100526

Superfund Program Proposed Plan

Standard Chlorine of Delaware, Inc.

New Castle County, Delaware April 1994

EPA ANNOUNCES PROPOSED PLAN

The U.S. Environmental Protection Agency ("EPA") is issuing this Proposed Remedial Action Plan ("Proposed Plan") to present its Preferred Remedial Alternative for cleaning up contamination at the Standard Chlorine of Delaware, Inc. Superfund Site ("Site" or "SCD Site") located approximately three miles northeast of Delaware City, Delaware, just west of Route 9 and adjacent to the Red Lion Creek. This Proposed Plan summarizes information obtained from a recently completed **Remedial Investigation** and **Feasibility Study** ("RI/FS"), and the technologies EPA is considering for the clean-up at the Site. The EPA has prepared this Proposed Plan to solicit public comment on its preferred alternative and the other alternatives for remediation of the contaminants present on the Site. EPA will select a remedy for the Site only after the public comment period has ended and any comments received during the comment period have been reviewed and considered. The remedy will be outlined in a **Record of Decision** ("ROD") for the Site. Based on new information and/or comments received, the remedy selected in the ROD may be different from the preferred alternative described in this Proposed Plan.

Dates to remember:

Apr 4 - May 4 1994
Public comment period on alternatives in Proposed Plan.

April 27, 1994
Public meeting at
Carpenters Union Hall
626 Wilmington Road
New Castle, DE 19720
at 7:00 PM

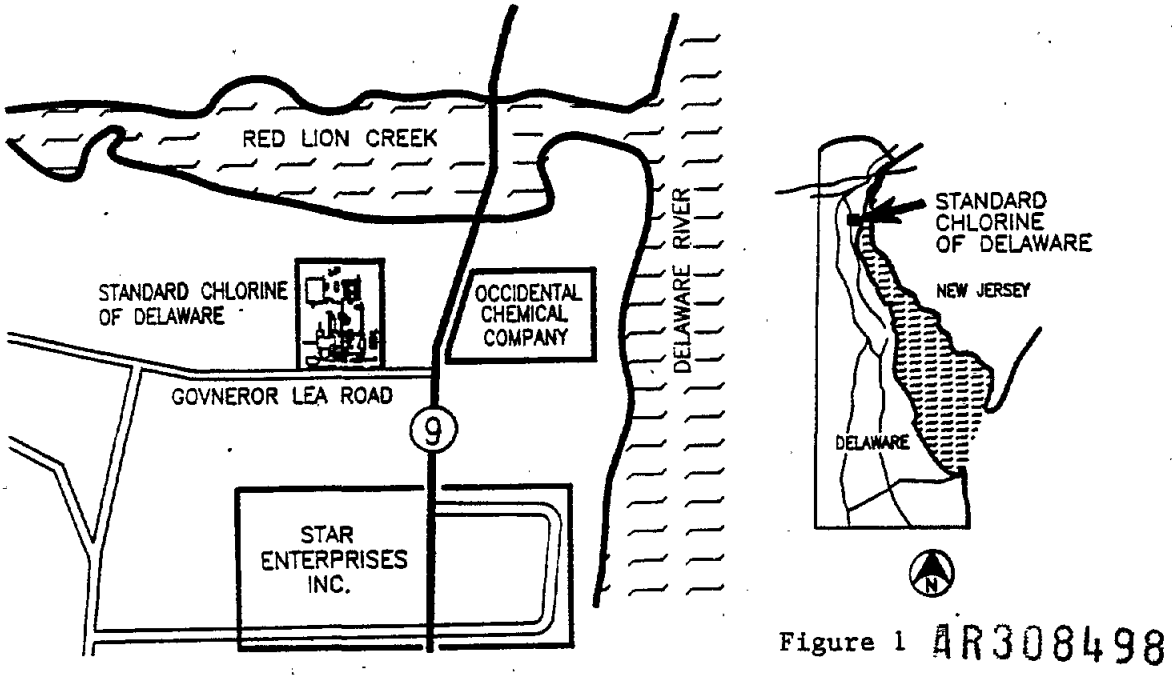


Figure 1

The Proposed Plan is being issued as part of EPA's public participation requirements under Section 117 of the **Comprehensive Environmental Response, Compensation, and Liability Act** of 1980, as amended ("CERCLA"). The public's comments will be considered and presented with discussion incorporated in the Responsiveness Summary contained in the ROD for the Site. This Proposed Plan summarizes information that can be found in greater detail in the RI/FS reports and other documents contained in the **Administrative Record** file for the Site. EPA encourages the public to review these documents in order to gain a more comprehensive understanding of the Site and the **Superfund** activities that have been conducted there. The locations of the Administrative Record file for the Site and the address to send comments on this Plan are given at the back of the Proposed Plan. The Proposed Plan also contains a glossary of terms that may be unfamiliar to the general public. The terms in **bold** print in the text are more fully defined in the glossary in the back of the Proposed Plan.

II. SITE BACKGROUND

The Standard Chlorine of Delaware, Inc. ("SCD") Superfund Site, approximately 40 acres in size, is located three miles northeast of Delaware City, Delaware. The SCD plant facility is bounded to the north and east by property owned by Occidental Chemical Corporation (formerly Diamond Shamrock Company), to the west by Air Products and Chemicals, Inc. and to the south by Governor Lea Road and property owned by Star Enterprise and Delmarva Power and Light. Red Lion Creek is located approximately 1,000 feet north of the SCD plant facility and flows east to the Delaware River (See Figure 1). The SCD facility was constructed in 1965 on farmland purchased from the Diamond Alkali Company which had purchased the land from the Tidewater Refinery Company. SCD operations were started in 1966 with the production of chlorinated benzenes including chlorobenzene, paradichlorobenzene, orthodichlorobenzene, and lesser amounts of metadichlorobenzene and trichlorobenzene. Although operational production has varied over the years, these chemicals are still the primary products produced at the SCD facility.

The SCD Site lies within the Atlantic Coastal Plain Physiographic Province, which consists of a southeasterly dipping wedge of unconsolidated sands, silts, clays and gravels. The Pleistocene Age Columbia Formation, which immediately underlies the SCD Site, is comprised of orange-brown and yellow-brown fine to coarse sand with silt and gravel lenses. The observed thickness of the Columbia Formation at the Site ranges from 40 to 75 feet. The Merchantville Formation is a dark grey to black micaceous sandy silt or silty/clayey fine sand which underlies the Columbia Formation at the Site with the exception of the central portion of the Site where it is absent. The Potomac Formation, which contains laterally discontinuous sand stringers, underlies the Merchantville Formation and the Columbia Formation where the Merchantville is absent. The Potomac Formation observed at the Site consists of red and gray variegated, stiff, plastic clay with a sand unit encountered at approximately 130 feet below ground surface in the immediate vicinity of the Site.

The uppermost aquifer beneath the Site is coincident with the Columbia Formation and is known as the Columbia aquifer. Depth to ground water in this aquifer as measured in August, 1990 ranged from 30 to 60 feet below ground surface. This aquifer is unconfined, and the general direction of ground water flow is to the north-northwest, north, and north-northeast toward the unnamed tributary to the Red Lion Creek, and Red Lion Creek. The Columbia aquifer is not known to be used as a current source for drinking water at the Site or in close proximity to the Site. The uppermost water-bearing sand within the Potomac Formation is located approximately 130 feet below ground surface in the Site vicinity and is referred to as the "uppermost Potomac aquifer" in the RI reports. The ground water flow direction in the uppermost Potomac aquifer at the Site is generally in a southeast direction. The Potomac aquifer is used as a drinking water source. The 60 to 70 feet combined thicknesses of the Merchantville Formation and clays of the Potomac Formation behave as an **aquitard** separating the Columbia aquifer and the uppermost Potomac aquifer.

A. Past Releases and Remedial Responses

In September 1981, a release of approximately 5,000 gallons of monochlorobenzene ("MCB") occurred at the SCD Site while workers were filling a railroad tank car. Some of the released chemical ran off in surface ditches toward a tributary to the Red Lion Creek. Figure 2 shows the approximate 1981 release flow pathway. In response to this spill, under the direction of the Delaware Department of Natural Resources and Environmental Control ("DNREC"), SCD moved to prevent the discharge of MCB to the Red Lion Creek. First, SCD took action to contain and recover the surface runoff. Second, SCD excavated and disposed of contaminated soils at an off-site permitted commercial facility. Finally, SCD conducted an investigation to determine the extent of contamination to the subsurface. In 1982, EPA and DNREC conducted a Preliminary Assessment/Site Inspection ("PA/SI") to determine if the Site was eligible for inclusion on the **National Priorities List ("NPL")**.

SCD's investigation revealed that the ground water beneath the Site was contaminated with other chlorinated benzene compounds, in addition to MCB. The primary source for the other chlorinated benzenes was attributed to the leaking of a process drainage **catch basin** (CB#1), which was discovered and repaired in March 1976. SCD installed a ground water recovery and treatment system in 1982. This system has been upgraded over time. The current configuration was implemented after a second major release from the facility which occurred in 1986 and is discussed below. Monitoring of the ground water recovery and treatment system is performed and has been documented in quarterly reports to DNREC since 1988.

A second major release occurred at the SCD facility on January 5, 1986 when approximately 400,000 gallons of paradichlorobenzene ("DCB") and approximately 169,000 gallons of trichlorobenzene ("TCB") were released at the Site due to a total above ground tank failure. The released material followed two pathways of flow, one easterly, onto asphalt paved plant property and one northerly, along the railroad tracks. Figure 3 shows the approximate flow pathways. The released material spread to the unnamed tributary of Red Lion Creek, adjacent to the SCD facility, and continued downstream to the point of confluence with Red Lion Creek (See Figure 4).

SCD used booms, dikes and a filter fence to contain and minimize further discharge of contamination through the unnamed tributary into the Red Lion Creek. Some of the spilled material was recovered for reprocessing. SCD built a sedimentation basin to store contaminated sediments. Contaminated soils and sediments were also excavated and stockpiled in waste piles adjacent to the SCD facility (identified as soil piles in Figure 4).

As a result of the above-described releases, the SCD Site was placed on the NPL on July 1, 1987. On January 12, 1988, SCD entered into a Consent Order with DNREC to conduct a RI/FS at the Site.

B. RI/FS Findings

The RI/FS reports and associated addendum for the SCD Site are contained in Volume III of the Administrative Record. The Administrative Record for the Site is available for public review at the local Site repository and at EPA's Offices (See Section VII of this Proposed Plan). The areas/media evaluated as part of the RI/FS are shown on Figure 4 and include the following:

1. Soils- surface and subsurface soils in the pathways of the 1981 and the 1986 releases;

2. Sediments - in the unnamed tributary and the Red Lion Creek;

3. Surface Water - in the sedimentation basin, the unnamed tributary, and the Red Lion Creek;

4. Ground Water - throughout the Site;

5. Soil Piles and Soil Pile Runoff Areas - clean-up activities associated with the 1986 release resulted in the placement of soil and sediments into waste piles;

6. Sedimentation Basin- saturated soils and sediments were excavated as part of the 1986 spill clean-up and were placed in a double lined basin. The integrity of the liner system is suspect;

7. Catch Basin #1 (CB#1)- a settling unit, fed by a process sewer line, in which the heavier chlorinated benzenes from SCD manufacturing operations settle and are recycled to the SCD production process; and

8. Effluent Pipeline- an underground wastewater pipeline which runs from SCD's facility to the Delaware River.

Based on the findings of the draft Remedial Investigation ("RI"), EPA and DNREC limited the boundaries of the Red Lion Creek investigation to the area west of Route 9 (See Figure 1). Occidental Chemical Company ("Oxychem"), a company whose property is located adjacent to that of Standard Chlorine, is under an Administrative Order on Consent with EPA, under the **Resource Conservation and Recovery Act ("RCRA")**, to conduct a RCRA Facility Investigation and Corrective Measure Study ("RFI/CMS") (similar to a RI/FS), which will address the investigation and remediation, if warranted, of Red Lion Creek east of Route 9. Information obtained from Oxychem's investigation is being shared by both RCRA and CERCLA investigatory groups at EPA. Depending on the results of the RFI, EPA may require Standard Chlorine to conduct additional remedial work concerning Red Lion Creek.

The RI findings revealed that surface, subsurface soils and sediments along the pathways of the 1981 and 1986 releases were contaminated with chlorinated benzenes as were the soil piles and sedimentation basin that were built following the 1986 release. Surface waters in the sedimentation basin, the unnamed tributary, and the Red Lion Creek contain chlorinated benzenes. An advisory issued by DNREC and the Division of Public Health on May 2, 1986 recommending that the public not consume fish taken from Red Lion Creek downstream of Route 13 is currently in effect.

The ground water investigation performed as part of the RI identified elevated levels of contaminants as well as the presence of **Dense Non Aqueous Phase Liquids ("DNAPLs")** in the Columbia aquifer which flows toward Red Lion Creek. DNAPLs are hydrocarbon liquids (organic compounds) such as chlorinated solvents, which are heavier (denser) than water and immiscible with water (do not mix well with water). The forces of gravity cause DNAPLs to migrate downward and infiltrate the subsurface soils and ground water table until the DNAPLs reach an impermeable layer. Although some DNAPLs may dissolve into the ground water, most pool as a separate distinct liquid on top of the impermeable layer when present in large volume. At the present time, EPA has not identified any proven technology to restore DNAPL zones in aquifers to **Maximum Contaminant Levels ("MCLs")**. MCLs are enforceable standards promulgated pursuant to the Safe Drinking Water Act (42 U.S.C. §§ 300f-300j) ("SDWA") for public drinking water supplies.

Sediments in the sedimentation basin are contaminated with chlorinated benzenes. The results of the RI indicate that the liner of the basin may be leaking. Water in the sedimentation basin is periodically pumped to the SCD facility's existing waste water treatment plant.

Soil sampling in the vicinity of Catch Basin #1 revealed elevated levels of contaminants to a depth of approximately 32 feet below the surface. CB#1 was excavated and repaired in 1976 because of a leak. Currently, an inspection of the integrity of CB#1 is conducted annually by SCD.

Samples were collected from the monitoring wells adjacent to the effluent pipeline (See Figure 4) in November 1991. Samples taken from monitoring well #16 revealed concentrations of chlorinated benzenes above the MCLs.

The remedial alternatives evaluated in the Feasibility Study are discussed in Section V of this Proposed Plan and summarized on Table 3.

III. SCOPE AND ROLE OF RESPONSE ACTION

The proposed Remedial Action described in this Proposed Plan will address the threat posed by the release of hazardous substances at the SCD Site. EPA has characterized the waste and contaminated materials on-site as either **principal threat wastes** or **low level threat wastes.** The concepts of principal threat wastes and low level threat wastes as developed by EPA in the **National Oil and Hazardous Substances Pollution Contingency Plan ("NCP")** are applied on a site-specific basis when characterizing source material. Source material is defined as material that includes or contains hazardous substances, pollutants, or contaminants which acts as a reservoir for migration of contamination to ground water, to surface water, to air, or which acts as a source for direct exposure. Source materials are considered to be principal threat wastes when they contain high concentrations of toxic compounds (e.g., several orders of magnitude above levels that allow for unrestricted use and unlimited exposure) or are highly mobile and cannot be reliably contained.

The principal threat wastes associated with the SCD Site are the surface soils along the 1981 and 1986 spill pathways, the soil piles, the sedimentation basin, some sediments in the unnamed tributary to the Red Lion Creek, soils adjacent to Catch Basin #1 (CB#1), and the DNAPL contamination in the subsurface.

Section 300.430(a)(1)(iii) of the NCP, 40 CFR § 300.430(a)(1)(iii), states that "EPA expects to use treatment to address the principal threats posed by a site, wherever practicable," that "EPA expects to use engineering controls, such as containment, for waste that poses a relatively low, long-term threat or where treatment is impracticable," that "EPA expects to use institutional controls... to supplement engineering controls as appropriate...," and that institutional controls "shall not substitute for active response measures... as the sole remedy unless such active measures are determined not to be practicable..."

EPA's Proposed Plan for this Site consists of two components, an interim action and a final action. The **interim action** component will address containment of ground water and DNAPLs. It will also attempt to minimize the continued release of contaminants into the adjacent wetlands, the unnamed tributary to Red Lion Creek, and to Red Lion Creek itself.

EPA will require that interim actions to contain ground water at the SCD Site be implemented, while additional information is collected and evaluated during the Remedial Design to determine the engineering feasibility and reliability of ground water restoration to federal and state drinking water quality criteria. As an interim action, EPA will require that the exposure of people and the area's ecosystem to contaminated ground water be prevented, and to the extent practicable, further contaminant migration be prevented. EPA will also require the removal of DNAPL pools as identified during Remedial Design.

As part of the interim action, additional data will be collected to determine the extent of DNAPL contamination. The review of the data and of this remedy will be ongoing as EPA continues to develop final remedial alternatives for the ground water and DNAPL contamination. Following implementation of the Interim Action, EPA will make a final decision on the ground water remedy which will be documented in a future ROD. Future actions will be consistent with the interim action component of this ROD.

The final action component of EPA's Proposed Plan will address the surface and subsurface soils along the pathways of the 1981 and 1986 releases, the sediments in the unnamed tributary to Red Lion Creek, the soil piles, the sedimentation basin, and the soils adjacent to CB#1. Only the subsurface soils that can be excavated around CB#1 without damaging the integrity of the structure will be remediated. Integrity testing of CB#1, such as a hydrostatic test, will be required to insure that there are no future releases.

It should be noted that the SCD facility is an operating plant which continues to produce chlorinated benzenes. The remedy identified in this Proposed Plan does not cover any

potential risk posed to the Site by the day-to-day operations of the manufacturing facility. EPA notes that the remedy described in this Proposed Plan addresses the environmental effects of the 1981 and 1986 chlorinated benzene spills and the release from Catch Basin #1 at the plant. Environmental effects of day-to-day operations and potential releases beyond the 1981 and 1986 spills are regulated by various Federal laws and regulations as well as those of the State of Delaware (e.g., including but not limited to Hazardous Substance Clean-up Act, 7 Del. C. Chapter. 91).

IV. SUMMARY OF SITE RISKS

A. Human Health Risk Assessment

A baseline risk assessment was prepared as part of the RI/FS work to evaluate the potential human health impacts that may result from exposure to Site contaminants if no remediation is conducted. The maximally exposed or most sensitive receptor was selected for each medium (e.g., soil, ground water) on the assumption that future use of the Site would be restricted to commercial/industrial use. The receptors evaluated included current and future worker; current and future visitor; and hunter/fisherman. Carcinogenic and chronic non-carcinogenic health effects were evaluated for ground water and soil ingestion, dermal contact with soil, fish ingestion, dermal exposure to surface water and sediments, and inhalation of airborne soil particles.

The contaminants contributing to the risk at the Site are referred to as contaminants of concern ("COCs") and consist of:

benzene*
chlorobenzene
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene*
hexachlorobenzene*
nitrobenzene
pentachlorobenzene
1,2,3,4-tetrachlorobenzene
1,2,4,5-tetrachlorobenzene
toluene
1,2,3-trichlorobenzene
1,2,4-trichlorobenzene
1,3,5-trichlorobenzene

Benzene is a known human carcinogen and the other starred items (*) are contaminants which are suspected human carcinogens. 1,4-dichlorobenzene poses the greatest carcinogenic risk at the Site, primarily due to the high levels detected in the soil.

Remedial action is generally warranted at a Site when the carcinogenic risk level exceeds 1×10^{-4}, meaning that one additional person out of 10,000 exposed is at risk of developing cancer. The potential for health effects resulting from exposure to non-carcinogenic compounds is evaluated by comparing an estimated daily dose presented by Site conditions to an acceptable level. If this ratio exceeds 1.0, there is a potential for impact based on hazard from that particular chemical. These ratios can be added for exposure to multiple contaminants. The sum, known as the **Hazard Index**, is not a mathematical prediction for the severity of toxic effects, but rather a numerical indicator of the transition from acceptable to unacceptable levels.

The risk assessment performed by SCD as part of the RI/FS determined that exposure to contaminants at the Site presented the greatest risk to the future worker. The tabulated results presented in Table 1 show that the Site would present a total carcinogenic risk of 4.5×10^{-3} to the future worker from soil ingestion, soil dermal contact, soil dust inhalation, and ground water ingestion. In other words, 4.5 additional persons (future workers) out of 1,000 exposed would be at risk of developing cancer. The risk for the future worker is greater than the risk to the current worker, because the calculations assumed that the future worker would consume ground water, whereas the current worker does not consume ground water.

The risk assessment also determined that the Hazard Index for non-carcinogenic effects for the future worker is 329 (see Table 2), whereas the Hazard Index for the current worker is 5.26. Once again, the calculations were based on

the conservative assumption that the future worker would consume ground water. A Hazard Index number greater than 1 indicates that exposure to contaminants may result in adverse health effects.

In summary, unacceptable risks are posed under both the current and future use scenarios. Exposure to ground water from the Columbia aquifer accounted for most of the future risk at the Site. Currently, ground water from the Columbia aquifer is not used as a drinking water supply source and there is no evidence that the contamination has entered the Potomac Formation aquifer.

B. Ecological Risk Assessment

The ecological risk assessment focused on identifying potential adverse effects of the Site contaminants of concern on the flora and fauna (i.e. plants and animals) in the area. Animals can be exposed to these contaminants through several routes including ingestion of surface water, fish, and vegetation, and/or contact with surface water, soil, sediments and vegetation. The great blue heron, the white-tailed deer, and the meadow vole were selected as representative species from the area for the ecological risk assessment. Toxicity tests were performed using earthworm, lettuce seeds and Hyallela azteca (a waterbug) as surrogates for soil fauna, soil flora, and aquatic life, respectively. The results of the assessment indicated a potential for adverse effects to occur to the meadow vole, the earthworm (soil fauna), aquatic life of Red Lion Creek, and terrestrial vegetation (soil flora).

C. Clean-up Criteria

CERCLA requires that on-site remedial actions must attain Federal and more stringent State **applicable or relevant and appropriate requirements ("ARARs")** of environmental laws. Both EPA and DNREC have promulgated chemical specific standards for drinking water and DNREC has promulgated standards for surface water. These standards include Maximum Contaminant Levels ("MCLs"), and the State of Delaware Surface Water Quality Standards.

There are no chemical-specific ARARs for soils or sediments. Therefore, the results of the human health and ecological risk assessments are used to establish acceptable exposure levels for soils and sediments.

Using the findings of the human health risk assessment, the clean-up criteria for on-site soils and sediments (includes soils and sediments inside the existing fence of the SCD plant and noted as the SCD facility boundary on Figure 2) based on risk to a future worker is 625 **mg/kg** for total COCs with a ceiling concentration of 450 mg/kg for 1,4-dichlorobenzene. (Hereafter, the on-site clean-up criteria will be referred to as 625/450 mg/kg of total COCs.) These values represent a carcinogenic risk of 1×10^{-5} to future workers. SCD calculated these levels using two conservative assumptions. SCD assumed first, that the worker would be exposed for 24 hours a day as opposed to a typical 8 hours a day scenario. Secondly, SCD assumed that contaminants would be absorbed through the skin.

For most chemicals, there are many uncertainties associated with calculating a risk related to dermal (skin) contact with contaminated soil. Consequently, EPA does not usually recommend quantifying risks related to skin exposure. By incorporating more realistic assumptions into the calculations, i.e., an 8-hour work day and elimination of skin contact as an exposure route, EPA has determined that the actual residual cancer risk to a future worker at the Site following remediation (at the proposed clean-up levels) is approximately 1×10^{-6}.

The clean-up criteria for off-site soils and sediments (includes soils and sediments outside the existing fence of the SCD plant and noted as the SCD facility boundary on Figure 2) is based on the risk to the ecological receptors (flora and fauna). Based on toxicity testing for the germination of lettuce seed and survival of the earthworm, the clean-up criteria is 33 mg/kg for total COCs for off-site soils and sediments.

Restoration of ground water to drinking water quality where DNAPLs are present may not be technically practicable. Interim measures to contain the ground water and recover DNAPL pools, as identified during Remedial Design, will be initiated while further investigation is conducted to determine the feasibility of remediating ground water. EPA will require that the interim action be protective of human health and the environment by preventing exposure to ground water. Each of the remedial alternatives discussed in Section V has a component for preventing exposure to ground water.

V. SUMMARY OF REMEDIAL ALTERNATIVES

The Feasibility Study ("FS") and the Feasibility Study Addendum contain all the remedial alternatives considered by SCD for the clean-up of the soils, sediments, and ground water at the SCD Site. Five alternatives were analyzed in detail in the FS and the FS Addendum which are contained in the Administrative Record. In addition, EPA evaluated an additional alternative which is a combination of Alternatives 5A and 5B and is called Alternative 6. These alternatives, which differ in the way they deal with soil and ground water contamination at the Site, include:

1) No Action
2) Containment
3) Closure and In Situ Bioremediation of Wetland Sediments
4A) Thermal Treatment & In Situ Bioremediation of Wetland Sediments
4B) Thermal Treatment
5A) Ex Situ Bioremediation
5B) In Situ Biological Treatment of Wetland Sediments to supplement Alternatives 3 and 4A
6) In Situ/Ex Situ Bioremediation

Alternatives 3 and 4A, as proposed in the Feasibility Study do not address remediation of the wetland sediments. Alternative 5B in the Feasibility Study Addendum is a description of the in situ bioremediation treatment for the wetland areas to supplement Alternatives 3 and 4A, as described in the FS. Since Alternative 5B is not a site wide alternative, but a supplement to Alternatives 3 and 4A, it will be discussed and evaluated as a component of Alternatives 3 and 4A.

Common Elements

Each of the alternatives evaluated in detail, except for Alternative 1 - (No Action) contain certain common components which are discussed below:

Ground water - Ground water remediation includes maintenance and operation of the existing ground water extraction wells. Recovered water will be treated in the existing air stripper and then discharged under SCD's NPDES permit requirements. Air emissions from the air stripping unit will go to the existing SCD plant boilers. Since SCD is an operating facility, and is subject to process changes, the treatment technology for ground water is subject to change, based on effectiveness and/or NPDES requirements. Any changes to the ground water treatment process will comply with applicable federal and state NPDES regulations. EPA will require controls for air emissions generated from treatment of ground water under SCD's NPDES permit. Low volume product recovery wells will be installed to attempt to recover DNAPLs. Four (4) product recovery wells were selected in the FS to develop cost estimates. The actual number and location of recovery wells will be determined as part of the Remedial Design. The recovered DNAPL will be stored on-site temporarily, and ultimately disposed of off-site, in accordance with applicable Federal and State regulations promulgated pursuant to RCRA.

In the event that SCD should cease or curtail production operations at the Site, EPA will require that the existing waste water treatment plant be modified or a new one constructed to manage contaminated ground water. Treatment of air emissions in accordance with applicable federal and state regulations would also be required.

Surface Water - Surface water will be addressed through remediation of the soils, sediments, and ground water.

Institutional Controls - Institutional controls for the Site will include deed restrictions intended to limit future land and ground water use; and security fences to limit access. DNREC will also implement a ground water management zone for the area impacted by the releases.

Monitoring - Site monitoring will include monitoring of the ground water in both the Columbia and Potomac Formations and monitoring of the surface water systems present at the Site (the wetlands, the unnamed tributary to Red Lion Creek, and Red Lion Creek). A monitoring plan will be prepared during the Remedial Design phase which will describe in detail the Site monitoring activities. The ground water monitoring activity will involve the installation of additional on-site and off-site monitoring wells. Ecological monitoring will be conducted over a six year timeframe, with the first round prior to the start of remedial action to establish a data baseline and then annually thereafter until the five year review. The ecological monitoring activities may include chemical analysis of surface water, sediments and fish tissue, and sediment bioassays.

The following is a brief description of the alternatives which were evaluated for this Site. A summary of each of the alternatives is included in Table 3.

Alternative 1 - No Action
Estimated Capital Costs: $0
Estimated Annual O&M Costs: $0
Estimated Present-Worth Costs: $0

The NCP requires that EPA consider a no action alternative for every site to establish a baseline for comparison to alternatives that do require action. Under this alternative, the existing ground water treatment and recovery system would be discontinued. The existing contaminated soils, soil piles, and sedimentation basin would remain in place. No further activities for upgrading or closure of the soil piles or sedimentation basin would occur.

Alternative 2 - Containment

Estimated Capital Costs: $2.24 million
Estimated Annual O&M Costs: $80,000
Estimated Present-Worth Costs: $3.47 million

Ground Water - In addition to the components discussed above under common elements, additional extraction wells would be installed to reduce the flow of ground water to the Red Lion Creek. Five additional extraction wells were used in the FS to develop cost estimates.

Soils - Soils along the western drainage gully (to a depth of 7 feet) that exceed the clean-up criteria of 33 mg/kg of total COCs and the soils along the eastern drainage ditch (to a depth of 3 feet) and Catch Basin #1 (to a depth of 15 feet) that exceed the clean-up criteria of 625/450 mg/kg of total COCs would be excavated and consolidated in the existing sedimentation basin, followed by in situ stabilization/solidification. The soil pile material would be consolidated in the basin as well. The basin would then be capped with a multi-layer cap. The excavated and backfilled areas where elevated levels of contaminants remain in the subsurface would be capped with either asphalt or a Flexible Membrane Liner ("FML"). An asphalt cap would be applied in the area of the railroad tracks and Catch Basin to reduce infiltration (See Figure 5).

Sediments - New silt fences would be installed in the unnamed tributary to Red Lion Creek to prevent contaminated sediment migration to the Red Lion Creek (See Figure 9). Excavated soils and sediments would be consolidated with the existing sediments in the sedimentation basin as described above in the paragraph titled "Soils".

Alternative 3 - Closure and In Situ Bioremediation of Wetland Sediments

Estimated Capital Costs: $5.2 million
Estimated Annual O&M Costs: $101,000
Estimated Present-Worth Costs: $6.8 million

Ground Water - In addition to the components discussed above under common elements, a

ground water containment system would be installed along the shorelines of the unnamed tributary and the Red Lion Creek to capture ground water before it enters the Red Lion Creek. A deep interceptor trench was described in the FS to evaluate the containment approach as well as to develop costs. Other physical barriers that could be used at the Site include sheet pilings or a slurry wall. The exact length and location (see Figure 7) of the hydraulic barrier to contain contaminated ground water and DNAPLs would be based on information gathered during remedial design ("RD") activities.

Soils - The same as Alternative 2 for surface and subsurface soils, except the sedimentation basin would be retrofitted with a new liner and leachate collection system (See Figure 6).

Sediments - Contaminated sediments along the unnamed tributary to the Red Lion Creek and the Red Lion Creek itself, that exceed the off-site (includes sediments outside the existing fence of the SCD plant and noted as the SCD Facility Boundary on Figure 2) clean-up criteria of 33 mg/kg of total COCs which are accessible from the shorelines using conventional equipment would be excavated, stabilized, and consolidated into the retrofitted sedimentation basin. The excavated sediments and the existing sediments in the sedimentation basin would be stabilized in a mechanical mixing plant prior to being placed back in the retrofitted basin. Those sediments that exceed the clean-up criteria of 33 mg/kg of total COCs and are difficult to access in the wetland area of the unnamed tributary to the Red Lion Creek and the Red Lion Creek would undergo in situ biological treatment. In situ bioremediation technology entails treating the contaminated soils in place, eliminating the need for soil excavation. The technology usually involves enhancing natural biodegradation processes by adding nutrients, oxygen, and in some cases, microorganisms. See Figure 9 for the approximate delineation of the area to be remediated in and along the wetlands.

Alternative 4 A - Thermal Treatment and In Situ Bioremediation of Wetland Sediment

Estimated Capital Costs: $10.1 million
Estimated Annual O&M Costs: $106,700
Estimated Present-Worth Costs: $11.7 million

This alternative includes the treatment of soils and sediments using thermal desorption technology. Thermal desorption is the heat-induced desorption, volatilization, and capture of volatile and semi-volatile organic compounds from contaminated solids. The contaminants are removed from the soil, collected, and concentrated in the vapor treatment system. The concentrated contaminants may be able to be returned to the SCD facility processing units for recycling or would be shipped to a RCRA permitted treatment or disposal facility.

Ground Water - same as Alternative 3

Soils - Soils along the western drainage gully (to a depth of 7 feet) that exceed the clean-up criteria of 33 mg/kg of total COCs and the soils along the eastern drainage ditch (to a depth of 3 feet) and Catch Basin #1 (to a depth of 15 feet) that exceed the on-site clean-up criteria of 625/450 mg/kg of total COCs would be excavated. These soils along with the soils in the soil piles and the sedimentation basin, would undergo thermal desorption. Treated soils would be used as backfill where the treatment is successful in remediating the soils to the clean-up levels. Those soils not remediated to clean-up criteria would be stabilized/solidified, if necessary, and consolidated into the sedimentation basin. The sedimentation basin would be retrofitted as delineated in Alternative 3. In excavated areas, where high concentration subsurface soils remain, a Flexible Membrane Liner or asphalt would be used to cap the backfilled excavations. An asphalt cap would be applied in the area of the railroad track and Catch Basin #1 to reduce infiltration (See Figure 8).

Sediments - Contaminated sediments along the unnamed tributary to Red Lion Creek and the Red Lion Creek that exceed the off-site

(includes sediments outside the existing fence of the SCD plant and noted as the SCD facility boundary of Figure 2) clean-up criteria of 33 mg/kg of total COCs which are accessible from the shorelines using conventional equipment would be excavated, thermally treated, and used as backfill. Those sediments not remediated to 33 mg/kg would be stabilized/solidified, if necessary, and consolidated into the retrofitted sedimentation basin as described above. Those sediments which exceed the clean-up criteria of 33 mg/kg of total COCs and are difficult to access in the wetland area of the unnamed tributary and the Red Lion Creek would undergo in situ biological treatment as described under Alternative 3. See Figure 9 for the approximate delineation of the wetland areas to be remediated.

Alternative 4 B - Thermal Treatment

Estimated Capital Costs: $15.5 million
Estimated Annual O&M Costs: $100,000
Estimated Present-Worth Costs: $17.06 million

Same as alternative 4A, except all soils and sediments, including those areas which are difficult to access, that exceed the clean-up criteria of 33 mg/kg of total COCs along the unnamed tributary to Red Lion Creek and the Red Lion Creek would be excavated and thermally treated (See Figures 8 and 9).

Alternative 5A - Ex Situ Biological Treatment

Estimated Capital Costs: $9 to 11.3 million
Estimated Annual O&M Costs: $100,000
Estimated Present-Worth Costs: $10.6-12.9 million

This alternative, as discussed in the FS Addendum, involves the **ex situ biological treatment** of contaminated soils and sediments. This treatment may take place under aerobic (the presence of oxygen) or anaerobic (absence of oxygen) conditions. The results of the treatability study conducted as part of the RI/FS to determine the viability of bioremediation technology for soils and sediments at the SCD Site were not definitive. Regardless, all of the contaminants are volatile and amenable to biodegradation, which suggests that bioremediation could be effectively used at this Site.

Ground Water - Same as Alternative 3

Soils/Sediments - Excavation of soils and sediments as delineated in Alternative 4B, only the treatment technology employed will be **ex situ biological treatment** rather than thermal treatment (See Figures 8 and 9).

EPA is recommending an alternative that is a modification of the alternatives proposed in the FS which will be described below as Alternative 6 and evaluated as a separate alternative in the comparison of alternatives.

Alternative 6 - Ex Situ/In Situ Bioremediation

Estimated Capital Costs: $4.9 to 10.8 million
Estimated Annual O&M Costs: $90,000
Estimated Present Worth Costs: $6.6 to 12.2 million

This alternative includes the treatment of soils and sediments using bioremediation technology and is a modification/combination of Alternatives 5A and 5B as described in the FS Addendum. The modification would include a combination of both in situ and ex situ bioremediation. The actual biological treatment process will be refined after additional studies including treatability studies and pilot scale tests are conducted.

Ground Water - Same as Alternative 3

Soils/Sediments - Soils along the western drainage gully (to a depth of 7 feet) that exceed the clean-up criteria of 33 mg/kg of total COCs and the soils along the eastern drainage ditch (to a depth of 3 feet) and Catch Basin #1 (to a depth of 15 feet) that exceed the clean-up criteria of 625/450 mg/kg of total COCs would either be excavated and biologically treated or biologically treated in place. After treatment, the soils adjacent to Catch Basin #1 would be capped (as described in Alternative 4A). The soils along

the railroad track area would be biologically treated in-place or capped (as described in Alternative 4A). Soils and sediments outside the existing fence that exceed the off-site clean-up criteria of 33 mg/kg for total COCs (includes soils and sediments outside the existing fence of the SCD plant and noted as the SCD facility boundary on Figure 2) would also be remediated with biological treatment. This alternative would remediate and cap the same soils and sediments as delineated under Alternatives 4A and 4B, only the treatment technology employed would be bioremediation. The sediments in the sedimentation basin would be removed from the basin for ex situ bioremediation. In turn, the sedimentation basin would be dismantled and closed. Closure would include testing of the soils underlying the existing liner to insure that the soils are not contaminated. Any contaminated soils underlying the basin that exceed the off-site clean-up criteria of 33 mg/kg for total COCs would be remediated with biological treatment.

Under this alternative, the soils (as discussed above) inside the existing fence would be treated until the soils are remediated to the on-site clean-up criteria of 625/450 mg/kg for total COCs. All soils and sediments outside the existing fence, which exceed the off-site clean-up criteria of 33 mg/kg for total COCs would be treated until the soils and sediments are remediated to the clean-up criteria of 33 mg/kg for total COCs. After the excavated soils are remediated to the clean-up criteria, they could be used to backfill the excavated areas. Those soils which are excavated and treated, but not used for backfill will be remediated to 33 mg/kg for total COCs. These treated soils which are not used for backfill would be placed in the area formerly occupied by the sedimentation basin. Closure of the area formerly occupied by the sedimentation basin would entail grading, seeding and stabilizing with a variety of plants and shrubs. Species will be selected for their value in development of diversity, density, and abundance of habitat values.

VI. EVALUATION OF ALTERNATIVES/SELECTION OF EPA'S PREFERRED ALTERNATIVE

Ground Water - EPA recommends an interim action to contain ground water and remove sources of DNAPL contamination (these sources of DNAPL contamination will be identified during Remedial Design) as delineated in Alternative 3. This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD which addresses remediation of ground water is implemented.

Soils/Sediments - EPA's recommendation for a final action to remediate the contaminated soils and sediments at the SCD Site is Alternative 6 - Ex Situ/In Situ Biological Treatment with a contingency final action of Alternative 4B - Thermal Treatment, if Alternative 6 is unable to remediate contaminated soils and sediments to the clean-up criteria. Additional studies of both ex situ bioremediation (Alternative 5A in the Feasibility Study Addendum) and in situ bioremediation (Alternative 5B in the Feasibility Study Addendum) will be conducted during RD to determine if ex situ and/or in situ biological treatment will be able to treat the soils/sediments to the clean-up criteria. If additional studies demonstrate that ex situ and/or in situ biological treatment is unable to remediate soils to the clean-up criteria as delineated in Section IV C, then Alternative 4B will be implemented.

Each of the alternatives in the FS proposed using the existing sedimentation basin for consolidating contaminated and or treated soils and sediments. EPA is recommending that the preferred alternative include dismantling of the existing sedimentation basin, and using the area that is currently occupied by the basin to place treated soils (i.e., soils containing less than 33 mg/kg total COCs). Closure of this area will consist of placement of top soil, seeding and planting a variety of plants and grasses. The flora species will be selected for survivability and suitability under the varying conditions of the Site and will include mixed herbs, grasses and shrubs.

In selecting EPA's preferred alternative EPA evaluated each proposed remedy against the nine criteria specified in the National Contingency Plan. Each alternative must first satisfy the threshold criteria as described below. Next the primary balancing criteria are used to weigh the tradeoffs or advantages and disadvantages of the various alternatives. Finally, after public comment has been obtained, the modifying criteria are considered. Below is a summary of the nine criteria that were used to evaluate the remedial alternatives for the SCD Site.

Threshold Criteria

- Overall protection of human health and the environment:

Whether the remedy provides adequate protection of human health and the environment and how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

- Compliance with ARARs:

Whether or not a remedy will meet all applicable or relevant and appropriate requirements (ARARs) of Federal and State environmental statutes and/or whether there are grounds for invoking a waiver. Whether or not the remedy complies with advisories, criteria and/or guidance that may be relevant.

Primary Balancing Criteria

- Long-Term effectiveness and permanence:

The ability of the remedy to afford long term, effective and permanent protection to human health and the environment along with the degree of certainty that the alternative will prove successful.

- Reduction of toxicity, mobility or volume:

The extent to which the alternative will reduce the toxicity, mobility, or volume of the contaminants causing the site risks.

- Short-term effectiveness:

The time until protection is achieved and the short-term risk or impact to the community, on-site workers and the environment that may be posed during the construction and implementation of the alternative.

- Implementability:

The technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement that remedy.

- Cost:

Includes estimated capital, operation and maintenance, and net present worth costs.

Modifying Criteria

- State Acceptance:

Whether the State concurs with, opposes, or has no comment on the Preferred Remedial Alternative.

- Community Acceptance:

Whether the public agrees with the Preferred Remedial Alternative (this will be assessed in the ROD following a review of the public comments received on the Proposed Plan).

COMPARATIVE ANALYSIS OF ALTERNATIVES

The following summary profiles the performance of the preferred alternative in terms of the nine criteria, noting how it compares to the other alternatives under consideration.

Overall Protection of Human Health and the Environment

Alternative 1 (No Action) would neither eliminate nor reduce to acceptable levels the threats to human health or the environment

presented by contamination at the Site. It is therefore unacceptable and will not be discussed in the remainder of this analysis.

Ground Water
The ground water alternatives are the same for Alternatives 3 through 6. Based on historical data of the existing pump and treat system, it is uncertain whether the ground water system proposed in Alternative 2 would be effective in preventing contaminated ground water from entering Red Lion Creek. The ground water containment and extraction system included as a component of Alternatives 3 through 6 is considered more protective of human health and the environment.

Soils/Sediments/Surface Water
Alternative 2 includes the installation of new silt fences along the unnamed tributary to Red Lion Creek to prevent migration of contaminants into the Red Lion Creek. Under Alternative 2, however, some of the contaminated sediments will be left in place which allow for continued exposure to ecological systems. Alternative 3 would treat some of the contaminated sediments and contain the remaining contaminated soils and sediments by placing them in a lined and capped disposal unit, thereby reducing exposure. Although Alternatives 4A, 5A and 6 will treat all surface soils and sediments exceeding clean-up criteria, in situ bioremediation is an innovative technology and its success for treating chlorinated benzenes has not been demonstrated in the field to date. Alternative 4B is considered more protective because there is sufficient technical information to demonstrate that thermal treatment will be successful in treating the soils and sediments to the clean-up criteria. Alternatives 4B, 5A and possibly 6 will, however, result in the temporary loss of some habitat during remediation. Under Alternatives 3, 4A, 4B, 5A and 6, surface water will be addressed through remediation of the soils, sediments, and ground water because contaminated ground water flow to the Red Lion Creek will be eliminated. Surface water run-off will no longer come in contact with highly contaminated soils and sediments because the contaminated soils will be remediated to the clean-up criteria.

Compliance with ARARS

Ground water
In accordance with EPA's Ground Water Protection Guidelines, the Columbia aquifer is classified as a **Class IIB aquifer** (i.e., potential for use as a drinking water source). Both the Federal and State Safe Drinking Water laws set minimum standards for drinking water called Maximum Contaminant Levels (MCLs), which are applicable under CERCLA. Since EPA is recommending an interim action to contain ground water and DNAPL, all of the alternatives will require that additional work be conducted to determine not only the extent of DNAPL contamination, but also the likelihood of remediating the ground water to MCLs and applicable state standards within a reasonable timeframe as determined by EPA in consultation with DNREC.

All of the alternatives will have air emissions from the ground water treatment systems which will be treated either in the existing plant boilers, or other appropriate equipment (approved by EPA in consultation with DNREC) to comply with Federal and State ARARs.

All of the alternatives will discharge treated ground water to the Delaware River and will comply with the substantive requirements of the NPDES program and Federal and State water laws.

Soils/Sediments/Surface Water
The soils and sediments are contaminated due to a release of commercial chemical products which are listed as hazardous wastes in 40 CFR Section 261.33. Once these soils are excavated, they must be managed in accordance with Federal and State RCRA regulations. All of the alternatives in the FS proposed placing excavated, treated and/or untreated, soils in the existing sedimentation basin. RCRA regulations would require that all the excavated contaminated soil be treated to satisfy Land Disposal Regulations (40 CFR Section 268) and that the sedimentation basin be designed and constructed in accordance with RCRA hazardous waste treatment, storage and disposal facility regulations.

The Hazardous and Solid Waste Amendments of 1984 (HSWA) prohibited the land disposal of untreated hazardous wastes. HSWA required that EPA set "...levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the wastes..." On June 1, 1990, EPA promulgated land disposal regulations for various hazardous wastes, including chlorobenzene (U037), 1,2-dichlorobenzene (U070), 1,3-dichlorobenzene (U071), and 1,4-dichlorobenzene (U072). These regulations delineated certain treatment standards and concentration based standards. The concentration based standards of 5.7 mg/kg for chlorobenzene and 6.2 mg/kg for 1,2-, 1,3-, and 1,4-dichlorobenzene "reflect the performance of well-designed and well operated incineration systems."

An interpretation of the Federal RCRA regulations, referred to as the "Contained In Rule", states that contaminated media (e.g., soil) which contains hazardous waste must be managed as if it were hazardous waste, subject to all treatment, storage and disposal requirements under RCRA Subtitle C, until it no longer contains hazardous waste. Under the "Contained In Rule", contaminated soil is considered to no longer contain listed hazardous waste when hazardous constituents of the listed waste are at or below health-based levels. The clean-up criteria for the SCD Site, as discussed in Section IV of this Proposed Plan, were developed after a thorough review of both the site specific human health risk assessment and the site specific ecological risk assessment which were prepared during the RI/FS. As such, the clean-up criteria or performance standards are health-based levels which, when met, will minimize the threat to human health and the environment.

Although the land disposal treatment standards are more stringent than the Superfund clean-up criteria which were selected for the SCD Site using the Superfund Risk Assessment Guidance Document and the site specific human health and ecological assessments, EPA believes that the clean-up criteria are protective and will minimize the threat to human health and the environment. Therefore, once the Superfund contaminated soils and sediments at the Site have been treated to reduce the concentration of COCs to below the clean-up criteria or performance standards, they need not be managed in accordance with all Subtitle C requirements provided the treated soils are managed/disposed at the SCD Superfund Site as that Site is described in Section II of this Proposed Plan. The site specific clean-up criteria, however, will only apply to the waste or contamination described in this Proposed Plan; they are not intended to be used as clean-up criteria or standards for any other contamination or wastes under any other circumstances.

Alternatives 2 and 3 would not be able to comply with these requirements because neither alternative will reduce the concentration of contaminants in the soils or sediments to satisfy the Land Disposal Regulations or health based numbers. Alternative 2 and Alternative 3, as they address the remediation of soils and sediments, will be eliminated from further consideration as viable alternatives since neither alternative will satisfy the RCRA ARARs.

Additional treatability studies/pilot tests are required to determine if Alternatives 5A and 6 would satisfy the above requirements. Previous studies have demonstrated that Alternatives 4A and 4B can remove 99.9% of the contaminants and it in turn will be able to comply with the above ARAR.

There are several other ARARs associated with remediation of the soils and sediments that need to be complied with, for example, the Delaware Wetlands Act of 1973 and the Archeological and Historical Preservation Act of 1974. All of the alternatives can be designed and implemented to comply with these requirements.

There are no ARARs that establish specific clean-up criteria for soils and sediments. Therefore, the results of the human health and ecological risk assessment performed as part of the RI/FS were used to establish acceptable exposure levels for soils and sediments. Alternatives 4B and 5A will have the greatest

negative impact on the surrounding wetlands, since they involve the physical removal of all contaminated soils and sediments above the established clean-up criteria. This impact is off-set by having the most assurance of satisfying Delaware Surface Water Quality Standards for Red Lion Creek. Each of the alternatives involves some impact on the wetland areas. Alternatives 3, 4A and 6 may be the least disruptive to the habitats in the wetlands, however, each alternative includes provisions for wetlands restoration.

Long-Term Effectiveness and Permanence

Ground Water
The ground water treatment and containment systems proposed in Alternatives 3, 4A, 4B, 5A and 6 provide a more effective barrier in containing the ground water plume than the option proposed in Alternative 2. All of the alternatives will result in hazardous substances remaining on-site above health-based levels. Since the ground water component of the remedy is an interim action, review of this portion of the remedy will be ongoing as EPA continues to develop final remedial alternatives for the ground water and DNAPLS.

Soils/Sediments/Surface Water
There is some uncertainty associated with remediating the sediments to clean-up criteria with in situ bioremediation in Alternatives 4A and 6. Previous studies have demonstrated that the thermal treatment in Alternatives 4A and 4B is capable of a 99.9% removal efficiency. If bioremediation is successful, Alternatives 5A and 6 provide for treatment of all surface soils and sediments above the clean-up criteria and therefore offer long-term effectiveness and permanence equivalent to Alternative 4B. There are uncertainties associated with bioremediation (Alternatives 4A, 5A and 6) in satisfying performance standards or clean-up criteria, which will require treatability studies and/or pilot scale tests prior to implementation. In the event that treatability studies demonstrate that the technology employed pursuant to Alternatives 4A, 5A and 6 is ineffective, (i.e., cannot reduce the level of contaminants in off-site soils/sediments to 33 mg/kg), the contingency Alternative 4B, will provide for long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment

Ground Water
Each of the alternatives would reduce the volume and toxicity of the contamination through the use of recovery wells at DNAPL pools identified during the remedial design. The interceptor trench in Alternatives 3 through 6 provides a more effective hydraulic barrier than the extraction wells in Alternative 2, and in turn would be more effective in reducing the mobility of contaminated ground water and DNAPLs.

Soils/Sediments/Surface Water
Alternatives 4A, 4B, 5A and 6 provide for maximum reduction of toxicity and mobility by permanently treating the soils and in turn conforming with the statutory preference for treatment as a principle element in remediation goals. If additional studies demonstrate that bioremediation (Alternatives 4A, 5A and 6) is ineffective, (i.e., cannot reduce the level of contaminants in off-site soils/sediments to 33 mg/kg), Alternative 4B, would be most effective in reducing the toxicity, mobility, and volume of contamination through treatment.

Short-Term Effectiveness

Ground Water
Alternative 2 requires the installation of additional extraction wells which is much less intrusive than the construction of the interceptor trench which is the ground water remedial measure proposed in Alternatives 3 through 6. The trench would require more manpower and could possibly expose workers and the environment to airborne emissions and contaminated ground water during its construction. Alternative 2 would have a minimum impact on the wetlands and could be implemented more quickly than the interceptor trench. The topography of the area where the trench would be constructed is steep in some

areas, resulting in space constraints and associated safety hazards.

Soils/Sediments/Surface Water
Alternatives 4A, 4B, and 5A require excavation of sediments which can result in additional exposure of workers and the environment to airborne emissions. Both 4B and 5A will have a short-term negative impact on wetlands, which will be mitigated as part of the remedial action. If additional treatability studies demonstrate that in situ bioremediation can satisfy the performance standards and clean-up criteria for sediments in the unnamed tributary, Alternatives 4A and 6 would be equivalent in short-term impacts. There is some uncertainty of the timeframes required for bioremediation, both in situ and ex situ (Alternatives 4A, 5A, and 6), to treat the soils and sediments to the clean-up criteria.

Implementability

Ground Water
Alternative 2 is easier to implement than Alternatives 3 through 6, because of the simpler design. Ground water remediation for Alternatives 3 through 6 employs conventional construction techniques but the limited space available, as well as the specific hydraulic barrier type selected, may affect the relative ease of implementability.

Soils/Sediments/Surface Water
Alternative 4B (Thermal Treatment) is a proven technology, but is more difficult to implement than Alternative 4A, due to difficulties in accessing some of the sediments, as well as pre-treating the sediments to reduce the moisture content. Alternative 5A (Ex Situ Biological Treatment) is a developing technology and would require additional treatability studies and/or pilot scale tests prior to implementing on a site-wide basis. Monitoring the effectiveness of in situ bioremediation (Alternatives 4A and 6) may present additional uncertainties.

Cost

All media
The costs of the alternatives shown above in Section V are based on capital costs and operation and maintenance ("O&M"). The cost estimates are based on a variety of information, including estimates from suppliers, construction unit costs, vendor information, and conventional cost estimating guides. Alternatives 4A, 4B, 5A and 6 are in line with the statutory preference for treatment to reduce inherent hazards posed by principle threats. The present worth cost of Alternative 4A is $11.7 million, 4B is estimated at $17.1 million, Alternative 5A is estimated to cost from $10.6 million to $12.9 million, and Alternative 6 is estimated to cost from $6.6 million to $12.2 million. EPA's recommendation to dismantle the existing sedimentation basin will result in a reduction to the present worth costs of approximately $800,000 for Alternatives 4A, 4B, and 5A.

State Acceptance
Based upon information available at this time, DNREC supports the preferred alternative (Alternative 6) with a contingency for Alternative 4B if additional studies conducted during RD demonstrate that biological treatment will not be able to achieve the clean-up criteria. However, DNREC will consider public comment on the proposed remedy and will make a final decision only after a review of public comments is completed. DNREC's decision regarding concurrence with the final remedy will be documented in the Record of Decision for the Site. DNREC does not advocate the uncontrolled stockpiling of soil with contamination levels greater than 33 ppm COCs at the SCD plant facility.

Community Acceptance
Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be discussed in the Responsiveness Summary in the ROD.

Summary of the Preferred Alternative
EPA's preferred alternative for the SCD Site is Alternative 6 - Biological Treatment with a contingency alternative of Alternative 4B - Thermal Treatment. The preferred alternative requires additional investigation (treatability study and/or pilot scale tests) during the remedial design phase of the Site remediation to demonstrate that the technology will satisfy performance standards and the clean-up

criteria. Both Alternative 6 and the contingency alternative of Alternative 4B provide for substantial risk reduction through the treatment of the principal threat of contaminated soils and sediments with an interim action to contain ground water at the Site.

Alternative 6 will biologically treat surface soils and sediments above the clean-up criteria (See Section IV C). The contingency alternative of Alternative 4B will thermally treat surface soils and sediments above the clean-up criteria. Under either alternative, the contaminated soils in the vicinity of the railroad tracks will be capped. 40 C.F.R. Section 300.430(a)(1)(iii) of the NCP states that:

"EPA expects to use innovative technology when such technology offers the potential for comparable or superior treatment performance or implementability... or lower costs for similar levels of performance..."

The FS Addendum identified Alternative 5B - In Situ bioremediation as a supplement to Alternatives 3 and 4A. EPA is recommending that the additional studies which will be conducted as part of the Remedial Design, evaluate the potential of both ex situ (Alternative 5A in the FS Addendum) and in situ (Alternative 5B in the FS Addendum) bioremediation. Either ex situ or in situ bioremediation, or a combination of both (Alternative 6), fulfills the NCP expectations to utilize innovative technology when appropriate.

The actual biological treatment process will be refined during the initial studies. One type of ex situ bioremediation under consideration is slurry phase bioremediation, where contaminated soils and sediments are placed in a reactor (tank) and combined with water to form a slurry. Other types of ex situ bioremediation that may be considered and evaluated include solid-phase bioremediation (landfarming) and composting. In situ bioremediation entails the addition of nutrients, oxygen (if the process is aerobic), and microorganisms to the contaminated sediments to enhance the natural biodegradation process.

If, based on the results of the additional treatability studies, bioremediation is performed in the field, it must effectively reduce the concentration of contaminants to satisfy the clean-up criteria. If biological remediation is unable to achieve these levels, Alternative 4B will be implemented.

If, based on the results of further testing during the remedial design phase, it is determined that in situ and/or ex situ bioremediation is not feasible for this Site, the contingency option is Alternative 4B - Thermal Treatment. Low Temperature Thermal Desorption (LTTD) heats contaminated soils/sediments at low temperatures ranging from 200 to 1000°F, driving off water and volatile contaminants. Off gases (air emissions) will be burned in an afterburner, sent to the existing boilers, or captured by carbon adsorption beds.

With the exception of the surface soils along the railroad tracks, the surface soils and sediments as described under Alternative 6, including the waste piles and sedimentation basin will undergo treatment to remediate the soils and sediments to clean-up criteria. Soils and sediments excavated from off-site (includes soils and sediments outside the existing fence of the SCD facility and noted as the SCD facility boundary on Figure 2) cannot be used for on-site (includes excavated areas inside the existing fence of the SCD facility and noted as the SCD facility boundary on Figure 2) backfill until they have undergone treatment to attempt to meet the clean-up criteria of 33 mg/kg of total COCs. Since shutting down the railroad tracks would result in shutting down plant operations, the remedy for the soils in this area will consist of either an asphalt cap or in situ biological treatment. Soils in the vicinity of the catch basin will be biologically treated in place or excavated to a depth of fifteen feet. Excavation beyond this depth would result in damage to the structural integrity of the catch basin. After the soils adjacent to the catch basin have been excavated and treated, the area will be backfilled and capped with an asphalt cap.

The clean-up criteria for on-site soils and sediments (includes soils and sediments inside the existing fence of the SCD facility and noted

as the SCD facility boundary on Figure 2) is 625 mg/kg of total COCs with a ceiling of 450 mg/kg for 1,4-dichlorobenzene. All excavated contaminated soils and sediments must be remediated to the on-site clean-up criteria before they can be used as backfill for the on-site excavated areas.

The clean-up criteria for off-site soils and sediments (includes soils and sediments outside the existing fence of the SCD facility and noted as the SCD facility boundary on Figure 2) is 33 mg/kg of total COCs. All excavated contaminated soils and sediments must be remediated to the off-site clean-up criteria before they can be used as backfill for the off-site excavated areas.

Any excavated contaminated soils which are not used as backfill material must be remediated to 33 mg/kg of total COCs. These soils and sediments can then be placed in the area formerly occupied by the sedimentation basin as described below.

The FS proposed placing all soils and sediments that could not be successfully treated to the clean-up criteria in a retrofitted sedimentation basin. Placement of contaminated soils in a sedimentation basin would be in violation of RCRA Land Disposal regulations. EPA will require that all soils and sediments be treated to the clean-up criteria prior to backfilling or placement on-site/off-site whether bioremediation (Alternative 6) or the contingency remedy of thermal treatment (Alternative 4B) is implemented. Based on previous Low Temperature Thermal Desorption Treatability studies, EPA anticipates that all soils and sediments can be successfully treated to 33 mg/kg of total COCs. In turn there is no need for retrofitting or using the sedimentation basin. EPA is recommending that the sedimentation basin be dismantled after the sediments are removed, and any underlying contaminated surface soil be excavated for treatment. The area formerly occupied by the sedimentation basin can then be used to place all treated soils and sediments which will not be used as backfill material. After all the soils and sediments are treated, the area can be graded and seeded in a manner to promote ecological diversity.

The ground water containment component of the preferred alternative is an interim remedy and consists of a physical barrier such as a trench or slurry wall. The physical barrier will be installed along the shorelines of the unnamed tributary and the Red Lion Creek to capture ground water and DNAPLs before they enter the Red Lion Creek. In addition, low volume recovery wells will be installed to attempt to recover DNAPLs. The recovered DNAPLs will be stored on-site temporarily and ultimately disposed of off-site in accordance with applicable hazardous waste regulations. Recovered ground water will be treated in the existing air stripper and then discharged to the Delaware River under SCD's NPDES permit requirements. Off gases will be burned in the existing facility boilers in accordance with all applicable federal and state requirements.

Repairs and upgrades (if necessary) of the existing ground water pump and treat system will be required. Historically, a few of the well pumps have not functioned at optimum capacity. At a minimum, measures to insure that the existing recovery wells pump at design capacity will be required. In addition, routine physical testing of Catch Basin #1 will be required to minimize the possibility of future releases.

Institutional controls including site monitoring, site access restrictions, and deed restrictions will be implemented. In addition, DNREC will implement a ground water management zone for the area.

The remedy includes a provision for the development of a plan to provide an alternate means of treating the ground water and DNAPLs in the event that SCD should cease or curtail operations at this location. Any other environmental concerns at the time of possible closure of the facility will be addressed by various Federal laws and regulations as well as those of the State of Delaware.

Additional investigative work will be required to define the extent of the DNAPL contamination. A detailed evaluation of the restoration potential of the aquifer will also be conducted. The FS did not address remediation of ground water in the vicinity of MW #16, which is

adjacent to the effluent pipeline. Since the investigation of this area was limited to one round of sampling, additional investigation of this area will be conducted during the remedial design. Upon completion of this additional work, EPA will make a final decision on the remedy which will be documented in a final ROD for ground water remediation.

Pre-remediation and post-remediation monitoring of the Site, according to a monitoring plan developed during remedial design, is required to ensure that the remedy is protective of resources at the Site. Site monitoring activities will include monitoring of the ground water in both the Columbia and Potomac Formations and monitoring of the surface water systems present at the Site (the wetlands, unnamed tributary to Red Lion Creek, and the Red Lion Creek). The ground water monitoring activity will involve the installation of additional on-site and off-site monitoring wells. Ecological monitoring will be conducted annually with the first round prior to the start of remedial action to establish a data baseline and then annually thereafter until the five-year review. The ecological monitoring activities may include chemical analysis of surface water, sediments and fish tissue, and sediment bioassays. Decisions regarding the possible need for additional remediation activities will only be made after the monitoring activities have been conducted long enough to establish trends and those trends have been thoroughly evaluated by EPA, DNREC, and any necessary support agencies. Decisions regarding the need for any possible additional remediation activities at the Site will be made by EPA and DNREC.

Excavation in the wetland areas will meet the following criteria:

1) The excavated areas in the low lying areas can remain at the excavated elevation and grade (as opposed to backfilling) if an acceptable marsh substrate exists. Temporary stabilization will include planting of water tolerant annual species in the exposed wetland area;

2) The upland areas and banks will be stabilized in accordance with substantive State erosion and sedimentation control requirements. Temporary stabilization will include planting of an acceptable annual species in the upland/bank areas. The plantings will be maintained until the area is stabilized; and

3) Natural succession is acceptable as long as there is a **Phragmites** control plan in place.

Both Alternative 6 and the contingency alternative of Alternative 4B may have a transfer of contaminants from the solid/liquid phase to the air phase. EPA will require controls for these air emissions.

Alternative 6 with a contingency of Alternative 4B, is the preferred alternative for the treatment of soils, sediments and ground water at the Site, since it meets the threshold criteria, and provides the best balance of effectiveness, permanence, implementability, and reduction of toxicity, mobility and volume of contaminants through treatment. The NCP states that EPA will place priority on treating materials that pose the principle threat at a given site. Alternative 6 is selected as the preferred alternative because it has the potential to achieve the same end result as Alternative 4B at a substantially lower cost. EPA and DNREC foresee the use of a combination of ex situ bioremediation and in situ-bioremediation at this Site. For example, ex situ bioremediation could be used for all surface soils and some sediments. If successful, in situ bioremediation would be used for the some of the sediments for which access is difficult along the unnamed tributary and the Red Lion Creek.

In the event, that additional investigation demonstrates that bioremediation will not be able to satisfy the performance standards, EPA recommends that Alternative 4B be implemented. Previous studies have demonstrated that this technology (low temperature thermal desorption) is capable of a 99.9% **Destruction and Removal Efficiency (DRE)** for the contaminants found in the soils and sediments at the Site. In addition, recovery and reuse of the product phase also reduces the volume of residuals which could require further treatment.

Based on the information available at this time, EPA believes that the preferred alternative, (Alternative 6) with the contingency alternative (Alternative 4B) will be protective of human health and the environment, will be cost effective, and will utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

EPA may, in consultation with DNREC and other Federal and State natural resource trustees, later modify the preferred alternative or select another remedial action presented in this Proposed Plan and RI/FS if new information or public comments warrant such action. The public, therefore, is encouraged to review and comment on all alternatives identified in this Proposed Plan. The RI/FS should be consulted for more information on these alternatives.

VII. COMMUNITY ROLE IN SELECTION PROCESS

This Proposed Plan is being distributed to solicit public comment regarding the proposed remedial alternatives for cleaning up the SCD Site. EPA relies on public input to assess the needs and concerns of the local community. To assure that the community's concerns are being addressed, a public comment period lasting thirty (30) days will follow this public notice and a public meeting will be held in the community. It is important to note that although EPA has proposed a Preferred Alternative, the final remedy selection for the SCD Site has not been made. All comments received will be considered and addressed by EPA before a final remedy selection is made.

Detailed information on the material discussed herein may be found in the Administrative Record for the Site, which contains the Remedial Investigation and Feasibility Study Reports, and other information used by EPA in the decision-making process. EPA encourages the public to review the Administrative Record in order to gain a more comprehensive understanding of the Site and Superfund activities that have been conducted there. Copies of the Administrative Record are available for review at the following **Information Repositories:**

Delaware Department of Natural Resources
and Environmental Control (DNREC)
715 Grantham Lane
New Castle, DE 19720
Attn: Anne Hiller
(302) 323-4540

U.S. EPA
Region III
841 Chestnut Building, 9th Floor
Philadelphia, PA 19107
Attn: Anna Butch (3HW01)
(215) 597-3037

Public Comment Period

EPA encourages comments from the public on all alternatives and on the information that supports the alternatives. Although EPA is proposing a preferred alternative, no final decision has been made. For this reason, EPA is providing a public comment period on the proposed plan. The public comment period begins on April 4, 1994 and concludes on May 4, 1994. This comment period will allow the public to comment on the alternatives summarized in this Proposed Plan, and on the preferred alternative in particular. EPA will select a remedy based on the information in the Administrative Record and on public comments. Public comments can influence EPA's choice. As a result, the final remedial action for the Site, as presented in the ROD, may be different from the preferred alternative presented here. EPA will hold a public meeting on April 27, 1994 at 7:00 p.m. at Carpenters Union Hall, 626 Wilmington Road, New Castle, Delaware, to present a summary description of the alternatives. Interested citizens will have an opportunity to ask questions and provide comments at that time. Also, written comments may be submitted to one of the following people:

Katherine Lose (3HW42)
Remedial Project Manager
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107
(215) 597-0910

Felicia Dailey, (3EA21)
Community Relations Coordinator
U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19107
(215) 597-7710

Anne Hiller
State Project Officer
DNREC
715 Grantham Lane
New Castle, DE 19720
(302) 323-4540

Following the conclusion of the thirty (30) day public comment period on this proposed plan, a Responsiveness Summary will be prepared. The Responsiveness Summary will summarize and respond to significant comments on EPA's Preferred Remedial Alternative. EPA will then prepare a formal decision document, the Record of Decision ("ROD"), that summarizes the decision process and the remedy selected for the Site. This ROD will include the Responsiveness Summary. Copies of the ROD will be made available for public review in the information repositories. Once the formal decision document is approved, EPA will begin negotiations with the parties responsible for contamination at the Site for the implementation of remedial design and remedial action ("RD/RA") for the Site.

GLOSSARY

Administrative Record - EPA's official compilation of documents, data, reports, and other information that is considered important to the status of, and decisions made, relative to a Superfund site. The record is placed in the information repositories to allow public access to the material.

Air Stripping - A treatment system that removes or "strips" volatile organic compounds from contaminated ground water by forcing an airstream through the water and causing the compounds to evaporate.

Aquifer - An underground geologic formation, or group of formations, containing useable amounts of ground water that can supply wells and springs.

Aquitard - a confining bed that retards but does not prevent the flow of ground water to or from an adjacent aquifer.

ARARs - Applicable, Relevant and Appropriate Requirements:

Applicable requirements are those clean-up standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and Appropriate requirements are those same standards mentioned above that while not "applicable" at the CERCLA site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site.

Biological Treatment - Generally refers to the breakdown of organic compounds (contaminants) by micro-organisms.

Capping - Construction of a protective cover over areas containing wastes or contamination. Caps prevent surface exposure of contaminated soils and sediments and reduce or eliminate infiltration of rain water or other precipitation into the soils or sediments. This minimizes the movement of contaminants from the site through ground water or surface water.

Carcinogen - A cancer-causing agent.

Catch Basin - For this Site, the term refers to a settling unit fed by process sewer lines, in which the heavier chlorinated compounds settle and are then recycled to the facility's process.

CERCLA - see Superfund

CFR - The Code of Federal Regulations. For example, the citation 40 CFR Part 260 means Title 40 of the Code of Federal Regulations, Part 260.

Class II B Aquifer - An aquifer that has the potential for use as a public drinking water source.

Desorption - The physical process of separating a volatile compound from a liquid or solid mixture into a gas.

DNAPL - Dense Non-aqueous Phase Liquids are organic compounds (or mixtures of compounds) that are immiscible (resistant to mixing) with water, and being more dense than water, sink downward.

DRE - Destruction and Removal Efficiency is defined as the ratio of the concentration of waste removed over the total waste input, multiplied by 100%. The equation is as follows: $\frac{(W_{in}-W_{out})}{W_{in}} \times 100\%$

Ex Situ Bioremediation - Treating soils in an above-grade treatment system using conventional soil management practices to enhance microbial degradation of contaminants.

Five-Year Review - An evaluation of a Superfund site conducted five years after the start of remedial action to insure that the remedy remains protective of human health.

Ground Water - Water found beneath the earth's surface that fills pores between soil, sand, and gravel particles to the point of saturation. Ground water often flows more slowly than surface water. When it occurs in sufficient quantity, ground water can be used as a water supply.

Hazard Index - The sum of more than one hazard quotient for multiple substances and/or multiple exposure pathways.

Hazard Quotient - The ratio of a single substance exposure level over a specified time period to a reference dose for that substance derived from a similar exposure period.

Information Repository - A location where documents and data related to a Superfund project are placed by EPA to allow the public access to the material.

In situ Bioremediation - The process of enhancing the microbial degradation of contaminants in subsurface soil and water without excavation of the contaminated soil. Nutrients and microorganisms may be added to stimulate biodegradation.

Interim action - a remedial action to respond to an immediate site threat. Interim actions are limited in scope and require additional work to provide definitive protection of human health and the environment for the long term.

Low Level Threat Waste - Those source materials that can generally be contained in a reliable manner, and that would present only a low level risk in the event of release. They include source materials that exhibit low toxicity, low mobility in the environment, or are near health-based levels.

Low Temperature Thermal Desorption - Contaminated soils/sediments are heated at low temperatures to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to a gas treatment system. The contaminants are not destroyed, rather they are physically separated from the soils and concentrated in a vapor treatment system before being disposed of properly.

MCLs - (Maximum Contaminant Levels) Enforceable standards for public drinking water supplies promulgated under the Safe Drinking Water Act, 42 U.S.C. §§ 300f-300j. MCLs are referred to as drinking water standards.

mg/kg - (milligram per kilogram) Five mg/kg is a fractional representation of five milligrams to one kilogram, and equivalent to ppm (See definition below) .

Monitoring Wells - Special wells drilled at specific locations on or off a hazardous waste site where ground water can be sampled at selected depths and studied to determine such parameters as the direction in which ground water flows and the types and amounts of contaminants present.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) - The Federal regulation at 40 CFR Part 300 that guides the determination and manner in which sites will be cleaned up under the Superfund program.

National Priorities List (NPL) - EPA's list of the nation's top priority hazardous waste sites that are eligible to receive federal money for response action under Superfund.

NPDES Permit - (National Pollution Discharge Elimination System Permit) A permit issued pursuant to the Clean Water Act, 33 U.S.C. §§ 1251-1387. These permits set limits on amounts of certain contaminants allowed in discharges to navigable waters.

Organic Compounds - Chemicals containing carbon. Many hundreds of thousands are known. At the SCD Site, the contaminants present are organics (i.e., chlorinated benzene compounds). Some organic compounds can cause cancer.

Phragmites - is a reed-like grass, sometimes called "dutch reed". It is a tall, upright stem that has a showy plume seed head. It is an aggressive and invasive plant of wetlands with little or no habitat value other than offering cover.

Plume - The three dimensional area of contamination in a particular media, such as ground water. A plume can expand due to ground water movement.

ppb - (Parts per billion) Five parts per billion is a fractional representation of 5 parts in 1 billion parts. For solids, ppb is a fraction based on weight, for example 5 pounds of a contaminant in a billion pounds (500,000 tons) of soil. For liquids ppb is based on volume, for example 5 tablespoons of a contaminant in a billion tablespoons (3,906,250 gallons) of water.

ppm - (Parts per million) Five ppm is a fractional representation of 5 parts in 1 million.

Present Worth Costs - The amount of money necessary to secure the promise of future payments, or series of payments, at an assumed interest rate.

Principal Threat Waste - Source material considered to be highly toxic or highly mobile that cannot generally be contained in a reliable manner, or would present a risk to human health or the environment should exposure occur.

RCRA (Resource Conservation and Recovery Act) - A statute at 42 U.S.C. §§ 6901 et. seq. under which EPA regulates the management of hazardous waste.

Record of Decision (ROD) - A legal decision document that describes the remedial actions selected for a Superfund site, why certain remedial action(s) were chosen as opposed to others, how much they will cost, and how the public's comments about the Proposed Plan were incorporated into the final decisional document.

Recovery Well - A well used to extract contaminated ground water or product from an aquifer for subsequent treatment.

Remedial Investigation and Feasibility Study (RI/FS) - A report composed of two scientific studies, the RI and the FS. The RI is the study to determine the nature and extent of contaminants present at a site and the problems caused by their release. The FS is conducted to develop and evaluate alternatives for the clean-up of a site.

Responsiveness Summary - A summary of oral and/or written public comments received by EPA during a comment period on key EPA documents, and EPA's responses to those comments. The responsiveness summary is a key part of the ROD, highlighting community concerns for EPA decision-makers.

Risk Assessment (RA) - The RA is an essential component of the Remedial Investigation ("RI") Report. This portion of the RI evaluates the carcinogenic and non-carcinogenic risks presented by the contaminants at a site. Risk is calculated both for current uses and potential future uses of the property by a defined population, (i.e., on and off-site residents, trespassers, etc.)

Scientific Notation - In dealing with particularly large or small numbers, scientists and engineers have developed a "short hand" means of expressing numerical values. For example, 1,000,000 can be written as 1×10^{6} and 1/1,000,000 can be written as 1×10^{-6}.

Superfund (Comprehensive Environmental Response Compensation and Liability Act) - A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act codified at 42 U.S.C. §§ 9601 et. seq. The Act created a Trust Fund, known as the Superfund, which is available to EPA to investigate and clean-up abandoned or uncontrolled hazardous waste sites.

Volatile Organic Compounds (VOCs) - Chemical compounds containing carbon that readily volatilize or evaporate when exposed to the air. These compounds can be used as solvents by industry.

TABLE 1
SUMMARY OF CARCINOGENIC RISKS[1]

EXPOSURE SCENARIOS	POTENTIAL RECEPTORS				
	Current Worker	Current Visitor	Future Worker	Future Visitor	Hunter/Fisherman
Soil Ingestion	2.13E-05	4.27E-06	2.13E-05	4.27E-06	2.54E-06
Soil Dermal Contact	1.00E-04	2.00E-05	1.00E-04	2.00E-05	1.62E-05
Soil Dust Ingestion	1.77E-07	1.77E-06	1.77E-07	1.77E-06	2.11E-06
Ground Water Ingestion	NA[2]	NA	4.38E-03	4.38E-04	NA
Fish Ingestion	NA	NA	NA	NA	0.00E+00
Surface Water Dermal Contact	NA	NA	NA	NA	9.61E-06
Sediment Dermal Contact	NA	NA	NA	NA	2.19E-05
TOTAL RISK*	1.22E-04	2.43E-05	4.50E-03	4.62E-04	5.03E-05

* Risk values represent the increased likelihood of developing cancer as a result of exposure to contaminants via each scenario. A risk value of of $1 \times E^{-05}$ or 1×10^{-05} means that an additional 1 in 1 million people exposed to site contaminants may develop cancer as a result of the exposure. The EPA uses a criteria of $1 \times E^{-04}$ or 1×10^{-4} in determining the need for remediation at a site.

1 Risk based on the upper 95% confidence limit exposure concentrations

2 Not applicable

TABLE 2
SUMMARY OF NON-CARCINOGENIC HAZARD INDICES[1]

EXPOSURE SCENARIOS	POTENTIAL RECEPTORS				
	Current Worker	Current Visitor	Future Worker	Future Visitor	Hunter/Fisherman
Soil Ingestion	0.837	0.167	0.837	0.167	0.105
Soil Dermal Contact	4.44	0.888	4.44	0.888	0.768
Soil Dust Ingestion	0.008	0.0008	0.008	0.0008	0.0007
Ground Water Ingestion	NA[2]	NA	324	32.4	NA
Fish Ingestion	NA	NA	NA	NA	0.00005
Surface Water Dermal Contact	NA	NA	NA	NA	0.239
Sediment Dermal Contact	NA	NA	NA	NA	0.21
TOTAL RISK*	5.28	1.08	329	33.4	1.32

* A risk number greater than 1 indicates that exposure of receptors to contaminants may result in adverse health effects.

1 Risk based on the upper 95% confidence limit exposure concentrations

2 Not applicable

TABLE 3
SUMMARY OF ALTERNATIVES

MEDIA	ALTERNATIVE 1 No Action	ALTERNATIVE 2 Containment	ALTERNATIVE 3 Closure and In Situ Bioremediation	ALTERNATIVE 4 (A) Thermal Treatment and In Situ Bioremediation (B) Thermal Treatment	ALTERNATIVE 5A Ex Situ Biological Treatment	ALTERNATIVE 5 Ex Situ/In Situ Biological Treatment
Surface Soils	No Action	- Institutional controls (deed restrictions) - Site Security (fencing) - Remove readily accessible, highly contaminated surface soils - Consolidate and contain removed materials in the sedimentation basin - Stabilize/solidify (in situ) materials in basin - Install multi-layer cap on sedimentation basin after consolidation - Asphalt cap in railroad track area and catch basin - Surface water controls as necessary	- Institutional controls and site security (same as Alternative 2) - Remove readily accessible, highly contaminated surface soils - Stabilize/solidify (ex situ) removed surface soils - Consolidate and contain removed materials in the sedimentation basin - Reconstruct sedimentation basin to include new liner, leachate collection system, and multi-layer cap - Asphalt cap in railroad track and catch basin - Surface water controls as necessary	Option A: - Institutional controls and site security (same as Alternative 2) - Remove readily accessible, highly contaminated surface soils - Treat removed soils using thermal desorption - Backfill treated soils into excavated areas - Surface water controls as necessary Option B: - All elements of option A	- Institutional controls and site security (same as Alternative 2) - Remove readily accessible, highly contaminated surface soils - Treat removed soils using ex situ biological treatment - Backfill treated soils into excavated areas - Surface water controls as necessary	Same as Alternative 5A
Subsurface Soils	No Action	- Remove, consolidate, in situ stabilize, and contain subsurface soils - Line excavations using an FML in excavated areas where high subsurface concentrations remain	- Remove, consolidate, stabilize/solidify (ex situ), and contain subsurface soils - Line excavations using an FML in excavated areas where high subsurface concentrations remain	Option A: - Remove, consolidate, thermally treat, and backfill subsurface soils - Line excavations using an FML in excavated areas where high subsurface concentrations remain Option B: - All elements of Option A	- Remove, consolidate, biologically treat, and backfill subsurface soils - Line excavations using an FML in excavated areas where high subsurface concentrations remain	Same as Alternative 5A
Sediments	No Action	- Institutional controls (deed restrictions) - Site monitoring - Sediment barriers (silt fences, aggregate materials) to prevent sediment transport - Consolidate sediments already in the basin with removed soils - Stabilize/solidify (in situ) materials in basin - Install multi-layer cap on sedimentation basin after consolidation	- Institutional controls (deed restrictions) - Site monitoring - Remove readily accessible, highly contaminated sediments - In situ bioremediation of remaining wetland sediments with contaminant concentrations above action levels - Restore disturbed wetlands - Remove materials from sedimentation basin for ex situ stabilization/solidification - Reconstruct sedimentation basin to include new liner, leachate collection system, and multi-layer cap - Consolidate stabilized/solidified sediments into reconstructed basin	Option A: - Institutional controls (deed restrictions) - Site monitoring - Remove readily accessible, highly contaminated sediments - Treatment using thermal desorption - In situ bioremediation of remaining wetland sediments with contaminant concentrations above action levels - Restore disturbed wetlands - Reconstruct sedimentation basin to include new liner, leachate collection system, and multi-layer cap - Consolidate treated sediments into reconstructed basin - Sediment barriers as necessary Option B: - All aspects of Option A with the exception that all sediments above action levels will be removed and thermally treated.	- Institutional controls (deed restrictions) - Site monitoring - Remove all sediments above action levels - Treat using ex situ biological treatment - Restore disturbed wetlands - Reconstruct sedimentation basin to include new liner, leachate collection system, and multi-layer cap - Consolidate treated sediments into reconstructed basin	- Institutional controls - Site monitoring - Treat all sediments above action levels using either in situ or ex situ biological treatment - Restore any disturbed wetlands - dismantle sedimentation basin with closure to include placement of topsoil, seeding, and establishing diverse vegetative growth
Ground Water	No Action	- Institutional controls (deed restrictions) - Site monitoring - Continue existing ground water extraction and treatment program - Additional extraction wells to reduce flux into surface water - Product recovery wells - Treatment using existing or modified ground water treatment system (air stripping)	- Institutional controls (deed restrictions) - Site monitoring - Enhance existing ground water recovery system to contain all ground water exiting the site. Will include use of extraction wells and hydraulic barriers (interceptor trenches) - Product recovery wells - Treatment using existing or modified ground water treatment system (air stripping)	Same as Alternative 3	Same as Alternative 3	Same as Alternative 3
Surface Water	No Action	- Deed restrictions (impose restricted wetland use)	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2

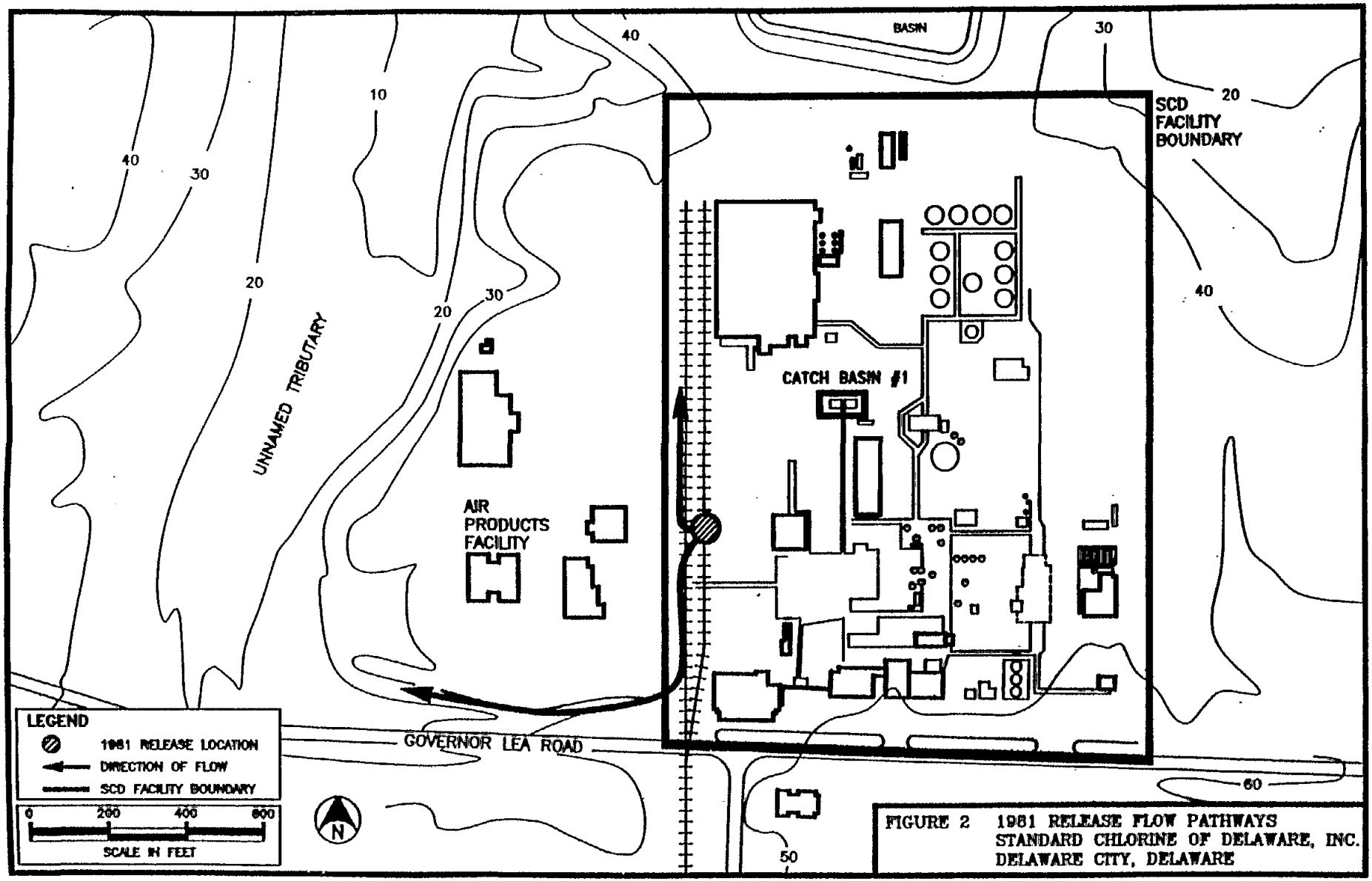


FIGURE 2 1981 RELEASE FLOW PATHWAYS
STANDARD CHLORINE OF DELAWARE, INC.
DELAWARE CITY, DELAWARE

AR308525

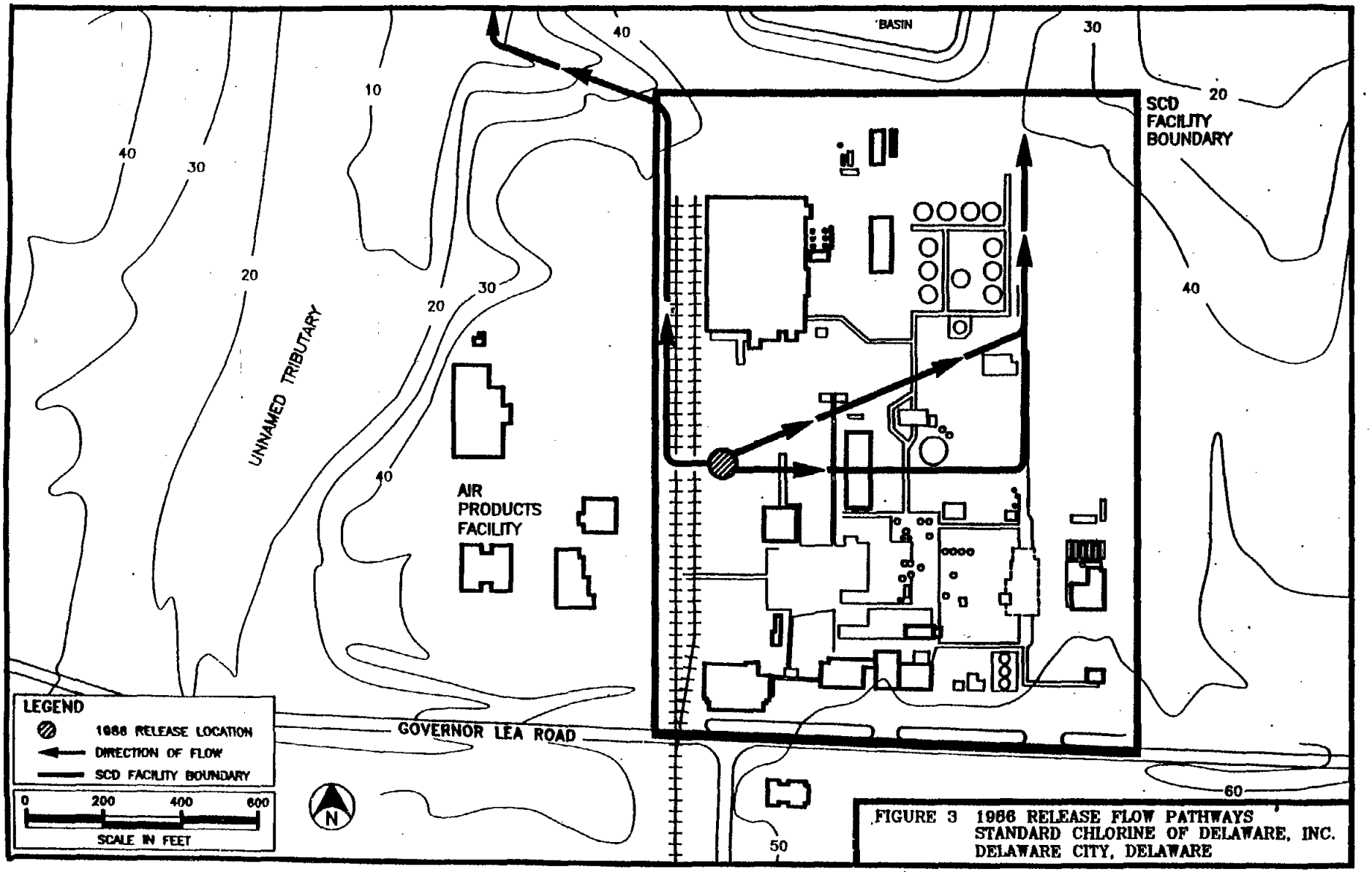
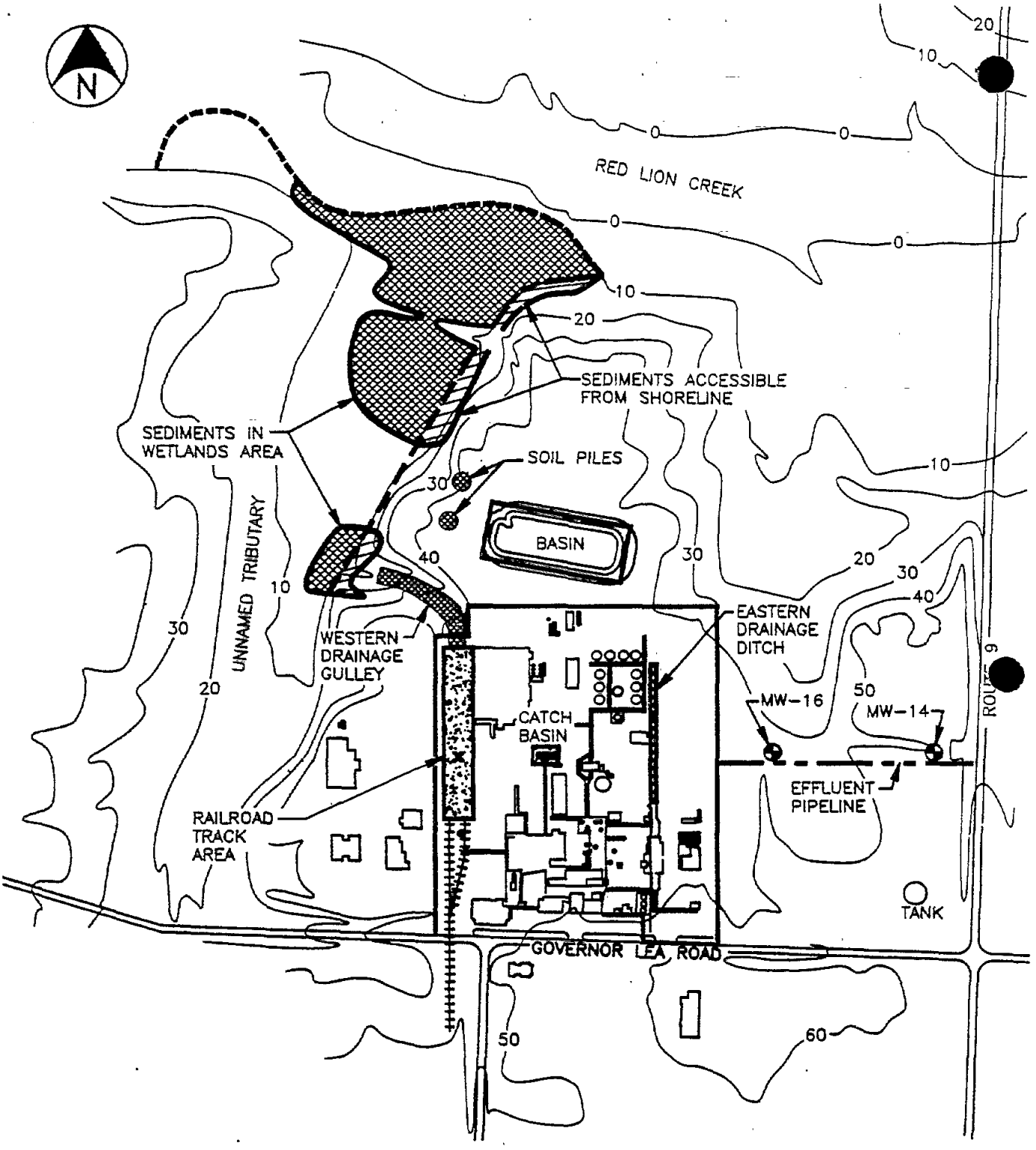


FIGURE 3 1986 RELEASE FLOW PATHWAYS
STANDARD CHLORINE OF DELAWARE, INC.
DELAWARE CITY, DELAWARE



0 200 400 600 800

SCALE IN FEET

FIGURE 4
RI/FS AREAS EVALUATED
STANDARD CHLORINE OF DELAWARE, INC
DELAWARE CITY, DELAWARE

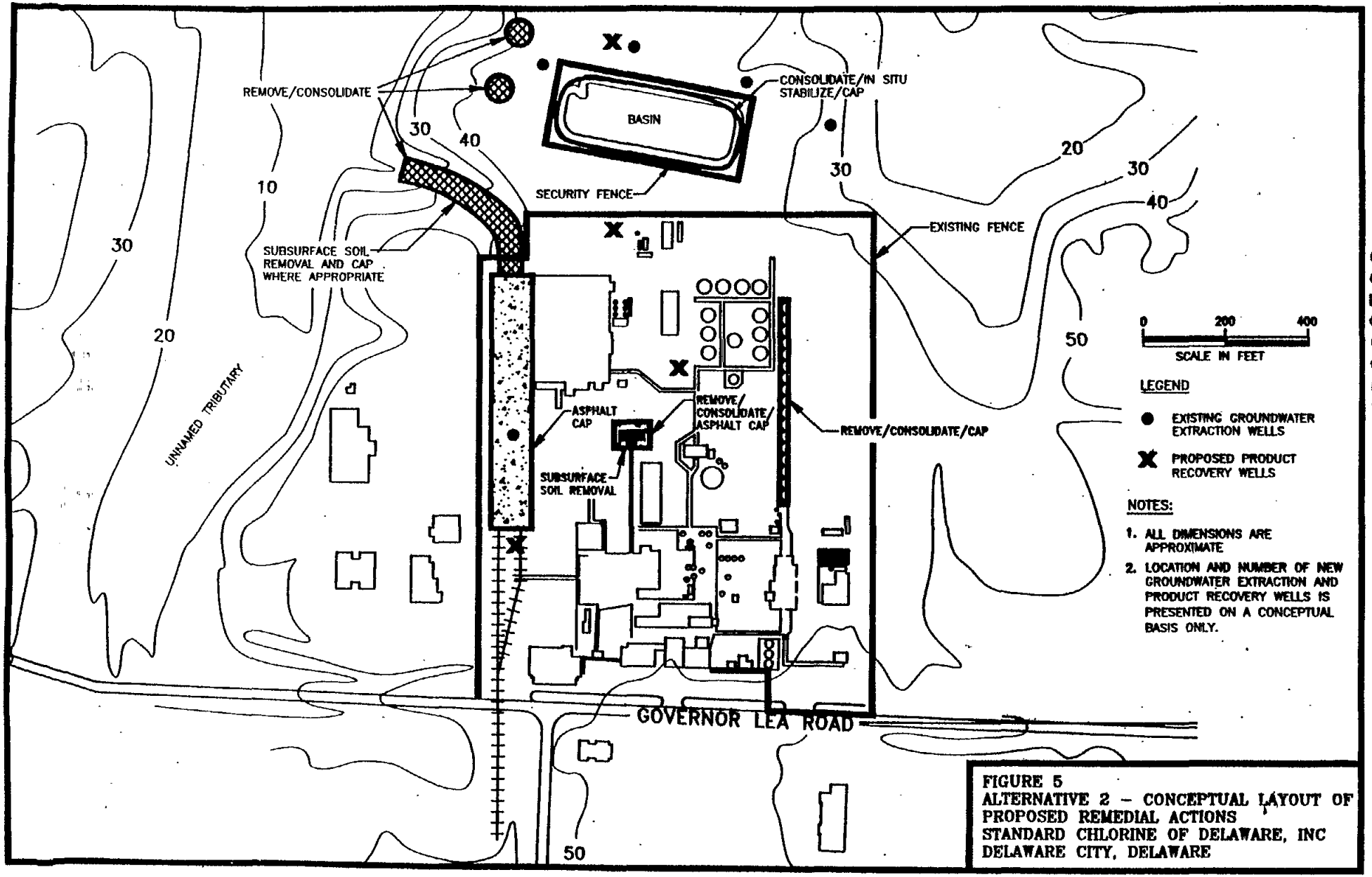


FIGURE 5
ALTERNATIVE 2 – CONCEPTUAL LAYOUT OF PROPOSED REMEDIAL ACTIONS
STANDARD CHLORINE OF DELAWARE, INC
DELAWARE CITY, DELAWARE

AR308528

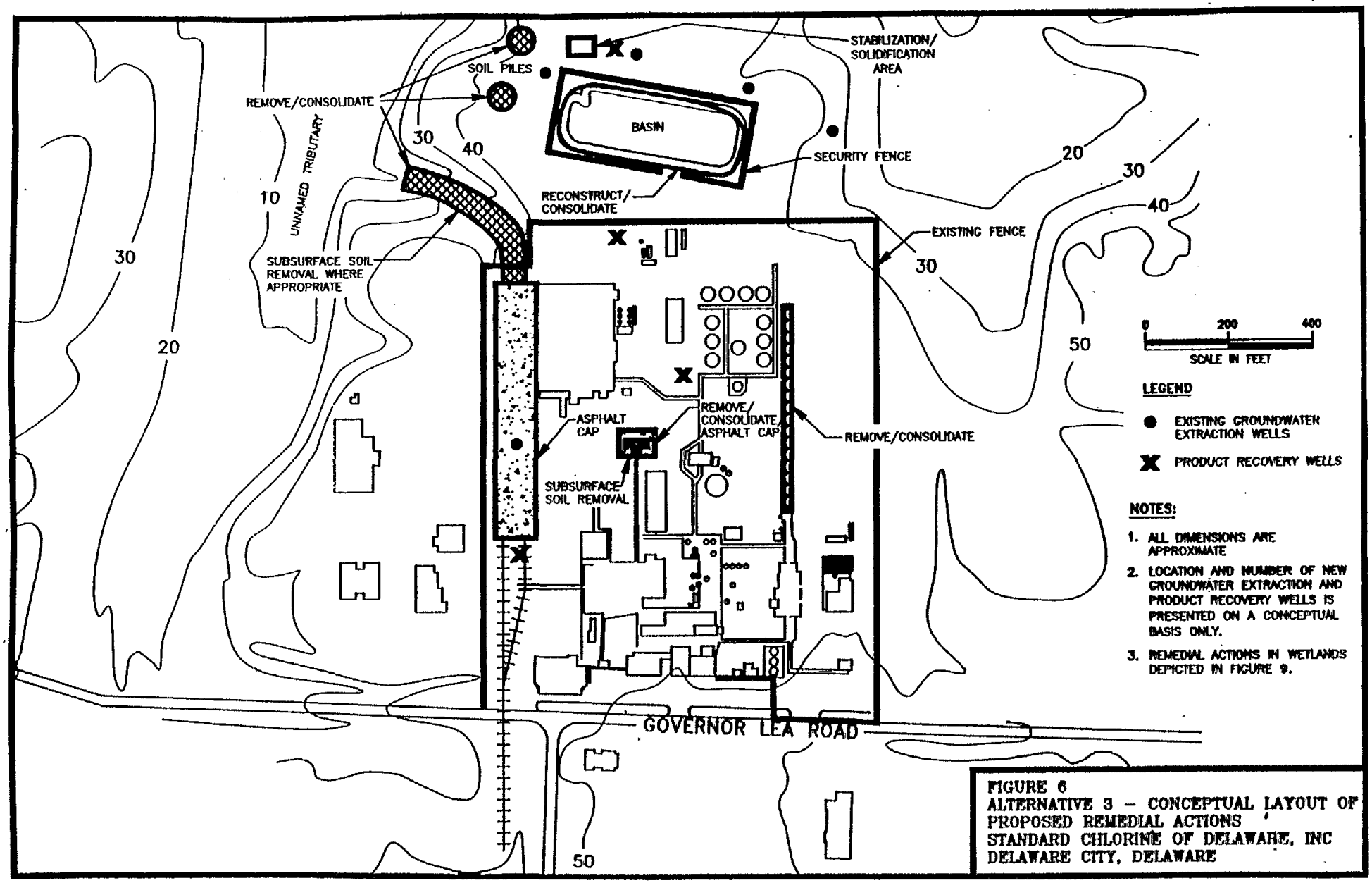


FIGURE 6
ALTERNATIVE 3 – CONCEPTUAL LAYOUT OF
PROPOSED REMEDIAL ACTIONS
STANDARD CHLORINE OF DELAWARE, INC
DELAWARE CITY, DELAWARE

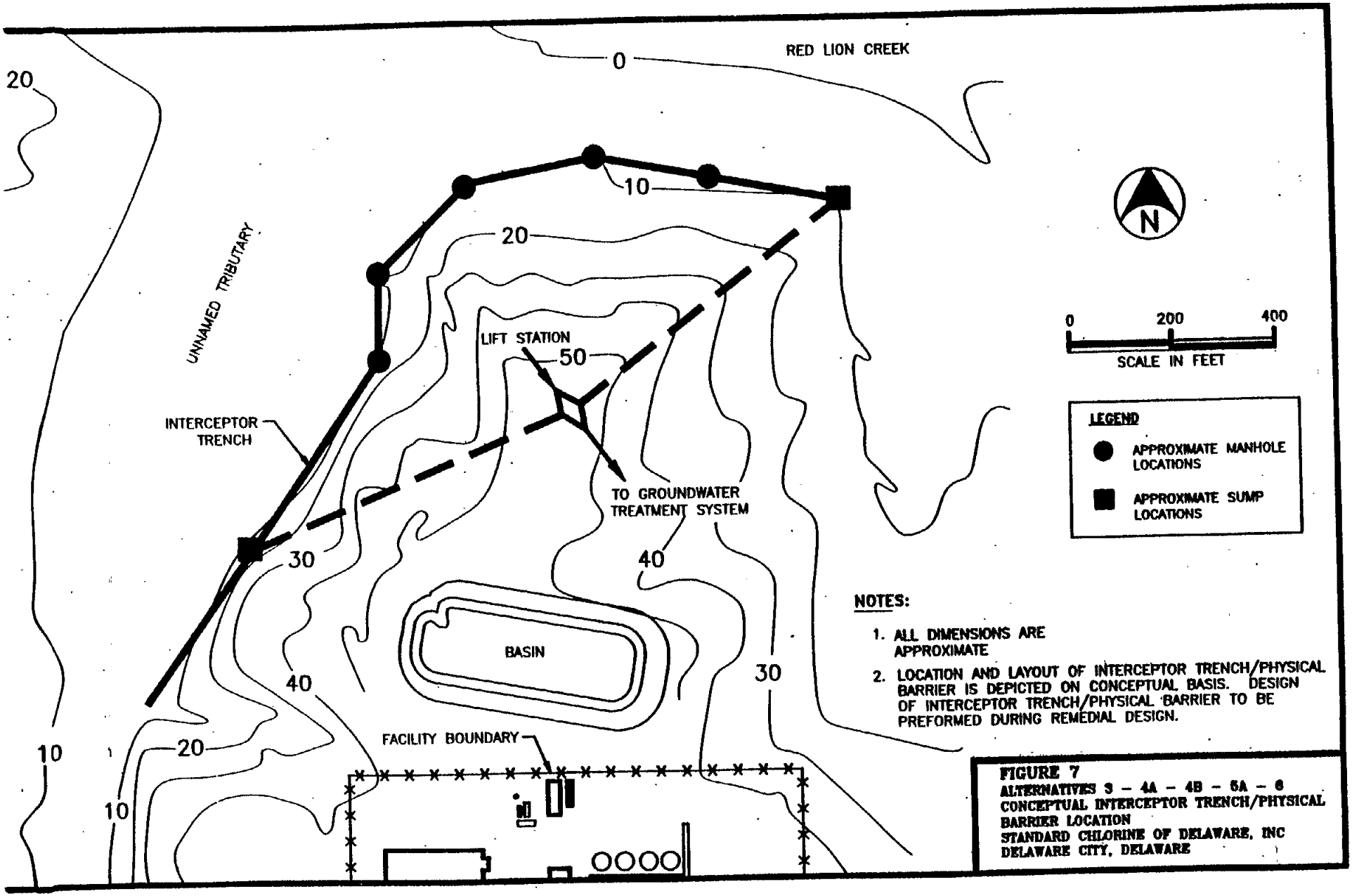


FIGURE 7
ALTERNATIVES 3 – 4A – 4B – 5A – 6
CONCEPTUAL INTERCEPTOR TRENCH/PHYSICAL BARRIER LOCATION
STANDARD CHLORINE OF DELAWARE, INC
DELAWARE CITY, DELAWARE

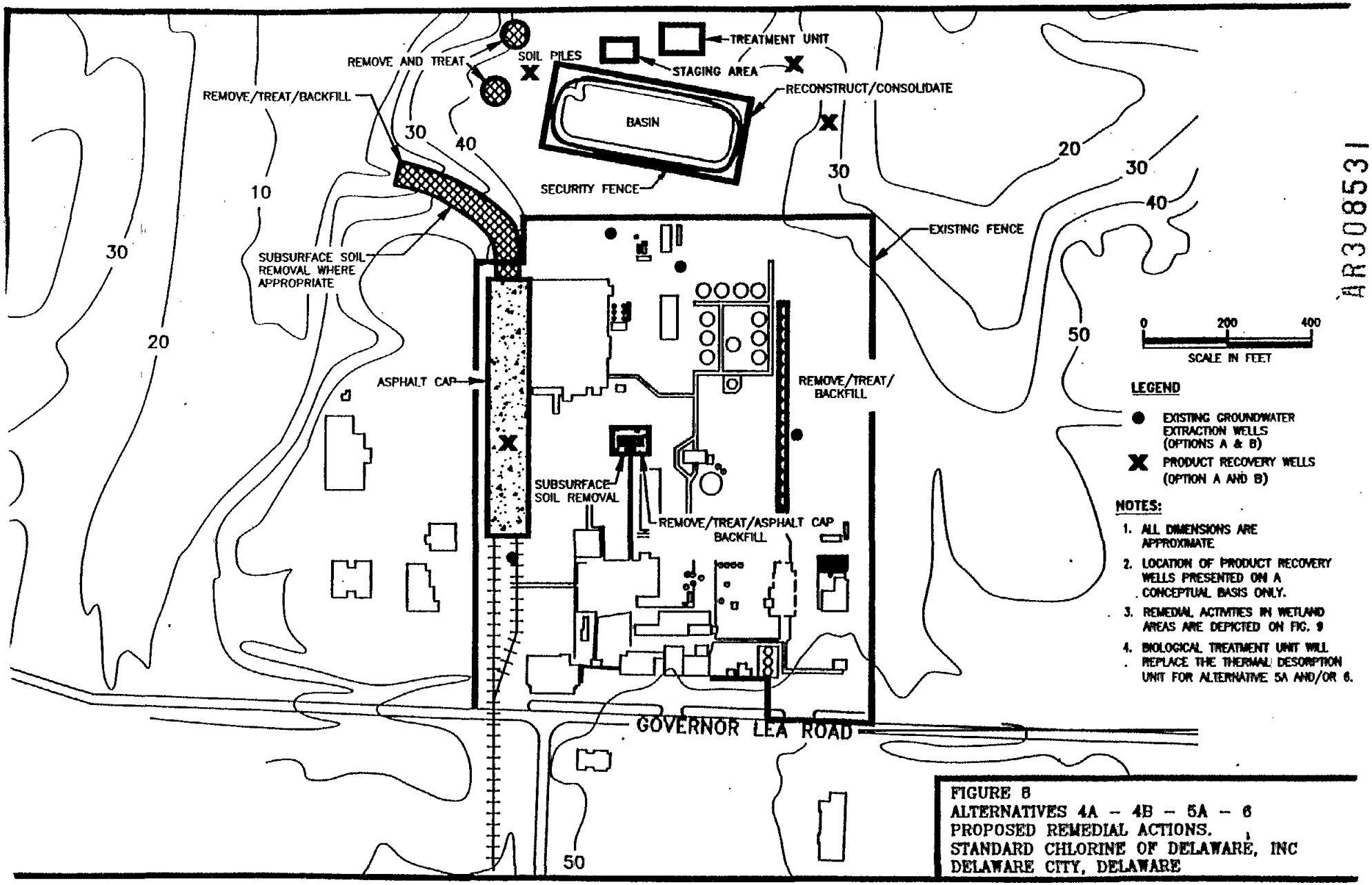
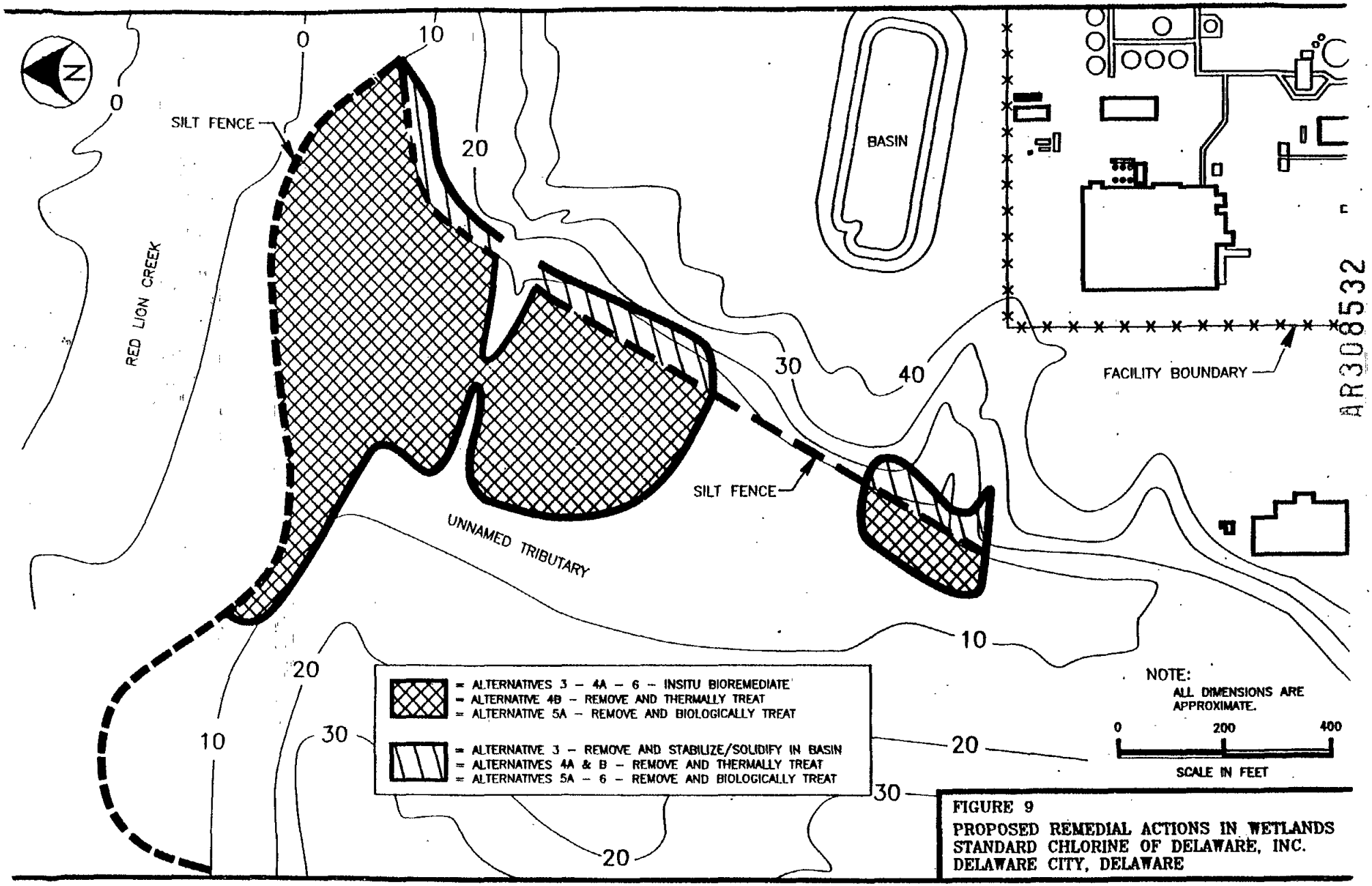


FIGURE 8
ALTERNATIVES 4A – 4B – 5A – 6
PROPOSED REMEDIAL ACTIONS.
STANDARD CHLORINE OF DELAWARE, INC
DELAWARE CITY, DELAWARE

AR308531



AR308532

FIGURE 9
PROPOSED REMEDIAL ACTIONS IN WETLANDS
STANDARD CHLORINE OF DELAWARE, INC.
DELAWARE CITY, DELAWARE