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Superfund Record of Decision:

William Dick Lagoons, PA

50272-101

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William Dick Lagoons, PA
First Remedial Action

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 4.4-acre William Dick Lagoons site is a chemical wastewater disposal site in West Caln Township, Chester County, Pennsylvania. Land use in the area is predominantly residential and agricultural, with adjacent woodlands. An estimated 30 residences located within 1,000 feet of the site use private wells for their drinking water supply. Two other Superfund sites are near the site: the Blosenski Landfill located 1.7 miles southeast; and the Welsh Landfill, 5 miles to the northwest. Originally, the site consisted of three unlined earthen lagoons or ponds covering 2.2 acres and an associated borrow area. From the 1950's to 1970, Mr. William Dick used the lagoons to dispose of wastewater left from cleaning the interiors of chemical and petroleum tank trailers owned primarily by Chemical Leaman Tank Lines, (CLTL), and residual chemical products. In 1970, the State ordered the lagoons closed after 37 wild geese descended into the lagoons, and were coated with waste. Later in 1970, vandalism caused the release of an estimated 300,000 gallons of wastewater into Birch Run, a tributary of the West Branch of Brandywine Creek. As a result of this discharge, more than 2,600 fish died, and water supplies that used Brandywine Creek as a water source were closed. In 1971, William Dick and CLTL began lagoon closure

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - William Dick Lagoons, PA
First Remedial Action
Contaminated Medium: gw
Key Contaminants: VOCs (benzene, PCE, TCE), other organics (phenols), metals

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 124
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

as part of a State agreement. Activities during 1971 included the addition of alum to the wastewater, spray irrigation of the treated wastewater into the woods, and covering and revegetating lagoons with soil. During 1985, site studies identified numerous organic compounds in soil samples, two spring-fed water supplies, and five wells. In 1988, EPA required CLTL to fence around the site, conduct yearly monitoring of residential wells, and install point-of-entry treatment systems for selected private wells. In 1990 and 1991, sampling revealed TCE and other contaminants in 30 to 40 private wells. As a result, CLTL installed point-of-entry carbon filtration units in 12 of the 30 to 40 homes where contamination in well water exceeded MCLs. This Record of Decision (ROD) provides an interim remedy and addresses contaminated residential water as Operable Unit 1 (OU1) and ground water as OU2. A future ROD will address source control and will provide a remedy for the cleanup of contaminated soil. The primary contaminants of concern affecting the ground water are VOCs including benzene, PCE, and TCE; other organics including phenols; and metals.

The selected remedial action for this site includes providing an alternate water supply to affected residences by extending the City of Coatesville Authority's water line; installing a water storage tank near the site to provide storage and pressure feed for the water line connections; monitoring nearby springs; collecting hydrogeologic data; conducting initial pumping and onsite treatment of the contaminated ground water plume using treatment components that will be selected during interim remedial design, which are expected to include chemical precipitation and one of more of the following: granular activated carbon, chemical oxidation, and air stripping, with possible emission controls; discharging the treated water onsite to surface water; installing monitoring and recovery wells to further characterize the entire plume; and implementing institutional controls including ground water use restrictions. The estimated present worth cost for this remedial action ranges from $5,991,000 to $7,028,000, which includes an annual O&M cost of $305,000 to $330,000 for years 0-5, and $21,000 to 46,000 for years 6-30.

PERFORMANCE STANDARDS OR GOALS: For OU2, EPA is invoking a waiver for Federal and state ground water clean-up standards because the remedial action is an interim measure. Chemical-specific ground water clean-up goals will be set in the final remedy.

RECORD OF DECISION

WILLIAM DICK LAGOONS SITE

DECLARATION

SITE NAME AND LOCATION

William Dick Lagoons Site
West Caln Township, Chester County, Pennsylvania

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the William Dick Lagoons Site in West Caln Township, Chester County, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for this site.

The Commonwealth of Pennsylvania agrees with the selected remedy. The information supporting this remedial action decision is contained in the Administrative Record for this site.

ASSESSMENT OF THE SITE

Pursuant to duly delegated authority, and pursuant to Section 106 of CERCLA, 42 U.S.C Section 9606, I hereby determine that actual or threatened releases of hazardous substances from this site, as discussed in the **Summary of Site Risks** section set forth in the attached Record of Decision (ROD), if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

Three operable units have been identified at the William Dick Lagoons Site. These operable units include:

- Alternate Water Supply - Operable Unit 1
- Groundwater - Operable Unit 2
- Source Control - Operable Unit 3

EPA is deferring selection of a remedy for Source Control - Operable Unit 3 and will address this unit in a subsequent Record of Decision (ROD). The Source Control ROD will present a decision on remediation of the contaminated soils at the site.

In this ROD, the Environmental Protection Agency (EPA) has selected remedies for Operable Units 1 and 2. The major components of each are as follows:

ALTERNATE WATER SUPPLY

1. The City of Coatesville Authority (CCA) water line will be extended from its current location on State Route 340 to service impacted or potentially impacted residents located near the William Dick Lagoons Site.

2. The pump station located on Route 340 near Sandy Hill Road will be upgraded to meet additional pumping needs, and a water storage tank will be installed near the site.

3. As available, through appropriate legal authority, institutional controls will be implemented to: (a) address water supply issues for newly constructed homes near the site, and (b) protect the health of those residents choosing to maintain the use of private wells.

GROUNDWATER

This remedy is considered an interim action for groundwater cleanup because final groundwater cleanup levels cannot be determined at this time. The primary objectives of the remedy are to minimize the migration of groundwater contaminants, to initiate the reduction of toxicity, mobility and volume of groundwater contaminants, and to collect data on aquifer and contaminant response to remediation measures. A final action addressing groundwater will be selected in a later ROD after the data gathered during the implementation of the interim action are evaluated.

The interim remedy contains the following major components:

1. Further study will be performed to adequately define site hydrogeologic conditions. This work will include the installation and sampling of monitoring wells, collection of water level measurements, and performance of aquifer tests.

2. Groundwater extraction wells will be installed at and surrounding the site. Groundwater will be pumped to a treatment plant designed and constructed to remove site-related contaminants. The actual treatment components of the plant will be determined during the initial phases of this remedy.

3. Treated groundwater will be discharged to a nearby stream.

4. Groundwater monitoring of selected wells will be performed.

DECLARATION OF STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment, are cost-effective, and comply with the Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action (referred to as ARARs) except to the extent that such requirements are waived. For Operable Unit 2, a waiver is invoked for Federal and State groundwater cleanup standards per the the justification requirements of CERCLA Section 121 (d)(4)(A). This section of the Act permits use of a waiver when the proposed remedial action is an interim measure which is expected to be followed by a complete measure that will attain all ARARs.

The remedy for Operable Unit 1 does not satisfy the statutory preference for treatment as a principal element because EPA believes that treatment of private well water at this site is not a practicable solution as a long-term remedy. Provision of regulated public water, from a source unaffected by the site, was deemed to be a more effective and permanent solution. Treatment of site groundwater will occur under the selected remedy for Operable Unit 2.

The remedy for Operable Unit 2 satisfies the statutory preference for remedies that employ treatment that reduce toxicity, mobility, or volume to the maximum extent practicable. The remedy is not a permanent solution, however, as existing hydrogeologic data are not adequate to make an informed decision on a final remedy at this time. The remedy may utilize alternative treatment of groundwater depending on the results of treatability work during initial phases of this remedy.

For Operable Unit 1, the five-year review required under Section 121 (c) of CERCLA, 42 U.S.C. Section 9621 (c), will not apply to this action since the remedy will not result in hazardous substances remaining onsite above health-based levels.

For Operable Unit 2, the selected remedy is an interim action for addressing the contaminated groundwater plume at the site. For this reason, a final remedy will be selected for this unit in the future. EPA estimates that a final ROD for groundwater can be issued within five years after commencement of the Operable Unit 2 remedial action. However, the Agency will conduct a five year review should the final ROD not be issued within this time frame.

Edwin B. Erickson
Regional Administrator
EPA Region III

Date: 6/28/91

RECORD OF DECISION
WILLIAM DICK LAGOONS SUPERFUND SITE

I. Site Location and Description

The William Dick Lagoons Site (the site) is located in West Caln Township, Chester County, Pennsylvania approximately 3.5 miles south-southeast of the Village of Honey Brook. The 4.4 acre site is located within a larger 105-acre parcel of land and is situated in a rural wooded setting on the crest of a small ridge known as the Baron Hills. It is accessible via Telegraph Road, at approximately 2,500 feet west of North Sandy Hill Road. The nearest residence is located roughly 300 feet to the north and approximately thirty homes are within 1000 feet of the Site. **Figures 1 and 5** provide a perspective of the site setting in relation to residential proximity.

The site currently appears as a sparsely vegetated field behind several residences located on the south side of Telegraph Road. The site is obscured from view by both the surrounding trees and its position at the crest of a hill. Land use surrounding the site is primarily residential, with a generally sparse population density. Housing development in the area is progressing relatively quickly and several new homes have been built since the commencement of site remedial investigative activities. The majority of the residences are single family dwellings with private wells and onsite septic systems. Several trailer parks and a campground exist within the vicinity of the site and two separate automobile junkyards are located just north of the site. Much of the area extending outward from the near-site residences is actively farmed. Important crops include corn, wheat, oats, soy beans and hay. Dairy cattle are also raised within the surrounding countryside.

Two other Superfund sites are located within five miles of the site. The Blosenski Landfill is located approximately 1.7 miles to the southeast and the Welsh Road Landfill is roughly 5 miles to the northwest.

II. Site History and Enforcement Activities

Waste disposal activities at the Site were initiated by its former owner, Mr. William Dick, in the late 1950s through May 1970. Originally, the Site consisted of three unlined earthen lagoons or ponds that were used for the disposal of wastewater. The lagoons covered approximately 2.2 acres of the 4.4 acre Site; the remaining 2.2 acres served as a borrow area for soil used to construct the compacted earthen ridges or berms around the perimeter of the lagoons (See **Figure 2**).

Principally, the lagoons were used to dispose of final rinse waters from the interior cleaning of tank trailers owned by Chemical Leaman Tank Lines Inc. (CLTL). However, it has been reported that minor amounts of residual chemical products were occasionally disposed of in the lagoons. The tank trailers were used for transporting petroleum products, latex, rhoplex, and resins. Following the rinsing and cleaning of the tank trailers at Chemical Leaman's Downingtown, Pennsylvania facility, the rinse water was delivered to the lagoons by tanker approximately every three days for disposal.

On April 26, 1970, 37 wild geese were shot at the site by the district game protector for humane reasons. The birds' feathers were coated with waste after the birds descended onto the lagoons. In May 1970, the Pennsylvania Department of Health (PADH) ordered the lagoons closed. On June 7, 1970, vandals allegedly caused a breach in the berm of the second lagoon, resulting in the release of an estimated 300,000 gallons of wastewater that moved into Birch Run, a tributary of the West Branch of Brandywine Creek. The discharge caused the death of more than 2,600 fish and the closure of public water supplies which used the creek as a water source as far downstream as Wilmington, Delaware.

In early 1971, per agreement with PADH, CLTL and William Dick began work to close the lagoons. This activity included the addition of alum to the lagoon wastewater, and spray irrigation of the "treated" wastewater into the woods adjacent to the lagoons. Settled residue remaining in the bottom of the lagoons was buried by pushing the earthen berms into the lagoons. The lagoons were completely filled in with soil and a vegetative cover planted on the surface.

In April 1985, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, an EPA contractor performed a site sampling inspection of the former lagoon site and collected well water samples from several surrounding residences. This inspection was conducted in response to a 1981 CERCLA notification to EPA by CLTL which indicated that the former lagoons may contain hazardous substances. During the inspection, elevated levels of numerous organic compounds were detected in the soil samples collected from the former lagoon area. A few site-related compounds also were found in two residential wells. In May 1987, additional sampling of 28 residential wells by EPA's Technical Assistance Team (TAT) found trichloroethene (TCE) to be the most prevalent organic compound, at the highest concentration, in groundwater. This volatile organic compound (VOC), a suspected carcinogen and common industrial solvent, was detected in two spring-fed water supplies and five wells. Following the completion of these follow-up evaluations, the Site was listed in July 1987 on the National Priorities List (NPL) of hazardous waste sites eligible for cleanup under Superfund.

As part of an immediate action to minimize public exposure to site-related contaminants, CLTL and EPA entered into negotiations in July 1987 to limit access to the area of the former lagoons, conduct more extensive sampling of residential wells, and supply point-of-entry water treatment units to homes with unacceptable levels of contaminants in well water. In September 1987, CLTL contracted with the Environmental Resources Management Group (ERM) for this work. On January 27, 1988, EPA and CLTL entered into an Administrative Order on Consent ("1988 Removal Order") which required CLTL to install a fence around the site, conduct at least yearly monitoring of residential wells (more frequent monitoring in some cases), and install point-of-entry treatment systems for home well water exceeding Maximum Contaminant Levels (MCLs). The fence was installed at the site in February 1988. The sampling and treatment unit provision requirements of the Consent Order continue to be in effect.

As a result of CLTL's three initial sampling events in 1987, TCE was detected at 23 of the 58 locations sampled. As of October 1990, approximately 130 home wells had been sampled. Of the 130 home wells sampled, 30 to 40 are believed to contain site-related contamination, the primary contaminant being TCE. Twelve of the 30 to 40 homes have been found to have levels of TCE contamination above EPA's MCL of 5 ppb. Trace concentrations of a few additional contaminants believed to be site-related have been found in limited homeowner wells, although none exceed MCLs. These additional compounds include chloroform, 1,2-dichloroethane, chlorobenzene, 1,4- 1,3- and 1,2-dichlorobenzene, 1,1- and 1,2- dichlorethene, styrene, toluene, 1,1,1-trichloroethane, tetrachloroethene, and di-n-butyl phthalate. During a sampling event in March of 1991, the compound bis(2-ethylhexyl)phthalate was found in one well at a level exceeding the proposed MCL of 4 ppb (because this compound has appeared in laboratory "blank" samples, its possible presence in several additional wells exceeding the MCL cannot be confirmed.) This March 1991 occurrence marks the first time that a compound other than TCE, determined to be site-related, has been detected in a homeowner well above a proposed or final MCL. (The affected well water is treated via carbon filtration.)

CLTL has supplied bottled water to all homes (approximately 34) in which TCE levels between 0 to 5 parts per billion (ppb) were detected in residential wells. The company has supplied bottled water under its own initiative; CLTL is not required to do so by EPA. To date, CLTL has installed point-of-entry carbon filtration units in the twelve homes where TCE concentrations in well water exceed EPA's MCL of 5 ppb.

On September 14, 1988, CLTL and EPA signed a second Administrative Order on Consent, requiring that a Remedial Investigation/Feasibility Study (RI/FS) be conducted. CLTL again obtained the services of ERM for this work. The RI began in December 1988 and progressed throughout the Spring and Summer of 1989. Based upon both EPA- and ERM- identified data gaps, a second shorter phase of RI work was initiated in October 1989. An interim RI report was submitted to EPA in December 1989. After EPA comments, a more detailed draft RI report, along with a draft FS report and Risk Assessment (RA), were submitted for EPA review on March 8, 1990. Following receipt of EPA comments, a Preliminary Final RI/RA/FS was submitted on September 6, 1990. (The RI, RA and FS reports are described as "preliminary final" until minor changes in language and/or emphasis are incorporated per EPA direction. Any changes to be made to the RI/FS/RA documents which have a bearing on EPA's decision on a remedial action have already been considered and documented in the Administrative Record for this site.)

On September 24, 1990, EPA informed the Rohm & Haas Company of Philadelphia, Pennsylvania of its potential responsibility regarding contamination at the site. This notification was based on information received on the company's past involvement at the site through interviews with former CLTL employees.

III. COMMUNITY RELATIONS HISTORY

In order to keep the community aware of ongoing actions, understand residents' concerns, and address public involvement requirements under CERCLA, EPA instituted several measures to contact and correspond with site residents. Following is a listing of the community relations efforts conducted by EPA:

> Summer 1987 - meeting held with approximately 35 residents at a local resident's home to discuss the initial sampling results of private wells;
>
> February 1988 - meeting held at Wagontown Fire Hall with approximately 25 residents to discuss upcoming RI/FS work at the site and to explain the Superfund process;
>
> February 1988 to March 1990 - this period was mainly devoted to telephone contact with individual residents concerning ongoing RI/FS work and the collection and analysis of residential well samples;
>
> March 1990 - "at home" interviews conducted with approximately 15 residents to gauge community interest, concerns, and opinions;

June 1990 - completion of a Community Relations Plan (CLP) the goal of which is to establish and maintain open communication among Federal, State, and local officials, and the residents of the site area; issued two fact sheets to residents on the site mailing list explaining the Superfund remedial process and procedures for obtaining a Technical Assistance Grant (TAG);

July 1990 - issued a fact sheet to mailing list site residents and government officials describing the RI/FS results and upcoming actions;

July 1990 - held public meeting with approximately 85 residents to explain the RI/FS results, risk posed by the site, future site actions, and the pros and cons of the potential remedial alternatives for an alternate water supply; solicited public comment on the residents' preference for alternate water;

December 1990 - issued fact sheet informing residents that the Proposed Remedial Action Plan (PRAP) will be issued in January 1991;

January 1991 - issued the PRAP for the site via press release, newspaper publication, and direct mailing to all individuals on the site mailing list; announced public meeting in February;

February 1991 - held public meeting with approximately 70 interested individuals to present EPA's rationale for the proposed remedial alternatives presented in the PRAP; solicited comments on the PRAP;

February 1991 - conducted a telephone survey to reach 50 residents residing within the groundwater contaminant plume to determine their preference for an alternate water supply and their position on EPA's proposed remedy for alternate water.

In addition, EPA has frequently placed copies of RI/FS technical reports for public review at the West Caln Township Building and has continually updated the Administrative Record placed at this location.

Based on public comments received to date, community concerns principally relate to the contamination of private well water, the nature of the final remedy for this problem, and the time required for completion of the remedy. Individuals have also expressed an interest in the type of remedy to clean up soils at the site. At the February 14, 1991 public meeting, residents expressed a strong desire to have the site responsible party compensate residents for any future water cost, whatever the chosen remedy. During the PRAP public comment period, several residents expressed a desire to have the site returned as near as possible to its original uncontaminated state. EPA's response to all comments received during the PRAP public comment period appear in the Responsiveness Summary at the end of this ROD.

IV. SCOPE AND ROLE OF RESPONSE ACTION

Based on the results of the Preliminary Final RI/FS, EPA has decided that remediation of the entire site can best be approached by considering the site as consisting of three separate "units". These units include:

(1) Residential Water Use (i.e. Alternate Water Supply)
- involves a remedy to protect residents from contaminated private well water

(2) Groundwater
- involves a remedy to remediate all or portions of the contaminated groundwater aquifer

(3) Source Control
- involves a remedy to clean up contaminated soils at the site; contaminated soil is the media considered to be the "principal threat" at the site per the definiton of principal threat in the NCP. (See 40 C.F.R. Section 300.430 (a)(1)(iii).)

At this time, EPA has decided to defer selection of the remedy for Unit 3 - Source Control for the following reasons:

(A) unresolved technical questions regarding the appropriateness of the soil leaching model used to calculate the type of protective cover needed at the site following completion of EPA's proposed remedy of Thermal Desorption;

(B) unresolved technical questions concerning soil cleanup criteria at the site as it involves the identification and concentration of contaminants to be included in the established cleanup levels. In addition, concerns regarding the ability of EPA's proposed remedy to meet the cleanup criteria proposed in the Preliminary Final FS;

(C) State concerns regarding attainment of State groundwater ARARs using EPA's proposed remedy;

(D) recent evaluation and discussion on the potential usefulness and appropriateness of a Treatability Study before a source control remedy is selected.

In contrast to the approach presented in the Preliminary Final FS, EPA has chosen to evaluate the two remaining units independently against the nine criteria required under the Superfund program (See Figure 3). This approach differs from that presented in the Preliminary Final FS which evaluated each of the units against EPA's three screening criteria (Effectiveness, Implementability and Cost) before developing site-wide alternatives for nine-criteria evaluation. Although the method presented in the FS is in accordance with EPA guidance, the Agency has decided to perform a complete evaluation of individual units in this ROD to present a clearer view of why each proposed unit remedial alternative was chosen.

Regarding Unit (2) Groundwater, the Agency does not believe that sufficient information exists at this time to conclude that the groundwater can be practicably restored to its beneficial use as a drinking water source within the areas of contamination. This belief is based on the site area's complex hydrogeology and the relatively high levels of contamination found in the deep fractured aquifer directly below or immediately surrounding the former lagoons. For this reason, EPA is proposing an **interim** remedial action for the Groundwater unit which will obtain information about the response of the aquifer to remediation measures in order to define final cleanup goals. This interim remedy will also initiate the reduction of toxicity, mobility and volume of contaminants as well as limit contaminant migration. After a period of approximately five years of interim remedy operation, EPA will select a final remedy for groundwater cleanup in a subsequent ROD.

EPA has also chosen to revise or add to the number of unit alternatives screened or evaluated in the Preliminary Final FS. Specifically, the Agency has added an alternative for the Groundwater Unit which calls for pump and treat at and adjacent to the site only. EPA believes this alternative warrants final consideration. The Agency has chosen to delete, in contrast to the Preliminary Final FS, the specific type of treatment technologies to be employed for groundwater remediation. EPA believes that a decision on the type of groundwater treatment at this stage is premature and will best be determined during remedial design following the performance of treatability studies. EPA has also deleted Spring Water Treatment of the Gregor property spring as a remedial option. The Agency believes that the spring is most efficiently addressed by an interim groundwater remedy which will attempt to remediate water discharging at the spring.

Finally, in contrast to the Preliminary Final FS, the Agency does not view the discharge of treated groundwater as a separate unit requiring detailed evaluation. Treated groundwater is generated as a result of a selected remedy at a site and is not an existing condition necessitating a cleanup option. Although the detailed evaluation in the Preliminary Final FS is appreciated, the Agency believes that only one discharge alternative, Stream Discharge, is applicable for this site. The rationale for this decision can be obtained from the discussion presented in the Preliminary Final FS as well as in the Responsiveness Summary.

V. SUMMARY OF SITE CHARACTERISTICS

The major findings of the Preliminary Final RI report are summarized below. A detailed discussion of all site conditions can be found in the Preliminary Final RI.

Geology and Groundwater:

- The site is located in the Honeybrook Uplift in an outcrop belt of a geological structure known as the Chickies Formation. It is situated on the crest of the Baron Hills Anticline in a fault block bounded by two normal faults to the north and south. (The Chickies is a white to light grey quartzite with interbedded phyllitic beds.) The site is located on a groundwater divide. The bedrock beneath the lagoons is highly weathered and forms a thick saprolite up to 100 feet thick. Although laboratory analysis indicates that the saprolite material is of low permeability, contaminants have migrated to the groundwater table (approximately 50 feet below the surface) through joints and fractures in the saprolite.

- Groundwater at the site, as determined by monitoring well sampling, is contaminated primarily by VOCs and, to a lesser extent in frequency and concentration, semi-VOCs. Again, TCE is the predominant VOC (average concentration = 1200 ppb, maximum concentration = 16,000 ppb) and phenol is the predominant semi-VOC (average = 800 ppb, maximum = 14,000 ppb). Other compounds found less frequently and/or in lower concentrations include chloroform, benzene, acetone, 2-methylphenol, 4-methylphenol, isophorone and other organic compounds. Vinyl chloride, a contaminant of specific concern from a human health standpoint, was detected on only one occasion in one monitoring well during post-RI/FS sampling. To date, three to four rounds of monitoring well samples have been collected, dependent on well location. See **Table 1** for a listing of maximum and average groundwater concentrations in onsite monitoring wells.

- By far, the highest groundwater concentrations of organic chemicals are found in two of the twelve monitoring wells installed at the site, wells MW-5 and MW-7. In addition, the seven deeper monitoring wells (110 to 397 feet deep) are generally more contaminated than the six shallow wells (70 to 80 feet deep). All wells were installed in bedrock (See **Figure 4**). At well MW-20, the southwest corner of the site, groundwater was found to be contaminated down to a depth of 397 feet.

- The groundwater surrounding the Site utilized by residents is also characterized by low-level TCE concentrations. Of the approximately 130 residential wells sampled to date (See **Figure 5**), roughly 30 to 40 appear to have some site-related contamination. Of these 30 to 40, eleven have concentrations of TCE in the 5 to 15 ppb range (the drinking standard is 5 ppb) and one well contains TCE at levels from 20 to 280 ppb, dependent on the sampling season. Many of the residential wells identified during commencement of the Consent Order with CLTL have been sampled a total of nine times to date. Homes within a predetermined radius of the site are sampled at least once a year; those homes found to have a detectable level of TCE are sampled twice a year. Due to the number of homes within the predetermined radius of the site (1 mile south, 1/2 mile north) the sampling schedule is set up so that samples are collected from 20 to 25 home wells every quarter of the year.

- The results of the RI and three years of residential sampling data indicate that TCE levels are not significantly increasing at the boundary of the contaminant plume where residential wells are generally located. Based on this information, the boundary of the groundwater area affected by site-related contaminants has been relatively well-defined (See **Figure 6**), although additional characterization work is needed.

- The regional groundwater flow at the Site appears to be toward the southeast. Three significant bedrock fracture features (two of which are faults) are believed to exist in the vicinity of the site. Each appears to provide pathways for contaminant migration to vary from the overall southeasterly flow direction and two may serve to partially block the flow of groundwater beyond the fractures. However, it seems that intersecting smaller fractures act as conduits for groundwater contamination to migrate beyond the three larger fractures, resulting in a rather complex flow pattern.

- Additional groundwater monitoring wells are needed and further studies are necessary to confirm the theory that groundwater flow is controlled by site geologic fractures, to determine the extent of groundwater flow to the north, and to determine the severity of contamination in the area generally south of the site.

Soil:

- Soils in the former lagoon are contaminated by volatile organic compounds (VOCs), principally trichloroethene (TCE), which was used at one time to clean out chemical tank trailers disposing material at the site, and semi-VOCs, which appear to be primarily associated with fuel oil residues. Other than TCE, compounds found at significant levels in site soils are 2-butanone, toluene, styrene, xylenes, ethylbenzene, chlorobenzene, and tetrachloroethene (all VOCs); and several semi-VOCs, especially phenol, 1,2,4-trichlorobenzene, naphthalene and bis(2-ethylhexyl) phthalate. The pesticide DDE was also found in concentrations suggesting that it was disposed of at the site. **Table 2** presents a listing of average and maximum soil contaminants.

  Soils are heavily contaminated from a depth of about one foot below the surface down to approximately 20 feet, depending on site location. Former lagoon #1 is most heavily contaminated, with concentrations decreasing as one moves across the site to former lagoon #2 and lagoon #3 (See **Figures 2 and 7**). Because groundwater is contaminated, and the water table lies at approximately 50 feet below the site, low-level subsurface soil contamination exists as deep as 50 feet although a significant drop-off in levels occurs after approximately 20 feet (See **Figure 8 and 9**). Contamination of soils at and below the surface appears to be confined to the area of the three former lagoons.

- As a result of the reported occasional burning of floating oils on the surface of the lagoons, the RI included an analyses for **dioxins** in the soil (dioxins can be created from the burning of chlorinated phenols and hydrocarbons). Although dioxins were detected in the parts per trillion (ppt) range (See **Table 3**), the levels do not present an unacceptable risk and will not require remediation. EPA generally considers the potential need for remediation of dioxins when levels are found to exist in the ppb range or higher.

- Based on the results of RCRA Subtitle C 40 CFR Section 261.24 Toxicity Characteristic Leaching Procedure (TCLP) analyses of three of six soil boring samples, the soil/waste mixture at the site would be classified as characteristic hazardous waste under RCRA. In addition, based on EPA's understanding of the nature of the operations leading to the generation of waste materials disposed of at the site, EPA Region III has interpreted RCRA's Land Disposal Restrictions (LDR) of November 8, 1984 to suggest that the soil/waste mixture also would be classified as a land disposal restricted hazardous waste under the RCRA program. The waste disposed at the site is considered by the Agency to be F001-F005 waste.

- The former spray irrigation and berm borrow areas (See **Figure 7**) only have minor levels of organic contamination which is not expected to present a direct contact risk. (See **Table 4** for spray irrigation area sampling results.)

- The site does not appear to have caused inorganic contamination of site soils, although levels were occasionally above background concentrations. This finding is in agreement with our understanding that organic chemical rinsewaters and wastes were disposed of at the site.

Air:

- The site does not negatively affect air quality based on real-time air monitoring results collected during boring and well installation activities as well as air dispersion modeling conducted for the Risk Assessment.

Surface Water and Sediments:

- Surface water and sediment samples were collected from fifteen stations in three streams surrounding the site. These streams include the West Branch of Brandywine Creek, Birch Run and Indian Spring Run (See **Figure 10**). Based on sampling results, the streams do not appear to be affected by site-related contaminants (See **Tables 5 and 6**). Although a few site-related compounds were discovered in sediments, the data do not indicate a contaminant distribution pattern with respect to dilution or accretion of concentrations associated with increasing distance from the site or tributary headwaters. The contaminants are spatially variable and their presence in the streams may be due to other sources. In addition, the compound levels found have not been shown nor are expected to cause an adverse impact.

Ecological Assessment:

- Analyses of surface water and sediment samples during the RI did not indicate that aquatic environmental receptors have been exposed to site-related contamination. Further, the habitat assessment, both of aquatic and terrestrial species surrounding the site, did not identify any potentially adverse effects of site-related contamination to the well-being of flora and fauna.

- The only areas visibly affected by contamination are the immediate area of the former lagoons and former berm borrow area. Vegetation directly in these locations is very sparse, consisting of hardy, pioneer species.

- No wetland areas exist onsite. Narrow fringe, forested wetlands along the various streams adjacent to and downgradient of the site do not appear to be affected by site contaminants.

VI. SUMMARY OF SITE RISKS

A Baseline Risk Assessment (RA) was performed for the site in accordance with EPA guidelines. The RA provides an estimation of risk to public health and the environment posed by the site if no remedial actions were taken. It involves assessing the toxicity or degree of hazard posed by substances found at the site by considering the levels at which these substances are present. The RA also entails describing the exposure routes by which humans and the environment could come into contact with these substances.

When estimating an individual's exposure to site substances, conservative assumptions regarding such factors as length of the exposure period, frequency of exposure, amount of skin exposed and/or quantity of substance ingested are purposely used to ensure that the risk is not underestimated. After evaluation of the site data, an assessment of toxicological information and potential exposure is performed, followed by calculations of the risks posed. Separate calculations are made for those substances that can cause cancer and for those that can cause other, non-carcinogenic health effects. Risks to both childen and adults are presented. General conclusions of the RA pertaining to public health impact are presented in Sections A through D below.

A) <u>Contaminant Identification</u>

The initial phase of the RA involves reviewing all RI data and identifying the chemicals of potential concern found in all exposure media at the site for further risk evaluation. The exposure media includes onsite soil, groundwater, surface water, springwater, fugitive dust and air emissions, and deer which might graze at the site. Identified chemicals are primarily chosen based on their relatively high toxicity, mobility, persistence and prevalence when compared to all contaminants present at the site. The chosen chemicals also provide a representative analyses of the potential risks at the site. Arithmetic average and maximum concentration levels of the chosen contaminants are utilized to develop most probable and maximum exposure scenarios in a later phase of the RA. A listing of the identified chemicals of concern or "indicator" chemicals appears in Table 7. Based on RI data, the selected chemicals represent 99% of the risk associated with each exposure scenario for each medium. Sources of uncertainty in selecting the indicator chemicals are discussed in the RA.

B) <u>Exposure Assessment Summary</u>

The next step in conducting the RA is an exposure assessment. The objectives of this task are to identify potential exposures associated with the chemicals of concern at the site and to estimate the magnitude of these exposures.

Based on the site's environmental setting, this RA has identified five potential populations who could be exposed to site contaminants. It should be noted that actual exposure by these groups is severely limited however, due to controls implemented at the site to date. Following is a listing of the potentially exposed populations, which shall be referred to as "potential exposure pathways". Rationale for their selection appears in **Table 8**:

- Use of groundwater (via private well) as a residential water supply by residents living in the area of estimated site-related impact. Exposure includes dermal contact with and ingestion of groundwater as well as inhalation of volatile organic chemicals released during showering and other activities.
- Dermal contact with and incidental ingestion of contaminated onsite soils by a casual trespasser.
- Ingestion of venison from deer that may graze onsite.
- Inhalation of volatile organic chemicals and fugitive dust released from on-site soils, and
- Recreational use of the ponds fed by spring #48 (a.k.a. the Baldwin Campground spring). Exposure includes dermal contact with and incidental ingestion of water, as well as inhalation of volatiles released from the water.
- Hypothetical residential use of groundwater from the onsite monitoring wells installed during RI field work.

When calculating the risks associated with each of these pathways, the RA considers three age groups as potentially exposed: adults, children ages 6 to 12, and children ages 2 to 6 (See **Table 9** for additional information on exposure duration.)

Actual quantification of potential exposure involves estimating exposure point concentrations and calculating potential intakes for each exposure pathway identified above. Exposure point concentrations (the contaminant concentration at which the resident is exposed) were based on the arithmetic average and maximum values for each indicator chemical found in each medium at the site. To determine the concentration of VOCs released from onsite soils and the pond fed by Spring #48, and to determine the concentrations in fugitive dust released from onsite soils, air screening models were utilized. When estimating VOC concentrations released during showering with private residential well water, an inhalation dose equivalent to that experienced via ingestion of such water was assumed. Summaries of the average and maximum exposure point concentrations appear in **Appendix A** of this ROD.

In the calculation of potential intakes (how much and for how long one is exposed to the exposure point concentrations), the characteristics of the various exposure pathways must be defined. Important parameters include the frequency, duration, and degree of exposure as well as physiologic characteristics of the exposed population, such as body weight and skin surface area. Estimates of these parameters are based on EPA guidelines, recommendations found in the current literature, and professional judgment. The exposure assumptions used in calculating the potential intakes appear in **Table 9**.

Several assumptions must be made regarding both the nature and extent of contamination present at the site as well as the behavior and characteristics of the populations potentially exposed to the contamination. Some of these assumptions include use of the following:

- monitoring data to represent exposure concentrations across a medium,
- screening level models to represent exposure concentrations across a medium,
- single values for exposure parameters to characterize the behavior of an entire population over an extended period of time, and
- the intake calculations for the deer ingestion scenario, which should be considered semi-quantitative in light of the numerous assumptions required.

C) <u>Toxicity Assessment Summary</u>

This task requires the assessment of the intrinsic toxicological properties of the chemicals of potential concern. Both carcinogenic and non-carcinogenic effects from the indicator chemicals must be presented. A summary of toxicological information on all indicator compounds assessed for the site appears in **Table 10**. This table identifies those compounds which are considered potential carcinogens and those identified for non-carcinogenic effects. In some cases, compounds are evaluated for both types of effect. In reviewing **Table 10**, several terms or acronyms require definiton.

<u>Cancer Potency Factors (CPFs)</u> have been developed by EPA's Carcinogenic Risk Assessment Verification Endeavor (CRAVE) for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a

potential carcinogen, in mg/kg-day, to provide an upper bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper-bound" reflects the conservative estimate of the risks calculated from the CPFs. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CPFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of daily exposure levels for humans, including sensitive individuals that are likely to be without an appreciable risk of adverse health effects. Estimated intakes of chemicals from environmental media (e.g., the amount of chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help insure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Carcinogenic Class refers to EPA's weight-of-evidence system for classifying chemicals suspected of being human carcinogens. Substances are classified based on their epidemiological association with human cancer, induction of cancer in multiple species of test animals, or induction of cancer in one species. Following is a brief description of the classes appearing on Table 10: Group A - human carcinogen, Group B1 - Probable human carcinogen based on limited human data, Group B2 - Probable human carcinogen based on sufficient evidence in animals but little or no evidence in humans, Group C - Possible human carcinogen, Group D - Not classified as to human carcinogenicity, Group E - Evidence of noncarcinogenicity for humans.

D) **Risk Characterization**

The final task of the RA is to integrate the results of the Exposure Assessment and Toxicity Assessment to quantitatively estimate the potential risk associated with the six exposure pathways previously identified. Both carcinogenic and noncarcinogenic effects will be considered.

Carcinogenic risk - Carcinogenic risk is calculated by multiplying the daily intake of each chemical, averaged over the years of exposure, by the appropriate CPF. Results are presented in probabilities expressed in scientific notation. For instance, a result of 1E-04 ($1x10^{-4}$) indicates, as a plausible upper bound, that an individual has a one in ten thousand chance of developing cancer as a result of site-related exposure to that chemical under the specific exposure conditions at the site. This estimate is often expressed as the incremental or excess individual cancer risk associated with exposure to a chemical.

The risk associated with exposure to a set of chemicals is estimated by adding the risks associated with exposure to each chemical. Several of the exposure scenarios at the site may involve more than one route of exposure. A summary of the results of the calculations for each age group under each exposure scenario, as well as a lifetime exposure scenario (calculated by adding the risk for each age group), is presented in **Table 11.** This table also provides a summation of risk associated with simultaneous exposure under mutiple scenarios. Based on EPA policy, a risk exceeding the range of 1E-04 to 1E-06 is generally considered as exceeding the acceptable risk level.

Noncarcinogenic Risk - Noncarcinogenic risk is determined by calculating the Hazard Index (HI). This number is found by dividing the daily intake by the appropriate RfD. The HI provides an estimation of the potential for toxic effects to devlop as a result of exposure to a chemical or set of chemicals under the assumed conditions of exposure.

The calculation of the HI asssumes that there is a threshold exposure, below which no toxic effects are expected to occur. Therefore, a HI less than one indicates that no toxic effects are expected to occur as a result of a given exposure, while a HI of greater than one indicates that there is a potential for an individual to experience adverse health effects as a result of a given exposure. Noncarcinogenic risk associated with exposure to a set of chemicals is conservatively estimated by adding the risks associated with exposure to each chemical. A summary of the results of the HI calculations for each age group under each exposure scenario, including a lifetime exposure scenario, appears in **Table 12.** As indicated in the carcinogenic risk section, a multiple exposure summation also appears in this table.

Environmental Risks

During the RI, an ecological investigation of the surrounding site area was conducted to assess site-related impacts to the local flora and fauna. The objectives of this work were to:

1) characterize the terrestrial and wetland communities of the site and surrounding area,

2) identify the macroinvertebrate communities of the

downgradient tributaries,

3) assess any site-related impacts on these various ecological communities.

Utilizing the data obtained from the above tasks, an ecological assessment of the site was conducted in a methodology similar to that described above for public health impact. After completion of the Exposure Assessment and Toxicity Assessment phases of the total ecological assessment, it was determined that RI analytical results of surrounding stream samples did not indicate an exposure of aquatic ecological receptors to site-related contaminants. In fact, the macroinvertbrate community in the streams surrounding the site were found to be diverse and healthy.

The only terrestrial receptors experiencing site-related impact would be those trespassing or residing directly on the 2.2 acre former lagoon area. The chain link fence around the site and the lack of an adequate food supply onsite acts to prevent surrounding wildlife from coming into direct contact with site soils. The vegetation surrounding the site appears quite healthy, and is not measurably affected by the site. Wildlife residing around the site is not expected to be impacted by the site contamination based on evaluation of the RI data, lack of access to the site, and the RA analysis of potential exposure to grazing deer. Due to past onsite dumping activities, onsite vegetation is quite sparse, resulting in the one measurable effect of the site to the local ecology.

Finally, although fringe, forested wetlands exist along the streams surrounding the site, they are determined not to be impacted based on both visual inspection and the analytical results of stream surface water and sediment samples. Based on consultation with the appropriate State and Federal agencies, no threatened or endangered species are known to exist in the site area, save the occasional transient species.

Significant Sources of Uncertainty

The RA for the site is based on conservative assumptions regarding exposure and toxicity. In making estimates of potential exposure and resultant intake, an effort was made to select parameters that overestimate actual exposures, so that the resulting estimates of potential risk also overestimates the actual risk associated with site-related exposures. Included among the conservative assumptions utilized are:

- the assumption that an individual may be exposed to any of these exposure conditions over the course of a lifetime,

- the assumption that an individual may be chronically exposed to concentrations of contaminants approaching the values used in the RA,

- the assumption that an individual may be simultaneously exposed to multiple pathways of exposure over the period of a lifetime,

- deliberate overestimation of toxicity indices where questions exist about the actual toxicity or carcinogenicity of a substance or group of substances. (One exception to this conservative methodology is the RA's assumption that the risk associated with exposure to more than one toxicant is additive. In some cases, depending on the chemicals, risk may be greater than additive.)

Several limitations of the RA should also be noted:

- analytical results from only five surface soil samples were available to evaluate the exposure pathways associated with dermal contact, contaminant air releases/fugitive dust emissions, and ingestion of venison associated with deer grazing onsite;

- the method utilized during the RI to identify the depth interval of soil borings for sample analyses may or may not have excluded samples with higher concentrations of semivolatile organic compounds:

- the sampling data utilized in the RA for exposure via use of residential well water is solely comprised of volatile organic analytical results, per the residential well sampling requirements in the EPA/CLTL Consent Order. For this reason, exposure and significance of such exposure of residents to other chemicals associated with site soils, such as semivolatile compounds and tentatively identified compounds (TICs), is uncertain, albeit unlikely. Results from the one round of sampling of residential wells for semivolatile organic analyses were not used based on the limited data set for these compounds.

- regarding exposure assumptions, the use of monitoring data, single concentration values, and screening level models (especially in the air and grazing deer exposure scenarios) all present a measure of uncertainty when estimating one's exposure to site contaminants.

- the RA is based on conditions of no action at the site. Protective measures instituted at the site, including the installation of a fence around the site and provision of point-of-entry carbon treatment units to homes with well water exceeding MCLs, results in risks considerably lower than that predicted in this RA.

Conclusions of the Risk Assessment

. The results of the calculations performed in the RA using the aforementioned exposure routes indicate that the estimate of most probable risk associated with all routes of exposure, except the Hypothetical Residential Use of Monitoring Well (or "Onsite") Groundwater, is within EPA's range of acceptable risk. The estimate of maximum or worst case risk exceeds EPA's range for two exposure routes; (1) the Hypothetical Residential Use of Onsite Groundwater and (2) the more realistic and actual Residential Use of Offsite Groundwater.

Following is a condensed table of the lifetime carcinogenic risks calculated for each exposure scenario:

Exposure Route	Most Probable	Worst Case
Residential Use of Offsite Groundwater	1×10^{-5}	3×10^{-4}*
Contact and Ingestion of Onsite Soils	9×10^{-6}	2×10^{-5}
Deer Meat Ingestion	5×10^{-6}	1×10^{-5}
Recreational Use of Spring Water at Campground	3×10^{-8}	3×10^{-8}
Inhalation of Dust and Vapor from Onsite Soils	5×10^{-6}	1×10^{-5}
TOTAL OF ALL "CURRENT" EXPOSURES	3×10^{-5}	4×10^{-4}*
Hypothetical Residential Use of Monitoring Well Groundwater	1×10^{-3}*	2×10^{-2}*

* outside of EPA's acceptable risk range

It is important to note that the RA principally evaluated the risk posed by the site under current conditions. Due to a lack of sufficient hydrogeologic data, the RA was not designed to predict the future risk associated with residential water use <u>if</u> the relatively highly contaminated groundwater below the site were to migrate to residential wells. The exposure route Hypothetical Residential Use of Monitoring Well Groundwater gives an indication of the carcinogenic risk which would be posed by use of groundwater directly below and adjacent to the site. When and if this contaminated groundwater, at or near to the concentration levels found below the site, could reach residential wells has not been determined at this point. Using a conservative approach to public health protection one would assume that groundwater contaminant concentrations approaching those levels below the site would ultimately reach residential wells if either the pollutant source or contaminated groundwater is not contained or remediated.

. In addition to carcinogenic risks, the RA calculated risks to humans of contracting non-carcinogenic health effects from substances associated with the site using the same identified exposure routes. The results of these calculations for non-carcinogenic health effects were below the EPA guideline of 1.0 for children and adults for all exposure scenarios <u>except</u> both the most probable and maximum Hypothetical Use of Onsite Groundwater scenarios. These results suggest that exposure to non-carcinogenic chemicals at the site is not anticipated to result in adverse health effects under the current conditions of exposure. As stated above, however, it implies that groundwater contaminants found at levels directly below and adjacent to the site could pose non-carcinogenic health effects to users. Therefore, if groundwater contaminant concentrations at or approaching these levels were to migrate to residences, non-carcinogenic health effects would be expected.

. For the two groundwater exposure scenarios exceeding EPA 's carcinogenic and noncarcinogenic guidelines (Residential Use of Offsite and Onsite Groundwater), TCE is the contaminant which poses the greatest carcinogenic risk and chloroform and tetrachloroethene pose the greatest noncarcinogenic risk.

. Under the scenario Hypothetical Residential Use of Monitoring Well Groundwater, it should be emphasized that no one is currently using this water. This scenario presents the risk which could be posed if the site were left unaddreseed and the contaminant plume continued to spread.

It is somewhat reassuring to note that three years of residential well data indicate that residential well concentrations are not significantly rising and site groundwater contaminant transport seems to be in "steady-state". Despite this apparent condition, several factors suggest that future site groundwater conditions are uncertain, warranting careful evaluation of future residential exposure to groundwater contamination. These factors include: (1) the complex hydrogeology of the site area, (2) limited knowledge of groundwater contaminant concentrations and flow patterns between the site and residential wells, (3) close proximity of homes to the site, and (4) based on the heterogenous and relatively unknown types of waste disposed of in the former lagoons, the possibility, although not considered likely, that compounds of an unknown nature may be present or migrating to homeowner wells.

. *From an environmental risk perspective, analyses of surface* water and sediment samples near the William Dick Lagoons Site do not indicate that these media are currently measurably affected by site-related contamination. Further, except for that of the immediate area of the former lagoons, the assessment made of the local environment did not identify any potentially adverse effects of site-related contamination to the wellbeing of plants and animals. Thus, it appears that the Site has had no persistent adverse effect upon the surrounding ecosystem.

EPA has determined that actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

VII. DESCRIPTION OF REMEDIAL ALTERNATIVES

The Preliminary Final FS discusses the alternatives evaluated for the site and provides supporting information leading to alternative selection by EPA. The Preliminary Final FS includes consideration of all EPA comments on the Draft FS. As mentioned, it is identified as a preliminary document since EPA is conducting one final review. Any paper revisions to the Preliminary Final FS will not affect EPA's alternative selection process since the rationale for these changes has already been incorporated into the Administrative Record.

As indicated in the section of this ROD entitled Scope and Role of Remedial Action, this document addresses remedial action for two of three units at the site. Specifically, this ROD presents a remedial decision for Unit 1-Alternate Water Supply and Unit 2 -Groundwater. The decision on Unit 3-Source Control, will be deferred to a later date, as previously indicated. Remedial objectives for the Unit 1 and 2 alternatives focus on the elimination of unacceptable human or environmental health risk and the reduction of contaminant concentrations in groundwater to meet ARARs and/or risk-based levels.

Section 121 of CERCLA requires that the selected remedial alternative to address contamination at a Superfund Site be protective of human health and the environment, comply with ARARs or justify a waiver, be cost effective, utilize permanent solutions and alternative technologies to the maximum extent practicable, and satisfy the preference for treatment as a component of the remedial action or explain why the preference is not satisfied.

The alternatives evaluated in this ROD for Units 1 and 2 appear below. As discussed previously, the method and detail of alternative evaluation differs from that presented in the Preliminary Final FS and several changes to the alternatives presented in the FS have been made.

ALTERNATE WATER SUPPLY - UNIT 1:

AWS 1: No Action

Estimated Capital Cost: $0
Estimated Annual Operation & Maintenance (O&M): $0
Estimated Present Worth: $0
Estimated Time to Complete: Immediate

- costs of existing requirements under the 1988 Removal Order not included

The Superfund program requires that the No Action alternative be evaluated for each site unit in order to establish a baseline for comparison. Under this alternative, EPA would take no remedial action at the site to prevent residential exposure to contaminated groundwater. However, CLTL would continue the provision of point of entry systems (i.e. granular activated carbon (GAC) units) and sampling of residential wells (and springs) as required under the 1988 Removal Order signed with EPA. A five year review of this remedy would be conducted in accordance with Section 121(c) of CERCLA.

Protection of public health and compliance with ARARs is potentially jeopardized under this scenario since the existing Removal Order was established as a temporary measure and may not contain a sufficient monitoring schedule to ensure that contaminants have not migrated to wells between individual monitoring events. A resident(s) could be exposed to contaminants above MCLs until such time as scheduled monitoring determines the presence of contaminants in his/her individual well. Operation and maintenance of the point of entry systems and monitoring of homes not supplied with point of entry systems must be performed with committed and persistent application for this remedy to be effective. Compliance with ARARs will require that spent carbon or regeneration waste from used systems will be disposed of in accordance with the Resource Conservation and Recovery Act, 42 U.S.C. Section 6901 et seq. (RCRA) and State hazardous waste disposal requirements.

The remedy meets the statutory requirement for treatment (at the residential well itself) but is not a permanent remedy since occasional replacement of the carbon in the point of entry systems will be needed on an approximately two to three year basis.

This alternative would prove to be difficult to implement if a pump and treat remedy is selected for Operable Unit 2. The installation and operation of recovery wells to collect and treat groundwater for Operable Unit 2 could act to draw contaminants into home wells since the complex site hydrogeology might prevent the adequate institution of preventative measures to prevent this event. In addition, the continued use of individual residential wells could act as a deterrent to the adequate collection of contaminated groundwater by the recovery wells since the home wells might act to draw groundwater away from the recovery wells.

AWS2: Institutional Controls

Estimated Capital Cost: $10,000
Estimated Annual O&M Cost: $2000

Estimated Present Worth : $30,600
Estimated Time to Complete: 1 to 2 Years

- costs of existing requirements under the 1988 Removal Order not included. Costs include personnel or man-hour expenditures for establishing and administering institutional controls.

Under this alternative, the existing Removal Order of 1988 would remain in effect. In addition, the alternative would include the imposition of institutional controls such as deed, zoning, and/or ownership restrictions to prevent residential use of contaminated groundwater by individuals moving into the area of the contaminated groundwater plume. For example, a deed restriction/ notice or property transfer advisory could be instituted for the sale of property within the area of the contaminated plume.

The Chester County Health Department (CCHD) has already established an internal mechanism whereby all new private wells drilled in Chester County must first obtain a permit from CCHD before drilling commences. For any prospective wells to be drilled within the area of the contaminant plume surrounding the Site, the resident is required to perform sampling and analyses of the well water immediately after well construction and on a yearly basis thereafter. Should the well water sample results indicate a contaminant(s) above drinking water standards, treatment of the water must be in place prior to granting of approval of private well use (**See Appendix C**). EPA would provide information to CCHD to enforce this requirement at the site should it be necessary. Existing well owners are entitled to periodic sampling and provision of a point of entry treatment system (if needed) by CLTL as a result of the 1988 Removal Order between EPA and CLTL.

A five year review of this remedy would be conducted per Section 121(c) of CERCLA. The potential for protection of public health and compliance with ARARs is slightly higher under this alternative due to the emphasis placed on institutional controls. Compliance with the statutory requirements of treatment preference, and utilization of a permanent remedy/alternative treatment technology whenever practicable, is identical to that of AWS1. Should a pump and treat remedy for Operable Unit 2 be selected, the same potential problems are associated with this remedy as identified for AWS1.

AWS 3: Point of Entry Systems with Institutional Controls

Estimated Capital Cost:	$0
Estimated Annual O&M Cost:	$16,000 to $74,500
Estimated Present Worth:	$720,000 to $1,158,000
Estimated Time to Install/Complete:	Several Weeks after MCL Exceedance

- range in costs based on present and future case scenarios. Costs include those associated with existing 1988 Removal Order plus additional monitoring requirements.

The monitoring of residential well water (and springs) and provision and monitoring of point of entry systems would continue as currently provided under the 1988 Removal Order. However, because the Removal Order requirements were originally envisioned as a temporary measure, and this decision contemplates a final remedy, EPA would institute steps to increase the frequency and potentially the scope of monitoring above that currently provided by CLTL. Currently, the frequency of monitoring for this alternative is expected to be that appearing on pages 3-13 and 3-14 of the Preliminary Final FS. The scope of monitoring would increase if the Agency determines that homes located outside of the current sampling radii (1/2 mile north and 1 mile south of the former lagoons) require periodic monitoring. This would be determined when planning for and/or during the additional hydrogeologic work scheduled for Operable Unit 2. Such efforts would continue until the contaminated groundwater is restored to its beneficial use. The institutional controls discussed under AWS2 would also be a component of this alternative.

This alternative has a greater propensity than AWS1 and AWS2 for meeting the statutory requirements to protect public health and comply with ARARs due to the increased scope and frequency of monitoring for this option. Compliance will require vigorous efforts to ensure that point of entry units are properly monitored and maintained including the proper disposal of contaminated carbon from spent units.

A five year review of this remedy would be conducted per Section 121(c) of CERCLA. Compliance with the statutory requirements of treatment preference, and utilization of a permanent remedy/alternative treatment technology whenever practicable, is identical to that of AWS1 and AWS2. Should a pump and treat remedy for Operable Unit 2 be selected, the potential incompatability problems identified for AWS1 and AWS2 also apply to this alternative.

AWS 4: Extension of the Coatesville Water Line with Institutional Controls

Estimated Capital Cost:	$1,631,000 to $2,187,000
Estimated Annual O&M Cost:	$21,000 to $46,000
Estimated Present Worth:	$2,034,000 to $3,071,000
Estimated Time to Install/Complete:	2+ Years

- range in costs based on current uncertainty regarding length of water line extension and the identification of all residents to be serviced.

This alternative addresses residential water use by extending the City of Coatesville Authority's (CCA) water line from its current location at the intersection of Coffroath Road and North Sandy Hill Road. Public water from the City of Coatesville's intakes on Birch Run, Rock Run, and/or Octoraro Creek, after treatment, would be supplied to affected and potentially affected site residents (i.e. homes located within the site groundwater contaminant plume). A water storage tank would be installed at a location near the site to provide storage and pressure feed for water line connections.

EPA will work with the appropriate local authorities to develop and/or enforce institutional controls in an attempt to ensure that current and future residents within the contaminated groundwater plume either obtain their water from the newly installed water line, or, should they decline to connect, that their groundwater well be periodically analyzed for site contaminants. Several existing rules and regulations of the Chester County Health Department (CCHD) apply to this situation:

- Section 501.14 of the Rules and Regulations of the CCHD requires that no individual water supply well may be used, constructed or maintained where a public water supply pipe is within 150 feet of the structure to be served by water (provided the structure is located within the franchise area of the water supplier.)

- The CCHD interprets Section 501.3.1. of the CCHD Rules and Regulations to require that all residents connecting to a public water supply must "abandon" their private well. Abandonment of a well requires filling and sealing of the well as defined in Section 501.9 of the CCHD Rules and Regulations.

- Section 501.13.2.3.3. of the CCHD Rules and Regulations grants CCHD the authority to require owners of newly drilled private wells to analyze the well water for harmful substances which the CCHD suspects are present. The CCHD has established an internal mechanism whereby all new private well drillers in Chester County must first obtain a permit from CCHD before drilling commences. For all new wells drilled within the area of the contaminant plume surrounding the Site, the resident is required to perform sampling and analyses of the well water immediately after well construction and on a yearly basis thereafter. Should the well water sample results indicate a contaminant(s) above drinking water standards, treatment of the water must be in place prior to granting of approval of private well use (See Appendix C).

If continued use of a well by a non-connecting resident is determined to present an unacceptable environmental or public health impact, EPA may initiate efforts to close the well under its CERCLA Section 106 authority. To determine the risk posed by exposure to well water by any individual within the groundwater contaminant plume who declines to connect to the water line and maintains and continues to use a private well, EPA may attempt to require periodic monitoring of the well water by the resident through cooperative enforcement efforts with the CCHD. Section 501.13.2.3.3. of the CCHD Rules and Regulations may provide a mechanism for this action via application to existing well owners. If necessary, monitoring could be conducted by EPA.

Based on existing data, it is anticipated that the line would be extended up North Sandy Hill Road toward the site and would extend westward to service affected or potentially affected residents on Telegraph Road. At this time, it is not known if the water line would be extended to service residents on Hill

Road or residents living northeast of the site near the intersection of North Sandy Hill Road and Telegraph Roads. A determination of all residents who will be offered the opportunity to connect to the line will be decided during water line design and following completion of additional hydrogeologic study scheduled to commence during mid-1991 (see the discussion of alternatives for Unit 2). One of the major tasks of the additional hydrogeologic work will be to make a definitive determination on the extent of the plume and thus determine which residents will be eligible for water line connection.

Current data indicates that approximately 50 residential locations lie within the estimated groundwater plume area (as identified in the RI). The additional hydrogeologic work in 1991 may indicate that a significantly larger number of residents may be affected or potentially affected by site groundwater contamination. It is expected that water line design will commence as additional hydrogeologic work proceeds.

A representative portion of existing residential locations beyond the reach of the proposed line would undergo periodic sampling of private wells if there is concern that the groundwater contaminant plume could migrate and impact such wells during the period of the remediation activity selected for Operable Unit 2. If such residences were to warrant connection to the CCA water supply in the future, EPA would take appropriate actions to extend the line. Nearby springs will also be monitored under this alternative.

This alternative meets all of the statutory requirements of Section 121 of CERCLA. The Coatesville water supply is in compliance with ARARs under the Safe Drinking Water Act and 25 PA Code Chapter 109. It is a permanent alternate water supply remedy. The statutory preference for treatment under CERCLA will be met by the groundwater remedy selected for Unit 2. Although the estimated cost is higher than the other alternatives, the cost is not excessively elevated in view of the permanence and reliability of the remedy and the elimination of the long-term need for future operation and maintenance.

Concerning this alternative's protection of public health, an added carcinogenic risk occurs as a result of exposure to trihalomethanes in the City of Coatesville Authority's (CCA) water supply. These compounds (chloroform, bromodichloromethane, chlorodibromomethane, and bromoform as identified by State law for monitoring purposes) are created as a result of the chlorination of surface waters containing natural organic precursor substances such as humic acid, fulvic acid, and plant extractives.

Based on a limited data base, the calculated current risk associated with trihalomethanes in the CCA water supply is approximately equal to that of the current risk from the use of residential well water contaminated with site-related chemicals. Specifically, the current average case total carcinogenic risk posed by the ingestion and inhalation of site-related groundwater compounds, using data collected from the 1988 Removal Order requirements, is calculated to be 7.58E-05 (or 1 additional cancer per 13193 exposed individuals). The current worst-case risk is calculated to be 2.92E-04 (or 1 additional cancer per 3425 individuals).

The current average case total carcinogenic risk posed by the ingestion and inhalation of trihalomethanes in the CCA water supply, using quarterly monitoring data obtained from Coatesville for the period of March 1990 to March 1991, is calculated to be 1.05E-04 (or 1 additional cancer per 9488 individuals). The current worst-case risk is calculated to be 1.6E-04 (or 1 additional cancer per 6097 individuals).

Although the current risk scenarios described above are roughly equal, it is important to note that the CCA water supply has been in compliance with all drinking water standards for trihalomethanes (i.e., a Maximum Contaminant Level (MCL) of 100 ppb for Total Trihalomethanes) at least over the last three years. In addition, EPA's Drinking Water Program is scheduled to propose new national standards for trihalomethanes in June of 1993, with promulgation of such standards scheduled for June of 1995. Current indications are that the trihalomethane standards will be set at a lower level, thus reducing the carcinogenic risk posed by these compounds. If the standard is reduced, the CCA will be required to comply with the new standard within a few years of promulgation. Finally, the CCA has expressed a desire to reduce trihalomethane levels as evidenced by its intention, expressed to EPA in April of 1991, to convert its disinfection system from chlorination to chlorine dioxide treatment. However, toxicity concerns regarding chlorine dioxide treatment residuals caused the CCA to postpone its plans for disinfection conversion.

EPA also considered the risk, again utilizing a limited data base, associated with the presence of natural radioactive substances (i.e., radon, radium. and uranium) in residential wells located near the site. These substances appear in elevated levels in site groundwater as a result of the geochemical characteristics of the Chickies rock formation, where the site lies. (Due to its use of surface water as a source of drinking water, the CCA water supply does not contain elevated levels of radioactive substances.)

The Agency has limited authority, under CERCLA (see CERCLA Sections 104 (a)(3) and (4)), to take a remedial action to address a release or a threatened release of a naturally-occurring substance in its unaltered form, or altered solely through naturally occcuring processes or phenomena, from a

location where it is naturally found. However, when risk results from both natural and man-made sources, the Agency considers it appropriate to evaluate the overall risk associated with the use of water from each source. Such an analysis presents a complete picture of the health risk associated with each water supply alternative.
An assessment performed for exposure to the natural radioactive substances in site groundwater found that provision of Coatesville water to site residents would actually reduce the risk of added cancer since it would eliminate the natural but rather significant risk posed by exposure to radionuclides in site groundwater. The current average carcinogenic risk associated with exposure to radionuclides in groundwater (not including the risk posed by site-related compounds), utilizing data collected by the US Geological Survey and ERM during 1988, is calculated to be 7.07E-04 (or 1 additional cancer per 1,400 exposed persons). The current worst-case carcinogenic risk associated with this exposure is calculated to be 2.7E-03 (or 1 additional cancer per 370 exposed individuals). These calculated risks are substantially higher than the risks posed by either site-related chemicals in groundwater or trihalomethanes in the City water supply.

A complete evaluation of the risks from all three exposure scenarios appears in **Appendix B** of this ROD.

> Note: Under alternative AWS 4, the campground and trailer park located approximately 3/4 mile and 1/2 mile southwest of the site would not receive public water due to: (1) their remote location from the remaining affected residences, (2) the considerable cost (roughly $360,000) associated with the extension of a water line several thousand feet to service only a few residents, and (3) the lack of contaminants found in their well water to date. Instead, this remedy would provide a point of entry system with applicable monitoring, similar to that which is currently performed.

AWS 5: Private Water Company With Institutional Controls

Estimated Capital Cost:	$1,190,000 to $1,748,000
Estimated Annual O&M Cost:	$21,000 to $23,100
Estimated Present Worth:	$1,706,000 to $2,298,000
Estimated Time to Install/Complete:	2+ Years

- range in costs based on current uncertainty regarding length of water service line and the identification of all residents serviced.

This alternative involves installation of a high capacity water supply well(s) in an uncontaminated groundwater location near the site to be utilized by residents within the contaminated groundwater plume. The water would be treated at an onsite treatment plant and distributed to residents for household use. Water quality and operation procedures would be required to meet all Federal and Pennsylvania standards for a public water supply. The well and treatment plant would be maintained by a licensed operator.

As in AWS 4, institutional controls would be implemented (see the earlier discusion on existing CCHD regulations) in an attempt to ensure that all current or future residents residing in the groundwater contaminant plume be required to connect to this water supply well treatment system. Should a resident within the plume decline to connect and instead maintains a private well, EPA may work with the CCHD to develop institutional controls to require periodic monitoring of the private well water by the owner to determine the level of site contaminants. EPA could monitor the well water if determined to be necessary. The Agency would take efforts to close the well if the well water is determined to pose an unnaceptable risk to health or the environment.

The identification of all residents to be offered an opportunity to connect to this system would be determined during remedial design and completion of the additional hydrogeologic investigation as discussed under AWS4. Limited monitoring of nearby springs and residential wells located outside the well system connection area also would occur.

This alternative could meet all of the statutory requirements of CERCLA Section 121 if designed and operated properly. However, a significant concern exists regarding the inability to adequately ensure the existence of a long-term operator for a new water supply system. (CERCLA does not permit EPA to expend Superfund monies to operate and maintain a water treatment plant.) In addition, the type and cost of treatment which would be required at the groundwater supply well is uncertain at this time. Based on the geochemical characteristics of the hydrogeology of the area, treatment for radioactive substances may be necessary if levels in the well water exceed drinking water standards.

> Note 1: Under alternative AWS 5, the campground and trailer park located approximately 3/4 mile and 1/2 mile southwest of the site would not receive public water due to: (1) their remote location from the remaining affected residences, (2) the considerable cost (roughly $360,000) associated with the extension of a water line several thousand feet to service only a few residents, and (3) the lack of contaminants found in their well water to date. Instead, this remedy would provide a point of entry system with applicable monitoring,

similar to that which is currently performed.

GROUNDWATER - UNIT 2 (INTERIM REMEDY)

Scope of Groundwater Remedy

As previously indicated, the remedy for this unit is an interim measure based on the lack of sufficient data to predict the response of the aquifer to pumping and thereby establish cleanup levels and timeframes. The goal of the selected interim remedy will be the collection of hydrogeologic data and commencement of an initial pump and treat system geared toward (1) initiation of the reduction of groundwater contaminant toxicity, mobility, and volume, and (2) the collection of data on aquifer and contaminant response to remediation measures.

The ultimate goal for remediation will be determined in a final ROD for groundwater at the site, which shall be prepared after evaluating data generated during the interim action. EPA estimates that a final ROD will be prepared within five years of interim remedy implementation. It is possible that sufficient data may be obtained before that time to enable selection of a final remedy. The interim action will continue until the selected final groundwater remedial action is chosen or implemented. The extraction and treatment operation of the interim remedy may become a major component of the final remedy.

EPA has decided that specification of the type of groundwater treatment technologies to be utilized at the site is premature at this time. The specific type of technologies will be determined during interim remedial design and are expected to consist of chemical precipitation and one or more of the following: granular activated carbon (GAC), chemical oxidation, and air stripping with possible emissions controls. Data presented in the Preliminary Final FS indicates that the cost of all possible combinations of these technologies which could be utilized at the site are within the range of fifteen percent from one alternative to the next. The differences among the alternatives presented below primarily focus on the scope of the interim remedy in addressing all or portions of the contaminant plume.

GWS 1: No Action

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth: $0
Estimated Time to Install/Complete: Immediate

The Superfund program requires that the No Action alternative be evaluated for each site unit in order to establish a baseline for comparison. Under this alternative, EPA would take no action at the site to attempt to cleanup the contaminated groundwater. The contaminated groundwater plume could increase in volume and severity and might well affect additional residential wells and migrate to ecological receptors. Unless an alternate water supply is provided, residents would be exposed to varying levels of contaminants. At least initially, 12 residential wells will have contaminants in excess of MCLs. A five year review of this action would be performed under CERCLA Section 121(c) since wastes would be left onsite above health based levels.

This remedy would not meet the statutory requirements to protect human health or the environment and does not satisfy the preference for treatment nor utilize permanent solutions/alternative technologies whenever practicable. Since no action is taken, ARARs do not apply.

GWS 2: Additional Hydrogeologic Study/Pumping Wells (At/Adjacent to Former Lagoons) With Groundwater Treatment, Stream Discharge

Estimated Capital Cost:	$1,078,000
Estimated Annual O&M:	$166,700
Estimated Present Worth:	$2,289,000
Estimated Time to Install/Complete:	2+ Years/5+ Years

(costs assume 5 years of groundwater pump and treat)

This interim alternative initially calls for the collection of additional hydrogeologic data followed by pumping and treating from the contaminated portion of the aquifer directly below and/or adjacent to the former lagoons.

Monitoring wells would first be installed and aquifer tests conducted to better define site hydrogeologic conditions; including flow patterns, contaminant extent and aquifer inhomogeneities. Following this work, an interim groundwater remedy for the highly contaminated portion of the aquifer would be designed and installed. Wells would be located below or adjacent to the site and possibly in the nearby bedrock fractures which may carry the majority of contaminated groundwater from the site. The intent of this conceptual design would be to capture groundwater moving under the former lagoon area to limit the migration of contaminants in the aquifer currently used by nearby residents. (The costs for this conceptual recovery system design appear in Appendix E of the Preliminary Final FS as the 8 well recovery system under Alternatives GW7 and D1. Costs for additional hydrogeologic work are based on the Geraghty & Miller proposal of December 12, 1990.)

The groundwater recovery system and hydrogeologic characterization under this alternative would not attempt to gather data regarding, nor attempt to determine the potential for remediation of, the remainder of the plume. This option assumes that, as the contaminated upgradient groundwater is cleaned, contaminated water near residential wells should improve in quality over time. Verification of this scenario or a time frame for this improvement cannot be provided with current hydrogeologic data.

The captured groundwater would be piped to an onsite treatment plant, specific components of which will be developed during remedial design. The plant is expected to include chemical precipitation and one or more of the following technologies: air stripping, granular activated carbon absorption and chemical oxidation. Appropriate emissions controls will be required as needed to meet State and Federal air emissions standards. Residuals generated during water or air treatment will be disposed offsite or regenerated as required by regulations under RCRA and 25 PA Code Sections 75.260.1 through 75.270.4. Following treatment, groundwater is expected to be discharged to Indian Spring Run located north of the site. Discharge water will be required to meet effluent limitations and water quality criteria requirements set by the Pennsylvania DER under 25 PA Code Chapters 92 and 93.

This alternative, in conjunction with an action-oriented remedy for Unit 1, would provide a measure of protection to human health and the environment by beginning to reduce the toxicity, volume, and mobility of contaminants and may serve to impede the flow of contaminants to residential wells and ecological receptors. However, it is not intended to reduce contaminant levels throughout the plume and its interim nature does not ensure that pumping and treating will continue until complete remediation. It will result in the collection of data needed to determine a final remedy on remediating all or at least portions of the aquifer. The remedy does not set specific cleanup standards but it will attempt to determine whether or not State and Federal groundwater standards can be met. Due to the remedy's interim nature, State and Federal groundwater, chemical-specific cleanup ARARs (i.e., "background" water quality for the State and drinking water standards or MCLs for Federal) will not and need not be attained per the ARAR waiver provisions of Section 121(d)(4)(A) of CERCLA. However, all regulated activities associated with the operation of the pump and treat system will comply with State and Federal ARARs.

The remedy does not meet the statutory permanency requirement based on its interim nature. This situation is justified since adequate data is lacking to make a decision on a permanent remedy. The statutory preference for treatment will be met.

GWS 3: Additional Hydrogeologic Study/Pumping Wells (At/Adjacent to and Within the Plume) With Groundwater Treatment, Stream Discharge

Estimated Capital Cost:	$2,232,000
Estimated Annual O&M:	$284,000
Estimated Present Worth:	$3,957,000
Estimated Time to Install/Complete:	2+ Years/5+ Years

(costs assume 5 years of groundwater pump and treat)

This interim alternative is similar to option GWS 2 except that the intent of both hydrogeologic data collection and the pump and treat system is to determine the potential for and feasibility of capturing and treating the entire contaminated groundwater plume. Monitoring wells will also be placed in an attempt to further characterize the plume and to obtain sufficient data to determine the extent of site-related groundwater contamination. Specifically, wells will be placed to determine if the site (1) is impacting or may impact groundwater located beyond the major fault located approximately 1/2 mile south of the site and (2) is impacting or may impact groundwater utilized by residents located north and northeast of the site along Telegraph Road, upper North Sandy Hill Road and Hill Road east and west of North Sandy Hill Road.

This remedy generally entails the installation of several recovery and/or monitoring wells located at a distance from the site to observe how large portions of the contaminant plume will respond to recovery operations and to determine the practicability of addressing this entire plume in a final decision for the site. (The estimated costs for this conceptual recovery system design are based on the 47 well recovery system for Alternatives GW7 and D1 appearing in Appendix E of the Preliminary Final FS. Estimated costs presented herein are lower than those appearing in the Preliminary Final FS document since EPA believes that the stated goals of this interim remedy do not suggest the installation of 47 wells. A total of 15 recovery wells was used for costing purposes for this interim remedy although the actual number of wells installed must await the results of the initial hydrogeologic data. The actual recovery well number may be more or less than 15. The cost for the additional hydrogeologic work required in this remedy is based on the Geraghty & Miller proposal of December 12, 1990.)

Although installation of recovery and monitoring wells is expected to occur in a staged approach, the intent of the remedy is to determine the practicability of remediating the entire contaminant plume, not simply the groundwater contamination nearest the former lagoons. If the collection and evaluation of data during the interim remedy suggests to EPA that remediation of the entire contaminated plume is impracticable, the final ROD will indicate which areas of the plume will require remediation and to what contaminant levels remediation will be attempted.

Similar to AWS 2, and in conjunction with an action-oriented remedy for Unit 1, this alternative provides a measure of protection to public health and the environment by beginning to reduce the toxicity, mobility, and volume of contaminants and it may serve to impede the flow of contaminants to residential wells and ecological receptors. Because the scope of this remedy is broader than AWS 2 in that it attempts to determine the potential for cleanup of the entire contaminated plume, the extent of contaminant reduction should be greater. This remedy also does not set cleanup standards although the action has greater potential for determining whether or not and at what cost Federal and State groundwater standards can be met throughout the entire plume. This alternative does not ensure that pumping and treating of the aquifer will continue until complete remediation but it will collect the information necessary to make a well-informed decision on such action. Waiver of groundwater cleanup ARARs is justified and would be invoked based on the interim nature of the remedy and the provisions of Section 121(d)(4)(A) of CERCLA. ARARs will be attained for all regulated activities associated with the operation of the pump and treat system.

Note: Both Alternatives GWS 2 and GWS 3 will require monitoring of the macroinvertebrate community at Stations 1 and 2 on Indian Spring Run and Stations 5, 6 and 7 on Birch Run as identified in the ecological assessment portion of the RI. Although the potential is considered minimal, this activity will be conducted to ensure that the pumping of groundwater does not result in hastening of the movement of groundwater contaminants into nearby streams. Such monitoring will include the EPT ratio (for ephemeroptera, plecoptera, and tricoptera) as found in EPA's Rapid Bioassessment Protocols for Use in Streams and Rivers, Benthic Macroinvertebrates and Fish, (EPA/444/4-89-001, May 1989). If the monitoring program indicates a decline in numbers, diversity, abundance, or EPT ratio, chronic toxicity testing of surface waters and sediments should be incorporated. (Additional monitoring requirements for the stream selected for discharge of treated groundwater will be determined by the State of Pennsylvania during issuance of a National Pollutant Discharge Elimination System (NPDES) permit.)

As the frequency, duration and specific details of the monitoring program will be determined during design of the pump and treat system, adequate cost figures cannot be made at this time and do not appear in the cost figures for Alternatives GWS 2 and GWS 3. However, it is roughly estimated that costs of the EPT ratio work will not exceed $10,000 per year.

VIII. COMPARATIVE ANALYSIS OF THE ALTERNATIVES:

Each of the remedial alternatives under both site units has been evaluated with respect to the nine evaluation criteria in the National Contingency Plan, 40 CFR Part 300.430(e)(9). A description of these criteria appears in **Figure 3**. The actual evaluation of the criteria for each unit appears in **Tables A and B.**

IX. SELECTED REMEDY:

Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, the remedial alternatives selected for implementation at the William Dick Lagoons Site are **Alternative AWS4, Extension of the Coatesville Water Line W/Institutional Controls and Alternative GWS3, Additional Hydrogeologic Study/Pumping Wells (At/Adjacent to and Within the Plume) with Groundwater Treatment, Stream Discharge.**

The goal of the selected remedy for Operable Unit 1, the Alternate Water Supply, is to provide a proven, protective and permanent water supply for the affected and potentially affected residents surrounding the site. An additional goal is to attempt to adequately meet the statutory preferences under CERCLA described in Section X of this ROD. The chosen remedy was especially selected to eliminate risk associated with potential future site exposure scenarios.

The primary goal of the chosen remedy for Operable Unit 2, Groundwater, is to collect the necessary data to make a final decision on the feasibility of complete groundwater restoration and to commence work to reduce the mobility, toxicity and volume of groundwater contamination. An additional goal of the initial hydrogeologic study portion of the remedy is to determine which residents, based on potential groundwater impact from the site, will require connection to the water line extension chosen for Operable Unit 1.

The components of each remedy have been discussed throughout this document. A breakdown of the capital, operation and maintenance, and present worth costs associated with the two remedies can be found in **Tables 13 and 14.**

Table A
Operable Unit 1
Alternate Water Supply

Evaluation Criteria	Alternative AWS 1 - No Action (1988 Removal Order Remains In Effect)	Alternative AWS 2 - Institutional Controls (1988 Removal Order Remains In Effect)
Overall Protectiveness to Health and Environment	Limited protection since existing 1988 Removal Order will remain in place. Monitoring schedule may not be adequate to determine contaminant exposure to residents not receiving a point of entry (POE) unit.	Slightly increased protection since 1988 Removal Order remains in effect and institutional controls would be implemented to aid in protection of future residents moving into the site area.
Compliance with ARARs	ARARs under the Safe Water Drinking Act (SDWA) & 25 PA Code Chapter 109 may be violated on occasion due to limited monitoring schedule. Offsite disposal of treatment unit residuals requires compliance with RCRA Subtitle C & 25 PA Code Chapters 75.21 to 75.38.	ARARs under the SDWA & 25 PA Code Chapter 109 may be violated on occasion due to limited monitoring schedule. Offsite disposal of treatment unit residuals requires compliance with RCRA Subtitle C & 25 PA Code Chapters 75.21 to 75.38.
Long Term Effectiveness	Point of entry systems only effective for one to three years. Replacement of the units will be needed as determined by residential monitoring. Homes without units will require continuous, efficient monitoring to ensure exposure prevention.	Point of entry systems only effective for one to three years. Replacement of the units will be needed as determined by residential monitoring. Homes without units will require continuous, efficient monitoring to ensure exposure prevention.
Reduction of Toxicity, Mobility and Volume	Reduction in toxicity as a result of treatment at the home well. Mobility and volume reduction would not be accomplished. Some concern regarding contaminant "breakthrough" from home treatment units, especially given limited monitoring.	Reduction in toxicity as a result of treatment at the home well. Mobility and volume reduction would not be accomplished. Some concern regarding contaminant "breakthrough" from home treatment units.
Short Term Effectiveness	Low risk to workers associated with water monitoring and changeover of home treatment units containing contaminanted carbon.	Low risk to workers associated with water monitoring and changeover of home treatment units containing contaminanted carbon.
Implementability	Implementation can be almost immediate since installation of home treatment units is relatively easy & inexpensive. Concerns exist regarding O&M of the units & continual sampling of numerous home wells by a responsible entity for 20+ yrs. EPA not permitted to conduct O&M. Institutional controls implementation somewhat questionable.	Implementation can be almost immediate since installation of home treatment units is relatively easy & inexpensive. Concerns exist regarding O&M of the units & continual sampling of numerous home wells by a responsible entity for 20+ yrs. EPA not permitted to conduct O&M. Institutional controls implementation & enforcement somewhat questionable.
Cost (Estimated to be -30% to +50% of actual cost)	Capital Costs: $0 * Operation & Maintenance (O&M): $0 * Present Worth: $0 *	CC: $10,000 * O&M: $2,000 * PW: $30,600 *
State/Community Acceptance	Not recommended by state. Community members preferring point-of-use treatment would be expected to prefer AWS 3.	Not recommended by state. Community members preferring point-of-use treatment would be expected to prefer AWS 3.

* Does not include costs associated with 1988 Removal Order requirements.

Table A (cont.)
Operable Unit 1
Alternate Water Supply

Evaluation Criteria	Alternative AWS 3 - Point of Entry System w/ Inst. Controls	Alternative AWS 4 - Water Line Extension w/ Inst. Controls	Alternative AWS 5 - Private Water Company w/ Inst. Controls
Overall Protectiveness to Health and Environment	Due to increased monitoring, expected greater protection to homeowners w/ POE systems provided monitoring is conducted effectively. Reliable O&M for 20 yrs or longer is a major concern. Homes w/out units must have water supply continually monitored for 20+ yrs to determine if exposure exists. Institutional controls help protect new residents.	Protection afforded to all exposed residents. Some additional risk due to trihalomethanes in city water system. Risk is considered acceptable and is expected to be reduced in future by regulation and/or treatment plant modification. Exposure to natural radioactive substances found in groundwater is eliminated.	Protection afforded to all exposed residents. Risk associated with natural radioactive substances would be reduced via treatment, if necessary.
Compliance with ARARs	Due to increased monitoring, SDWA & 25 PA Code Chapter 109 complied with at the residents' homes provided treatment units are monitored and maintained. Offsite disposal of treatment unit residuals requires compliance with RCRA Subtitle C & 25 PA Code Chapters 75.21 to 75.38.	SDWA and 25 PA Code Chapter 109 complied with for residences connected to the water line provided water treatment plant continues adequate treatment. Based on historic monitoring data, compliance is expected.	SDWA and 25 PA Code Chapter 109 complied with provided private water treatment plant operates effectively. Potential is high for ARAR compliance. Offsite disposal of plant residuals must comply with State Bureau of Waste Management regulations.
Long Term Effectiveness	Point of entry systems only effective for one to three years. Replacement of the units will be needed as determined by residential monitoring. Homes without units will require continuous, efficient monitoring to ensure exposure prevention.	Extension of water line expected to be a permanent solution to prevent human exposure to contaminated groundwater. As per SDWA, all water sampling/ monitoring will be conducted by a regulated third party, the City of Coatesville Authority (CVA).	Private water plant should provide a long-term water supply with little concern over water quality if operated properly. Concern exists regarding the selection and permanence of the plant operator.
Reduction of Toxicity, Mobility and Volume	Reduction in toxicity as a result of treatment at the home well. Mobility and volume reduction would not be accomplished. Some concern regarding contaminant "breakthrough" from home treatment units.	Not applicable since remedy provides a non-treatment alternative to existing contaminated groundwater	Not applicable since remedy provides a non-treatment alternative to existing contaminated groundwater
Short Term Effectiveness	Low risk to workers associated with water monitoring and changeover of home treatment units containing contaminanted carbon.	Minor physical risk to workers associated with construction of water line. During construction, residential monitoring of home wells would continue.	Minor physical risk to workers associated with construction of well and groundwater treatment plant. During construction, residential monitoring of home wells would continue.
Implementability	Implementation can be almost immediate since installation of home treatment units is relatively easy & inexpensive. Concerns exist regarding O&M of the units & continual sampling of numerous home wells by a responsible entity for 20+ yrs. EPA not permitted to conduct O&M. Institutional controls implementation somewhat questionable.	Construction of water line will require considerable coordination and administrative management effort by several regulatory agencies. A period of construction design will be necessary before construction commences. Construction of the water line may require 2+ years from ROD date.	Construction of high capacity well and water treatment plant will require considerable coordination & administrative management effort by several regulatory agencies. Construction design period will be necessary. Completion of construction will require 2+ years from ROD date.
Cost (Estimated to be -30% to +50% of actual cost)	CC: $0 O&M: $16,000 to $74,500 PW: $720,000 to $1,158,000	CC: $1,631,000 to $2,187,000 O&M: $21,000 to $46,000 PW: $2,034,000 to $3,071,000	CC: $1,190,000 to $1,748,000 O&M: $21,000 to $23,100 PW: $1,706,000 to $2,298,000
State/Community Acceptance	Not first choice of State. Community opinion divided.	Recommended and approved by State. Community acceptability appears generally low but divided. More acceptable to community if future water costs defrayed.	Not first choice of State. Apparently not acceptable to most of community.

Table B
Operable Unit 2
Groundwater (Interim Remedy)

Evaluation Criteria	Alternative GWS 1 - No Action	Alternative GWS 2 - Add'l Hydrogeologic Study/Pumping Wells (at/adjacent to former lagoons) w/ Groundwater (GW) Treatment, Stream Discharge	Alternative GWS 3 - Add'l Hydrogeologic Study/Pumping Wells (at, adjacent to, and removed from former lagoons) w/ GW Treatment, Spring Discharge
Overall Protectiveness to Health and Environment	Will not be protective to environment since groundwater contaminant concentrations may increase. Surface water bodies & aquatic life could be affected. Unprotective of human health if residents continue to contact, ingest, and/or inhale contaminants in groundwater.	Environment receives limited protection since highly contaminated groundwater near the site is captured and treated. Portion of contaminated plume removed from site continues to discharge to surface water until contaminants are reduced by natural dilution. Residents receive little reduction in risk since most residents use the contaminated portion of groundwater which is not addressed by this remedy. Interim remedy would not be geared toward determining if groundwater used by residents can be actively, practicably treated.	Environment receives greater protection since a larger area of contaminated groundwater is captured & treated. Contaminant levels in groundwater discharging to surface water bodies should be reduced. Most residential wells will continue to receive contaminated groundwater until a final remedy is selected. (Provision of an alternate water supply under OU1 will prevent exposure). Interim remedy goal is to determine if total area of groundwater contamination can be actively and practicably treated.
Compliance with ARARs	No further evaluation required since alternative is not protective.	Compliance with Federal and State groundwater cleanup standards is beyond the scope of this interim action. Groundwater ARARs are being waived per the justification requirements of CERCLA Section 121(d)(4)(A). All other pertinent Federal and State ARARs*, including wastewater discharge, treatment residual disposal, and air emission standards, will be met. Remedy ultimately is not directed toward meeting EPA goal of restoring entire contaminated plume to its beneficial use.	Compliance with Federal and State groundwater standards is beyond the scope of this interim remedial action. Groundwater ARARs are being waived per the justification requirements of CERCLA 121(d)(4)(A). All other pertinent Federal and State ARARs*, including wastewater discharge, treatment residual disposal, and air emissions standards, will be met. Remedy ultimately is directed toward meeting EPA goal of restoring the entire contaminated plume to its beneficial use.
Long Term Effectiveness	No further evaluation required since alternative is not protective.	Criterion is not applicable since this is an interim, short-term remedy. However, this alternative will be effective in beginning to reduce pollutant concentrations in a heavily contaminated portion of the aquifer. The "offsite" or downgradient portion of the aquifer will benefit from pollutant reduction in this upgradient area (i.e. water flowing into the downgradient area is expected to have lower contaminant concentrations.)	Criterion is not applicable since this is an interim short-term remedy. However, this alternative will be effective for beginning to reduce plume-wide contamination and determining the practicability of remediating all such groundwater contamination.

* For a complete description of State laws applicable, relevant and appropriate to these remedial alternatives, see the "Compliance with ARARs" section in the ROD.

Table B (cont.)
Operable Unit 2
Groundwater (Interim Remedy)

Evaluation Criteria	Alternative GWS 1 - No Action	Alternative GWS 2 - Add'l Hydrogeologic Study/Pumping Wells (at/adjacent to former lagoons) w/ Groundwater (GW) Treatment, Stream Discharge	Alternative GWS 3 - Add'l Hydrogeologic Study/Pumping Wells (at, adjacent to, and removed from former lagoons) w/ GW Treatment, Spring Discharge
Reduction of Toxicity, Mobility and Volume	No further evaluation required since alternative is not protective.	Mobility and volume of contaminants in groundwater will be reduced in the area of the extraction wells at and adjacent to the site. Toxicity of groundwater is reduced as a result of the treatment technologies employed. Minor transfer of contaminants to sludges and/or carbon material generated during the treatment process.	Mobility and volume of contaminants reduced in a wider area as a result of extraction wells placed beyond locations adjacent to lagoons. Toxicity of the groundwater is reduced as a result of the treatment technologies employed. Slightly larger transfer of contaminants to sludges and/or carbon material as a result of probable larger amount of groundwater undergoing treatment.
Short Term Effectiveness	No further evaluation required since alternative is not protective.	Minimal risk associated with the implementation of this remedy beyond that normally experienced during construction work. Minor contact with contaminated water by workers is possible. Air emissions during water treatment will be controlled as necessary to prevent risk to community.	Same as GWS 2.
Implementability	No further evaluation required since alternative is not protective.	Work is considered easily implementable as the technologies employed are conventional and well developed. Interim nature of the remedy does not require compliance with specific groundwater cleanup goals. Assuming no unusual circumstances, design and start-up of the pump and treat portion of the remedy should begin within 2 1/2 years of ROD signature. Additional hydrogeologic work can begin within 6 months of ROD signature.	Same as GWS 2 except time frame may be longer due to expected larger size of the recovery operation.
Cost (Estimated to be -30% to +50% of actual cost)	No further evaluation required since alternative is not protective.	CC: $1,078,000 O&M: $166,700 PW: $2,289,000	CC: $2,232,000 O&M: $284,000 PW: $3, 957,000
State/Community Acceptance	No further evaluation required since alternative is not protective.	Not acceptable to State. Minimal expression of community interest in groundwater remedy.	Acceptable to State as an interim remedy only. Minimal expression of community interest in groundwater remedy.

Current data gaps regarding the extent of the groundwater contaminant plume preclude an exact delineation of the water line configuration and residents to be serviced. This information will be obtained following completion of the hydrogeologic study planned for Operable Unit 2, the groundwater remedy. The current draft plan for the hydrogeologic study consists of the installation of 10 to 17 monitoring wells with subsequent sampling, water level monitoring, and aquifer testing.

Although cost estimating needs required selection of a specific groundwater treatment technology (i.e., pumping wells, iron precipitation, air stripping with emissions controls, chemical oxidation, stream discharge), the actual type of treatment will be selected after the ROD pending treatability studies. The actual number of recovery wells to be installed and volume of groundwater to be treated will be determined after the initial hydrogeologic study (for costing purposes, 15 wells were selected, pumping at a rate of 8 gallons per minute). The number of wells may be augmented during the life of the interim remedy as the work is expected to take place in an iterative fashion, reactive to continuing data collection efforts.

X. *STATUTORY DETERMINATIONS*

Section 121 of CERCLA establishes several requirements and preferences when selecting remedial actions at Superfund sites:

(1) the selected remedy should be protective of human health and the environment;

(2) it should attain ARARs (or adequately explain the rationale for invoking a waiver);

(3) it should be cost-effective;

(4) it should utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable;

(5) it is preferable that the remedy permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances.

Following is a discussion of how the selected remedy for each unit satisfies the above statutory requirements:

Protection of Human Health and the Environment

Alternate Water Supply - Extension of the City of Coatesville

Authority (CCA) water line with institutional controls was selected primarily to: (1) eliminate the current risk associated with the use of contaminated groundwater, and (2) eliminate the potential future risk associated with the migration of site groundwater contaminants to residential wells.

The Agency also has chosen the water line extension since it is a permanent and regulated remedy not subject to the constant monitoring of individual home wells for an unspecified period of time. It provides a more manageable water supply in that the specific types of chemicals disposed of at the William Dick Lagoons Site are basically unknown. Such a scenario presents risks associated with the inability, due to analytical limitations, to identify all site-related chemicals potentially in groundwater and available for human or environmental exposure. Alternative AWS 4 also prevents any future exposure risk to residents should contaminated groundwater directly below the site migrate to residential wells. This possibility is a significant concern since:

(1) groundwater directly below the site presents relatively high risks (maximum carcinogenic risk = 2.0E-02 or 2 cancers per 100 individuals exposed, average carcinogenic risk = 1.0E-03 or 1 cancer per 1000 individuals exposed, maximum noncarcinogenic Hazard Index = 30, average noncarcinogenic Hazard Index = 2 (a Hazard Index above 1 suggests the potential for toxic effects),

(2) several residential homes exist within 500 feet of the site and over 70 residences are within 1/2 mile of the site,

(3) details of groundwater contaminant flow, direction of groundwater flow, and the proximity of elevated concentrations of contaminants to residential wells are not well known at this point,

(4) the technical feasibility of fully remediating the groundwater contaminant plume at this site is questionable due to the complex hydrogeology of the area. A decision on whether or not such action can occur may require five years or more of groundwater study and partial groundwater pumping and treating, and

(5) the remedy selected for Operable Unit 2 will require the pumping of groundwater from several recovery wells. It is possible that the active pumping of these wells, along with the active pumping of surrounding residential wells, could result in the migration of contaminants into home wells.

Based on the assessment presented in Appendix B and discussed earlier in the description of remedial alternative AWS4, the Agency acknowledges that a current carcinogenic risk exists as a result of the presence of trihalomethanes in the CCA water supply. *In fact*, the risk currently posed by use of CCA water, in comparison to the use of untreated groundwater contaminated with site-related compounds, is approximately equal. However, it is important to note that EPA utilized the standard assumed exposure period of a lifetime or 70 years when calculating the carcinogenic risk posed by each water source. Because the Agency currently is scheduled to propose and promulgate new standards for trihalomethanes in 1993 and 1995, respectively, and such standards are currently expected to be lowered, it is possible that CCA water users will not be exposed to existing trihalomethane levels for more than 6 to 8 years (possibly less if CCA voluntarily acts to reduce trihalomethane levels sooner). A decrease in the period of exposure would serve to substantially reduce the carcinogenic risk associated with this remedy.

Although not a basis for undertaking remedial action at this site, Alternative AWS 4 also provides an incidental benefit in that it will eliminate the residential use of groundwater contaminated with naturally occuring radioactive substances. Because such risk is significant, AWS4 will incidentally result in greater protection of public health. **Appendix B** discusses this risk scenario further.

It should be noted that the risk incurred by consumers of both groundwater and public water does not end with the contaminants referred to above. There are many additional chemical and bacterial waterborne health threats which are generically associated with water bodies and have little relation to the site. A regulated public water supply can best address the majority of these potential waterborne contaminants via the relatively stringent monitoring requirements of over 100 substances (both chemical and biological) as imposed by the Commonwealth of Pennsylvania via Chapter 109 of Title 25 of the Pennsylvania Code. Many of the substances monitored in a public water supply will not be addressed via the continued use of private wells. Only contaminants known to be associated with the site will be monitored. (See **Appendix D** for a discussion of this issue and related matters concerning alternate water options.)

Should such measures be needed, institutional controls will be established, as legally available, to assist in protecting public health and the environment from the use of well water by residents not selected or not choosing to connect to the water line.

(A more detailed discussion of institutional controls appears in **Section VII. Description of Remedial Alternatives**)

Finally, there are no unacceptable short-term risks associated with the implementation of this remedy. No cross media impacts are expected. In fact, this remedy avoids the effects of potential cross-media impacts to residential water use that might occur during the implementation of pump and treat measures under the Unit 2 remedy.

Groundwater - Selected Alternative GWS 3 is an interim groundwater remedy which will be designed to collect sufficient additional data and commence an initial pump and treat action to enable EPA to make a final decision on groundwater remediation within approximately five years. This interim remedy, although not intended to clean groundwater to background quality or risk-based levels, will provide a measure of protection by reducing the mobility, toxicity, and volume of groundwater contaminants. The remedy may result in a mitigation of contaminant flow to residential wells although containment of the groundwater plume is not a primary goal of this activity.

Any potential unacceptable short-term risks associated with this remedy will be controlled via proper implementation. Any potential cross media effects, including reduction in the availability of residential well water or augmentation of contaminant migration from the site to private wells, will be addressed during design and operation. Potential impacts to stream ecology will be evaluated via the macroinvertebrate monitoring program identified in the selected alternative.

Compliance With ARARs

The following ARARs, expressed as chemical-, location-, and action-specific (as well as To-Be-Considered Materials), are identified for the two selected remedies:

Alternate Water Supply - all of the ARARs identified for the selected remedy for this Unit are expected to be met:

(1) Chemical-Specific

(a) Maximum Contaminant Levels (MCLs) and monitoring requirements promulgated under the Safe Drinking Water Act (SDWA), 40 CFR Parts 141 and 143 are applicable to the water to be supplied to the residents since the chosen remedy obtains water from a regulated public water supply;

(b) Pennsylvania State Law requirements established in 25 PA Code Chapter 109 are applicable as they apply to standards set for drinking water systems and drinking water quality.

(2) Action-Specific

(a) 25 PA Code Chapter 102 requirements concerning the control of soil erosion and sedimentation from earth-moving activities are applicable;

(b) OSHA standards for worker protection, 29 CFR Parts 1904, 1910, and 1926 are applicable.

(3) Location-Specific

(a) Depending on the location of the proposed water tank, 40 CFR Part 6, Appendix A as it pertains to provisions for carrying out Executive Order 11990 (Protection of Wetlands) may be applicable.

4) To-Be-Considered Material:

(a) Section 501.14 of the Rules and Regulations of the Chester County Health Department (CCHD) requires that no individual water supply well be used, constructed or maintained where a public water supply pipe is within 150 feet of the structure to be served by water. Section 501.13.2.3.3. of the CCHD Rules and Regulations grants CCHD the authority to require new well drillers to analyze well water for harmful substances which the CCHD suspects are present. The CCHD interprets Section 501.3.1 of the CCHD Rules and Regulations to require that all residents connecting to a public water supply must "abandon" their private well. Abandonment of a well requires filling and sealing of the well as defined in Section 501.9 of the CCHD Rules and Regulations. Depending on the configuration of the water line and/or the development of new housing within the site area, these requirements would be applicable.

(b) Page 3-13 of the <u>Guidance Document for Providing Alternate Water Supplies</u>, OSWER Directive 9355.3-03, EPA/540/6-87/006, February 1988, strongly encourages connection to existing water supplies when considering actions for alternate water supply provision. The selected remedy follows this recommendation.

<u>Groundwater</u> - the following identified ARARs for the chosen remedy GWS 3 are described in terms of compliance capability:

1) Chemical-specific

(a) MCLs promulgated under SDWA 40 CFR Sections 141 and 143 are relevant and appropriate in terms of attaining these criteria to restore the Class II aquifer to its beneficial use as a drinking water source:

(b) 25 PA Code Sections 75.264.90 - 75.264.100, particularly 25 PA Code Sections 75.264.97(i),(j) and 75.264.100(a)(9), maintain that all groundwater containing hazardous substances must be restored to "background" quality. EPA recognizes this requirement as an ARAR for remediation of groundwater at Superfund sites.

Note: EPA is waiving the requirement to comply with the above two ARARs based on the interim nature of the selected remedy, in accordance with CERCLA Section 121(d)(4)(A). This interim remedy will attempt to obtain sufficient data to support selection of a remedy meeting all ARARs in a subsequent ROD.

All of the remaining ARARs for this remedy are expected to be complied with:

2) Action-specific

(a) Since the site groundwater is contaminated by the leaching of RCRA-listed waste, the groundwater treatment plant will be designed and operated in accordance with relevant and appropriate RCRA Subtitle C miscellaneous treatment unit standards (40 CFR Section 264, Subpart X) and/or tank system standards (40 CFR Part 264, Subpart J), as appropriate. The groundwater will be managed in accordance with the "Contained-In Interpretation" (EPA OSW Memorandum of November 13, 1986, M. Williams, Director of Ofice of Solid Waste to P. Tobin, Director of Waste Management Division, Region 4);

(b) The potential use of a carbon adsorption system to treat groundwater and/or emissions from air stripping processes will result in the generation of spent carbon or liquid regeneration waste. These wastes are expected to be characteristic wastes under RCRA as well as listed RCRA wastes as a result of the Derived-from Rule found at 40 CFR 261.3(c)(2). These wastes will require treatment and/or disposal. The following ARARs are therefore applicable:

- RCRA Subtititle C 40 CFR Part 261 for the listing and identification of characteristic hazardous wastes. RCRA Subtitle C 40 CFR Parts 262 and 263 and Department of Transportation regulations at 49 CFR Parts

171-179 for the generation and transportation of hazardous wastes. RCRA Subtitle C 40 CFR Part 264 for the management of hazardous wastes. RCRA Subpart C 40 CFR Part 268 which establishes Land Disposal Restrictions for the management of hazardous waste.

- 25 PA Code Sections 75.259 through 75.270.42 which establish State requirements for the generation, transportation, storage and treatment of hazardous wastes are also applicable. Specifically, 25 PA Code Section 75.262 requirements for generators of hazardous wastes, 25 PA Code Section 75.263 requirements for the transportation of hazardous wastes, and 25 PA Code Section 75.264 requirements for the treatment, storage and disposal of hazardous wastes.

(c) Use of chemical precipitation to remove iron and manganese is expected to result in the generation of non-hazardous sludges requiring storage, transportation and disposal. The following ARAR is therefore applicable:

- 25 PA Code Chapter 299 sets forth provisions for the collection, storage and transportation of residual waste. Dependent on the type of disposal chosen, one or more of the following apply: 25 PA Code Chapters 287, 288, 289, 291 and 297.

If the iron and manganese sludge should fail the toxicity characteristic leaching procedure (TCLP) test established under 40 CFR Section 261.3, requirements for the generation, storage, transportation and disposal of the sludge under 40 CFR Sections 262-264 the Land Disposal Restrictions of Section 268 would be applicable. In addition, 25 PA Code Sections 75.259 through 75.270.42, establishing requirements for the generation, storage, transportation and treatment of hazardous wastes, also would be applicable. Specifically, 25 PA Code Section 75.262 requirements for generators of hazardous wastes, 25 PA Code Section 75.263 requirements for the transportation of hazardous wastes, and 25 PA Code Section 75.264 requirements for the treatment, storage and disposal of hazardous wastes.

(d) The Pennsylvania National Pollutant Discharge Elimination System (NPDES) requirements established under 25 PA Code Chapter 92, the Pennsylvania water quality criteria established under 25 PA Code Chapter

93, and the wastewater treatment requirements for all dischargers under 25 PA Code Chapter 95 are applicable for the discharge of treated groundwater to Indian Spring Run (or other appropriate local stream.) Indian Spring Run is classified by PADER as a cold water fishery. It is not certain, at this point, if the discharge will occur "offsite" or "onsite";

(e) 25 PA Code Chapter 102 requirements concerning the control of soil erosion and sedimentation from earth-moving activities are applicable during the construction of treatment facilities;

(f) The Fish and Wildlife Coordination Act (16 USC Section 661, et seq.) sets requirements to protect fish and wildlife as a result of control or structural modification of a natural stream or water body. This law is applicable to the proposed discharge of treated groundwater to Indian Spring Run;

(g) The following ARARs apply for air emissions from groundwater treatment units:

- National Ambient Air Quality Standards (NAAQS) under the Clean Air Act (40 CFR Part 50) for the release of volatile organic emissions from the air strippers (the site lies within an ozone non-attainment area);

- RCRA Subtitle C 40 CFR Section 264 Subparts AA and BB for the release of emissions from treatment units;

- 25 PA Code Section 127.1 requires control of the emissions to the maximum extent practicable and consistent with the best available technology, unless found to be exempt under 25 PA Code Section 127.14. In addition, 25 PA Code Section 127.11 requires plan approval by the Department of Environmental Resources.

- all air contamination sources must comply with the emission limitations, work practices, and other applicable requirements contained in 25 PA Code Chapters 121, 122, 123, 124, 129, and 135, specifically Section 123.31 which prohibits malodors from crossing the property line and Section 123.41 which prohibits visible emissions beyond a prescribed level;

(h) OSHA standards for worker protection, 29 CFR Parts 1904, 1910, and 1926, and the requirements of 40 CFR

Section 300.150 are applicable.

3) Location Specific

a) 40 CFR Section 6.302 calls for action to avoid adverse affects, minimize potential harm, and preserve and enhance wetlands to the extent possible.
25 PA Code Chapter 105 sets forth provisions for the regulation and supervision of dams, reservoirs, water obstructions, encroachments, and wetlands. These ARARs are applicable to the discharge point for treated groundwater due to the presence of fringe, forested wetlands.

b) Section 404 of the Clean Water Act (40 CFR Part 230) establishes requirements regarding the discharge of dredge and fill material into wetlands. It is relevant and appropriate to the construction and bedding of a treated groundwater discharge pipe if it traverses the fringe wetlands to the receiving stream.

c) Executive Order 11990 (Protection of Wetlands) which calls for action to protect and preserve wetlands to the extent practicable is applicable.

4) To-Be-Considered (TBC) Material:

a) Substantive requirements for well drilling, groundwater pump tests and discharges as found in the Pennsylvania DER's Bureau of Water Quality Management ARARs document are expected to be complied with.

b) EPA's Groundwater Protection Strategy (August 1984) was created to protect groundwaters for their highest current or potential form of use. Since the aquifer at the William Dick Lagoons Site is classified as a Class II groundwater, the strategy recommends cleanup to background or drinking water levels. This TBC will not be complied with under the scope of this interim remedy. However, the remedy is designed to ultimately determine the technical feasibility of returning the groundwater to its intended use.

c) The intent of Recommendation 1 in OSWER Directive 9355.4-03, Considerations in Groundwater Remediation at Superfund Sites, October 18, 1989, has been followed via selection of the interim remedy for groundwater in this ROD.

d) The "Off-Site Policy", Revised Procedures for Planning and Implementing Off-Site Response Actions, OSWER Directive 9834.11, November 13, 1987, is expected to be adhered to when disposing of wastes generated during the remedial action.

Cost Effectiveness

EPA believes that the two selected remedies are cost effective in that they provide overall effectiveness in proportion to their costs. Although each remedy is the highest in cost of the associated alternatives evaluated, the Agency believes that the chosen remedies provide the best balance of tradeoffs among all nine evaluation criteria. The permanency and regulated status of the selected alternative for Unit 1 was regarded as an important factor in its selection over other alternatives. Selection of the Unit 2 remedy was primarily based on its stated goal of gathering data and commencing remedial operations to ultimately determine the potential for total contaminant plume remediation (per the intent of Section 121 of CERCLA).

The estimated present worth costs associated with EPA's water supply selection are roughly $1.3 to $2 million in excess of the point-of-entry system remedy strongly recommended by a site responsible party. The Agency believes these added costs are warranted when considering the extensive oversight and monitoring which would be needed for 30+ years of individual point-of-entry system use. In addition, the potential for human error and negligence under such a scenario is an unquantified cost which the Agency chooses not to ignore.

Regarding contaminated groundwater, the responsible party recommended the continuation of further study. Although the Agency decision for Unit 2 also includes additional study, it provides for immediate follow-up by an active pump and treat system which will begin partial groundwater cleanup and provide adequate data to determine the best means of remediating the entire contaminant plume. Such action is consistent with recent EPA guidance on groundwater remediation efforts (see Considerations in Groundwater Remediation at Superfund Sites, OSWER Directive 9355.4-03, October 18, 1989) as well as the goal of CERCLA to expeditiously commence the cleanup of Superfund sites nationwide. The difference in cost between the responsible party's proposal to continue further study and the EPA decision is estimated at approximately $3.3 million. As stated above, the Agency believes this additional cost is justified.

As a comparison to what the remedy may have cost, the Agency originally considered making a final groundwater decision for the site which was estimated to require 55 pumping wells at a present worth cost of from $6.8 to $8.2 million. This decision would have attempted to remediate the entire groundwater plume in accordance with the intent of CERCLA to restore groundwater to its original use. However, EPA chose not to consider nor select this option since it was determined that data gaps regarding site hydrogeology precluded consideration of such an approach at this time. The cost estimate for such a remedy and the time estimate for groundwater restoration would have been extremely speculative.

Preference for Treatment as a Principal Element

The selected remedy for the water supply alternative does not entail treatment of the contaminated water; such action will best be addressed via the interim and final remedies for the groundwater unit. The remedy includes the provision of a source of water unaffected by the site, which the Agency believes is a more effective remedy than individual household treatment. The unselected alternative of point-of-entry systems at each affected household would entail treatment, but at a location and manner which poses significant questions regarding long term operation and management.

The selected remedy for the groundwater unit satisfies the preference for treatment in that a pump and treat operation will commence in the mid- to later phase of this remedy. The interim nature of the remedy does not ensure that treatment of the entire groundwater plume will be performed, but it will assist in achieving this goal in a final ROD, if determined to be technically feasible.

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

EPA has determined that the selected remedies represent the maximum extent to which permanent solutions and alternative treatment technologies can be utilized while providing the best balance among the evaluation criteria. The nature of the environmental problems to be addressed serve to limit the ability to select from numerous alternative treatment technologies in this case. However, it is possible that the treatment scheme chosen during design to cleanse groundwater may include the use of an alternative treatment technology.

A major reason for EPA's selection of the Coatesville water line as the chosen alternate water supply is its status as a regulated, permanent water source. Extension of public water will eliminate the need, under the point-of-entry scenario, for extensive and rigorous monitoring (i.e., sampling and analyses) of questionable effectiveness for more than 100 residential wells over an unknown period of time. (The 100 residences includes both those provided with point-of-entry systems and those residing in the plume who must continually have the well monitored.) Concerns regarding the identity of the company or regulatory authority to operate and maintain the systems, as well as manage the monitoring program, also will be eliminated. The line extension would eliminate the need to replace home treatment units every one to three years. It is preferred over the private water company since all future operation and maintenance can be addressed by an existing operator, its permanency is practically assured, and the minimal additional residual waste generated as a result of processing a slightly larger quantity of water can easily be assimilated by the existing treatment plant.

As previously discussed, although the water line option will exclude the risk presented by the potential migration of site-related groundwater contaminants to residential wells, it presents an expected short period of carcinogenic risk associated with trihalomethanes in the city water supply. This option continues to be preferred, however, based on:

(1) the permanance of the water supply and its compliance with State and Federal standards;

(2) the generally lower carcinogenic risk posed by the use of city water when compared to the potential future risk posed by migration of site contaminated groundwater to residential wells (see the discussion under **Section X. Statutory Determinations - Protection of Human Health and the Environment**);

(3) concerns regarding the unknown materials disposed of at the site as it involves the potential leaching of these chemicals to groundwater. Sampling of home wells under the point-of-entry scenario cannot adequately address unknown chemicals;

(4) EPA's intent to officially revise the drinking water standard for trihalomethanes in 1995. Current indications are that the Agency will reduce the permissable concentration of trihalomethanes in public water supplies;

(5) several issues raised regarding the effectiveness of point-of-entry systems, including:

a) published reports that bacteria buildup in GAC systems are a potential health problem. These reports suggest additional monitoring of the systems for bacteria or, if necessary, the placement of UV lights after the installed system. If enacted, such action would add to both the oversight and operation and maintenance burden;

b) concerns raised by an EPA researcher that backwash water associated with system operation may contain contaminants. Backwash water is routinely discharged to septic systems and can ultimately leach down to groundwater. Again, monitoring of this water may be necessary as a minimum measure. The same researcher expressed concerns that systems undergoing backwash may result in reconfiguration of unit carbon, thus making contaminant breakthrough to water consumers more likely and rather unpredictable for monitoring to detect.

c) concerns regarding the permanency and reliability of the entity responsible for operation and maintenance of the units over a potential 30+ year time frame.

(7) since a pump and treat remedy has been proposed for Operable Unit 2, the potential exists for migration of contaminants to home wells as a result of the concomitant pumping of remedial action recovery wells and residential wells in a rather complex and somewhat poorly understood hydrogeologic system.

(8) the following incidental benefits: (a) the significant carcinogenic risk associated with the presence of naturally occuring radioactive substances in private well water will be eliminated and, (b) the water supply of connected residences will be monitored for over 100 contaminants, some unrelated to the site. This relatively large scale protective measure will not occur under the point-of-entry monitoring program.

Regarding groundwater remediation, the two action-oriented alternatives merely differ in the scope of the action to be implemented. Where Alternative GW2 merely attempts to determine if the most contaminated portion of the aquifer nearest the former lagoons can be remediated, the intent of the chosen interim remedy is to collect data and begin actions needed to restore the entire contaminated groundwater area. As stated, the prospects for the practicability of this goal are unknown at this time and a final decision on the scope of groundwater remediation will be made at the latter stages of this interim action.

EPA considered proposing total groundwater remediation as a final remedy in this decision document. Although such a remedy is generally the goal of groundwater cleanups under CERCLA, the Agency realized that current data was insufficient to pursue such an option and that such a decision would be premature at this point.

At the public meeting on February 14, 1991 announcing EPA's proposed decision on the site, a large majority of residents expressed dissatisfaction with EPA's proposal to extend the CCA water line. Several residents indicated that "the water tastes bad" and expressed the opinion that they did not move out to the area to drink "city" water. Most of these residents, however, appeared to be unhappy with the thought of paying a relatively high monthly water bill since EPA could not gaurantee that affected residents would be reimbursed for the cost of their well installation or have all or a portion of their monthly water bill paid for by a site responsible party.

Since EPA was unsure of the overall public sentiment as a result of this meeting and an earlier public informational meeting in August 1990, the Agency decided to conduct a telephone survey of residents whose well water was known to be impacted by site groundwater contamination. The telephone survey was conducted during the week of February 25 and reached 27 of 50 residences identified for contact. Survey results indicated that 20 of the 27 residences did not approve of the water line even if all costs of installation were paid by EPA (or a responsible party) but monthly water bill costs were incurred by the resident. However, 10 of the 20 non-approving residents would accept the water line if some co-payment of monthly water bill costs were made or if the costs associated with earlier private well installation were reimbursed to the resident.

Only 3 of 27 residents approved of installation of a community water well to be operated by a private company. Apparently, the major concern with this option (again assuming that all hook-ups costs to the distribution system were not paid by the homeowner) involved the unknown costs of monthly water bills and the identity of the long term well and treatment plant operator.

Concerning continuation of the current point-of-entry system procedures (with more frequent monitoring), 12 of 27 residents approved and 15 of 27 residents disapproved. The rationale for each individual response on this issue was not determined as part of the survey.

During the public comment period on the Proposed Plan, an allied group of homeowners indicated that they did approve of the water line alternative if the site responsible party is ordered to pay monthly residential water bills. A local chapter of the Sierra Club suggested the installation of water conservation devices in homes connected to the line to help defray water bill costs and conserve water. The principal site responsible party strongly objects to EPA's reasoning for the water line and recommends continuation of point-of-entry systems. The Commonwealth of Pennsylvania agrees with the water line alternative.

The groundwater proposal for the site did not generate as much comment as the remedy for alternate water. At the public meeting, most questions were concerned with descriptive

information on site hydrogeology. During the comment period, one resident suggested reccommendations for implementing a pumping strategy at the site which the Agency will take into consideration. The principal site responsible party suggested foregoing the pump and treat portion of the interim remedy until further hydrogeologic study is complete. A local chapter of the Sierra Club questioned EPA's proposal to discharge treated groundwater to a nearby stream. The Commonwealth of Pennsylvania accepts the interim groundwater remedy but is watchful regarding the future decision on a final groundwater cleanup as it relates to compliance with State groundwater cleanup goals.
All of the above public comments have been evaluated by EPA before choosing the selected remedies. As indicated above, and in Section III Community Relations History, the public opinion on the alternate water supply remedy was carefully evaluated and sought out. A response to each public comment or recommendation during the public meeting and comment period appears in the Responsiveness Summary at the end of this ROD.

The Proposed Plan for the site also included a remedy for cleanup of site soils. This remedy was identified as Unit 3 - Source Control in the Proposed Plan. Several comments were made on EPA's proposed alternative of Thermal Desorption with a Protective Cover. The allied group of homeowners suggested incineration of site soils as the most appropriate remedy. A company involved in unrelated cleanup negotiations with the principal site responsible party also believes that incineration is the best remedy. At this point in time, subject to further evaluation and study, the Commonwealth of Pennsylvania believes that incineration of site soils is the best approach. The rationale for the above recommendations center on several issues, namely: concern that thermal desorption will create more toxic and mobile chemicals as a result of oxidation reactions, concern that the thermal desorption/protective cover remedy will not restore the property to its former precontaminated beneficial use as well as incineration might, and concern that the thermal desorption/protective cover remedy will not adequately mitigate contaminant leaching to comply with State groundwater ARARs.
The principal site responsible party believes that the alternative Vacuum Extraction with Protective Cover, as discussed in the Proposed Plan, should be further evaluated via a pilot study as an appropriate alternative for the site.

Because of the above public comments, as well as the rationale presented in **Section IV. Scope and Role of Response Action,** EPA has decided to defer its decision on the Source Control remedy.

DOCUMENTATION OF SIGNIFICANT CHANGES

The major revision to the selected remedy since the issuance of the Proposed Plan is that of deferring selection of a remedy for Unit 3 - Source Control. As mentioned, EPA proposed a remedy of

Thermal Desorption with Protective Cover. The reasons for deferring selection of a remedy for Unit 3 are discussed in **Section IV. Scope and Role of Response Action** of this ROD. EPA expects to select a final remedy for Unit 3 within twelve months of this ROD.

Minor revisions since Proposed Plan issuance include the following:

- the description of alternatives AWS1 and AWS2 has been revised to reflect the continuation of the 1988 Removal Order and its requirements;
- a component has been added to the Groundwater remedy which requires ecological monitoring of selected locations of nearby streams to determine any changes in stream quality or macroinvertebrate diversity;
- estimations of time needed to complete each remedial alternative for each unit have been revised slightly in some cases per additional evaluation;
- the titles of groundwater remedies GWS2 and GWS3 have been revised to more accurately indicate the importance of the initial hydrogeologic study work
- minor changes have been made to the tables discussing the nine evaluation criteria to more accurately reflect EPA's analysis.

WILLIAM DICK LAGOONS
RECORD OF DECISION

TABLES 1 through 14

TABLE 1

GROUND WATER QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Maximum Concentration	Average Maximum*	Average Concentration	Frequency of Detection**
VOLATILES (µg/l)				
methylene chloride	36	36	3	1 of 11
acetone	960	480	39	4 of 13
carbon disulfide	32J	17J	4	6 of 13
1,2-dichloroethene, (total)	210	153J	20	3 of 13
chloroform	560	487	39	8 of 13
1,2-dichloroethane	120	102J	11	3 of 13
2-butanone	350	207	16	3 of 13
1,2-dichloropropane	17J	9J	<1	1 of 13
trichloroethene	16,000	14,000	1,200	9 of 13
benzene	180	170J	14	5 of 13
4-methyl-2-pentanone	220	105J	13	3 of 13
tetrachloroethene	320	250J	19	2 of 13
toluene	510	430	35	3 of 13
chlorobenzene	32J	19J	2	2 of 13
ethylbenzene	46J	27J	2	2 of 13
total xylenes	160	127J	12	3 of 13
SEMIVOLATILES (µg/l)				
phenol	14,000	10,300	818	3 of 13
bis (2-chloroethyl) ether	24	17	2	2 of 13
2-chlorophenol	41	14	1	1 of 13
benzyl alcohol	19	17	1	1 of 13
2-methylphenol	300	217J	18	2 of 13
4-methylphenol	560	397J	32	3 of 13
isophorone	250	247	28	3 of 13
2,4-dimethylphenol	70	23	2	2 of 13
benzoic acid	480J	413J	32	3 of 13
2,4-dichlorophenol	46	30	3	2 of 13
1,2,4-trichlorobenzene	3J	1J	<1	1 of 13
naphthalene	58	35	3	2 of 13
4-chloro-3-methylphenol	21	7	<1	1 of 13
2-methylnapthalene	6J	3J	<1	1 of 13
dimethyl phthalate	7J	5J	<1	1 of 13
diethyl phthalate	4	3J	<1	2 of 13
bis(2-ethylhexyl)phthalate	170	96J	23	7 of 13

GROUND WATER QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Maximum Concentration	Average Maximum*	Average Concentration	Frequency of Detection**
METALS (dissolved) (µg/l)				
aluminum	1,430	1,430	164	3 of 12
barium	83.7	83.7	25.7	12 of 12
beryllium	1.6	1.6	0.1	1 of 12
calcium	5,280	5,280	1,875	9 of 9
cobalt	20.8	20.8	3.3	4 of 12
copper	14.4	14.4	3.9	2 of 5
iron	20,200	19,800	4,870	11 of 11
lead	1	1	0.27	4 of 11
magnesium	4,260	4,260	1,705	3 of 4
manganese	863	863	193	11 of 12
potassium	8,520	4,260	426	1 of 10
selenium	2.4	2.4	0.2	1 of 12
sodium	32,500	32,500	8,182	7 of 12
zinc	61.2	61.2	61.2	1 of 1
CONVENTIONAL PARAMETERS (mg/l)				
biochemical oxygen demand (BOD)	91	91	<15	12 of 12
total dissolved solids (TDS)	560	560	<85	12 of 12
nitrate	3.1	3.1	<1.3	12 of 12
alkalinity (as $CaCO_3$)	20	20	8.2	12 of 12
chloride	20	20	<5	12 of 12
hardness (as $CaCO_3$)	64	64	22	12 of 12
total organic carbon (TOC)	52	52	<8.4	12 of 12
pH***			5.6	

* Average maximum concentration is calculated when the maximum concentration is reported for a well from which two or more samples were taken. It is the average of the reported concentrations from this well.

** Out of a maximum of 13 wells for organics and 12 wells for metals; excludes from the total sample count those sample in which the analyte was detected in the blank.

*** From pump test on MW-20, October/November 1989.

Note: Pesticides/PCBs not detected in any wells.

J – Estimated concentration

TABLE 2

LAGOON AND BERM AREA SOIL QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Average Concentration	Maximum Concentration	Frequency of Detection*
VOLATILES (µg/kg)			
1,1-dichloroethane	137	3,700	1 of 27
1,2-dichloroethene, (total)	3,120	48,000	5 of 27
chloroform	179	4,100	4 of 27
1,2-dichloroethane	741	15,000	4 of 27
2-butanone	12,040	325,000J	1 of 27
1,1,1-trichloroethane	<1	5J	1 of 27
1,2-dichloropropane	<1	1J	1 of 27
trichloroethene	3,634,600	93,000,000	12 of 27
benzene	233	5,500J	2 of 24
4-methyl-2-pentanone	106	2,800J	2 of 27
tetrachloroethene	3,790	73,500J	8 of 27
toluene	118,100	2,500,000	12 of 27
chlorobenzene	4,320	64,000	12 of 27
ethylbenzene	16,800	200,000	14 of 27
styrene	11,700	217,500	4 of 27
total xylenes	258,200	5,500,000	12 of 26
SEMIVOLATILES (µg/kg)			
phenol	15,100	350,000J	10 of 27
1,4-dichlorobenzene	99	2,200J	4 of 27
1,2-dichlorobenzene	990	7,200J	10 of 27
2-methylphenol	1,650	36,000J	5 of 27
4-methylphenol	2,480	44,000J	8 of 27
nitrobenzene	63	3,400J	1 of 27
isophorone	1,390	31,000J	2 of 27
2,4-dimethylphenol	1,010	20,000J	3 of 27
benzoic acid	41	900J	2 of 27
2,4-dichlorophenol	1,810	38,000J	6 of 27
1,2,4-trichlorobenzene	63,600	1,300,000J	15 of 27
naphthalene	88,700	1,500,000J	15 of 27
4-chloroaniline	4,830	130,000J	2 of 27
hexachlorobutadiene	67	1,800J	1 of 27
4-chloro-3-methylphenol	133	3,300J	3 of 27
2-methylnaphthalene	21,000	220,000J	15 of 27
2,4,5-trichlorophenol	8	210J	1 of 27
2-chloronaphthalene	31	1,700J	1 of 27

LAGOON AND BERM AREA SOIL QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Average Concentration	Maximum Concentration	Frequency of Detection*
SEMIVOLATILES (cont'd) (µg/kg)			
dimethyl phthalate	11	590J	1 of 27
acenaphthylene	740	7,000J	8 of 27
acenapthene	3,970	47,000J	13 of 27
dibenzofuran	3,570	36,000J	13 of 27
diethyl phthalate	83	1,400J	2 of 27
fluorene	4,240	41,000J	13 of 27
N-nitrosodiphenylamine	734	5,300J	5 of 27
pentachlorophenol	2	54J	1 of 27
phenanthrene	16,500	280,000J	16 of 27
anthracene	1,830	13,000J	16 of 27
di-n-butylphthalate	5,910	32,000J	14 of 27
fluoranthene	8,360	200,000J	16 of 27
pyrene	6,020	120,000J	16 of 27
butylbenzylphthalate	11,300	78,000J	15 of 27
benzo (a) anthracene	1,860	30,000J	13 of 27
chrysene	2,130	29,000J	16 of 27
bis(2-ethylhexyl)phthalate	169,000	1,200,000J	22 of 27
di-n-octylphthalate	4,720	29,000J	15 of 27
benzo(b and/or k)fluoranthene	3,540	54,000J	15 of 27
benzo(a)pyrene	1,250	26,000J	11 of 27
indeno(1,2,3,c,d)pyrene	300	7,600J	5 of 27
dibenzo(a,h)anthracene	81	2,700J	3 of 27
benzo(g,h,i)perylene	300	8,000J	5 of 27
PESTICIDES/PCBs (µg/kg)			
heptachlor epoxide	6	150	1 of 27
4,4'-DDE	34,300	220,000	17 of 27
METALS (mg/kg)			
aluminum	8,040	15,100	27 of 27
arsenic	5.2	14J	27 of 27
barium	81	672J	27 of 27
beryllium	0.09	0.51	1 of 6
cadmium	0.04	1.1J	1 of 26
calcium	2,190	11,100	6 of 6
chromium	39	349J	26 of 27

LAGOON AND BERM AREA SOIL QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Average Concentration	Maximum Concentration	Frequency of Detection*
METALS (cont'd) (mg/kg)			
cobalt	1.4	4.1	5 of 6
copper	19	40J	7 of 8
iron	7,960	18,000	27 of 27
lead	24	269J	27 of 27
magnesium	916	5,080	18 of 18
manganese	64	160	23 of 23
mercury	0.01	2.3	3 of 27
nickel	5.4	14	17 of 27
potassium	628	3,070	4 of 17
silver	0.1	1.7	2 of 27
sodium	38	644	1 of 17
vanadium	13	28J	27 of 27
zinc	52	253J	23 of 23

J - estimated concentration

* excludes from the total sample count those samples in which analyte was detected in the blank.

TABLE 3

Dioxin Data Summary
William Dick Lagoons Site
West Cain Township, Chester County

ERM T.R. No.	23297	23298	23301	23299
Sample Location	D-Background	D-9 (2-4)	D-4 (0-2)	D-6 (2-4)
Sample Date	10/11/89	10/11/89	10/11/89	10/11/89
units	ug/Kg	ug/Kg	ug/Kg	ug/Kg
2,3,7,8-TCDD		*		
other TCDD			0.18	
2,3,7,8-TCDF			0.01	
other TCDF		0.06	0.19	0.035
2,3,7,8-PCDD				
other PCDD			0.01	
2,3,7,8-PCDF			0.006	
other PCDF			0.024	
2,3,7,8-HxCDD			0.05	
other HxCDD	0.008		0.27	
2,3,7,8-HxCDF			0.03	0.095
otherHxCDF			0.03	
2,3,7,8-HpCDD			0.37	
other HpCDD	0.05		0.42	
2,3,7,8-HpCDF			0.08	0.26
other HpCDF			0.01	
OCDD	5.9	3.6	4.1	
OCDF			0.18	2.4
2,3,7,8 TCDD equivalents	ug/Kg	ug/Kg	ug/Kg	ug/Kg
	0.007	0.0044	0.0248	0.0145

* These results are approximate only; matrix interference would not allow accurate quantitation.
Concentrations not detected at or above the method detection limit have not been reported.

TABLE 4

FORMER SPRAY IRRIGATION AREA SOIL QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Average Concentration	Maximum Concentration	Frequency of Detection
VOLATILES			ND
SEMIVOLATILES (µg/kg)			
benzoic acid	45	360J	1 of 8
4-chloro-3-methylphenol	6	50J	1 of 8
pyrene	23	180J	1 of 8
bis(2-ethylhexyl)phthalate	20	160J	1 of 8
PESTICIDES/PCBs			ND
METALS (mg/kg)			
aluminum	10,645	14,500	8 of 8
arsenic	2.2	3.5	8 of 8
barium	39	46	8 of 8
beryllium	0.32	0.58	6 of 8
chromium	10	20	8 of 8
cobalt	2.7	4.3	7 of 8
iron	7,856	11,700	8 of 8
lead	8.6	15	8 of 8
magnesium	730	1,260	8 of 8
manganese	121	291	8 of 8
mercury	0.1	0.65	1 of 8
potassium	748	2,170	4 of 8
sodium	254	1,070	2 of 8
vanadium	15.5	21	8 of 8
zinc	31	38	8 of 8

J - estimated concentration
ND - not detected

TABLE 5

SURFACE WATER QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Maximum Concentration	Average Concentration	Frequency of Detection*
VOLATILES			ND
SEMIVOLATILES			ND
PESTICIDES/PCBs			ND
METALS (dissolved) (µg/L)			
aluminum	119	32	8 of 15
barium	58	31	15 of 15
calcium	18200	7515	15 of 15
iron	117	46	14 of 14
lead	2	0.5	7 of 15
magnesium	7730	5400	8 of 8
manganese	37	14	13 of 15
nickel	82	5	1 of 15
zinc	37	37	2 of 2

* - Total number of samples excludes samples in which the analyte was detected in the blank.

ND - Not detected

TABLE 6

STREAM SEDIMENT QUALITY
WILLIAM DICK LAGOONS SITE

Compound	Maximum Concentration	Average Concentration	Frequency of Detection*
VOLATILES (µg/kg)			
chloroform	2J	1	10 of 15
toluene	5J	0.3	1 of 15
SEMIVOLATILES (µg/kg)			
benzoic acid	82J	5	1 of 15
phenanthrene	73J	5	1 of 15
fluoranthene	67J	5	1 of 15
pyrene	65J	4	1 of 15
bis(2-ethylhexyl)phthalate	95J	13	3 of 15
PESTICIDES/PCBs			ND
METALS (mg/kg)			
aluminum	8,630J	3,374	15 of 15
arsenic	5.8J	1.4	10 of 15
barium	107	32	15 of 15
beryllium	0.69	0.21	6 of 15
calcium	3,320	884	15 of 15
chromium	29	11	13 of 15
copper	36	12	1 of 3
iron	15,900J	7,034	15 of 15
lead	21	8	15 of 15
magnesium	1,990	618	13 of 15
manganese	1,300J	276	15 of 15
potassium	2,380	273	2 of 15
selenium	0.79J	0.08	2 of 15
vanadium	119	19	14 of 15
zinc	119J	34	15 of 15

* Total number of samples excludes samples in which the analyte was detected in the blank.

J - estimated value

TABLE 7

SUMMARY OF CHEMICALS OF CONCERN IN EACH MEDIUM

Off-Site Ground Water	Soil	On-Site Ground Water
1,2-dichloroethene (total)	chloroform	chloroform
1,2-dichloroethane	trichloroethene	1,2-dichloroethane
chloroform	tetrachloroethene	trichloroethene
1,1,1-trichloroethane	chlorobenzene	benzene
trichloroethene	1,2,4-trichlorobenzene	tetrachloroethene
tetrachloroethene	naphthalene	bis(2-chloroethyl)ether
chlorobenzene	phenanthrene	barium
dichlorobenzene(1,2)	fluoranthene	beryllium
dichlorobenzene(1,4)	bis(2-ethylhexyl)phthalate	manganese
1,1-dichloroethene	4,4'-DDE	bis(2-ethylhexyl)phthalate
1,1-dichloroethane	acenapthene	phenol
	fluorene	1,2-dichloroethene (total)
	benzo(a)pyrene equivalent	chlorobenzene
	anthracene	4-methylphenol (p-cresol)
	heptachlor epoxide	2,4-dichlorophenol
	2,4-dichlorophenol	
	arsenic	
	barium	
	chromium	
	manganese	
	vanadium	
	zinc	

TABLE 8

Exposure and Migration Pathways
William Dick Lagoons

Media	Source	Exposure Point	Exposure Route	Selected for Analysis
Ground water	Contaminated soil/leachate	drinking water aquifer	Dermal contact Ingestion Inhalation while showering	yes - residential wells nearby yes - residential wells nearby yes - residential wells nearby
Surface water	Discharge of contaminated ground water	Indian Spring Run, Birch Run	Dermal contact Ingestion-water Ingestion-fish	No - no significant contaminants detected No - no significant contaminants detected No - no significant contaminants detected
Sediments	Discharge of contaminated ground water	Indian Spring Run, Birch Run	Dermal contact Food chain bioaccumulation	No - no significant contaminants detected No - no significant contaminants detected
Air	Contaminated soil & dust	MEI	Inhalation of fugitive dust Inhalation of volatiles	Yes Yes
Surface soil	Contaminated soil	On site	Dermal contact Incidental ingestion	Yes Yes
Deer meat ingestion	Contaminated soil water	Off site	Ingestion	Yes

TABLE 9

STANDARD PARAMETERS FOR CALCULATION OF DOSAGE AND INTAKE
WILLIAM DICK LAGOONS SITE

		Adult	Child Age 6-12	Child Age 2-6
PHYSICAL CHARACTERISTICS				
Average Body Weight	(a)	70 kg	29 kg	16 kg
Average Skin Surface Area	(a)	18,150 cm2	10,470 cm2	6980 cm2
Average No. Yrs Exposure in 70 year Lifetime	(d)	58 yrs	6 yrs	4 yrs
ACTIVITY CHARACTERISTICS				
RESIDENTIAL USE OF GROUND WATER				
Amount of Water Ingested Daily	(b,e)	2 liters	2 liters	2 liters
Percentage of water from home supply	(e)	75%	75%	75%
Percentage of Skin Surface Area Immersed While Showering/Bathing	(g)	100%	100%	100%
Duration of Dermal Exposure	(d)	30 min/d	30 min/d	30 min/d
SOIL EXPOSURE				
Amount of Soil Ingested Incidentally	(d,e)	100 mg	100 mg	200 mg
Percentage of Skin Area Contacted by Soil Contact	(d)	20%	20%	20%
Skin Absorption Rate of Compounds in Soil	(c)	0.06	0.12	0.12
Frequency of Soil Contact	(d)	14 D/yr	30 D/yr	14 D/yr
VENISON INGESTION EXPOSURE				
Amount of Venison Ingested	(b,d)	112 g	112 g	56 g
Frequency of Ingestion	(d)	14 d/yr	14 d/yr	14 d/yr
INHALATION EXPOSURE				
Inhalation Rate	(b,d,e)	0.83 m3/hr	0.46 m3/hr	0.25 m3/hr
Absorption Rate of Inhaled Air	(d)	100%	100%	100%
Duration of Exposure (for MEI)	(d)	24 hr/d	24 hr/d	24 hr/d
Frequency of Exposure (for MEI)	(d)	365 d/yr	365 d/yr	365 d/yr
SWIMMING				
Percentage of Skin Area Contacted While Swimming	(e)	100%	100%	100%
Frequency of Swimming Event	(b)	7 D/yr	7 D/yr	---
Duration of Swimming Event	(b)	2.6 Hr/D	2.6 Hr/D	---
MATERIAL CHARACTERISTICS				
Dust Adherence	(b)	1.45 mg/cm2	1.45 mg/cm2	1.45 mg/cm2
Soil Matrix Effect	(c)	15%	15%	15%
Mass Flux Rate (water-based)	(e)	0.5 mg/cm2/hr	0.5 mg/cm2/hr	0.5 mg/cm2/hr

a - Anderson, E., Browne, N., Duletsky, S., Warn, T., "Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments", PB 85-242667/AS, US EPA, Office of Health and Environmental Assessment, 1984.
b - Human Health Evaluation Manual
c - J.K. Hawley, "Assessment of Health Risk from Exposure to Contaminated Soil", Risk Analysis, Vol. 5, No. 4, 1985
d - ERM Staff Professional Judgement
e - Superfund Exposure Assessment Manual
f - Kimbrough R, Falk H, Stehr P, Fries G. 1984. "Health implications of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) contamination of residential soil", Journal of Toxicology and Environmental Health 14:47-93.

TABLE 10

Summary of Toxicological Information
William Dick Lagoons

Compound	Oral RfD * (mg/kg/day)	Inhalation RfD * (mg/kg/day)	Oral CPF ** (1/mg/kg/day)	Inhalation CPF ** (1/mg/kg/day)	Carcinogenic Class	Source
1,1,1-trichloroethane	9.00E-02	3.00E-01	NA	NA	NA	IRIS/HEAST
1,1-dichloroethane	1.00E-01	1.00E-01	NA	9.10E-02	B2	HEAST
1,1-dichloroethene	9.00E-03	NA	6.00E-01	1.20E+00	C	IRIS
1,2-dichloroethane	NA	NA	9.10E-02	9.10E-02	B2	IRIS
1,2-dichloroethene (total)	2.00E-02	NA	NA	NA	NA	IRIS (for trans- isomer)
1,2-dichloropropane	NA	NA	6.80E-02	NA	B2	HEAST
2-butanone	5.00E-02	NA	NA	NA	D	IRIS
4-methyl-2-pentanone	5.00E-02	2.00E-02	NA	NA	NA	IRIS/HEAST
benzene	NA	NA	2.90E-02	2.90E-02	A	IRIS
bromodichloromethane	2.00E-02	NA	NA	NA	NA	IRIS
carbon disulfide	1.00E-01	NA	NA	NA	NA	IRIS
chlorobenzene	2.00E-02	5.00E-03	P	P	NA	IRIS/HEAST
chloroform *	1.00E-02	NA	6.10E-03	8.10E-02	B2	IRIS
cis-1,3-dichloropropene	3.00E-04	NA	NA	NA	B2	IRIS
ethylbenzene	1.00E-01	NA	NA	NA	D	IRIS
styrene	2.00E-01	NA	P	P	NA	IRIS
tetrachloroethene	1.00E-02	NA	5.10E-02	3.30E-03	B2	IRIS/HEAST
toluene	3.00E-01	P	NA	NA	D	IRIS
total xylenes	2.00E+00	P	NA	NA	D	IRIS
trans-1,3-dichloropropene	3.00E-04	NA	NA	NA	B2	IRIS
trichloroethene	P	NA	1.10E-02	1.70E-02	B2	IRIS/W/HEAST
1,1,1-trichloroethane	9.00E-02	NA	NA	NA	NA	IRIS
1,1,2-trichloroethane	4.00E-03	NA	5.70E-02	5.70E-02	C	IRIS
1,2,4-trichlorobenzene	2.00E-02 (W)	3.00E-03	NA	NA	D	IRIS/HEAST
1,2-dichlorobenzene	9.00E-02	4.00E-02	NA	NA	D	IRIS/HEAST
1,2-dimethylbenzene	2.00E+00	NA	NA	NA	D	IRIS (Total Xylenes)
1,3-dichlorobenzene	NA	NA	NA	NA	NA	-
1,3-dimethylbenzene	2.00E+00	NA	NA	NA	D	IRIS (Total Xylenes)
1,4-dichlorobenzene	NA	7.00E-01	2.40E-02	NA	B2	HEAST
2,4-dichlorophenol	3.00E-03	NA	NA	NA	NA	IRIS
2,4-dimethylphenol	5.00E-02	NA	NA	NA	NA	O
2-chlorophenol	5.00E-03	NA	NA	NA	NA	IRIS
2-methylnapthalene	4.00E-01	NA	NA	NA	NA	O
2-methylphenol (o-cresol)	5.00E-02	NA	NA	NA	NA	IRIS
4-chloro-3-methylphenol	5.00E-02	NA	NA	NA	NA	O
4-methylphenol(p-cresol)	5.00E-02	NA	NA	NA	NA	IRIS
acenaphthylene	5.70E-03	NA	NA	NA	NA	O
acenapthene	5.70E-03	NA	NA	NA	NA	O
anthracene	5.70E-03	NA	NA	NA	NA	O
benzo(a)pyrene equivalent	NA	NA	1.15E+01	NA	B2	IRIS/O
benzoic acid	4.00E+00	NA	NA	NA	NA	IRIS
benzyl alcohol	4.00E-01	NA	NA	NA	NA	O
bis(2-chloroethyl)ether	NA	NA	1.10E+00	1.10E+00	B2	IRIS
bis(2-ethylhexyl)phthalate	2.00E-02	NA	1.40E-02	NA	B2	IRIS
butylbenzylphthalate	2.00E-01	NA	NA	NA	C	IRIS
di-n-butylphthalate	1.00E-01	NA	NA	NA	NA	IRIS
di-n-octylphthalate	8.00E-01	NA	NA	NA	NA	O
dibenzofuran	4.00E-01	NA	NA	NA	NA	O
dimethylphthalate	8.00E-01	NA	NA	NA	D	IRIS/O
diethylphthalate	8.00E-01	NA	NA	NA	NA	IRIS
fluoranthene	5.70E-03	NA	NA	NA	NA	O
fluorene	5.70E-03	NA	NA	NA	NA	O
isophorone	2.00E-01	NA	4.10E-03 (P)	P	P	IRIS
n-nitrosodiphenylamine	NA	NA	4.90E-03	NA	B2	IRIS
napthalene	4.00E-01 (P)	NA	NA	NA	NA	HEAST
phenanthrene	5.70E-03	NA	NA	NA	NA	O
phenol	6.00E-01	NA	NA	NA	NA	IRIS
aluminum	NA	NA	NA	NA	NA	-
arsenic	1.00E-03 (P)	NA	1.75E+00	5.00E+01	A	IRIS/HEAST
barium	5.00E-02	1.00E-04 (P)	NA	NA	NA	IRIS/HEAST
beryllium	5.00E-03	NA	4.30E+00	8.40E+00	B2	IRIS
calcium	NA	NA	NA	NA	NA	-
chromium	5.00E-03	P	NA	4.10E+01	A	IRIS (CR+6 used)
cobalt	5.00E-03	NA	NA	NA	NA	O
copper	NA	NA	NA	NA	D	IRIS
cyanide	2.00E-02	NA	NA	NA	NA	IRIS
iron	NA	NA	NA	NA	NA	-
lead	NA	NA	NA	NA	B2	-
magnesium	NA	NA	NA	NA	NA	-
manganese	2.00E-01	3.00E-04	NA	NA	D	IRIS/HEAST
mercury	3.00E-04	NA	NA	NA	NA	HEAST (Inorganic)
nickel	2.00E-02	P	NA	NA	NA	IRIS (Soluble Salts)
potassium	NA	NA	NA	NA	NA	-
selenium	3.00E-03 (UR)	1.00E-03	NA	NA	NA	HEAST
silver	3.00E-03	NA	NA	NA	D	IRIS
sodium	NA	NA	NA	NA	NA	-
vanadium	7.00E-03	NA	NA	NA	NA	HEAST
zinc	2.00E-01	NA	NA	NA	NA	HEAST
2,3,7,8-TCDD equivalent	NA	NA	1.56E+05	1.56E+05	B2	HEAST
4,4'-DDE	5.00E-04	NA	3.40E-01	NA	B2	IRIS/HEAST (for DDT)
heptachlor epoxide	1.30E-05	NA	9.10E+00	9.10E+00	B2	IRIS

References:
IRIS - EPA's On-Line Integrated Risk Information System accessed February 1990.
HEAST - EPA's Health Effects Assessment Summary Tables Third Quarter FY 1989 (July 1989).
P - Pending
O - Other: See Section 3 for Explanation
W - Withdrawn
UR - Under Review
NA - Not Available

*Noncarcinogenic effects
**Carcinogenic effects

RfD - Reference Dose
CPF - Carcinogenic Potency Factor

Note: Oral RfDs/CPFs values were used in the risk characterization equations for compounds where the inhalation RfD/CPF values were not availa

POOR QUALITY ORIGINAL

The ERM Group

TABLE 11

SUMMARY OF CARCINOGENIC RISK
William Dick Lagoons

POPULATION:	Adult	Child 6-12	Child 2-6	Lifetime
POTENTIAL EXPOSURE SCENARIOS UNDER CURRENT CONDITIONS				
Off-Site Ground Water	7E-06 - *2E-04*	2E-06 - 4E-05	2E-06 - 5E-05	1E-05 - *3E-04*
On-Site Soils	5E-06 - 1E-05	3E-06 - 6E-06	2E-06 - 6E-06	9E-06 - 2E-05
Deer Meat Ingestion	4E-06 - 9E-06	9E-07 - 2E-06	6E-07 - 1E-06	5E-06 - 1E-05
Inhalation	4E-06 - 1E-05	6E-07 - 2E-06	4E-07 - 1E-06	5E-06 - 1E-05
Recreational Use of Spring #48	3E-08 - 3E-08	4E-09 - 5E-09	NA - NA	3E-08 - 3E-08
Total	**2E-05 - *2E-04***	**6E-06 - 5E-05**	**5E-06 - 6E-05**	**3E-05 - *3E-04***
HYPOTHETICAL EXPOSURE SCENARIO UNDER FUTURE USE CONDITIONS				
Hypothetical Use of On-Site Ground Water	*1E-03* - *1E-02*	*2E-04* - *3E-03*	*3E-04* - *3E-03*	*1E-03* - *2E-02*

NOTE: USEPA guidelines for evaluation of carcinogenic risk specify a target range of acceptable risk between 1 E-6 and 1 E-4. Values in italics indicate estimated potential risks which exceed this guideline.

TABLE 12

SUMMARY OF NONCARCINOGENIC HAZARD INDICES
William Dick Lagoons

POPULATION:	Adult	Child 6-12	Child 2-6
POTENTIAL EXPOSURE SCENARIOS UNDER CURRENT CONDITIONS			
Off-Site Ground Water	5E-03 - 1E-01	1E-02 - 3E-01	2E-02 - 5E-01
On-Site Soils	2E-02 - 5E-02	1E-01 - 3E-01	1E-01 - 3E-01
Deer Meat Ingestion	4E-02 - 1E-01	9E-02 - 3E-01	8E-02 - 3E-01
Inhalation	3E-03 - 8E-03	4E-03 - 1E-02	3E-03 - 1E-02
Recreational Use of Spring #48	6E-06 7E-06	9E-06 - 1E-05	NA - NA
Total	**6E-02 - 3E-01**	**2E-01 - 9E-01**	**2E-01 - 9E-01**
HYPOTHETICAL EXPOSURE SCENARIO UNDER FUTURE USE CONDITIONS			
Hypothetical Use of On-Site Ground Water	4E-01 - *6E+00*	1E+00 - *1E+01*	2E+00 - *2E+01*

NOTE: USEPA guidelines for evaluation of noncarcinogenic hazard indices specify a value of 1.0 for interpretation. Hazard indices which exceed 1.0 indicate that there is the potential for adverse health effects associated with the defined exposure conditions. Hazard indices greater than 1.0 are given in italics.

TABLE 13
Estimated Costs for Extension of Water Line

Capital Cost:

ITEM	QUANTITY	COST
Water Line Distribution System	14750 to 19950 linear feet at $50/ft.	$737,500 to $997,500
Service connections	80 homes at $2000/home	$160,000
Water Storage Tank	1 at 250,000 gals.	$250,000
Pump Station w/new pump	1 at 200 hp	$4,000
	Total Direct Construction Cost (TDCC)	$1,051,900 to $1,411,500
	Engineering, Legal, Health, and Safety at 25% of TDCC	$262,975 to $352,875
	Contingency at 30% of TDCC	$315,570 to $423,450
	Estimated Total Installed Cost	$1,630,445 to $2,187,825

Operation and Maintenance Costs:

Monthly water bills minus private well operation, site monitoring		$21,000 to $46,000 (Annual O&M for 30 years)
	<u>Total Present Worth</u> (assuming 5% discount rate)	$2,034,000 to $3,071,000 (rounded)

TABLE 14
ESTIMATED COSTS FOR GROUNDWATER REMEDY

(Note: Costs are estimates based on scaled down version of Alternative GW-7 appearing in the Preliminary FS. Treatment units presented below are used for cost estimating purposes only. The actual treatment units employed at the site may vary.)

Capital Costs:

ITEM	QUANTITY	COST
Hydrogeologic Study (11 monitoring wells, sampling, aquifer tests)		$700,000
Recovery Wells	15 at $12,000 each	$180,000
Piping	4800 ft at $15/ft	$72,000
Tee Connections	15 at $26/ft	$390
Well Pumps	15 at $3000 each	$45,000
Sumps	2 at $2.200 each	$4,400
Sump Pump System	2 at $15,000 each	$30,000
Equalization Tank	1 - 10,000 gallon tank	$25,000
Equalization Tank Pump System	1	$15,000
Iron Precipitation System	1	$300,000
Process Pump	2 at $5,000 each	$10,000
Building	1100 sq ft at $50/sg ft	$55,000
Oxidation/Air Stripping System		$200,000
	Total Direct Construction Cost (TDCC)	$937,000 (rounded)

TABLE 14
ESTIMATED COSTS FOR GROUNDWATER REMEDY

	Engineering, Legal, Health & Safety, Construction Management (ELHSCM) at 25%	$234,000
	Contingency at 30%	$281,000
Discharge to Surface Waters	5280 feet discharge line at $10/ft (plus contingency and ELHSCM)	$80,000
	Estimated Total Installed Cost	$2,232,000

Operation & Maintenance Costs:

Includes sludge disposal, sludge transportation, iron precipitation and oxidation/air stripping operation, pump maintenance, equipment maintenance, discharge line maintenance and labor for an estimated 5 years. (Contingency and ELHSCM included.)	$284,000 (Annual O&M for 5 yrs)
<u>Total Present Worth</u>* (5% Discount Rate)	$3,957,000

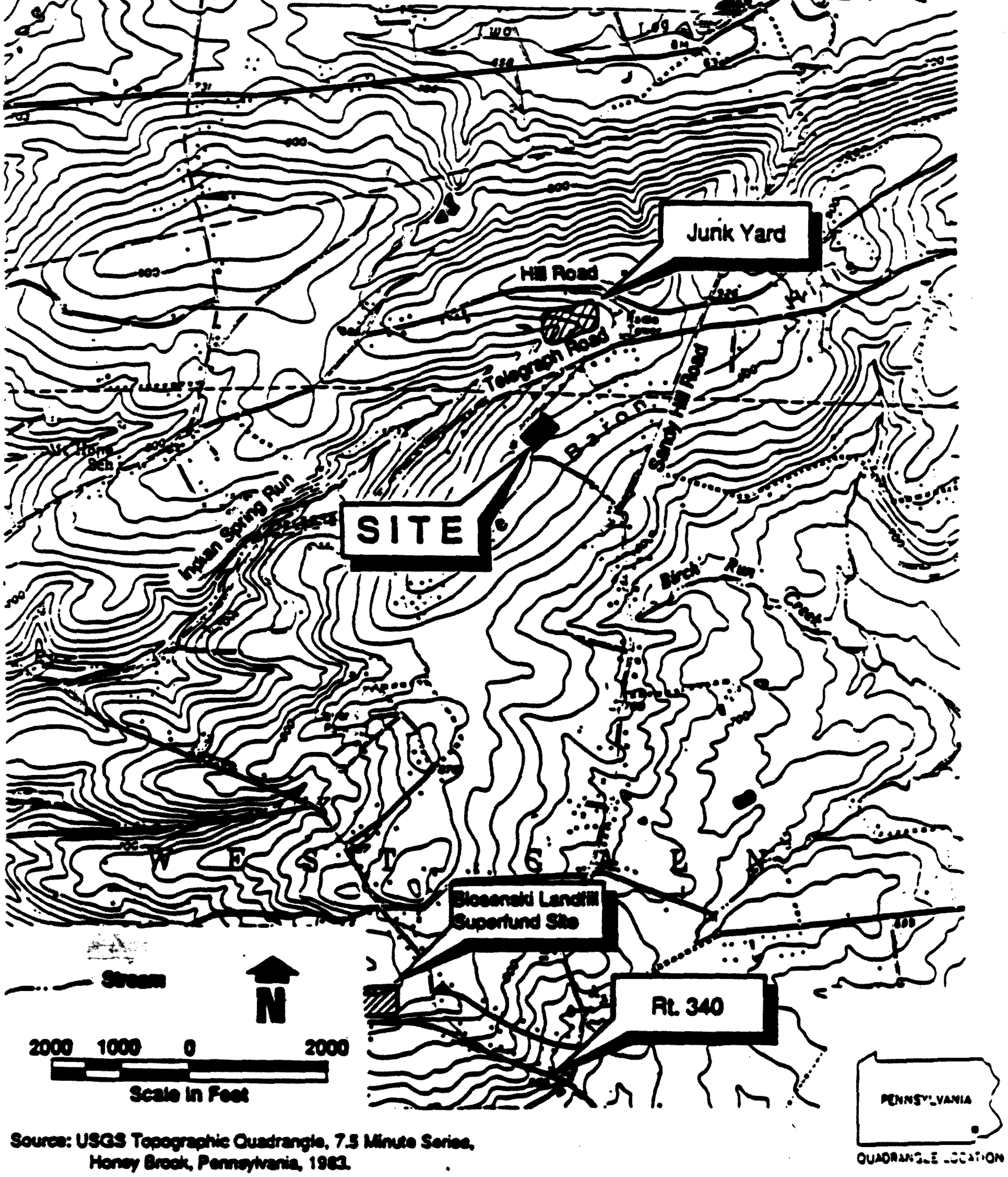
* Cost associated with ecological monitoring not included.

WILLIAM DICK LAGOONS
RECORD OF DECISION

FIGURES 1 through 10

FIGURE 1

Site Location Map
William Dick Lagoons Site
West Cain Township
Chester County, Pennsylvania

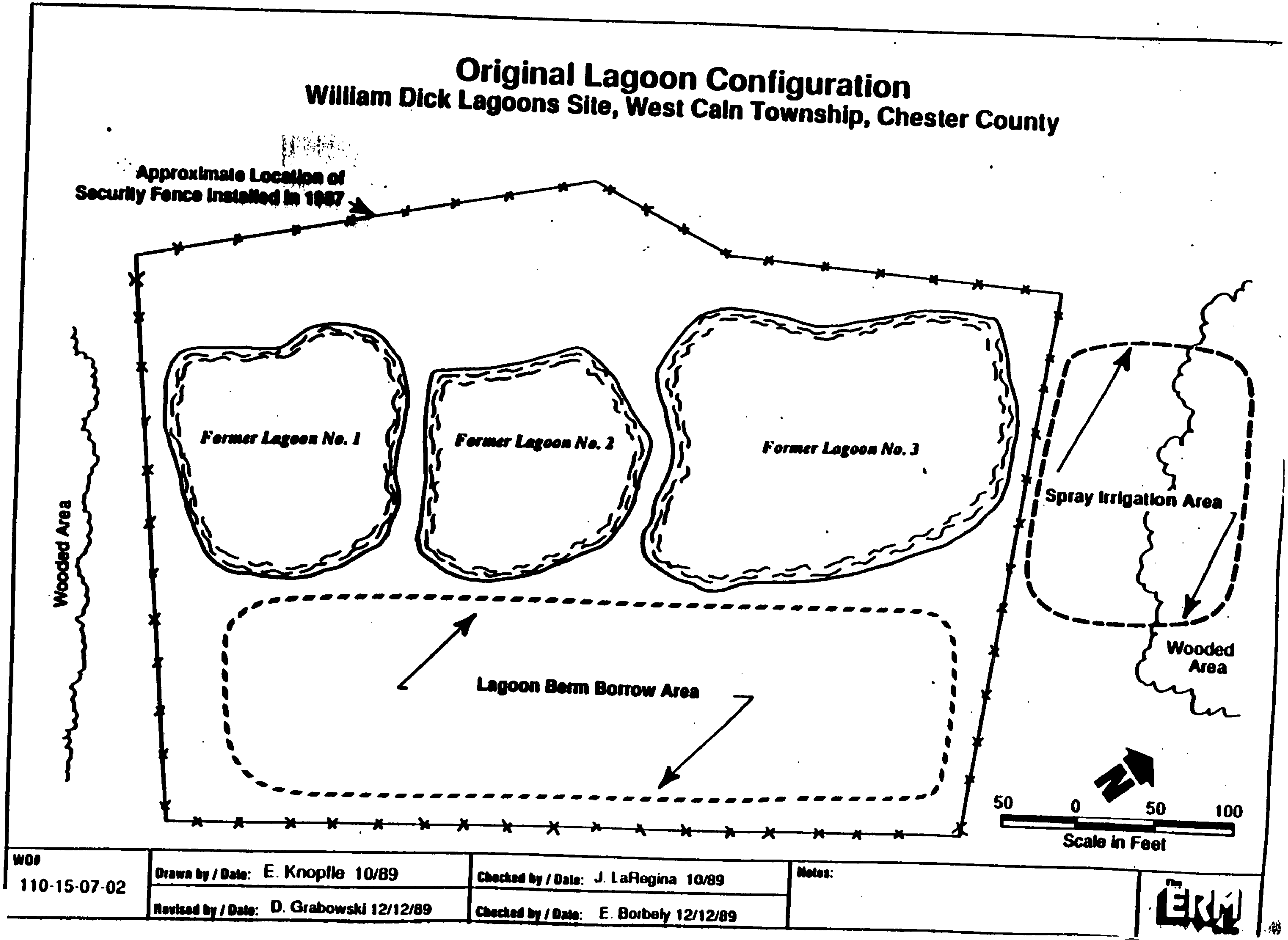


Source: USGS Topographic Quadrangle, 7.5 Minute Series, Honey Brook, Pennsylvania, 1983.

W0#		
110-15-07-02	Drawn by / Date: D. Grabowski 10/89	Checked by / Date:
	Revised by / Date: D. Grabowski 12/12/89	Checked by / Date: E. Borbely 12/12/89

ERM

FIGURE 2



Original Lagoon Configuration
William Dick Lagoons Site, West Caln Township, Chester County
Approximate Location of Security Fence Installed in 1987
Former Lagoon No. 1
Former Lagoon No. 2
Former Lagoon No. 3
Spray Irrigation Area
Wooded Area
Wooded Area
Lagoon Berm Borrow Area
N
50 0 50 100
Scale in Feet
WO#
110-15-07-02
Drawn by / Date: E. Knopfle 10/89
Revised by / Date: D. Grabowski 12/12/89
Checked by / Date: J. LaRegina 10/89
Checked by / Date: E. Borbely 12/12/89
Notes:

THE NINE REMEDIATION EVALUATION CRITERIA

FIGURE 3

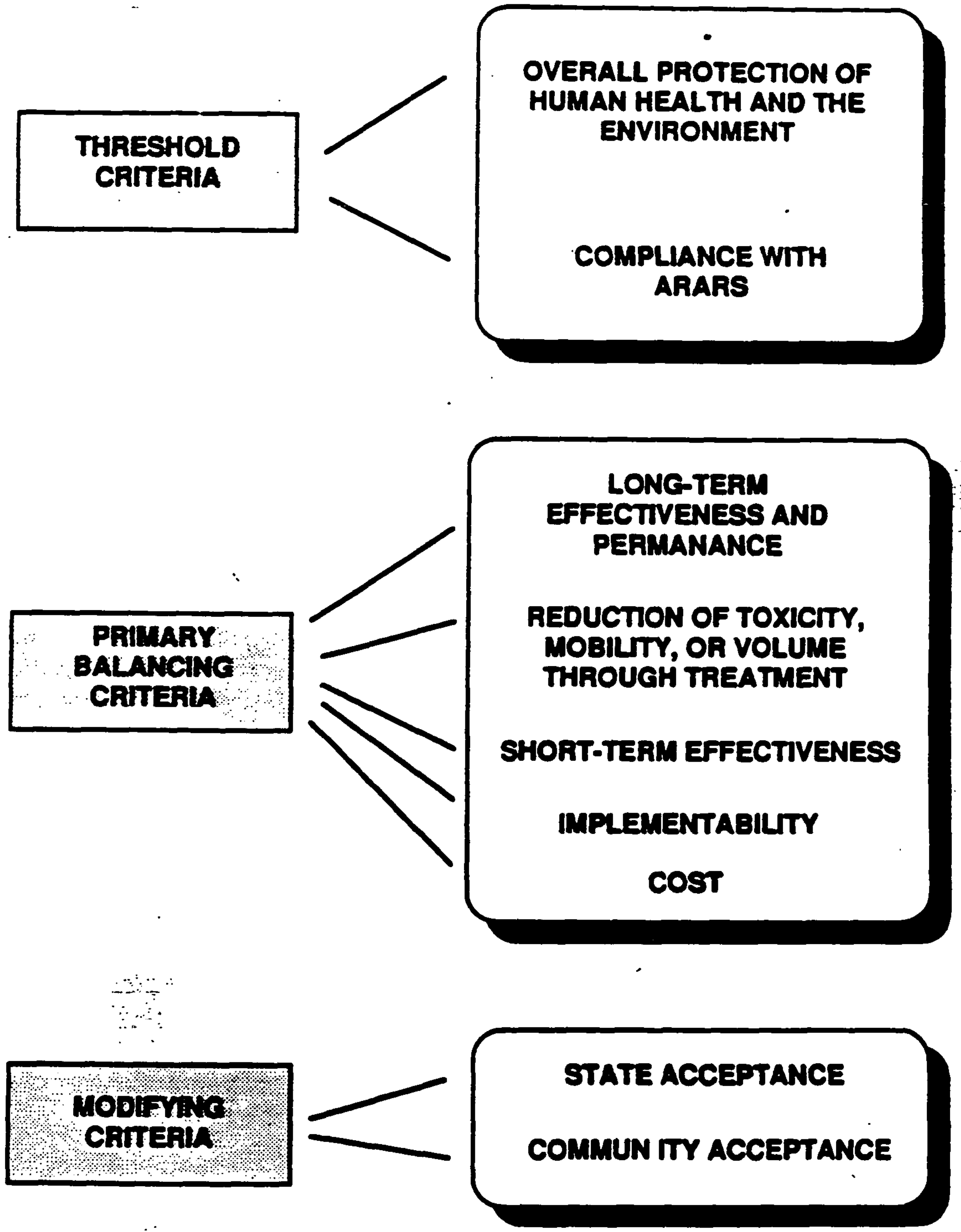
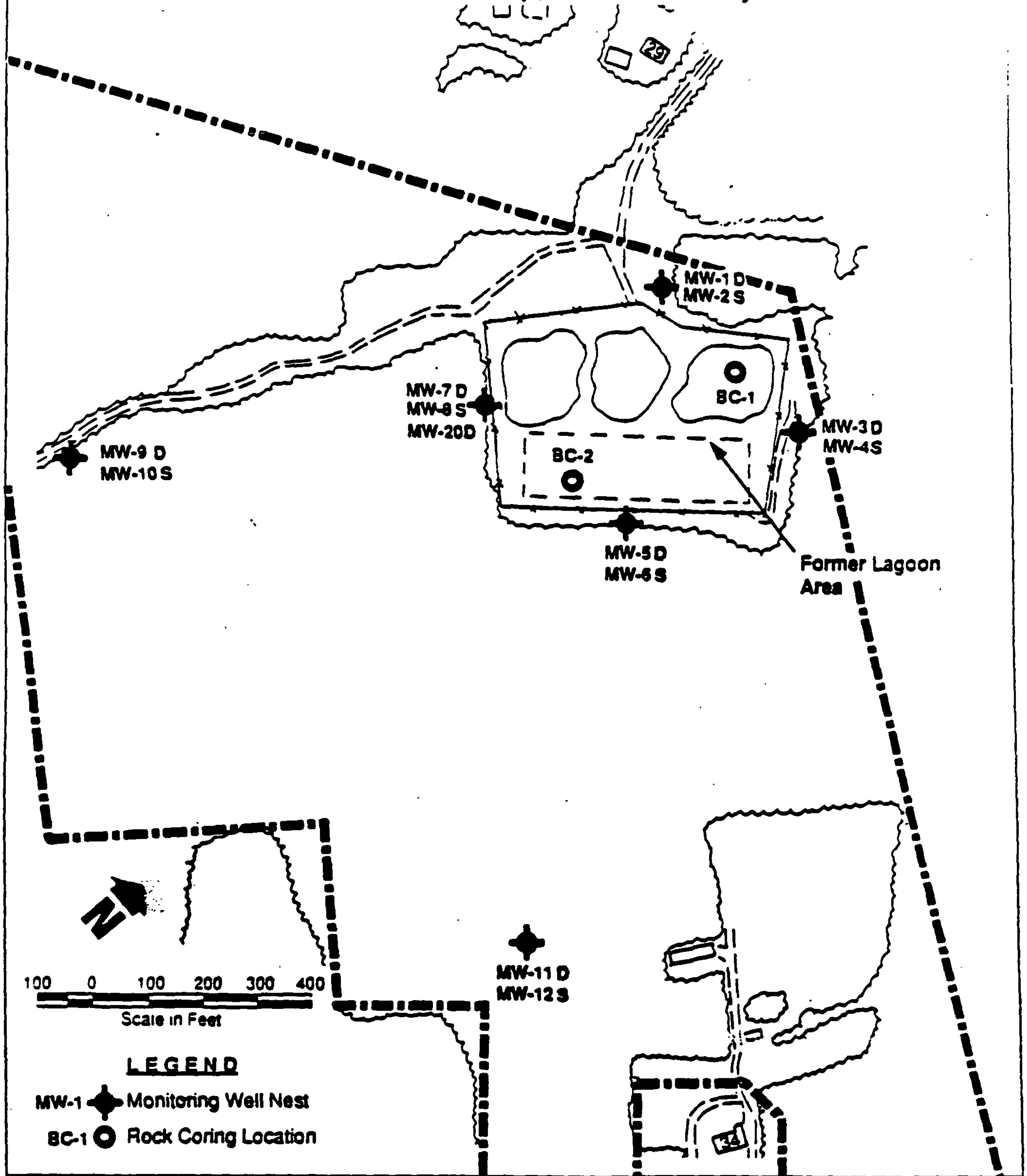


FIGURE 4

Monitoring Well Locations

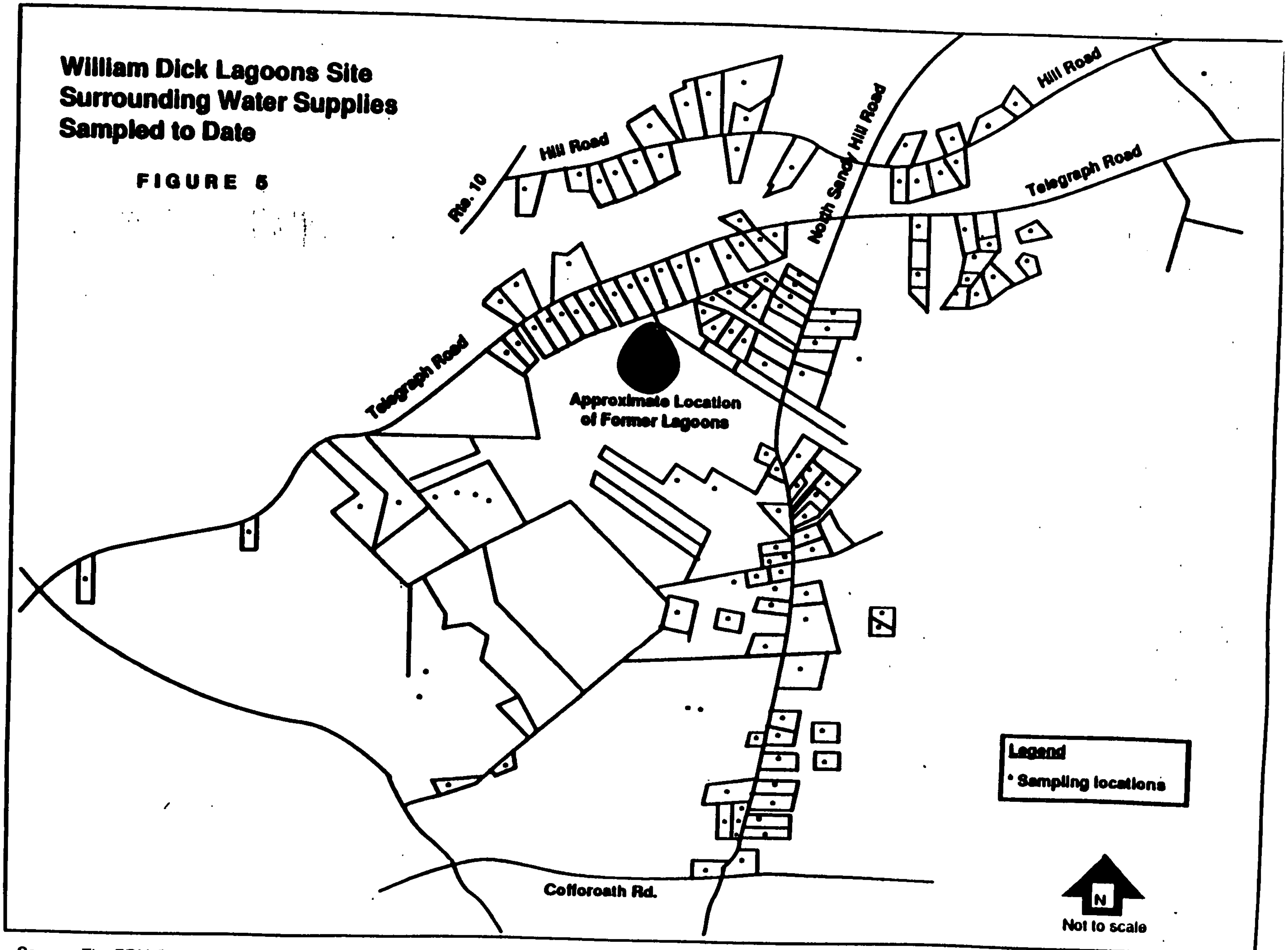
William Dick Lagoons Site
West Cain Township, Chester County



W0#	Drawn by / Date: D.Grabowski 11/15/89	Checked by / Date: E.Borbely 11/15/89	The ERM Group
110-15-07-02	Revised by / Date: D. Grabowski 3/7/90		

William Dick Lagoons Site Surrounding Water Supplies Sampled to Date

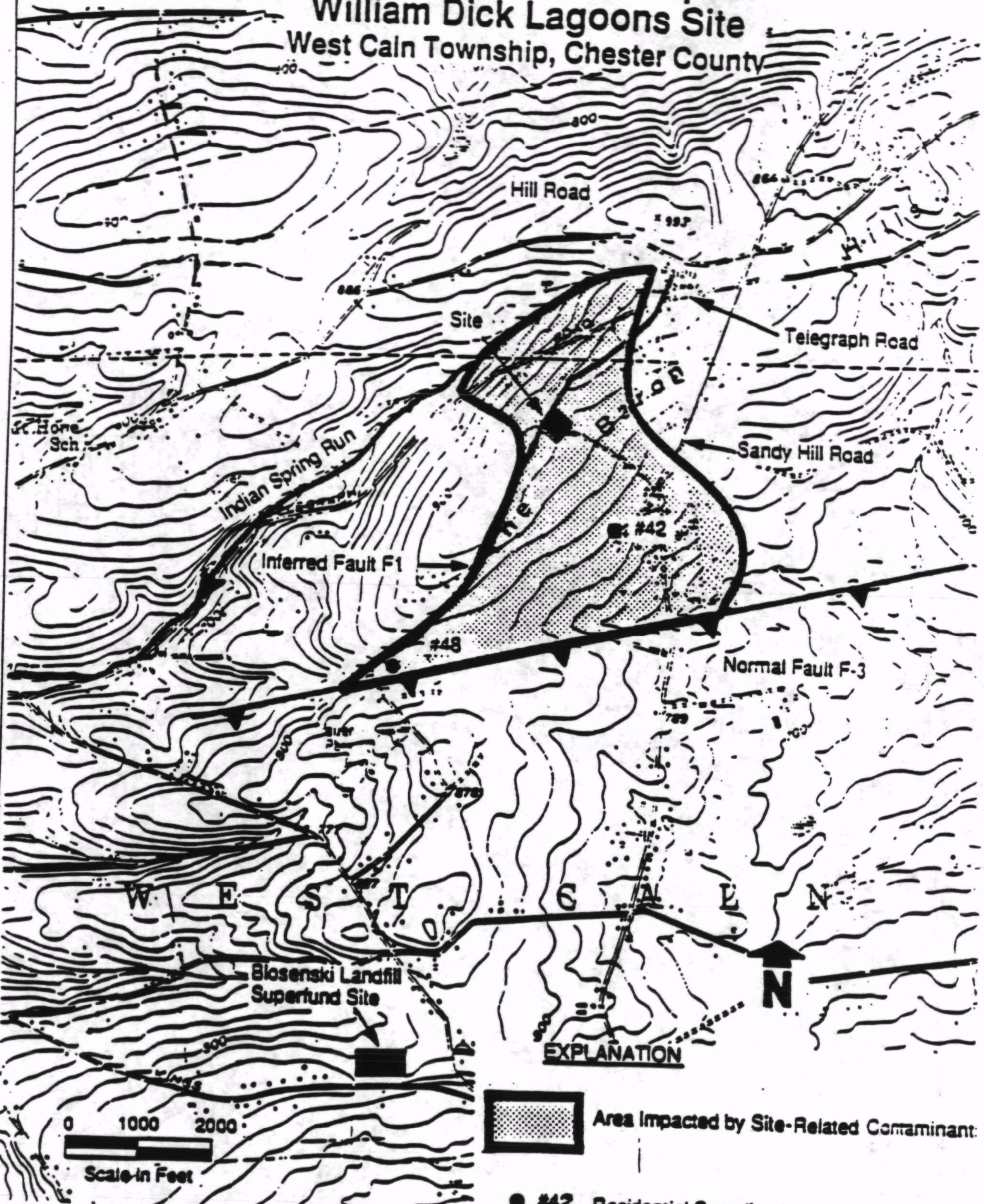
FIGURE 5



Source: The ERM Group
Preliminary Final RI/FS September 6, 1990

FIGURE 6

Area of Site Related Impact
William Dick Lagoons Site
West Cain Township, Chester County



WO#		
110-15-07-02	Drawn by / Date: D. Grabowski 3/7/90	Checked by / Date: R. Baker 3/7/90
	Revised by / Date:	Checked by / Date:

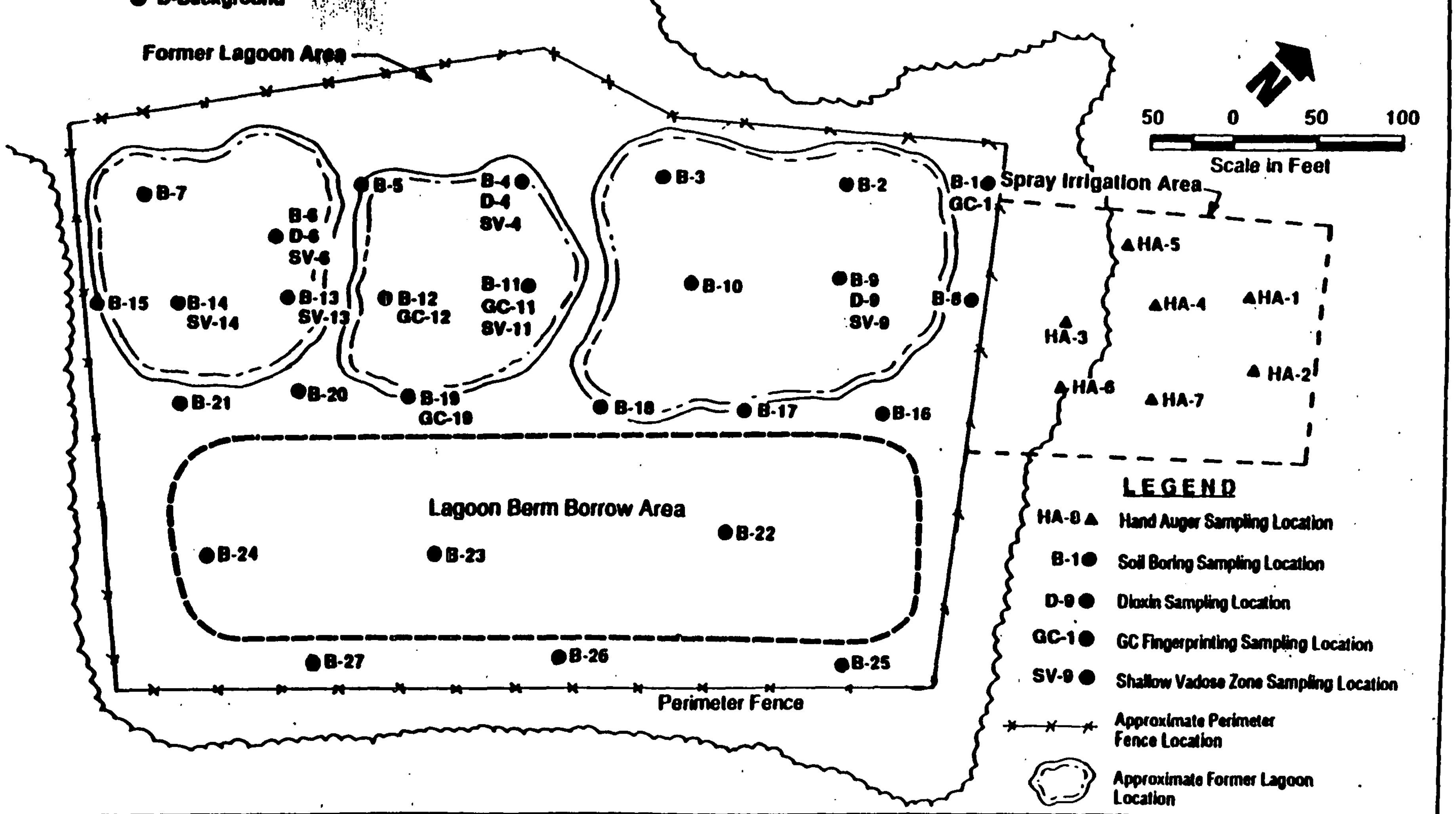
The ERM

FIGURE 7

Soil Sampling Locations

Former Lagoon and Spray Irrigation Areas

William Dick Lagoons Site, West Caln Township, Chester County



WO#			Notes:
110-15-07-02	Drawn by / Date: D. Grabowski 12/12/89	Checked by / Date: E. Borbely 12/12/89	
	Revised by / Date: D. Grabowski 2/19/90	Checked by / Date: E. Borbely 2/19/90	

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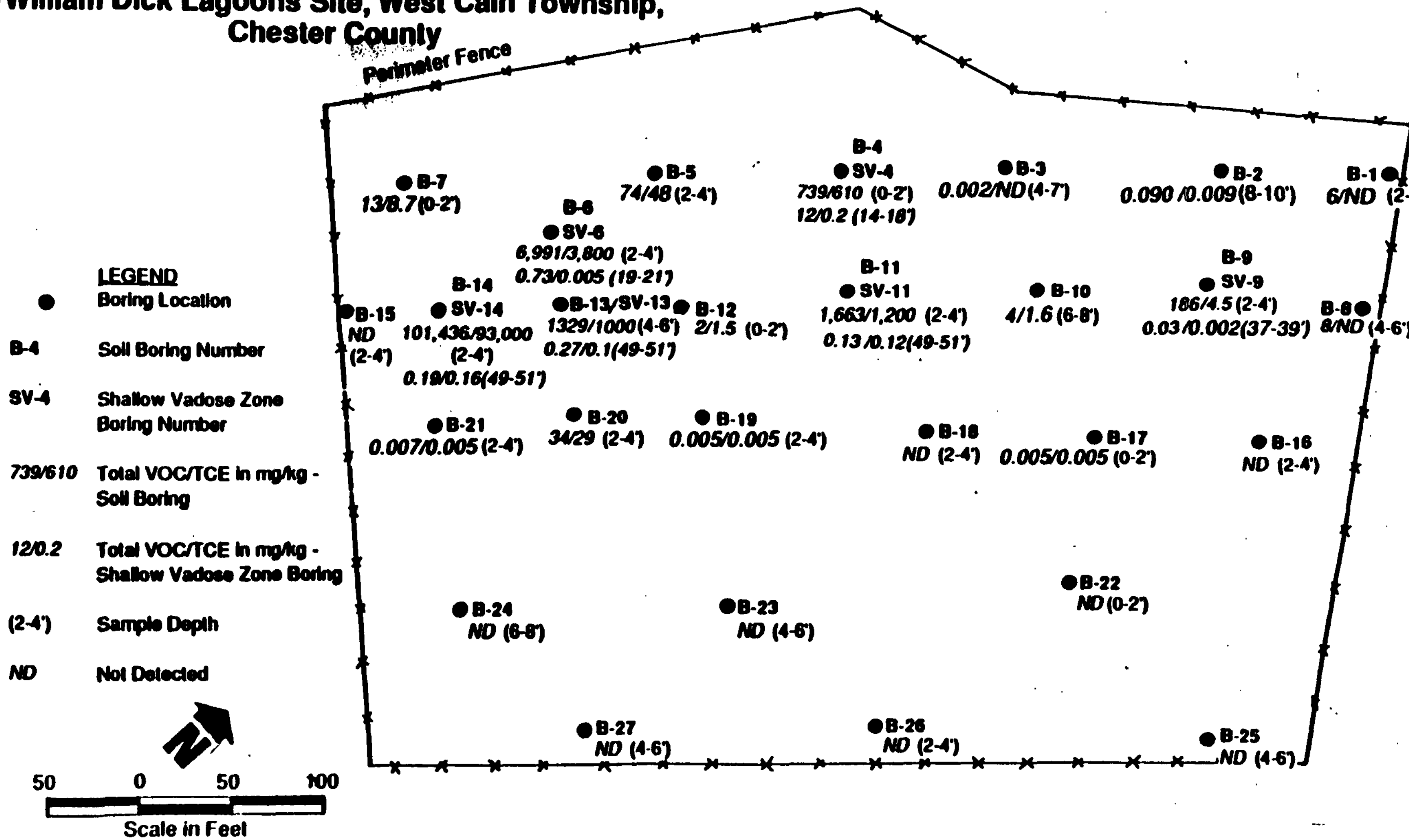
FIGURE 8

Total VOCs and Trichloroethene Detected in On-Site Soils

William Dick Lagoons Site, West Cain Township, Chester County

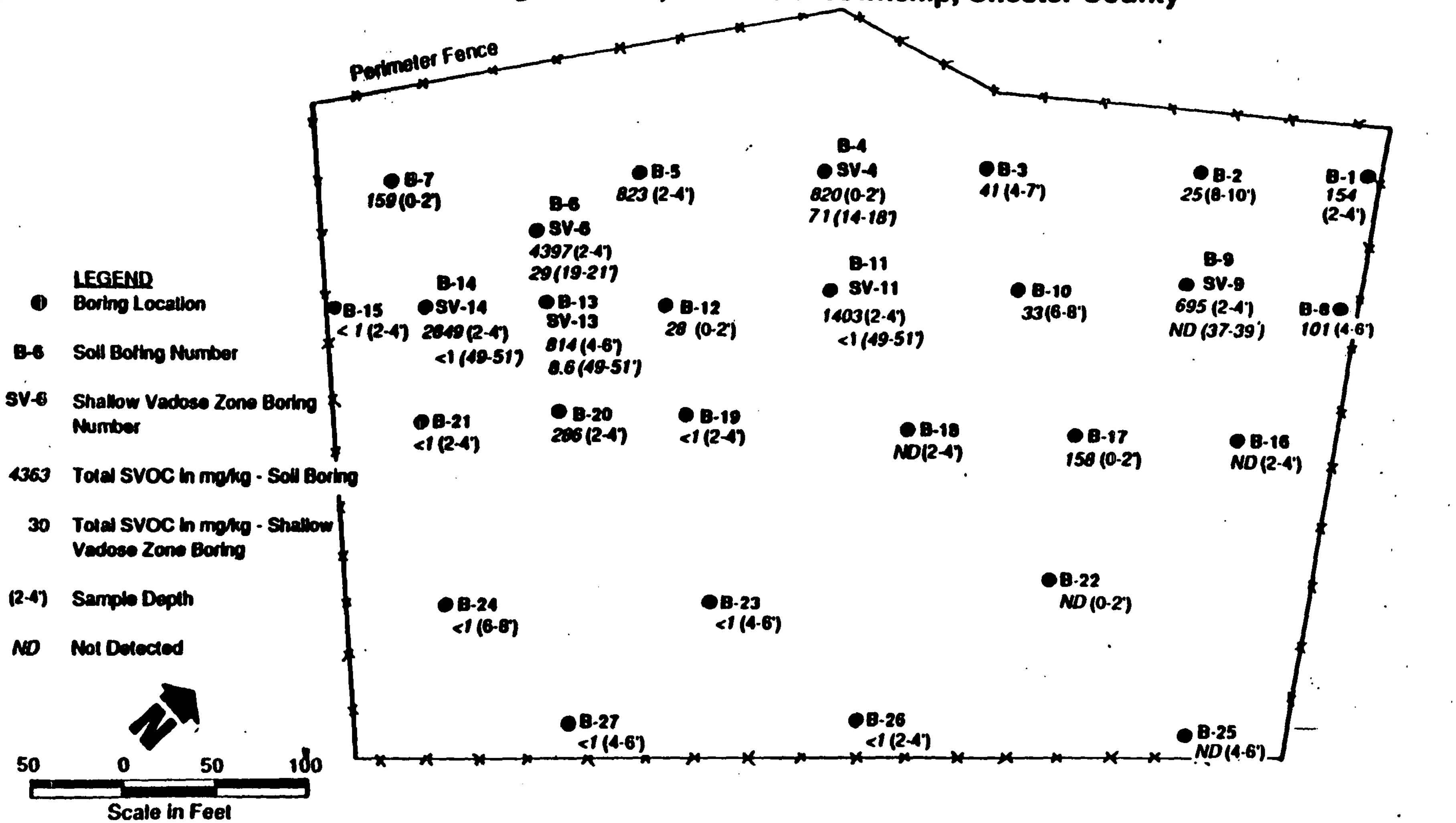


WO# 110-15-07-02	Drawn by / Date: D. Grabowski 10/89	Checked by / Date: J. LaRegina 10/89	Notes:	The ERM Group
	Revised by / Date: E. McAllister 3.6.90	Checked by / Date: E. Borbely 3.6.90		

FIGURE 9

Total TCL Semivolatile Compounds Detected in On-Site Soils

William Dick Lagoons Site, West Caln Township, Chester County



WO#			Notes:
110-15-07-02	Drawn by / Date: E. Knopfle 10/89	Checked by / Date: J. LaRegina 10/89	
	Revised by / Date: E. McAllister 3.6.90	Checked by / Date: E. Borbely 3.6.90	

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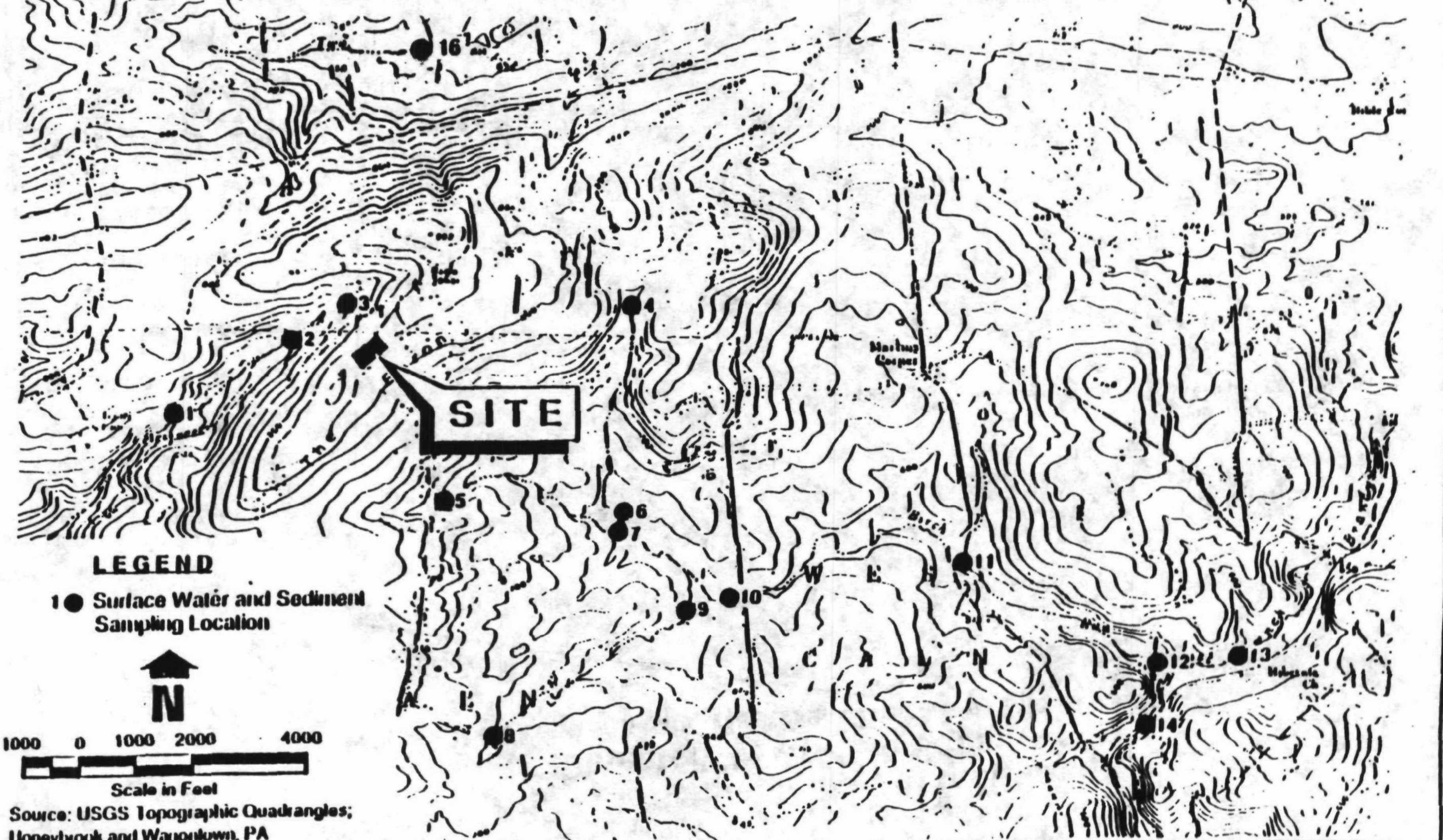
FIGURE 10

Surface Water and Sediment Sampling Locations

William Dick Lagoons Site, West Caln Township, Chester County



WO# 110-15-07-01	Drawn by / Date: D. Grabowski 2/26/90	Checked by / Date: E. Borboly 2/26/90	Notes:
	Revised by / Date: D. Grabowski 3/7/90	Checked by / Date: R. Streeter 3/7/90	

The ERM Group

WILLIAM DICK LAGOONS
RECORD OF DECISION

APPENDICES A through D

SUMMARY TABLES: INTAKE CALCULATIONS

Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Off-Site Ground Water
William Dick Lagoons
Adults

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	1,2-dichloroethene (total)	2.70E-03	1.60E-04	1.16E-07	6.88E-09
	1,2-dichloroethane	2.00E-03	1.80E-04	8.60E-08	7.74E-09
	chloroform	3.70E-03	3.60E-04	1.59E-07	1.55E-08
	1,1,1-trichloroethane	7.00E-03	2.60E-04	3.01E-07	1.12E-08
	trichloroethene	2.80E-01	9.47E-03	1.20E-05	4.07E-07
	tetrachloroethene	5.00E-03	2.10E-04	2.15E-07	9.03E-09
	chlorobenzene	1.10E-02	2.27E-04	4.73E-07	9.76E-09
	dichlorobenzene(1,2)	2.30E-03	1.60E-04	9.89E-08	6.88E-09
	dichlorobenzene(1,4)	3.20E-03	2.50E-04	1.38E-07	1.08E-08
	1,1-dichloroethene	1.80E-03	1.73E-04	7.74E-08	7.44E-09
	1,1-dichloroethane	1.20E-03	2.10E-04	5.16E-08	9.03E-09
Ingestion	1,2-dichloroethene (total)	2.70E-03	1.60E-04	5.78E-05	3.42E-06
	1,2-dichloroethane	2.00E-03	1.80E-04	4.28E-05	3.85E-06
	chloroform	3.70E-03	3.60E-04	7.92E-05	7.70E-06
	1,1,1-trichloroethane	7.00E-03	2.60E-04	1.50E-04	5.56E-06
	trichloroethene	2.80E-01	9.47E-03	5.99E-03	2.03E-04
	tetrachloroethene	5.00E-03	2.10E-04	1.07E-04	4.49E-06
	chlorobenzene	1.10E-02	2.27E-04	2.35E-04	4.86E-06
	dichlorobenzene(1,2)	2.30E-03	1.60E-04	4.92E-05	3.42E-06
	dichlorobenzene(1,4)	3.20E-03	2.50E-04	6.85E-05	5.35E-06
	1,1-dichloroethene	1.80E-03	1.73E-04	3.85E-05	3.70E-06
	1,1-dichloroethane	1.20E-03	2.10E-04	2.57E-05	4.49E-06
Inhalation During Showering	1,2-dichloroethene (total)	2.70E-03	1.60E-04	5.78E-05	3.42E-06
	1,2-dichloroethane	2.00E-03	1.80E-04	4.28E-05	3.85E-06
	chloroform	3.70E-03	3.60E-04	7.92E-05	7.70E-06
	1,1,1-trichloroethane	7.00E-03	2.60E-04	1.50E-04	5.56E-06
	trichloroethene	2.80E-01	9.47E-03	5.99E-03	2.03E-04
	tetrachloroethene	5.00E-03	2.10E-04	1.07E-04	4.49E-06
	chlorobenzene	1.10E-02	2.27E-04	2.35E-04	4.86E-06
	1,2-dichlorobenzene	2.30E-03	1.60E-04	4.92E-05	3.42E-06
	1,4-dichlorobenzene	3.20E-03	2.50E-04	6.85E-05	5.35E-06
	1,1-dichloroethene	1.80E-03	1.73E-04	3.85E-05	3.70E-06
	1,1-dichloroethane	1.20E-03	2.10E-04	2.57E-05	4.49E-06

Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Off-Site Ground Water
William Dick Lagoons
Child 6-12

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	1,2-dichloroethene (total)	2.70E-03	1.60E-04	1.61E-07	9.54E-09
	1,2-dichloroethane	2.00E-03	1.80E-04	1.19E-07	1.07E-08
	chloroform	3.70E-03	3.60E-04	2.21E-07	2.15E-08
	1,1,1-trichloroethane	7.00E-03	2.60E-04	4.17E-07	1.55E-08
	trichloroethene	2.80E-01	9.47E-03	1.67E-05	5.64E-07
	tetrachloroethene	5.00E-03	2.10E-04	2.98E-07	1.25E-08
	chlorobenzene	1.10E-02	2.27E-04	6.56E-07	1.35E-08
	dichlorobenzene(1,2)	2.30E-03	1.60E-04	1.37E-07	9.54E-09
	dichlorobenzene(1,4)	3.20E-03	2.50E-04	1.91E-07	1.49E-08
	1,1-dichloroethene	1.80E-03	1.73E-04	1.07E-07	1.03E-08
	1,1-dichloroethane	1.20E-03	2.10E-04	7.15E-08	1.25E-08
Ingestion	1,2-dichloroethene (total)	2.70E-03	1.60E-04	1.40E-04	8.32E-06
	1,2-dichloroethane	2.00E-03	1.80E-04	1.04E-04	9.36E-06
	chloroform	3.70E-03	3.60E-04	1.92E-04	1.87E-05
	1,1,1-trichloroethane	7.00E-03	2.60E-04	3.64E-04	1.35E-05
	trichloroethene	2.80E-01	9.47E-03	1.46E-02	4.92E-04
	tetrachloroethene	5.00E-03	2.10E-04	2.60E-04	1.09E-05
	chlorobenzene	1.10E-02	2.27E-04	5.72E-04	1.18E-05
	dichlorobenzene(1,2)	2.30E-03	1.60E-04	1.20E-04	8.32E-06
	dichlorobenzene(1,4)	3.20E-03	2.50E-04	1.66E-04	1.30E-05
	1,1-dichloroethene	1.80E-03	1.73E-04	9.36E-05	9.00E-06
	1,1-dichloroethane	1.20E-03	2.10E-04	6.24E-05	1.09E-05
Inhalation During Showering	1,2-dichloroethene (total)	2.70E-03	1.60E-04	1.40E-04	8.32E-06
	1,2-dichloroethane	2.00E-03	1.80E-04	1.04E-04	9.36E-06
	chloroform	3.70E-03	3.60E-04	1.92E-04	1.87E-05
	1,1,1-trichloroethane	7.00E-03	2.60E-04	3.64E-04	1.35E-05
	trichloroethene	2.80E-01	9.47E-03	1.46E-02	4.92E-04
	tetrachloroethene	5.00E-03	2.10E-04	2.60E-04	1.09E-05
	chlorobenzene	1.10E-02	2.27E-04	5.72E-04	1.18E-05
	dichlorobenzene(1,2)	2.30E-03	1.60E-04	1.20E-04	8.32E-06
	dichlorobenzene(1,4)	3.20E-03	2.50E-04	1.66E-04	1.30E-05
	1,1-dichloroethene	1.80E-03	1.73E-04	9.36E-05	9.00E-06
	1,1-dichloroethane	1.20E-03	2.10E-04	6.24E-05	1.09E-05

Appendix A
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Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Off-Site Ground Water
William Dick Lagoons
Child 2-6

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	1,2-dichloroethene (total)	2.70E-03	1.60E-04	1.94E-07	1.15E-08
	1,2-dichloroethane	2.00E-03	1.80E-04	1.44E-07	1.30E-08
	chloroform	3.70E-03	3.60E-04	2.66E-07	2.59E-08
	1,1,1-trichloroethane	7.00E-03	2.60E-04	5.04E-07	1.87E-08
	trichloroethene	2.80E-01	9.47E-03	2.02E-05	6.82E-07
	tetrachloroethene	5.00E-03	2.10E-04	3.60E-07	1.51E-08
	chlorobenzene	1.10E-02	2.27E-04	7.92E-07	1.63E-08
	1,2-dichlorobenzene	2.30E-03	1.60E-04	1.66E-07	1.15E-08
	1,4-dichlorobenzene	3.20E-03	2.50E-04	2.30E-07	1.80E-08
	1,1-dichloroethene	1.80E-03	1.73E-04	1.30E-07	1.25E-08
	1,1-dichloroethane	1.20E-03	2.10E-04	8.64E-08	1.51E-08
Ingestion	1,2-dichloroethene (total)	2.70E-03	1.60E-04	2.54E-04	1.50E-05
	1,2-dichloroethane	2.00E-03	1.80E-04	1.88E-04	1.69E-05
	chloroform	3.70E-03	3.60E-04	3.48E-04	3.38E-05
	1,1,1-trichloroethane	7.00E-03	2.60E-04	6.58E-04	2.44E-05
	trichloroethene	2.80E-01	9.47E-03	2.63E-02	8.90E-04
	tetrachloroethene	5.00E-03	2.10E-04	4.70E-04	1.97E-05
	chlorobenzene	1.10E-02	2.27E-04	1.03E-03	2.13E-05
	1,2-dichlorobenzene	2.30E-03	1.60E-04	2.16E-04	1.50E-05
	1,4-dichlorobenzene	3.20E-03	2.50E-04	3.01E-04	2.35E-05
	1,1-dichloroethene	1.80E-03	1.73E-04	1.69E-04	1.63E-05
	1,1-dichloroethane	1.20E-03	2.10E-04	1.13E-04	1.97E-05
Inhalation During Showering	1,2-dichloroethene (total)	2.70E-03	1.60E-04	2.54E-04	1.50E-05
	1,2-dichloroethane	2.00E-03	1.80E-04	1.88E-04	1.69E-05
	chloroform	3.70E-03	3.60E-04	3.48E-04	3.38E-05
	1,1,1-trichloroethane	7.00E-03	2.60E-04	6.58E-04	2.44E-05
	trichloroethene	2.80E-01	9.47E-03	2.63E-02	8.90E-04
	tetrachloroethene	5.00E-03	2.10E-04	4.70E-04	1.97E-05
	chlorobenzene	1.10E-02	2.27E-04	1.03E-03	2.13E-05
	1,2-dichlorobenzene	2.30E-03	1.60E-04	2.16E-04	1.50E-05
	1,4-dichlorobenzene	3.20E-03	2.50E-04	3.01E-04	2.35E-05
	1,1-dichloroethene	1.80E-03	1.73E-04	1.69E-04	1.63E-05
	1,1-dichloroethane	1.20E-03	2.10E-04	1.13E-04	1.97E-05

Appendix A
4 of 18

Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes for Spring #48
William Dick Lagoons
Adults

Route Of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intakes (mg/kg/day)
Dermal Contact	1,2-dichloroethane	3.20E-04	1.90E-04	2.07E-09	1.23E-09
	chloroform	3.10E-04	1.50E-04	2.00E-09	9.69E-10
	trichloroethene	6.90E-03	4.50E-03	4.46E-08	2.91E-08
Incidental Ingestion	1,2-dichloroethane	3.20E-04	1.90E-04	1.14E-08	6.76E-09
	chloroform	3.10E-04	1.50E-04	1.10E-08	5.34E-09
	trichloroethene	6.90E-03	4.50E-03	2.46E-07	1.60E-07
Inhalation *	1,2-dichloroethane	1.07E-04	1.07E-04	6.32E-08	6.32E-08
	chloroform	9.90E-05	9.90E-05	5.85E-08	5.85E-08
	trichloroethene	2.14E-03	2.14E-03	1.26E-06	1.26E-06

* - The maximum concentration detected in samples collected from Spring #48 were used as input to the box model for calculation of the ambient air concnetration.

Appendix A

Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes for Spring #48
William Dick Lagoons
Child 6-12

Route Of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intakes (mg/kg/day)
Dermal Contact	1,2-dichloroethane	3.20E-04	1.90E-04	2.88E-09	1.71E-09
	chloroform	3.10E-04	1.50E-04	2.79E-09	1.35E-09
	trichloroethene	6.90E-03	4.50E-03	6.21E-08	4.05E-08
Incidental Ingestion	1,2-dichloroethane	3.20E-04	1.90E-04	2.75E-08	1.63E-08
	chloroform	3.10E-04	1.50E-04	2.67E-08	1.29E-08
	trichloroethene	6.90E-03	4.50E-03	5.93E-07	3.87E-07
Inhalation *	1,2-dichloroethane	1.07E-04	1.07E-04	8.46E-08	8.46E-08
	chloroform	9.90E-05	9.90E-05	7.83E-08	7.83E-08
	trichloroethene	2.14E-03	2.14E-03	1.69E-06	1.69E-06

* - The maximum concentration detected in samples collected from Spring #48 were used as input to the box model for calculation of the ambient air concnetration.

Appendix A
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Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Soil
William Dick Lagoons
Adults

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	chloroform	4.10E+00	1.12E+00	1.07E-07	2.92E-08
	trichloroethene	6.10E+02	1.24E+02	1.59E-05	3.22E-06
	tetrachloroethene	5.50E+00	1.22E+00	1.43E-07	3.17E-08
	chlorobenzene	6.40E+00	1.39E+00	1.06E-07	3.60E-08
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	4.42E-06	9.24E-07
	naphthalene	2.00E+02	4.03E+01	5.20E-06	1.06E-06
	phenanthrene	2.60E+01	5.73E+00	6.76E-07	1.49E-07
	fluoranthene	1.30E+01	3.43E+00	3.38E-07	8.91E-08
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	5.98E-06	2.67E-06
	4,4'-DDE	2.20E+02	8.94E+01	5.72E-06	2.32E-06
	acenaphthene	1.00E+01	2.36E+00	2.60E-07	6.14E-08
	fluorene	1.10E+01	2.44E+00	2.86E-07	6.33E-08
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	1.39E-07	5.20E-08
	anthracene	4.00E+00	9.89E-01	1.04E-07	2.57E-08
	heptachlor epoxide	1.50E-01	5.48E-02	3.90E-09	1.42E-09
	2,4-dichlorophenol	9.50E+00	2.14E+00	2.47E-07	5.55E-08
	arsenic	1.40E+01	6.24E+00	3.64E-07	1.62E-07
	barium	6.72E+02	2.11E+02	1.75E-05	5.48E-06
	chromium	3.49E+02	9.18E+01	9.07E-06	2.38E-06
	manganese	1.60E+02	6.00E+01	4.16E-06	1.72E-06
	vanadium	2.10E+01	1.10E+01	5.46E-07	3.64E-07
	zinc	2.53E+02	8.50E+01	6.58E-06	2.21E-06
Incidental Ingestion	chloroform	4.10E+00	1.12E+00	2.25E-07	6.15E-08
	trichloroethene	6.10E+02	1.24E+02	3.34E-05	6.80E-06
	tetrachloroethene	5.50E+00	1.22E+00	3.01E-07	6.67E-08
	chlorobenzene	6.40E+00	1.39E+00	3.51E-07	7.59E-08
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	9.32E-06	1.95E-06
	naphthalene	2.00E+02	4.03E+01	1.10E-05	2.21E-06
	phenanthrene	2.60E+01	5.73E+00	1.42E-06	3.14E-07
	fluoranthene	1.30E+01	3.43E+00	7.12E-07	1.88E-07
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.26E-05	5.64E-06
	4,4'-DDE	2.20E+02	8.94E+01	1.21E-05	4.90E-06
	acenaphthene	1.00E+01	2.36E+00	5.48E-07	1.29E-07
	fluorene	1.10E+01	2.44E+00	6.03E-07	1.33E-07
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	2.94E-07	1.10E-07
	anthracene	4.00E+00	9.89E-01	2.19E-07	5.42E-08
	heptachlor epoxide	1.50E-01	5.48E-02	8.22E-09	3.00E-09
	2,4-dichlorophenol	9.50E+00	2.14E+00	5.21E-07	1.17E-07
	arsenic	1.40E+01	6.24E+00	7.67E-07	3.42E-07
	barium	6.72E+02	2.11E+02	3.68E-05	1.16E-05
	chromium	3.49E+02	9.18E+01	1.91E-05	5.03E-06
	manganese	1.60E+02	6.60E+01	8.77E-06	3.62E-06
	vanadium	2.10E+01	1.40E+01	1.15E-06	7.67E-07
	zinc	2.53E+02	8.50E+01	1.39E-05	4.66E-06
Deer Meat Ingestion	chloroform	4.10E+00	1.12E+00	6.08E-12	1.67E-12
	trichloroethene	6.10E+02	1.24E+02	1.41E-09	2.88E-10
	tetrachloroethene	5.50E+00	1.22E+00	1.62E-11	3.58E-12
	chlorobenzene	6.40E+00	1.39E+00	8.01E-08	1.73E-08
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	2.13E-03	4.45E-04
	naphthalene	2.00E+02	4.03E+01	4.41E-06	8.88E-07
	phenanthrene	2.60E+01	5.73E+00	5.74E-07	1.26E-07
	fluoranthene	1.30E+01	3.43E+00	2.87E-07	7.56E-08
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	5.76E-04	2.58E-04
	4,4'-DDE	2.20E+02	8.94E+01	1.36E-06	5.54E-07
	acenaphthene	1.00E+01	2.36E+00	2.21E-07	5.21E-08
	fluorene	1.10E+01	2.44E+00	2.43E-07	5.37E-08
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	1.18E-07	4.41E-08
	anthracene	4.00E+00	9.89E-01	8.82E-08	2.18E-08
	heptachlor epoxide	1.50E-01	5.48E-02	4.91E-13	1.79E-13
	2,4-dichlorophenol	9.50E+00	2.14E+00	3.88E-11	8.75E-12
	arsenic	1.40E+01	6.24E+00	2.56E-07	1.14E-07
	barium	6.72E+02	2.11E+02	8.60E-11	2.70E-11
	chromium	3.49E+02	9.18E+01	4.08E-08	1.07E-08
	manganese	1.60E+02	6.60E+01	2.07E-11	8.52E-12
	vanadium	2.10E+01	1.40E+01	1.41E-11	9.40E-12
	zinc	2.53E+02	8.50E+01	3.13E-11	1.05E-11

POOR QUALITY ORIGINAL

Appendix A
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Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes Per Soil
William Dick Lagoons
Child 6-12

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	chloroform	4.10E+00	1.12E+00	6.36E-07	1.74E-07
	trichloroethene	6.10E+02	1.24E+02	9.46E-05	1.92E-05
	tetrachloroethene	5.50E+00	1.22E+00	8.53E-07	1.89E-07
	chlorobenzene	6.40E+00	1.39E+00	9.92E-07	2.15E-07
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	2.64E-05	5.51E-06
	naphthalene	2.00E+02	4.03E+01	3.10E-05	6.24E-06
	phenanthrene	2.60E+01	5.73E+00	4.03E-06	8.88E-07
	fluoranthene	1.30E+01	3.43E+00	2.02E-06	5.31E-07
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	3.57E-05	1.59E-05
	4,4'-DDE	2.20E+02	8.94E+01	3.41E-05	1.39E-05
	acenaphthene	1.00E+01	2.36E+00	1.55E-06	3.66E-07
	fluorene	1.10E+01	2.44E+00	1.71E-06	3.78E-07
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	8.31E-07	3.10E-07
	anthracene	4.00E+00	9.88E-01	6.20E-07	1.53E-07
	heptachlor epoxide	1.50E-01	5.48E-02	2.33E-08	8.49E-09
	2,4-dichlorophenol	9.50E+00	2.14E+00	1.47E-06	3.31E-07
	arsenic	1.40E+01	6.24E+00	2.17E-06	9.67E-07
	barium	6.72E+02	2.11E+02	1.04E-04	3.27E-05
	chromium	3.49E+02	9.18E+01	5.41E-05	1.42E-05
	manganese	1.60E+02	6.60E+01	2.48E-05	1.02E-05
	vanadium	2.10E+01	1.40E+01	3.26E-06	2.17E-06
	zinc	2.53E+02	8.50E+01	3.92E-05	1.32E-05
Incidental Ingestion	chloroform	4.10E+00	1.12E+00	1.10E-06	3.17E-07
	trichloroethene	6.10E+02	1.24E+02	1.73E-04	3.51E-05
	tetrachloroethene	5.50E+00	1.22E+00	1.56E-06	3.45E-07
	chlorobenzene	6.40E+00	1.39E+00	1.81E-06	3.92E-07
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	4.81E-05	1.01E-05
	naphthalene	2.00E+02	4.03E+01	5.08E-05	1.14E-05
	phenanthrene	2.60E+01	5.73E+00	7.36E-06	1.62E-06
	fluoranthene	1.30E+01	3.43E+00	3.68E-06	9.69E-07
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	6.51E-05	2.91E-05
	4,4'-DDE	2.20E+02	8.94E+01	6.23E-05	2.53E-05
	acenaphthene	1.00E+01	2.36E+00	2.83E-06	6.68E-07
	fluorene	1.10E+01	2.44E+00	3.11E-06	6.89E-07
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	1.52E-06	5.66E-07
	anthracene	4.00E+00	9.88E-01	1.13E-06	2.80E-07
	heptachlor epoxide	1.50E-01	5.48E-02	4.25E-08	1.55E-08
	2,4-dichlorophenol	9.50E+00	2.14E+00	2.69E-06	6.04E-07
	arsenic	1.40E+01	6.24E+00	3.96E-06	1.77E-06
	barium	6.72E+02	2.11E+02	1.90E-04	5.97E-05
	chromium	3.49E+02	9.18E+01	9.88E-05	2.60E-05
	manganese	1.60E+02	6.60E+01	4.53E-05	1.87E-05
	vanadium	2.10E+01	1.40E+01	5.94E-06	3.96E-06
	zinc	2.53E+02	8.50E+01	7.16E-05	2.41E-05
Deer Meat Ingestion	chloroform	4.10E+00	1.12E+00	1.47E-11	4.02E-12
	trichloroethene	6.10E+02	1.24E+02	3.42E-09	6.94E-10
	tetrachloroethene	5.50E+00	1.22E+00	3.90E-11	8.68E-12
	chlorobenzene	6.40E+00	1.39E+00	1.93E-04	4.18E-05
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	5.13E-03	1.07E-03
	naphthalene	2.00E+02	4.03E+01	1.06E-05	2.14E-06
	phenanthrene	2.60E+01	5.73E+00	1.38E-06	3.06E-07
	fluoranthene	1.30E+01	3.43E+00	6.92E-07	1.82E-07
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.39E-03	6.22E-04
	4,4'-DDE	2.20E+02	8.94E+01	3.29E-05	1.34E-05
	acenaphthene	1.00E+01	2.36E+00	5.32E-07	1.26E-07
	fluorene	1.10E+01	2.44E+00	5.88E-07	1.30E-07
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	2.85E-07	1.06E-07
	anthracene	4.00E+00	9.88E-01	2.13E-07	5.27E-08
	heptachlor epoxide	1.50E-01	5.48E-02	1.19E-12	4.33E-13
	2,4-dichlorophenol	9.50E+00	2.14E+00	9.38E-11	2.11E-11
	arsenic	1.40E+01	6.24E+00	6.19E-07	2.76E-07
	barium	6.72E+02	2.11E+02	2.08E-10	6.51E-11
	chromium	3.49E+02	9.18E+01	9.81E-08	2.58E-08
	manganese	1.60E+02	6.60E+01	4.98E-11	2.06E-11
	vanadium	2.10E+01	1.40E+01	3.40E-11	2.27E-11
	zinc	2.53E+02	8.50E+01	7.58E-11	2.54E-11

Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes Per Soil
William Dick Lagoons
Child 2-6

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	chloroform	4.10E+00	1.12E+00	3.56E-07	9.80E-08
	trichloroethene	6.10E+02	1.24E+02	5.33E-05	1.06E-05
	tetrachloroethene	5.50E+00	1.22E+00	4.81E-07	1.06E-07
	chlorobenzene	6.40E+00	1.39E+00	5.59E-07	1.21E-07
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	1.49E-05	3.11E-06
	naphthalene	2.00E+02	4.03E+01	1.75E-05	3.52E-06
	phenanthrene	2.60E+01	5.73E+00	2.27E-06	5.01E-07
	fluoranthene	1.30E+01	3.43E+00	1.14E-06	2.99E-07
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	2.01E-05	8.99E-06
	4,4'-DDE	2.20E+02	8.94E+01	1.92E-05	7.81E-06
	acenaphthene	1.00E+01	2.36E+00	8.74E-07	2.06E-07
	fluorene	1.10E+01	2.44E+00	9.61E-07	2.13E-07
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	4.68E-07	1.75E-07
	anthracene	4.00E+00	9.89E-01	3.50E-07	8.64E-08
	heptachlor epoxide	1.50E-01	5.48E-02	1.31E-08	4.79E-09
	2,4-dichlorophenol	9.50E+00	2.14E+00	8.30E-07	1.87E-07
	arsenic	1.40E+01	6.24E+00	1.22E-06	5.45E-07
	barium	6.72E+02	2.11E+02	5.87E-05	1.84E-05
	chromium	3.49E+02	9.18E+01	3.05E-05	8.02E-06
	manganese	1.60E+02	6.60E+01	1.40E-05	5.77E-06
	vanadium	2.10E+01	1.40E+01	1.84E-06	1.22E-06
	zinc	2.53E+02	8.50E+01	2.21E-05	7.43E-06
Incidental Ingestion	chloroform	4.10E+00	1.12E+00	1.96E-06	5.37E-07
	trichloroethene	6.10E+02	1.24E+02	2.92E-04	5.94E-05
	tetrachloroethene	5.50E+00	1.22E+00	2.63E-06	5.83E-07
	chlorobenzene	6.40E+00	1.39E+00	3.07E-06	6.63E-07
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	8.14E-05	1.70E-05
	naphthalene	2.00E+02	4.03E+01	9.58E-05	1.93E-05
	phenanthrene	2.60E+01	5.73E+00	1.25E-05	2.74E-06
	fluoranthene	1.30E+01	3.43E+00	6.23E-06	1.64E-06
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.10E-04	4.93E-05
	4,4'-DDE	2.20E+02	8.94E+01	1.05E-04	4.28E-05
	acenaphthene	1.00E+01	2.36E+00	4.79E-06	1.13E-06
	fluorene	1.10E+01	2.44E+00	5.27E-06	1.17E-06
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	2.57E-06	9.58E-07
	anthracene	4.00E+00	9.89E-01	1.92E-06	4.74E-07
	heptachlor epoxide	1.50E-01	5.48E-02	7.19E-08	2.62E-08
	2,4-dichlorophenol	9.50E+00	2.14E+00	4.55E-06	1.02E-06
	arsenic	1.40E+01	6.24E+00	6.71E-06	2.99E-06
	barium	6.72E+02	2.11E+02	3.22E-04	1.01E-04
	chromium	3.49E+02	9.18E+01	1.67E-04	4.40E-05
	manganese	1.60E+02	6.60E+01	7.66E-05	3.16E-05
	vanadium	2.10E+01	1.40E+01	1.01E-05	6.71E-06
	zinc	2.53E+02	8.50E+01	1.21E-04	4.07E-05
Deer Meat Ingestion	chloroform	4.10E+00	1.12E+00	1.33E-11	3.64E-12
	trichloroethene	6.10E+02	1.24E+02	3.10E-09	6.29E-10
	tetrachloroethene	5.50E+00	1.22E+00	3.54E-11	7.84E-12
	chlorobenzene	6.40E+00	1.38E+00	1.75E-04	3.79E-05
	1,2,4-trichlorobenzene	1.70E+02	3.56E+01	4.65E-03	9.73E-04
	naphthalene	2.00E+02	4.03E+01	9.65E-06	1.94E-06
	phenanthrene	2.60E+01	5.73E+00	1.26E-06	2.76E-07
	fluoranthene	1.30E+01	3.43E+00	6.27E-07	1.65E-07
	bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.26E-03	5.64E-04
	4,4'-DDE	2.20E+02	8.94E+01	2.98E-06	1.21E-06
	acenaphthene	1.00E+01	2.36E+00	4.83E-07	1.14E-07
	fluorene	1.10E+01	2.44E+00	5.31E-07	1.18E-07
	benzo(a)pyrene equivalent	5.36E+00	2.00E+00	2.58E-07	9.65E-08
	anthracene	4.00E+00	9.89E-01	1.93E-07	4.77E-08
	heptachlor epoxide	1.50E-01	5.48E-02	1.07E-12	3.92E-13
	2,4-dichlorophenol	9.50E+00	2.14E+00	8.51E-11	1.91E-11
	arsenic	1.40E+01	6.24E+00	5.61E-07	2.50E-07
	barium	6.72E+02	2.11E+02	1.88E-10	5.90E-11
	chromium	3.49E+02	9.18E+01	8.88E-08	2.34E-08
	manganese	1.60E+02	6.60E+01	4.52E-11	1.86E-11
	vanadium	2.10E+01	1.40E+01	3.08E-11	2.05E-11
	zinc	2.53E+02	8.50E+01	6.86E-11	2.30E-11

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Deer Meat Intake
William Dick Lagoons
Adults

Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	BCF (µg/g)/(µg/g)	Cmax	Cave	BTF (µg/g)/(µg/g)	Meat MAXIMUM	Meat AVERAGE	Intake MAXIMUM	Intake AVERAGE
chloroform	4.10E+00	1.12E+00	2.81E+00	4.31E-02	1.18E-02	2.30E-06	9.92E-08	2.71E-08	6.09E-12	1.67E-12
trichloroethene	6.10E+02	1.24E+02	1.63E+00	3.82E+00	7.77E-01	6.03E-06	2.31E-05	4.69E-06	1.41E-09	2.88E-10
tetrachloroethene	5.50E+00	1.22E+00	1.22E+00	2.64E-02	5.84E-03	1.00E-05	2.64E-07	5.84E-08	1.62E-11	3.58E-12
chlorobenzene	6.40E+00	1.39E+00	6.18E+00	1.45E-01	3.14E-02	9.00E+00	1.30E+00	2.82E-01	8.01E-05	1.73E-05
1,2,4-trichlorobenzene	1.70E+02	3.56E+01	6.18E+00	3.85E+00	8.05E-01	9.00E+00	3.47E+01	7.25E+00	2.13E-03	4.45E-04
naphthalene	2.00E+02	4.03E+01	4.20E-01	3.82E-01	7.70E-02	1.88E-01	7.19E-02	1.45E-02	4.41E-06	8.89E-07
phenanthrene	2.60E+01	5.73E+00	4.20E-01	4.97E-02	1.10E-02	1.88E-01	9.35E-03	2.06E-03	5.74E-07	1.26E-07
fluoranthene	1.30E+01	3.43E+00	4.20E-01	2.49E-02	6.55E-03	1.88E-01	4.67E-03	1.23E-03	2.87E-07	7.56E-08
bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.08E-04	9.21E-02	4.12E-02	1.02E+02	9.39E+00	4.20E+00	5.76E-04	2.58E-04
4,4'-DDE	2.20E+02	8.94E+01	3.48E-03	9.08E-02	3.69E-02	2.45E-01	2.22E-02	9.03E-03	1.36E-06	5.54E-07
acenaphthene	1.00E+01	2.36E+00	4.20E-01	1.91E-02	4.51E-03	1.88E-01	3.59E-03	8.48E-04	2.21E-07	5.21E-08
fluorene	1.10E+01	2.44E+00	4.20E-01	2.10E-02	4.66E-03	1.88E-01	3.95E-03	8.76E-04	2.43E-07	5.37E-08
benzo(a)pyrene equivalent	5.35E+00	2.00E+00	4.20E-01	1.02E-02	3.82E-03	1.88E-01	1.92E-03	7.19E-04	1.18E-07	4.41E-08
anthracene	4.00E+00	9.89E-01	4.20E-01	7.65E-03	1.89E-03	1.88E-01	1.44E-03	3.56E-04	8.82E-08	2.18E-08
heptachlor epoxide	1.50E-01	5.48E-02	1.07E+00	6.35E-04	2.32E-04	1.26E-05	8.00E-09	2.92E-09	4.91E-13	1.79E-13
2,4-dichlorophenol	9.50E+00	2.14E+00	8.16E-01	3.17E-02	7.13E-03	2.00E-05	6.34E-07	1.43E-07	3.89E-11	8.75E-12
arsenic	1.40E+01	6.24E+00	1.56E+00	8.42E-02	3.75E-02	4.96E-02	4.18E-03	1.86E-03	2.56E-07	1.14E-07
barium	6.72E+02	2.11E+02	2.75E-01	9.34E-01	2.93E-01	1.50E-06	1.40E-06	4.40E-07	8.60E-11	2.70E-11
chromium	3.49E+02	9.18E+01	2.43E-01	4.45E-01	1.17E-01	1.49E-01	6.62E-02	1.74E-02	4.06E-06	1.07E-06
manganese	1.60E+02	6.60E+01	2.54E-01	2.10E-01	8.68E-02	1.60E-06	3.36E-07	1.39E-07	2.07E-11	8.52E-12
vanadium	2.10E+01	1.40E+01	1.00E-02	9.16E-03	6.10E-03	2.51E-05	2.30E-07	1.53E-07	1.41E-11	9.40E-12
zinc	2.53E+02	8.50E+01	4.49E-01	5.10E-01	1.71E-01	1.00E-06	5.10E-07	1.71E-07	3.13E-11	1.05E-11
2,3,7,8-TCDD equivalent	2.26E-05	1.30E-05	2.38E+00	2.03E-07	1.17E-07	2.48E+01	5.03E-06	2.89E-06	3.08E-10	1.77E-10

Appendix A
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Deer Meat Intake
William Dick Lagoons
Child 6-12

Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	BCF (µg/g)/(µg/g)	Cmax	Cave	BTF (µg/g)/(µg/g)	Meat MAXIMUM	Meat AVERAGE	Intake MAXIMUM	Intake AVERAGE
chloroform	4.10E+00	1.12E+00	2.81E+00	4.31E-02	1.18E-02	2.30E-06	9.92E-08	2.71E-08	1.47E-11	4.02E-12
trichloroethene	6.10E+02	1.24E+02	1.63E+00	3.82E+00	7.77E-01	6.03E-06	2.31E-05	4.69E-06	3.42E-09	6.94E-10
tetrachloroethene	5.50E+00	1.22E+00	1.22E+00	2.64E-02	5.84E-03	1.00E-05	2.64E-07	5.84E-08	3.90E-11	8.65E-12
chlorobenzene	6.40E+00	1.39E+00	6.18E+00	1.45E-01	3.14E-02	9.00E+00	1.30E+00	2.82E-01	1.93E-04	4.18E-05
1,2,4-trichlorobenzene	1.70E+02	3.56E+01	6.18E+00	3.85E+00	8.05E-01	9.00E+00	3.47E+01	7.25E+00	5.13E-03	1.07E-03
naphthalene	2.00E+02	4.03E+01	4.20E-01	3.82E-01	7.70E-02	1.88E-01	7.19E-02	1.45E-02	1.06E-05	2.14E-06
phenanthrene	2.60E+01	5.73E+00	4.20E-01	4.97E-02	1.10E-02	1.88E-01	9.35E-03	2.06E-03	1.38E-06	3.05E-07
fluoranthene	1.30E+01	3.43E+00	4.20E-01	2.49E-02	6.55E-03	1.88E-01	4.67E-03	1.23E-03	6.92E-07	1.82E-07
bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.08E-04	9.21E-02	4.12E-02	1.02E+02	9.39E+00	4.20E+00	1.39E-03	6.22E-04
4,4'-DDE	2.20E+02	8.94E+01	3.48E-03	9.08E-02	3.69E-02	2.45E-01	2.22E-02	9.03E-03	3.29E-06	1.34E-06
acenaphthene	1.00E+01	2.36E+00	4.20E-01	1.91E-02	4.51E-03	1.88E-01	3.59E-03	8.48E-04	5.32E-07	1.26E-07
fluorene	1.10E+01	2.44E+00	4.20E-01	2.10E-02	4.66E-03	1.88E-01	3.95E-03	8.76E-04	5.86E-07	1.30E-07
benzo(a)pyrene equivalent	5.35E+00	2.00E+00	4.20E-01	1.02E-02	3.82E-03	1.88E-01	1.92E-03	7.19E-04	2.85E-07	1.06E-07
anthracene	4.00E+00	9.89E-01	4.20E-01	7.65E-03	1.89E-03	1.88E-01	1.44E-03	3.56E-04	2.13E-07	5.27E-08
heptachlor epoxide	1.50E-01	5.48E-02	1.07E+00	6.35E-04	2.32E-04	1.26E-05	8.00E-09	2.92E-09	1.19E-12	4.33E-13
2,4-dichlorophenol	9.50E+00	2.14E+00	8.16E-01	3.17E-02	7.13E-03	2.00E-05	6.34E-07	1.43E-07	9.39E-11	2.11E-11
arsenic	1.40E+01	6.24E+00	1.56E+00	8.42E-02	3.75E-02	4.96E-02	4.18E-03	1.86E-03	6.19E-07	2.76E-07
barium	6.72E+02	2.11E+02	2.75E-01	9.34E-01	2.93E-01	1.50E-06	1.40E-06	4.40E-07	2.08E-10	6.51E-11
chromium	3.49E+02	9.18E+01	2.43E-01	4.45E-01	1.17E-01	1.49E-01	6.62E-02	1.74E-02	9.81E-06	2.58E-06
manganese	1.60E+02	6.60E+01	2.54E-01	2.10E-01	8.68E-02	1.60E-06	3.36E-07	1.39E-07	4.98E-11	2.06E-11
vanadium	2.10E+01	1.40E+01	1.00E-02	9.16E-03	6.10E-03	2.51E-05	2.30E-07	1.53E-07	3.40E-11	2.27E-11
zinc	2.53E+02	8.50E+01	4.49E-01	5.10E-01	1.71E-01	1.00E-06	5.10E-07	1.71E-07	7.56E-11	2.54E-11
2,3,7,8-TCDD equivalent	2.28E-05	1.30E-05	2.38E+00	2.03E-07	1.17E-07	2.48E+01	5.03E-06	2.89E-06	7.45E-10	4.28E-10

Deer Meat Intake
William Dick Lagoons
Child 2-6

Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	BSF (µg/g)/(µg/g)	Cmax	Cave	BTF (µg/g)/(µg/g)	Meat MAXIMUM	Meat AVERAGE	Intake MAXIMUM	Intake AVERAGE
chloroform	4.10E+00	1.12E+00	2.81E+00	4.31E-02	1.18E-02	2.30E-06	9.92E-08	2.71E-08	1.33E-11	3.64E-12
trichloroethene	6.10E+02	1.24E+02	1.63E+00	3.82E+00	7.77E-01	6.03E-06	2.31E-05	4.69E-06	3.10E-09	6.29E-10
tetrachloroethene	5.50E+00	1.22E+00	1.22E+00	2.64E-02	5.84E-03	1.00E-05	2.64E-07	5.84E-08	3.54E-11	7.84E-12
chlorobenzene	6.40E+00	1.39E+00	6.18E+00	1.45E-01	3.14E-02	9.00E+00	1.30E+00	2.82E-01	1.75E-04	3.79E-05
1,2,4-trichlorobenzene	1.70E+02	3.56E+01	6.18E+00	3.85E+00	8.05E-01	9.00E+00	3.47E+01	7.25E+00	4.65E-03	9.73E-04
naphthalene	2.00E+02	4.03E+01	4.20E-01	3.82E-01	7.70E-02	1.88E-01	7.19E-02	1.45E-02	9.65E-06	1.94E-06
phenanthrene	2.60E+01	5.73E+00	4.20E-01	4.97E-02	1.10E-02	1.88E-01	9.35E-03	2.06E-03	1.25E-06	2.76E-07
fluoranthene	1.30E+01	3.43E+00	4.20E-01	2.49E-02	6.55E-03	1.88E-01	4.67E-03	1.23E-03	6.27E-07	1.65E-07
bis(2-ethylhexyl)phthalate	2.30E+02	1.03E+02	1.08E-04	9.21E-02	4.12E-02	1.02E+02	9.39E+00	4.20E+00	1.26E-03	5.64E-04
4,4'-DDE	2.20E+02	8.94E+01	3.48E-03	9.08E-02	3.69E-02	2.45E-01	2.22E-02	9.03E-03	2.99E-06	1.21E-06
acenaphthene	1.00E+01	2.36E+00	4.20E-01	1.91E-02	4.51E-03	1.88E-01	3.59E-03	8.48E-04	4.83E-07	1.14E-07
fluorene	1.10E+01	2.44E+00	4.20E-01	2.10E-02	4.66E-03	1.88E-01	3.95E-03	8.76E-04	5.31E-07	1.18E-07
benzo(a)pyrene equivalent	5.35E+00	2.00E+00	4.20E-01	1.02E-02	3.82E-03	1.88E-01	1.92E-03	7.19E-04	2.58E-07	9.65E-08
anthracene	4.00E+00	9.89E-01	4.20E-01	7.65E-03	1.89E-03	1.88E-01	1.44E-03	3.56E-04	1.93E-07	4.77E-08
heptachlor epoxide	1.50E-01	5.48E-02	1.07E+00	6.35E-04	2.32E-04	1.26E-05	8.00E-09	2.92E-09	1.07E-12	3.92E-13
2,4-dichlorophenol	9.50E+00	2.14E+00	8.16E-01	3.17E-02	7.13E-03	2.00E-05	6.34E-07	1.43E-07	8.51E-11	1.91E-11
arsenic	1.40E+01	6.24E+00	1.56E+00	8.42E-02	3.75E-02	4.96E-02	4.18E-03	1.86E-03	5.61E-07	2.50E-07
barium	6.72E+02	2.11E+02	2.75E-01	9.34E-01	2.93E-01	1.50E-06	1.40E-06	4.40E-07	1.88E-10	5.90E-11
chromium	3.49E+02	9.18E+01	2.43E-01	4.45E-01	1.17E-01	1.49E-01	6.62E-02	1.74E-02	8.89E-06	2.34E-06
manganese	1.60E+02	6.60E+01	2.54E-01	2.10E-01	8.68E-02	1.60E-06	3.36E-07	1.39E-07	4.52E-11	1.86E-11
vanadium	2.10E+01	1.40E+01	1.00E-02	9.16E-03	6.10E-03	2.51E-05	2.30E-07	1.53E-07	3.09E-11	2.06E-11
zinc	2.53E+02	8.50E+01	4.49E-01	5.10E-01	1.71E-01	1.00E-06	5.10E-07	1.71E-07	6.85E-11	2.30E-11
2,3,7,8-TCDD equivalent	2.26E-05	1.30E-05	2.38E+00	2.03E-07	1.17E-07	2.48E+01	5.03E-06	2.89E-06	6.75E-10	3.88E-10

Exposure Point Concentrations and Calculated Intakes For On-Site Ground Water
William Dick Lagoons
Adults

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	chloroform	5.60E-01	4.07E-02	2.41E-05	1.75E-06
	1,2-dichloroethane	1.20E-01	1.45E-02	5.16E-06	6.24E-07
	trichloroethene	1.60E+01	1.25E+00	6.88E-04	5.38E-05
	benzene	1.80E-01	1.65E-02	7.74E-06	7.10E-07
	tetrachloroethene	3.20E-01	2.24E-02	1.38E-05	9.61E-07
	bis(2-chloroethyl)ether	2.70E-02	6.83E-03	1.16E-06	2.94E-07
	barium	8.37E-02	2.68E-02	3.60E-06	1.15E-06
	beryllium	1.60E-03	6.77E-04	6.88E-08	2.91E-08
	manganese	8.63E-01	2.13E-01	3.71E-05	9.16E-06
	bis(2-ethylhexyl)phthalate	1.70E-01	1.97E-02	7.31E-06	8.47E-07
	phenol	1.40E+01	9.28E-01	6.02E-04	3.99E-05
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	9.03E-06	1.17E-06
	chlorobenzene	3.20E-02	5.65E-03	1.38E-06	2.43E-07
	4-methylphenol (p-cresol)	5.60E-01	4.00E-02	2.41E-05	1.72E-06
	2,4-dichlorophenol	4.60E-02	7.00E-03	1.98E-06	3.01E-07
Ingestion	chloroform	5.60E-01	4.07E-02	1.20E-02	8.71E-04
	1,2-dichloroethane	1.20E-01	1.45E-02	2.57E-03	3.10E-04
	trichloroethene	1.60E+01	1.25E+00	3.42E-01	2.68E-02
	benzene	1.80E-01	1.65E-02	3.85E-03	3.53E-04
	tetrachloroethene	3.20E-01	2.24E-02	6.85E-03	4.78E-04
	bis(2-chloroethyl)ether	2.70E-02	6.83E-03	5.78E-04	1.46E-04
	barium	8.37E-02	2.68E-02	1.79E-03	5.74E-04
	beryllium	1.60E-03	6.77E-04	3.42E-05	1.45E-05
	manganese	8.63E-01	2.13E-01	1.85E-02	4.56E-03
	bis(2-ethylhexyl)phthalate	1.70E-01	1.97E-02	3.64E-03	4.22E-04
	phenol	1.40E+01	9.28E-01	3.00E-01	1.99E-02
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	4.49E-03	5.83E-04
	chlorobenzene	3.20E-02	5.65E-03	6.85E-04	1.21E-04
	4-methylphenol (p-cresol)	5.60E-01	4.00E-02	1.20E-02	8.56E-04
	2,4-dichlorophenol	4.60E-02	7.00E-03	9.84E-04	1.50E-04
Inhalation during Showering	chloroform	5.60E-01	4.07E-02	1.20E-02	8.71E-04
	1,2-dichloroethane	1.20E-01	1.45E-02	2.57E-03	3.10E-04
	trichloroethene	1.60E+01	1.25E+00	3.42E-01	2.68E-02
	benzene	1.80E-01	1.65E-02	3.85E-03	3.53E-04
	tetrachloroethene	3.20E-01	2.24E-02	6.85E-03	4.78E-04
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	4.49E-03	5.83E-04
	chlorobenzene	3.20E-02	5.65E-03	6.85E-04	1.21E-04

Exposure Point Concentrations and Calculated Intakes For On-Site Ground Water
William Dick Lagoons
Child 6-12

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	chloroform	5.60E-01	4.07E-02	3.34E-05	2.43E 06
	1,2-dichloroethane	1.20E-01	1.45E-02	7.15E 06	8.64E 07
	trichloroethene	1.60E+01	1.25E+00	9.54E-04	7.46E 05
	benzene	1.80E-01	1.65E-02	1.07E 05	9.83E 07
	tetrachloroethene	3.20E-01	2.24E-02	1.91E-05	1.33E 06
	bis(2-chloroethyl)ether	2.70E-02	6.83E-03	1.61E 06	4.07E 07
	barium	8.37E-02	2.68E-02	4.99E 06	1.60E-06
	beryllium	1.60E-03	6.77E-04	9.54E-08	4.03E-08
	manganese	8.63E-01	2.13E-01	5.14E-05	1.27E-05
	bis(2-ethylhexyl)phthalate	1.70E-01	1.97E-02	1.01E-05	1.17E-06
	phenol	1.40E+01	9.28E-01	8.34E 04	5.53E-05
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	1.25E-05	1.62E 06
	chlorobenzene	3.20E-02	5.65E-03	1.91E-06	3.37E-07
	4-methylphenol (p-cresol)	5.60E-01	4.00E-02	3.34E-05	2.38E 06
	2,4-dichlorophenol	4.60E-02	7.00E-03	2.74E-06	4.17E-07
Ingestion	chloroform	5.60E-01	4.07E-02	2.91E-02	2.12E-03
	1,2-dichloroethane	1.20E-01	1.45E-02	6.24E-03	7.54E-04
	trichloroethene	1.60E+01	1.25E+00	8.32E-01	6.51E-02
	benzene	1.80E-01	1.65E-02	9.36E-03	8.58E-04
	tetrachloroethene	3.20E-01	2.24E-02	1.66E-02	1.16E-03
	bis(2-chloroethyl)ether	2.70E-02	6.83E-03	1.40E-03	3.55E-04
	barium	8.37E-02	2.68E-02	4.35E-03	1.39E-03
	beryllium	1.60E-03	6.77E-04	8.32E-05	3.52E-05
	manganese	8.63E-01	2.13E-01	4.49E-02	1.11E-02
	bis(2-ethylhexyl)phthalate	1.70E-01	1.97E-02	8.84E-03	1.02E-03
	phenol	1.40E+01	9.28E-01	7.28E-01	4.83E-02
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	1.09E-02	1.42E-03
	chlorobenzene	3.20E-02	5.65E-03	1.66E-03	2.94E-04
	4-methylphenol (p-cresol)	5.60E-01	4.00E-02	2.91E-02	2.08E-03
	2,4-dichlorophenol	4.60E-02	7.00E-03	2.39E-03	3.64E-04
Inhalation during Showering	chloroform	5.60E-01	4.07E-02	2.91E-02	2.12E-03
	1,2-dichloroethane	1.20E 01	1.45E-02	6.24E 03	7.54E-04
	trichloroethene	1.60E+01	1.25E+00	8.32E 01	6.51E 02
	benzene	1.80E-01	1.65E-02	9.36E-03	8.58E 04
	tetrachloroethene	3.20E 01	2.24E 02	1.66E 02	1.16E 03
	1,2-dichloroethene (total)	2.10E 01	2.72E 02	1.09E 02	1.42E 03
	chlorobenzene	3.20E 02	5.65E-03	1.66E 03	2.94E 04

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Exposure Point Concentrations and Calculated Intakes For On-Site Ground Water
William Dick Lagoons
Child 2-6

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Dermal Contact	chloroform	5.60E-01	4.07E-02	4.03E-05	2.93E-06
	1,2-dichloroethane	1.20E-01	1.45E-02	8.64E-06	1.04E-06
	trichloroethene	1.60E+01	1.25E+00	1.15E-03	9.01E-05
	benzene	1.80E-01	1.65E-02	1.30E-05	1.19E 06
	tetrachloroethene	3.20E-01	2.24E-02	2.30E-05	1.61E-06
	bis(2-chloroethyl)ether	2.70E-02	6.83E-03	1.94E-06	4.92E 07
	barium	8.37E-02	2.68E-02	6.03E-06	1.93E 06
	beryllium	1.60E-03	6.77E-04	1.15E-07	4.87E-08
	manganese	8.63E-01	2.13E-01	6.21E 05	1.53E 05
	bis(2-ethylhexyl)phthalate	1.70E-01	1.97E-02	1.22E-05	1.42E-06
	phenol	1.40E+01	9.28E-01	1.01E 03	6.68E-05
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	1.51E-05	1.96E-06
	chlorobenzene	3.20E-02	5.65E-03	2.30E-06	4.07E 07
	4-methylphenol (p-cresol)	5.60E-01	4.00E-02	4.03E-05	2.88E 06
	2,4-dichlorophenol	4.60E-02	7.00E-03	3.31E-06	5.04E-07
Ingestion	chloroform	5.60E-01	4.07E-02	5.26E-02	3.83E-03
	1,2-dichloroethane	1.20E-01	1.45E-02	1.13E-02	1.36E-03
	trichloroethene	1.60E+01	1.25E+00	1.50E+00	1.18E-01
	benzene	1.80E-01	1.65E-02	1.69E-02	1.55E 03
	tetrachloroethene	3.20E-01	2.24E-02	3.01E-02	2.10E-03
	bis(2-chloroethyl)ether	2.70E-02	6.83E-03	2.54E-03	6.42E-04
	barium	8.37E-02	2.68E-02	7.87E-03	2.52E-03
	beryllium	1.60E-03	6.77E-04	1.50E-04	6.36E-05
	manganese	8.63E-01	2.13E-01	8.11E-02	2.00E-02
	bis(2-ethylhexyl)phthalate	1.70E-01	1.97E-02	1.60E-02	1.85E-03
	phenol	1.40E+01	9.28E-01	1.32E+00	8.72E-02
	1,2-dichloroethene (total)	2.10E-01	2.72E-02	1.97E-02	2.56E-03
	chlorobenzene	3.20E-02	5.65E-03	3.01E-03	5.31E-04
	4-methylphenol (p-cresol)	5.60E-01	4.00E-02	5.26E-02	3.76E-03
	2,4-dichlorophenol	4.60E-02	7.00E-03	4.32E-03	6.58E-04
Inhalation during Showering	chloroform	5.60E-01	4.07E-02	5.26E 02	3.83E-03
	1,2-dichloroethane	1.20E-01	1.45E-02	1.13E-02	1.36E-03
	trichloroethene	1.60E+01	1.25E+00	1.50E+00	1.18E 01
	benzene	1.80E 01	1.65E-02	1.69E 02	1.55E 03
	tetrachloroethene	3.20E 01	2.24E 02	3.01E 02	2.10E 03
	1,2-dichloroethene (total)	2.10E-01	2.72E 02	1.97E 02	2.56E 03
	chlorobenzene	3.20E-02	5.65E 03	3.01E 03	5.31E 04

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Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Air
William Dick Lagoons
Adults (Maximum Exposed Individual)

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intake (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Volatilization	1,2-dichloroethane	6.67E-08	6.67E-08	1.91E-08	1.91E-09
	chloroform	3.12E-12	3.12E-12	8.91E-13	8.91E-13
	1,2-dichloroethene	2.40E-08	2.40E-08	6.86E-09	6.86E-09
	2-butanone	1.02E-06	1.02E-06	2.91E-07	2.91E-07
	trichloroethene	1.33E-04	1.33E-04	3.80E-05	3.80E-05
	benzene	8.42E-09	8.42E-09	2.41E-09	2.41E-09
	tetrachloroethene	1.69E-07	1.69E-07	4.83E-08	4.83E-08
	toluene	3.58E-08	3.58E-08	1.02E-08	1.02E-08
	chlorobenzene	8.09E-08	8.09E-08	2.31E-08	2.31E-08
	ethylbenzene	2.93E-07	2.93E-07	8.37E-08	8.37E-08
	styrene	4.58E-07	4.58E-07	1.31E-07	1.31E-07
	total xylenes	6.93E-05	6.93E-05	1.98E-09	1.98E-08
Inhalation of Fugitive Dust	chloroform	1.48E-08	4.04E-09	4.23E-09	1.15E-09
	trichloroethene	2.20E-06	4.47E-07	6.29E-07	1.28E-07
	tetrachloroethene	1.98E-08	4.40E-09	5.66E-09	1.26E-09
	chlorobenzene	2.31E-08	5.01E-09	6.60E-09	1.43E-09
	1,2,4-trichlorobenzene	6.13E-07	1.28E-07	1.75E-07	3.66E-08
	naphthalene	7.31E-07	1.45E-07	2.09E-07	4.14E-08
	phenanthrene	9.37E-08	2.07E-08	2.68E-08	5.91E-09
	fluoranthene	4.69E-08	1.24E-08	1.34E-08	3.54E-09
	bis(2-ethylhexyl)phthalate	8.29E-07	3.71E-07	2.37E-07	1.06E-07
	4,4'-DDE	7.93E-07	3.22E-07	2.27E-07	9.20E-08
	acenaphthene	3.60E-08	8.51E-09	1.03E-08	2.43E-09
	fluorene	3.96E-08	8.79E-09	1.13E-08	2.51E-09
	benzo(a)pyrene equivalent	1.93E-08	7.21E-09	5.51E-09	2.06E-09
	anthracene	1.44E-08	3.56E-09	4.11E-09	1.02E-09
	heptachlor epoxide	5.41E-10	1.97E-10	1.58E-10	5.63E-11
	2,4-dichlorophenol	3.42E-08	7.71E-09	9.77E-09	2.20E-09
	arsenic	5.05E-08	2.25E-08	1.44E-08	6.43E-09
	barium	2.42E-06	7.60E-07	6.91E-07	2.17E-07
	chromium	1.26E-06	3.31E-07	3.60E-07	9.46E-08
	manganese	5.77E-10	2.38E-07	1.65E-10	6.80E-08
	vanadium	7.57E-08	5.05E-08	2.16E-08	1.44E-08
	zinc	9.12E-07	3.08E-07	2.61E-07	8.74E-08

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Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Air
William Dick Lagoons
Child 2-6 (Maximum Exposed Individual)

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Volatilization	1,2-dichloroethene	6.67E-08	6.67E-08	2.50E-08	2.50E-08
	chloroform	3.12E-12	3.12E-12	1.17E-12	1.17E-12
	1,2-dichloroethane	2.40E-08	2.40E-08	9.00E-09	9.00E-09
	2-butanone	1.02E-06	1.02E-06	3.83E-07	3.83E-07
	trichloroethene	1.33E-04	1.33E-04	4.99E-05	4.99E-05
	benzene	8.42E-09	8.42E-09	3.16E-09	3.16E-09
	tetrachloroethene	1.69E-07	1.69E-07	6.34E-08	6.34E-08
	toluene	3.58E-06	3.58E-06	1.34E-06	1.34E-06
	chlorobenzene	8.08E-09	8.08E-09	3.03E-09	3.03E-09
	ethylbenzene	2.93E-07	2.93E-07	1.10E-07	1.10E-07
	styrene	4.58E-07	4.58E-07	1.72E-07	1.72E-07
	total xylenes	6.93E-06	6.93E-06	2.60E-06	2.60E-06
Inhalation of Fugitive Dust	chloroform	1.48E-08	4.04E-09	5.55E-09	1.52E-09
	trichloroethene	2.20E-06	4.47E-07	8.25E-07	1.68E-07
	tetrachloroethene	1.98E-08	4.40E-09	7.43E-09	1.65E-09
	chlorobenzene	2.31E-08	5.01E-09	8.66E-09	1.88E-09
	1,2,4-trichlorobenzene	6.13E-07	1.28E-07	2.30E-07	4.80E-08
	naphthalene	7.21E-07	1.45E-07	2.70E-07	5.44E-08
	phenanthrene	9.37E-08	2.07E-08	3.51E-08	7.76E-09
	fluoranthene	4.69E-08	1.24E-08	1.76E-08	4.65E-09
	bis(2-ethylhexyl)phthalate	8.29E-07	3.71E-07	3.11E-07	1.39E-07
	4,4'-DDE	7.93E-07	3.22E-07	2.97E-07	1.21E-07
	acenaphthene	3.60E-08	8.51E-09	1.35E-08	3.19E-09
	fluorene	3.96E-08	8.79E-09	1.49E-08	3.30E-09
	benzo(a)pyrene equivalent	1.93E-08	7.21E-09	7.24E-09	2.70E-09
	anthracene	1.44E-08	3.56E-09	5.40E-09	1.34E-09
	heptachlor epoxide	5.41E-10	1.97E-10	2.03E-10	7.39E-11
	2,4-dichlorophenol	3.42E-08	7.71E-09	1.28E-08	2.89E-09
	arsenic	5.05E-08	2.25E-08	1.89E-08	8.44E-09
	barium	2.42E-06	7.60E-07	9.08E-07	2.85E-07
	chromium	1.26E-06	3.31E-07	4.73E-07	1.24E-07
	manganese	5.77E-10	2.38E-07	2.16E-10	8.93E-08
	vanadium	7.57E-08	5.05E-09	2.84E-08	1.89E-09
	zinc	9.12E-07	3.06E-07	3.42E-07	1.15E-07

Potential Exposures for Existing Conditions
Exposure Point Concentrations and Calculated Intakes For Air
William Dick Lagoons
Child 6-12 (Maximum Exposed Individual)

Route of Exposure	Chemical of Concern	Maximum Concentration (ppm)	Average Concentration (ppm)	Maximum Chronic Daily Intakes (mg/kg/day)	Most Probable Daily Intake (mg/kg/day)
Volatilization	1,2-dichloroethene	6.67E-08	6.67E-08	2.54E-08	2.54E-08
	chloroform	3.12E-12	3.12E-12	1.19E-12	1.19E-12
	1,2-dichloroethane	2.40E-08	2.40E-08	9.14E-09	9.14E-09
	2-butanone	1.02E-06	1.02E-06	3.88E-07	3.88E-07
	trichloroethene	1.33E-04	1.33E-04	5.06E-05	5.06E-05
	benzene	8.42E-09	8.42E-09	3.21E-09	3.21E-09
	tetrachloroethene	1.69E-07	1.69E-07	6.43E-08	6.43E-08
	toluene	3.58E-08	3.58E-08	1.36E-08	1.36E-08
	chlorobenzene	8.08E-08	8.08E-08	3.08E-08	3.08E-08
	ethylbenzene	2.93E-07	2.93E-07	1.12E-07	1.12E-07
	styrene	4.58E-07	4.58E-07	1.74E-07	1.74E-07
	total xylenes	6.93E-05	6.93E-05	2.64E-05	2.64E-05
Inhalation of Fugative Dust	chloroform	1.48E-08	4.04E-09	5.63E-09	1.54E-09
	trichloroethene	2.20E-06	4.47E-07	8.38E-07	1.70E-07
	tetrachloroethene	1.98E-08	4.40E-09	7.54E-09	1.68E-09
	chlorobenzene	2.31E-08	5.01E-09	8.79E-09	1.91E-09
	1,2,4-trichlorobenzene	6.13E-07	1.28E-07	2.33E-07	4.87E-08
	naphthalene	7.21E-07	1.45E-07	2.74E-07	5.52E-08
	phenanthrene	9.37E-08	2.07E-08	3.57E-08	7.88E-09
	fluoranthene	4.69E-08	1.24E-08	1.79E-08	4.72E-09
	bis(2-ethylhexyl)phthalate	8.29E-07	3.71E-07	3.16E-07	1.41E-07
	4,4'-DDE	7.93E-07	3.22E-07	3.02E-07	1.23E-07
	acenaphthene	3.60E-08	8.51E-09	1.37E-08	3.24E-09
	fluorene	3.96E-08	8.79E-09	1.51E-08	3.35E-09
	benzo(a)pyrene equivalent	1.93E-08	7.21E-09	7.35E-09	2.74E-09
	anthracene	1.44E-08	3.56E-09	5.48E-09	1.36E-09
	heptachlor epoxide	5.41E-10	1.97E-10	2.06E-10	7.50E-11
	2,4-dichlorophenol	3.42E-08	7.71E-09	1.30E-08	2.94E-09
	arsenic	5.06E-08	2.25E-08	1.92E-08	8.57E-09
	barium	2.42E-06	7.60E-07	9.21E-07	2.89E-07
	chromium	1.26E-06	3.31E-07	4.80E-07	1.26E-07
	manganese	5.77E-10	2.38E-07	2.20E-10	9.06E-08
	vanadium	7.57E-08	5.05E-08	2.88E-08	1.92E-08
	zinc	9.12E-07	3.06E-07	3.47E-07	1.16E-07

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region III
841 Chestnut Building
Philadelphia, PA 19107

SUBJECT: Drinking Water Comparison
William Dick Lagoons

Date: July 24, 1990

From: Dawn A. Ioven, Toxicologist
Technical Support Section (3HW15)

To: Jack Kelly, RPM
SE PA Remedial Section (3HW21)

Background

To aid in the determination of an appropriate remedy at the William Dick Lagoons site, viable drinking water alternatives for area residents were evaluated for potential toxicological impacts. That is, the health risks posed by the various potable supply options were assessed and compared. The potable water alternatives examined include:

1. untreated ground water, which is contaminated with site-related volatile organic compounds (VOCs),

2. the municipal water supply, which contains trihalomethane by-products as a result of the mandatory disinfection process, and

3. ground water, which contains elevated levels of naturally occurring radionuclides. (It should be noted that treatment of VOC-contaminated ground water by granulated activated carbon units at the wellhead is not expected to significantly reduce the levels of radioisotopes at the tap.)

Assumptions

In performing the risk calculations for each of the foregoing exposure scenarios, several assumptions were made:

1. For each contaminant, both an average and a maximum (worst-case) concentration was used.

a. For residential wells, VOC levels were calculated based upon raw water sampling results obtained from 9/87 through 9/89. Non-detects and detectable quantities qualified with a "B" code (indicating blank contamination) were excluded from concentration computations.

b. With regard to the municipal water supply, only results generated by Cedar Grove Environmental Analytical Labs (2/89 through 4/90) were assessed. Results produced by PA DER for the City of Coatesville Authority were discarded, since the units of concentration in these data summary tables were unclear.

c. For the determination of radionuclide levels, all USGS sampling data (6/88, 8/88, unknown dates) and ERM sampling data (1/88, 2/88) were utilized, irrespective of whether samples were collected pre-, mid- or post-treatment.

2. Risk calculations for each contaminant were conducted for adults weighing 70 kg, who ingest 2 liters of contaminated water each day for 70 years.

3. Following the completion of each chemical-specific risk calculation, the *total* risk for each exposure scenario (untreated ground water, municipal water, and ground water containing radionuclides) was estimated. This method of quantitative risk assessment assumes that similar risks (carcinogenic vs. noncarcinogenic) are additive.

Comparative Risk

As indicated on the attached worksheet, the total carcinogenic risks associated with consumption of untreated ground water (average = 3.79E-05, or 1 additional cancer per 26,400 exposed individuals; worst-case = 1.46E-04, or 1 additional cancer per 6,800 exposed individuals) and municipal water (average = 4.78E-05, or 1 additional cancer per 20,900 exposed individuals; worst-case = 5.99E-05, or 1 additional cancer per 16,700 exposed individuals) are virtually identical. It should be noted, however, that an additional risk of similar magnitude may be elicited by exposure to VOCs via the inhalation pathway. Exposure through this route during typical household water usage (showering, laundering, etc.) may serve to double the risk posed by consumption alone.

Clearly, the most significant risk of the three exposure scenarios is contributed by ground water containing naturally occurring radionuclides (radium, radon, and uranium). Radium, radon and uranium are classified as Group A - Human Carcinogens by the EPA.[1] The primary route of exposure to radium and uranium in drinking water is via ingestion, while radon, being a vapor, generally follows an inhalation pathway.

Based upon carcinogenicity information provided in the September 30, 1986 issue of the Federal Register for radium-226 and natural uranium, lifetime oncogenic risks in the 10^{-6} (1/1,000,000) range are incurred at respective levels of 0.1 and 0.7 pCi/l in drinking water. Therefore, given the reported levels of radium and uranium in sampled ground water, the elevated *individual* cancer risks related to ingestion of ground water are 1.47E-04 (average) and 3.86E-04 (worst-case) for radium and 5.24E-06 (average) and 1.43E-05 (worst-case) for uranium.

The carcinogenic risk associated with exposure to radon in ground water was calculated by a different method than that used to assess radium- and uranium-related risks. A relationship exists between the concentration of radon in water and the concentration of radon in the atmosphere. It is generally assumed that for every 10000 pCi of radon per liter of water, 1 pCi of radon diffuses into 1 liter of air (Telecon with Bill Belanger). Consequently, since 2220 pCi/l (average) and 9200 pCi/l (worst-case) of radon were reported in sampled homewells, it is estimated that 0.222 pCi/l and 0.920 pCi/l, respectively, of this radionuclide are present in household air. Further, since 0.0004 pCi/l of radon in air is estimated to elicit a 10^{-6} cancer risk (Telecon with Bill Belanger), the elevated *individual* carcinogenic risks associated with 0.222 and 0.920 pCi of radon are 5.55E-04 and 2.30E-03, respectively.

The *combined* carcinogenic risk from exposure to radionuclides in ground water is **7.07E-04** (average), or 1 additional cancer per 1,400 exposed persons, and **2.7E-03** (worst-case), or 1 additional cancer per 370 exposed individuals. While these carcinogenic risks are greater than those usually considered "acceptable" at Superfund hazardous waste sites, it must be stressed that the reported radionuclides are *naturally occurring* and that similar risk levels are not uncommon in other geographic areas containing radionuclides in ground water.

With regard to noncarcinogenic risks, none of the foregoing exposure scenarios (untreated ground water, municipal water, and ground water containing radionuclides) appears to represent a health threat. (Please refer to attached worksheet.)

References

1. Federal Register, Part VI. 40 CFR Part 141, Tuesday, September 30,1986.

GENERAL EXPOSURE ASSUMPTIONS

Adult mass (kg):	70.00 AD_MASS	Water Consumed (l/d):	2.00 DRINK
Length of Lifetime (years):	70.00 LIFE		
Length of adult's exposure (years):	70.00 YRS_EXP_AD		

Pollutant	DOSE-RESPONSE INFORMATION: Oral RfD: (mg/kg/d)	Inhaled RfD: (mg/kg/d)	Oral Potency Factor: (1/(mg/kg/d))	Inhaled Potency Factor: (1/(mg/kg/d))	DRINKING WATER Ambient Conc. (ug/l)	(Cancer) Lifetime Intake mg/kg/d	(Non-cancer) Chronic Intake mg/kg/d	Upper Bound Lifetime Cancer Risk	Hazard Index (Intake/RfD)
1,1-Dichloroethylene	9.00E-03		6.00E-01	1.20E+00	1.09E+00	3.10E-05	3.10E-05	1.86E-05	3.44E-03
1,2-Dichloroethylene (tran	2.00E-02				1.55E+00	4.43E-05	4.43E-05	0.00E+00	2.21E-03
1,1-Dichloroethane	1.00E-01	1.00E-01	9.10E-02		8.07E-01	2.31E-05	2.31E-05	2.10E-06	2.31E-04
1,2-Dichloroethane			9.10E-02	9.10E-02	9.80E-01	2.80E-05	2.80E-05	2.55E-06	0.00E+00
Chloroform	1.00E-02		6.10E-03	8.10E-02	9.20E-01	2.63E-05	2.63E-05	1.60E-07	2.63E-03
1,1,2-Trichloroethane	4.00E-03	6.30E+00	5.70E-02	5.70E-02	2.90E-01	8.29E-06	8.29E-06	4.72E-07	2.07E-03
1,1,1-Trichloroethane	9.00E-02				1.65E+00	4.71E-05	4.71E-05	0.00E+00	5.24E-04
Bromodichloromethane	2.00E-02		1.30E-01		5.50E-01	1.57E-05	1.57E-05	2.04E-06	7.86E-04
1,3-Dichloropropene	3.00E-04		1.80E-01		6.60E-01	1.89E-05	1.89E-05	3.39E-06	6.29E-02
Trichloroethylene (TCE)			1.10E-02	1.70E-02	1.56E+01	4.44E-04	4.44E-04	4.89E-06	0.00E+00
Tetrachloroethylene (PCE)	1.00E-02		5.10E-02	3.30E-03	1.50E+00	4.28E-05	4.28E-05	2.18E-06	4.28E-03
Toluene	3.00E-01	1.50E+00			1.26E+00	3.60E-05	3.60E-05	0.00E+00	1.20E-04
Chlorobenzene	2.00E-02	5.70E-03			4.16E+00	1.19E-04	1.19E-04	0.00E+00	5.94E-03
1,4-Dichlorobenzene			2.40E-02		1.47E+00	4.20E-05	4.20E-05	1.01E-06	0.00E+00
1,3-Dichlorobenzene	8.90E-02				4.43E-01	1.27E-05	1.27E-05	0.00E+00	1.42E-04
1,2-Dichlorobenzene	9.00E-02				1.00E+00	2.86E-05	2.86E-05	0.00E+00	3.17E-04
Xylene (mixed)	2.00E+00	4.00E-01			1.06E+00	3.03E-05	3.03E-05	0.00E+00	1.51E-05
Styrene	2.00E-01		3.00E-02		6.23E-01	1.78E-05	1.78E-05	5.34E-07	8.90E-05
							TOTAL:	3.79E-05	8.57E-02
Chloroform	1.00E-02		6.10E-03	8.10E-02	4.71E+01	1.35E-03	1.35E-03	8.20E-06	1.35E-01
Bromodichloromethane	2.00E-02		1.30E-01		9.86E+00	2.82E-04	2.82E-04	3.66E-05	1.41E-02
Chlorodibromomethane	2.00E-02		8.40E-02		1.23E+00	3.51E-05	3.51E-05	2.95E-06	1.76E-03
							TOTAL:	4.78E-05	1.50E-01
Radium 226, 228					1.47E+01	NA	NA	1.47E-04	NA
Radon 222					2.22E+03	NA	NA	5.55E-04	NA
Uranium (soluble salts)	3.00E-03				3.67E+00	1.05E-04	1.05E-04	5.24E-06	3.50E-02
							TOTAL:	7.07E-04	3.50E-02

Ambient concentrations represent average values.
Please note that the ambient concentrations for radium and radon are reported in units of pCi/l.
NA = not applicable. Please refer to the attached memo for risk estimates.

GENERAL EXPOSURE ASSUMPTIONS

Adult mass (kg):	70.00 AD_MASS	Water Consumed (l/d):	2.00 DRINK
Length of Lifetime (years):	70.00 LIFE		
Length of adult's exposure (years):	70.00 YRS_EXP_AD		

Pollutant	DOSE-RESPONSE INFORMATION: Oral RfD: (mg/kg/d)	Inhaled RfD: (mg/kg/d)	Oral Potency Factor: (1/(mg/kg/d))	Inhaled Potency Factor: (1/(mg/kg/d))	DRINKING WATER Ambient Conc. (ug/l)	(Cancer) Lifetime Intake mg/kg/d	(Non-cancer) Chronic Intake mg/kg/d	Upper Bound Lifetime Cancer Risk	Hazard Index (Intake/RfD)
1,1-Dichloroethylene	9.00E-03		6.00E-01	1.20E+00	1.80E+00	5.14E-05	5.14E-05	3.09E-05	5.71E-03
1,2-Dichloroethylene (tran	2.00E-02				2.70E+00	7.71E-05	7.71E-05	0.00E+00	3.86E-03
1,1-Dichloroethane	1.00E-01	1.00E-01	9.10E-02		1.20E+00	3.43E-05	3.43E-05	3.12E-06	3.43E-04
1,2-Dichloroethane			9.10E-02	9.10E-02	2.00E+00	5.71E-05	5.71E-05	5.20E-06	0.00E+00
Chloroform	1.00E-02		6.10E-03	8.10E-02	3.70E+00	1.06E-04	1.06E-04	6.45E-07	1.06E-02
1,1,2-Trichloroethane	4.00E-03	6.30E+00	5.70E-02	5.70E-02	3.30E-01	9.43E-06	9.43E-06	5.37E-07	2.36E-03
1,1,1-Trichloroethane	9.00E-02				7.00E+00	2.00E-04	2.00E-04	0.00E+00	2.22E-03
Bromodichloromethane	2.00E-02		1.30E-01		5.50E-01	1.57E-05	1.57E-05	2.04E-06	7.86E-04
1,3-Dichloropropene	3.00E-04		1.80E-01		1.00E+00	2.86E-05	2.86E-05	5.14E-06	9.52E-02
Trichloroethylene (TCE)			1.10E-02	1.70E-02	2.80E+02	8.00E-03	8.00E-03	8.80E-05	0.00E+00
Tetrachloroethylene (PCE)	1.00E-02		5.10E-02	3.30E-03	5.00E+00	1.43E-04	1.43E-04	7.29E-06	1.43E-02
Toluene	3.00E-01	1.50E+00			1.80E+00	5.14E-05	5.14E-05	0.00E+00	1.71E-04
Chlorobenzene	2.00E-02	5.70E-03			1.10E+01	3.14E-04	3.14E-04	0.00E+00	1.57E-02
1,4-Dichlorobenzene			2.40E-02		3.20E+00	9.14E-05	9.14E-05	2.19E-06	0.00E+00
1,3-Dichlorobenzene	8.90E-02				1.00E+00	2.86E-05	2.86E-05	0.00E+00	3.21E-04
1,2-Dichlorobenzene	9.00E-02				2.30E+00	6.57E-05	6.57E-05	0.00E+00	7.30E-04
Xylene (mixed)	2.00E+00	4.00E-01			1.70E+00	4.86E-05	4.86E-05	0.00E+00	2.43E-05
Styrene	2.00E-01		3.00E-02		1.50E+00	4.29E-05	4.29E-05	1.29E-06	2.14E-04
							TOTAL:	1.46E-04	1.53E-01
Chloroform	1.00E-02		6.10E-03	8.10E-02	6.77E+01	1.93E-03	1.93E-03	1.18E-05	1.93E-01
Bromodichloromethane	2.00E-02		1.30E-01		1.18E+01	3.37E-04	3.37E-04	4.38E-05	1.69E-02
Chlorodibromomethane	2.00E-02		8.40E-02		1.80E+00	5.14E-05	5.14E-05	4.32E-06	2.57E-03
							TOTAL:	5.99E-05	2.13E-01
Radium 226, 228					3.86E+01	NA	NA	3.86E-04	NA
Radon 222					9.20E+03	NA	NA	2.30E-03	NA
Uranium (soluble salts)	3.00E-03				1.00E+01	2.86E-04	2.86E-04	1.43E-05	9.52E-02
							TOTAL:	2.70E-03	9.52E-02

Ambient concentrations represent worst-case values.
Please note that the ambient concentrations for radium and radon are reported in units of pCi/l.
NA = not applicable. Please refer to the attached memo for risk estimates.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Coatesville Water Supply **DATE:** May 13, 1991

FROM: Jack Kelly, RPM

TO: Dawn Ioven, Toxicologist

Dawn,

Enclosed are the additional lab reports presenting trihalomethane results for the City of Coatesville Authority (CCA) water supply. The enclosed analytical reports from Cedar Grove Laboratories are for quarterly samples taken from 3/1/90 to 3/21/91. The individual sample results for the Coatesville Treatment Plant water customers include the following dates: 3/1/90, 5/2/90, 9/24/90, 12/12/90 and 3/13/91. The individual results for the Octoraro Treatment Plant water customers include the following: 4/5/90, 5/2/90, 9/24/90, 12/12/90 and 3/21/91. I believe that your July 24, 1990 assessment only evaluated sampling results taken on 12/12/89, 2/22/90 and 3/1/90 for each plant's water distribution customers. For your information, I have been informed that the residents around the William Dick Site essentially would obtain water from both plants if they were to be connected to the CCA system.

Please review the attached and get back to me to discuss an approach to update your earlier risk assessment. Please do so within a few days if possible.

Thanks!

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region III
841 Chestnut Building
Philadelphia, PA 19107

SUBJECT: Evaluation of Trihalomethanes
William Dick Lagoons

Date: May 28, 1991

From: Dawn A. Ioven, Toxicologist
Technical Support Section (3HW15)

To: Jack Kelly, RPM
SE PA Remedial Section (3HW21)

Background

To aid in the determination of an appropriate remedy at the William Dick Lagoons site, the potential toxicological impacts posed by consumption of water from the City of Coatsville Authority (CCA) were evaluated. The CCA is a municipal water supplier which, by law, disinfects potable water prior to distribution. As a result of the disinfection process currently utilized by the CCA, several unavoidable trihalomethane by-products are introduced to the drinking water supply. A conservative estimate of the potential health risks associated with exposure to these trihalomethane by-products is provided below.

Assumptions

In performing the risk calculations, several assumptions were made:

1. For each trihalomethane contaminant, both an average and a maximum (worst-case) concentration was used.

2. A series of sampling results (3/90 through 3/91) generated by Cedar Grove Environmental Analytical Labs were assessed. The analyzed samples were collected from various points along the CCA distribution route.

3. Risk calculations for each contaminant were conducted for adults weighing 70 kg, who ingest 2 liters of contaminated water each day for 70 years.

4. Following the completion of each chemical-specific risk calculation, the *total* risk under each exposure scenario (average and worst-case) was estimated. This method of quantitative risk assessment assumes that similar risks (carcinogenic vs. noncarcinogenic) are additive.

Potential Health Risks

As indicated on the attached worksheet, the total carcinogenic risks associated with consumption of municipal water is 5.27E-05 (average), or 1 additional cancer per 19,000 exposed individuals, and 8.24E-05 (worst-case), or 1 additional cancer per 12,000 exposed individuals. Please note, however, that an additional risk of similar magnitude may be elicited by exposure to these contaminants via the inhalation pathway, as is true for any volatile organic compound. Exposure through this route during typical household water usage (showering, laundering, etc.) may serve to double the risk posed by consumption alone.

With regard to noncarcinogenic risks, neither exposure scenario (average or worst-case) appears to represent a health threat. (Please refer to attached worksheet.)

GENERAL EXPOSURE ASSUMPTIONS

Adult mass (kg):	70.00 AD_MASS	Water Consumed (l/d):	2.00 DRINK
Length of Lifetime (years):	70.00 LIFE		
Length of adult's exposure (years):	70.00 YRS_EXP_AD		

Pollutant	DOSE-RESPONSE INFORMATION: Oral RfD: (mg/kg/d)	Inhaled RfD: (mg/kg/d)	Oral Potency Factor: (1/(mg/kg/d))	Inhaled Potency Factor: (1/(mg/kg/d))	DRINKING WATER Ambient Conc. (ug/l)	(Cancer) Lifetime Intake mg/kg/d	(Non-cancer) Chronic Intake mg/kg/d	Upper Bound Lifetime Cancer Risk	Hazard Index (Intake/RfD)
Chloroform	1.00E-02		6.10E-03	8.10E-02	5.17E+01	1.48E-03	1.48E-03	9.01E-06	1.48E-01
Bromodichloromethane	2.00E-02		1.30E-01		1.08E+01	3.09E-04	3.09E-04	4.01E-05	1.54E-02
Chlorodibromomethane	2.00E-02		8.40E-02		1.50E+00	4.29E-05	4.29E-05	3.60E-06	2.14E-03
							TOTAL:	5.27E-05	1.65E-01

Ambient concentrations represent average values.

Pollutant	DOSE-RESPONSE INFORMATION: Oral RfD: (mg/kg/d)	Inhaled RfD: (mg/kg/d)	Oral Potency Factor: (1/(mg/kg/d))	Inhaled Potency Factor: (1/(mg/kg/d))	DRINKING WATER Ambient Conc. (ug/l)	(Cancer) Lifetime Intake mg/kg/d	(Non-cancer) Chronic Intake mg/kg/d	Upper Bound Lifetime Cancer Risk	Hazard Index (Intake/RfD)
Chloroform	1.00E-02		6.10E-03	8.10E-02	9.10E+01	2.60E-03	2.60E-03	1.59E-05	2.60E-01
Bromodichloromethane	2.00E-02		1.30E-01		1.67E+01	4.77E-04	4.77E-04	6.20E-05	2.39E-02
Chlorodibromomethane	2.00E-02		8.40E-02		1.90E+00	5.43E-05	5.43E-05	4.56E-06	2.71E-03
							TOTAL:	8.24E-05	2.87E-01

Ambient concentrations represent maximum values.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

MEMORANDUM

MAR 14 1991

TO: Jack Kelly
Eastern PA Remedial Section (3HW21)

FROM: Bill Foster
Drinking Water Section (3WM41)

RE: William Dick Lagoons/CLTL Site- Comments on Drinking Water Supply Options...

In reviewing EPA's pending decision in this case regarding the development of alternative water supplies and/or treatment solutions for the private wells impacted (or potentially impacted) by ground water contamination from the Site and the Respondent's criticisms, I tried to balance out the relative benefits and disbenefits of PWS and Point of Entry solutions. (By the way, make sure to change those references from "point of use" to "point of entry". That terminology will cause confusion every time a new person reads it.) In general, I feel that the arguments presented by CLTL against connection of the residences in question to the Coatesville PWS are good ones, however, I do not feel their analysis of the situation covers all the bases.

The regulations, which CLTL's attorneys are so fond of quoting, [40 C.F.R. §§ 300.430(a)(1)(i) and 300.430(e)(9)(iii)(A)] do specify that EPA attempt to reduce the impact to human health to the greatest extent possible. However, each of these sections specifically refers to long term, as well as short term, effectiveness of remedial solutions. There is, without a doubt, a greater degree of long term reliability attributable to the PWS option, a number of which are mentioned below. With regard to CLTL's specific assertion that the cancer risk posed by the presence of THM's in Coatesville water is greater than that attributable to treated well water, my response is three-fold:

1) First, the excess cancer risk for GAC treated water will NEVER be zero. The point may be mute, but it is not an appropriate statement.

2) The cancer potency factor for THM's, specifically chloroform, is still under review, and is by no means well accepted in the scientific community. There is a possibility that the potency factor could be reduced by as much as an order of magnitude by the time the smoke clears. This uncertainty apparently stems

from the particular study, which was done on mice who had chloroform administered orally in a corn oil-based medium, upon which the existing unfinalized cancer risk assessments are based. Apparently, there is reason to believe that the corn oil medium itself can be related to the incidence of cancer among the test animals.

3) The most important point: The risk incurred by water consumers does not end with exposure to THM's. There are many chemical and bacterial water-borne health threats. PWS's are regulated to address the entire spectrum of such threats. PWS water quality is presently monitored regularly for bacterial presence and for about 60 additional contaminants and water quality parameters. The extent to which water would be monitored under the Respondent's point of entry proposal is no greater than twice per year, for a restricted list of VOC's. The level of preemptive protective measures involved is on an entirely different level.

The ground water quality in Chester County has been impacted by intense agricultural activity, urbanization, and residential and industrial waste discharges for many years. Frankly, I doubt there is any place in the county that is not vulnerable to nitrate, pesticide or organic chemical contamination. Radon is also a health potential health threat in some areas. While it is obviously not within the scope of this project to consider removing all contaminants from regional drinking water supplies, it is required that EPA consider the overall protection of human health in selecting a remedial option. It is not appropriate to consider only THM's in addition to the contaminants of concern at the Site when examining water supply options. Bearing this and the above points in mind, and the fact that ground water quality and information on health effects are both constantly changing, I feel that a PWS, which will be required to respond to any upcoming regulatory changes and is best capable of detecting and reacting to changes in water quality, is clearly the most protective option overall.

Further, there are technical and economic aspects of the long-term point of entry system option with which I am not comfortable.

1) Selection of such a program would require oversight by EPA's remedial program far into the future, which is not desireable. It would require not only that proper maintenance and monitoring of units be assured, but that the Responsible Party be able to carry out such operations for as long as necessary. The PWS option would require no such effort, since all PWS's are regulated by state and federal programs specifically designed to assure the provision of safe drinking water to PWS customers.

2) Disposal or recycling of spent filters-- Note that 40 C.F.R. § 300.430(a)(1)(i) also addresses minimization of untreated waste. PWS are generally pretty good at this. At least they have an economy of scale on their side.

3) Newly constructed houses and existing wells that become impacted by contamination will need new treatment systems. I know that some level of analysis has been done in this area. However, CLTL claims that the characteristics of the ground water plume have not been identified well enough yet to begin remediation of the ground water operable unit. I fail to see how a reliable estimate of the future cost associated with installation of POE systems can be made if such is the case. How many homes are likely to impacted? What level of development is likely to occur in the area? There are some calculations available in the FS, but I can't find any basis for them.

4) This lack of certainty regarding the ground water plume also raises questions as to the predicted effectiveness of POE units in the future. If we cannot be certain about the ground water quality in each of the wells in question, we cannot be certain about the level of protection provided by the treatment units.

Finally, as far as the relative benefits of connecting to the Coatesville PWS versus establishing a new system... I have an old copy of the design and operations manual for a PWS operating in PA. It is pretty detailed. Also, I believe it is required that new systems have redundant treatment now, which could increase the construction costs. There are also many new requirements in the regulatory pipeline which will make it very hard for all small water systems to survive, economically. Consequently, I feel that connection to the Coatesville system, regardless of the THM issue is preferable to establishing a new system.

Also. small systems are not required to monitor as frequently as larger systems for certain biological and chemical contaminants and therefore could potentially be considered less protective to human health, although, in the opinion of the drinking water section, a small PWS would still be more protective than individual point of entry treatment systems.

SIERRA CLUB COMMENTS:

I think the suggestion regarding retrofitting of reduced-flow water fixtures in the homes being effected is a very valuable idea. It is something we never would have thought of, but it is an idea the EPA should support 100%. If this option would be considered appropriate under Superfund guidelines, we should sound out the residents to see if they'd be agreeable to it. I'm not convinced that there would a huge dent put in monthly water bills, but it could make a little deference. The fixtures themselves are relatively inexpensive, as Mr. Cassel noted. Unfortunately, EPA does not have any information on them, to the best of my knowledge. I am checking with a couple of offices at headquarters and the with American Water Works Association. I'll let you know if I get any useful information.

PS. Also, I'd go back to the Sierra Club and ask them if they would be willing to dig up info on reduced-flow plumbing fixtures.

THE COUNTY OF CHESTER

Commissioners:
D. T. Marrone, Chairman
Joseph J. Kenna
Patricia M. Baldwin

HEALTH DEPARTMENT
326 North Walnut Street
West Chester, PA 19380
(215) 344-6225

November 23, 1990

Mr. Abraham Ferdos
Acting Director
Superfund Office
U.S. Environmental Protection Agency
Region 3
841 Chestnut Building
Philadelphia, PA 19107

Dear Mr. Ferdos:

As a follow-up to Ms. Batory's letter to you dated October 29, 1990, this letter is to inform you that the Chester County Health Department has instituted the recommended water well testing procedures outlined in your letter of October 17, 1990.

All wells drilled within the outlined study areas of the 9 NPL sites in Chester County will be tested for the contaminants of concern. If any of the contaminants are above drinking water standards, treatment will be required prior to granting approval to use the supply. Additionally, yearly testing of the supply for the known contaminants will be required as a condition of the approval.

To keep your staff informed we will contact the appropriate project manager if a well is contaminated. Therefore, it is important that the County be kept informed as to any personnel changes that are made at these sites.

Please feel free to contact me at 344-6239 should you have any questions concerning our procedure. Thank you for providing the information necessary for us to institute this program.

Sincerely,

Maria T. Goman

Maria T. Goman
Environmental Health Supervisor

MTG/svf

cc: David Jackson, R.S.
Joan Batory
George Danyliw, PA DER
File

THE COUNTY OF CHESTER

Commissioners:
D. T. Marrone, Chairman
Joseph J. Kenna
Patricia M. Baldwin

HEALTH DEPARTMENT
326 North Walnut Street
West Chester, PA 19380
(215) 344-6225

November 14. 1990

TO: Water and Sewage Staff

FROM: Maria T. Goman
Environmental Health Supervisor

RE: Additional Water Testing Requirements for Wells Drilled Near Superfund Sites

Distributed at today's staff meeting are maps of the 9 Superfund sites identified in the County thus far. Also mapped are the "study areas" which EPA has identified as being potentially impacted by the sites. Also, a list of the contaminants found at each site and a list of potentially responsible parties is included in the packet.

Any wells drilled in these "study areas" must be tested for the contaminants listed for the specific site as a condition of permit issuance. If any tested substance is above the drinking water standard treatment must be in place prior to approval to use being granted. Also. as a condition of approval the well owner will be required to test the well annually for the contaminant that is above drinking water standards.

Should you have any questions, please feel free to contact me.