PLUG WELLS	EA	$4,500.00	6	$27,000
SUBTOTAL				$14,173,726
CONTINGENCY (25%)				$3,543,431
SUBTOTAL				$17,717,157
ENGINEERING (15%)				$2,657,574
TOTAL COST				$20,374,730

Table 6

OPERATION AND MAINTENANCE COSTS FOR ALTERNATIVE 4A

REMEDIAL ALTERNATIVE ITEM	UNITS	UNIT COST	QUANTITY	YEARS	ANNUAL COST
ANNUAL SAMPLING	LS	$11,000.00	-	24	$11,000
ANNUAL SAMPLING EACH 5 YEARS	LS	$14,000.00	-	6	$14,000

9621, establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action for a site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a statutory waiver is justified. The selected remedy must also be cost-effective and utilize permanent treatment technologies or resource recovery technologies to the maximum extent practicable. The statute also contains a preference for remedies that employ treatment as a principal element. The following sections discuss how the selected remedy for the Site meets these statutory requirements.

<u>Protection of Human Health and the Environment</u>

In order to meet the remedial objectives outlined in the FS, the risks associated with exposure to the contamination at the Site must fall within the acceptable risk range for carcinogens (10^{-4} to 10^{-6}) and the Hazard Indices for non-carcinogens must be less than 1. Excavation and treatment of the contaminated soil and sediments, removal and disposal of the concrete pads, and sliplining the storm sewer will assure the Site risks will fall within EPA's acceptable risk range.

The selected remedy protects human health and the environment by:

1. Eliminating direct contact with the contaminant levels in the surface and subsurface soils, the storm sewer sediments, and the K001 sediments by excavating, treating and disposing of these wastes in an approved offsite facility;

2. Reducing contaminant levels in the concrete pads by testing to determine whether they are a characteristic hazardous waste, scarification and treatment of the top one inch of the pads if they are a characteristic waste, removal of any residual soil, and offsite disposal of the remaining portion of the pads;

3. Eliminating direct contact with the water in the wastewater pond by treating and discharging of the water as determined during design; and

4. Reducing the contaminant levels in the existing concrete storm sewer by cleaning and sliplining the sewer.

Of all of the alternatives evaluated, Alternative 4A provides the best protection of human health without significant adverse impact on the environment. No unacceptable short-term effects or cross-media impacts would be caused by implementing this remedy.

Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all Applicable or Relevant and Appropriate Requirements (ARARs) as depicted in Table 4.

Chemical-Specific ARARs: The selected remedy will achieve compliance with chemical specific ARARs related to the concrete pads. Specifically, the concrete pads will undergo a TCLP test to determine if they are RCRA characteristic wastes in accordance with 40 C.F.R. Part 261.

Action-Specific ARARs: If the concrete pads are determined to be RCRA characteristic wastes, the top one inch of the pads will be scarified and that material will be solidified prior to disposal. The remainder of the concrete pads will be cleaned of any residual soil prior to disposal. The K001 sediments will be treated by the dechlorination process prior to disposal in a RCRA Subtitle C facility. The soil and storm sewer sediments will be treated by the low temperature thermal desorption process prior to disposal. The level of treatment will determine whether disposal must be in either a RCRA Subtitle C landfill or a solid waste landfill, depending on the operating guidance at the time of disposal and the requirements of Part 8 of the VSWMR. Transportation to a RCRA-permitted treatment and/or disposal facility would conform with RCRA regulations at 40 C.F.R. Parts 262 and 263, the Department of Transportation regulations of Title 49 of the Code of Federal Regulations, and Part 7 of the VHWMR. The substantive requirements of the Virginia Erosion and Sediment Control Law will be achieved. Storage of soils in a waste pile must conform with Section 10.11 of the VHWMR. Storage of the K001 wastes must conform with Sections 10.8 and 10.9 of the VHWMR. The substantive requirements of a VPDES permit by the Virginia State Water Control Board must be complied with for the discharge of treated ground water. All air emissions from Site activities must conform with the Virginia Department of Air Pollution Control Regulations for Control and Abatement of Air Pollution.

Location-Specific ARARs: The National Historic Preservation Act is an ARAR for this Site. Due to the archaeological potential of the Site, as well as the possible project impacts, a Phase 1 archaeological field survey would be completed during the design phase. The purpose of the survey is to locate all archaeological resources which may be impacted by the remedial action. The Endangered Species Act is a potential ARAR due to the possible existence of the Dismal Swamp Southeastern Shrew on the Site. As such, a biological assessment must be conducted to determine if the shrew or the shrew's habitat is present on or in close proximity to the Site. If so, mitigating measures would be required such that the shrew or the shrew's critical habitat would not be adversely affected by the remedial activities.

Other Criteria, Advisories or Guidance To Be Considered: Although the Safe Drinking Water Act MCL for PCP is presently 200 $\mu g/l$, EPA has proposed a revised MCL of 1 μg/l to take effect in 1992. Since the remedial action is not likely to be complete prior to the effective date, EPA has decided to utilize the proposed value in this ROD. Because the ground water in the Columbia aquifer and the Yorktown aquifer has the characteristics of a Class II aquifer, the ground water must not exceed 1 μg/l at the boundary of the plume.

Cost-Effectiveness

The selected remedy is cost-effective because it mitigates the risks posed by the Site contamination within a reasonable period of time. Section 300.430(f)(1)(ii)(D) of the NCP requires EPA to evaluate cost-effectiveness by first determining if the alternative satisfies the threshold criteria: protection of human health and the environment and compliance with ARARs. The effectiveness of the alternative is then determined by evaluating the following three of the five balancing criteria: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness. The selected remedy meets these criteria and is cost-effective because the costs are proportional to its overall effectiveness. The estimated present worth cost for the selected remedy is $20,485,000.

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

EPA has determined that the selected remedy, Alternative 4A, represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for remediation of the Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy, Alternative 4A, provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

Alternative 4A was selected because it is protective of human health and the environment, complies with all ARARs, has a higher degree of long-term effectiveness and permanence, reduces the toxicity, mobility or volume through treatment, and is easily implemented. By treating all of the contaminated media at the Site to EPA acceptable risk levels, Alternative 4A is protective of human health while also reducing the toxicity of the contaminants through treatment. Because the treated soil and sediments will be disposed offsite, Alternative 4A meets all ARARs, including the VSWMR. Also, the offsite disposal offers a higher level of long-term effectiveness and permanence because at the risk-based soil cleanup level, PCP may leach into the ground water at levels exceeding the ground water cleanup level. Also, the treatment systems utilized under Alternative 4A (dechlorination, low temperature thermal desorption, scarification, solidification and ground water treatment) could be easily implemented.

Alternative 3A is equal to the selected alternative with regard to being protective of human health and the environment, complying with all ARARs, having a high degree of long-term effectiveness and permanence, reducing toxicity, mobility or volume through treatment, and being easily implemented. However, Alternative 3A is not as cost-effective as the selected alternative. With a present worth cost of $25,934,000, Alternative 3A would cost $4,449,000 more than Alternative 4A. Since Alternatives 3A and 4A have the same effectiveness, the one with the lower cost, Alternative 4A, is more cost-effective.

Although Alternative 5 has a lower present worth cost and meets all ARARs, it does not have as much long-term effectiveness and permanence as Alternatives 3A and 4A. Also, because of the nature of the treatment process, it may not be as implementable as these other alternatives.

Alternatives 3B and 4B were not selected because neither alternative complies with all ARARs. Since both alternatives contain onsite disposal of the treated soil and storm sewer sediments, the VSWMR is not met for either alternative. Also, since the soil cleanup level may allow PCP to leach into the ground water at levels exceeding the ground water attainment level, Alternatives 3B and 4B do not provide as much long-term effectiveness or permanence as the selected alternative.

Alternative 2 was not selected because it does not fulfill the statutory requirements to utilize treatment technologies to the maximum extent practicable and the preference for treatment as a principal element. In addition, it does not reduce the toxicity, mobility or volume through treatment.

The Virginia Department of Waste Management has concurred with the selected remedy.

<u>Preference for Treatment as a Principal Element</u>

The selected remedy satisfies the statutory preference for treatment as a principal element. The PCP contamination in the soil constitutes the major human health risk associated with the Site and is considered a principal threat. The low temperature thermal desorption treatment system will effectively remove the PCP from the soil by heating it to 400^0 F to 800^0 F. The exhaust will then be vented to a cyclone or baghouse unit to remove any entrained particulate material. Next, the air will be directed into a condenser where the PCP will be condensed for subsequent treatment such as a carbon adsorption unit or an afterburner. The K001 sediments will be treated with the dechlorination process which will effectively destroy all of the organic contaminants including PCP and dioxin. The ground water recovered during the excavation and dewatering of the soils and the water from the wastewater pond will also be treated. Finally, if the concrete pads are determined to be a RCRA characteristic hazardous waste, approximately the top one inch of the pads will be scarified and solidified prior to disposal.

K. Documentation of Significant Changes

The Proposed Plan, which identified Alternative 4A as EPA's preferred alternative for the Site, was released for public comment on May 23, 1991. EPA reviewed all written and verbal comments submitted during the public comment period and determined that no significant change to the remedy identified in the Proposed Plan was necessary.