United States Environmental Protection Agency

Office of Emergency and Remedial Response

EPA/ROD/R03-90/088
June 1990

EPA

Superfund Record of Decision:

Croyden TCE, PA

DECLARATION
for the
RECORD OF DECISION

SITE NAME AND LOCATION

Croydon TCE Site
Bristol Township, Bucks County, Pennsylvania
Ground Water Operable Unit

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Croydon TCE Site in Bucks County, Pennsylvania, selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). This decision is based on the Administrative Record for this site (index attached).

The Commonwealth of Pennsylvania concurs with the selected remedial action. A copy of the concurrence letter is attached.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDY

This ground water operable unit is the second of two operable units planned for this site. The first operable unit involved provision of an alternate water supply to those residents who were not serviced by the public water supply system, and who were dependent on ground water that was contaminated with volatile organic compounds, primarily trichloroethene (TCE). This second operable unit addresses the containment, treatment, and discharge of the contaminated ground water plume. While the source(s) of the ground water contamination have not been identified, the objectives of the selected remedy will be to contain the further migration of the contaminant plume while attempting to reduce ground water contaminant levels.

The selected remedy includes the following major components:

- Construction and long-term operation of four pumping/extraction wells located in positions to adequately contain the migration of the contaminant plume.

- Treatment of the extracted ground water via air stripping, followed by carbon adsorption as an ancillary treatment step.

- Onsite discharge of the treated ground water to the East Branch of Hog Run Creek.

- Ground water sampling will be conducted outside of the TCE plume area to monitor the possible advancement of ground water contaminants. Wells will be sampled and analyzed for TCE, tetrachloroethene, vinyl chloride, 1,1,1-trichloroethane, 1,1-dichloroethane, and 1,1-dichloroethene.

STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, the selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within 5 years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

6/29/90
Date

Edwin B. Erickson
Regional Administrator
Region III

bstract (Continued)

The selected remedial action for this site includes ground water pumping and onsite treatment using air stripping, followed by carbon adsorption as an ancillary treatment step before onsite discharge of the treated ground water; vapor-phased carbon adsorption treatment of air stripper exhaust, followed by offsite disposal or treatment of spent carbon; implementation of institutional controls to prevent the use of contaminated ground water during remediation; and ground water monitoring. The estimated present worth cost for this remedial action is $1,345,000, which includes an estimated annual O&M cost of $46,709 for 45 years (i.e., assuming that the State ARARs of remediating ground water to background levels are to be met by extending treatment from 30 to 45 years).

PERFORMANCE STANDARDS OR GOALS: The ground water remedy is designed to contain further migration of the plume while attempting to restore ground water to the State ARAR of background levels, including TCE 1 ug/l and 1,1-DCE 1 ug/l (assuming no additional release of contaminants to the aquifer). However, because the source of ground water contamination has not been identified, a permanent solution may not be achieved.

REMEDIAL ALTERNATIVE RECORD OF DECISION SUMMARY
CROYDON TCE SITE

SITE LOCATION AND DESCRIPTION

The Croydon TCE Site is located in the southernmost portion of Bristol Township, Bucks County, Pennsylvania (see Figure 1). Elevated levels of volatile organics, primarily trichloroethene (TCE), are present in ground water and surface water, but the actual source has not been determined.

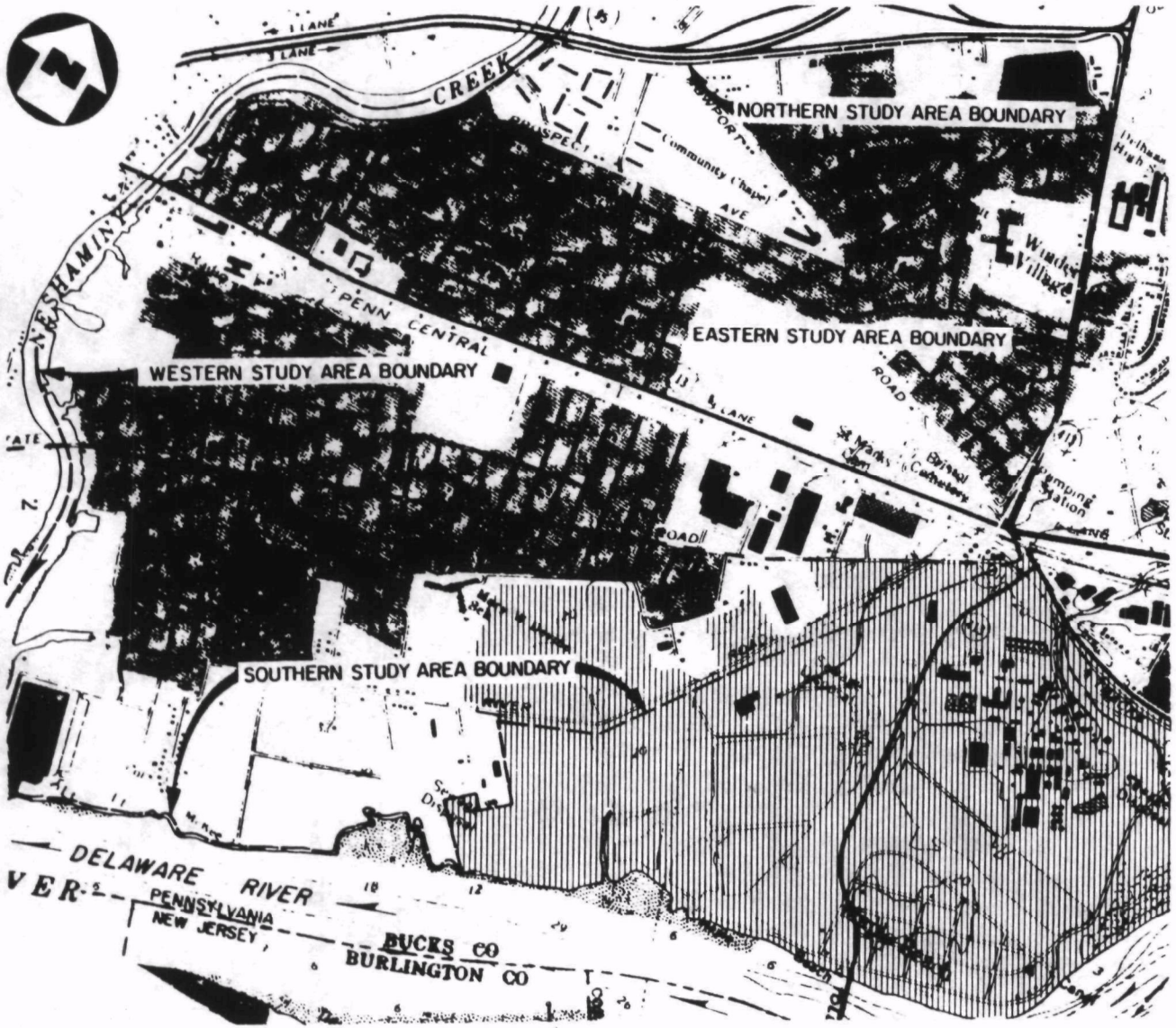
Approximately 3.5 square miles in total area, the site is bordered by Interstate 95 to the north, the Delaware River to the south, Route 413 to the east, and Neshaminy Creek to the west. The delineation of the study area is quite large, however this was necessary since the source and extent of ground water contamination was unknown, and widespread ground water contamination was observed throughout this portion of Bucks County. The Phase I Remedial Investigation (RI) conducted in 1988 assessed the entire study area.

Within this 3.5 square mile area is a smaller area on which the Phase I and II remedial investigations were primarily focused. This area, as depicted in Figure 2, is referred to as the "focused area of investigation" and encompasses the area east of the Mary Devine Elementary School, west of Route 413, and north of River Road, to just north of U.S. Route 13. The focused area of investigation was studied extensively because (1) ground water in this area was known to be contaminated with volatile organic compounds, primarily elevated levels of TCE, (2) previous studies in the local area provided data which indicated that the source of the TCE-contaminated ground water might be located within this area, and (3) analysis of historical aerial photographs identified 11 potential source areas within the focused area of investigation.

The focused area of investigation includes a portion of the Croydon residential community and an area where several small- to large-scale manufacturing and commercial establishments are located. Most of the commercial establishments are located along State Road and U.S. Route 13; the large manufacturing facilities are located between these two roads in the southeastern portion of the focused area of investigation.

The area outside of the focused area of investigation is mainly residential communities, constructed in the 1940s to 1960s. These communities include Croydon, Croydon Heights, Croydon Acres, Maple Shade, West Bristol, Belardy, and Rockdale.

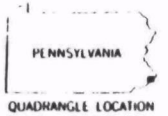
It is estimated that 2,000 to 3,000 people reside within the study area. Land use within the study area is predominantly single-family dwellings, and small- to large-scale industry.



LEGEND

Study Area Boundary

Rohm and Haas Company Property



QUADRANGLE LOCATION

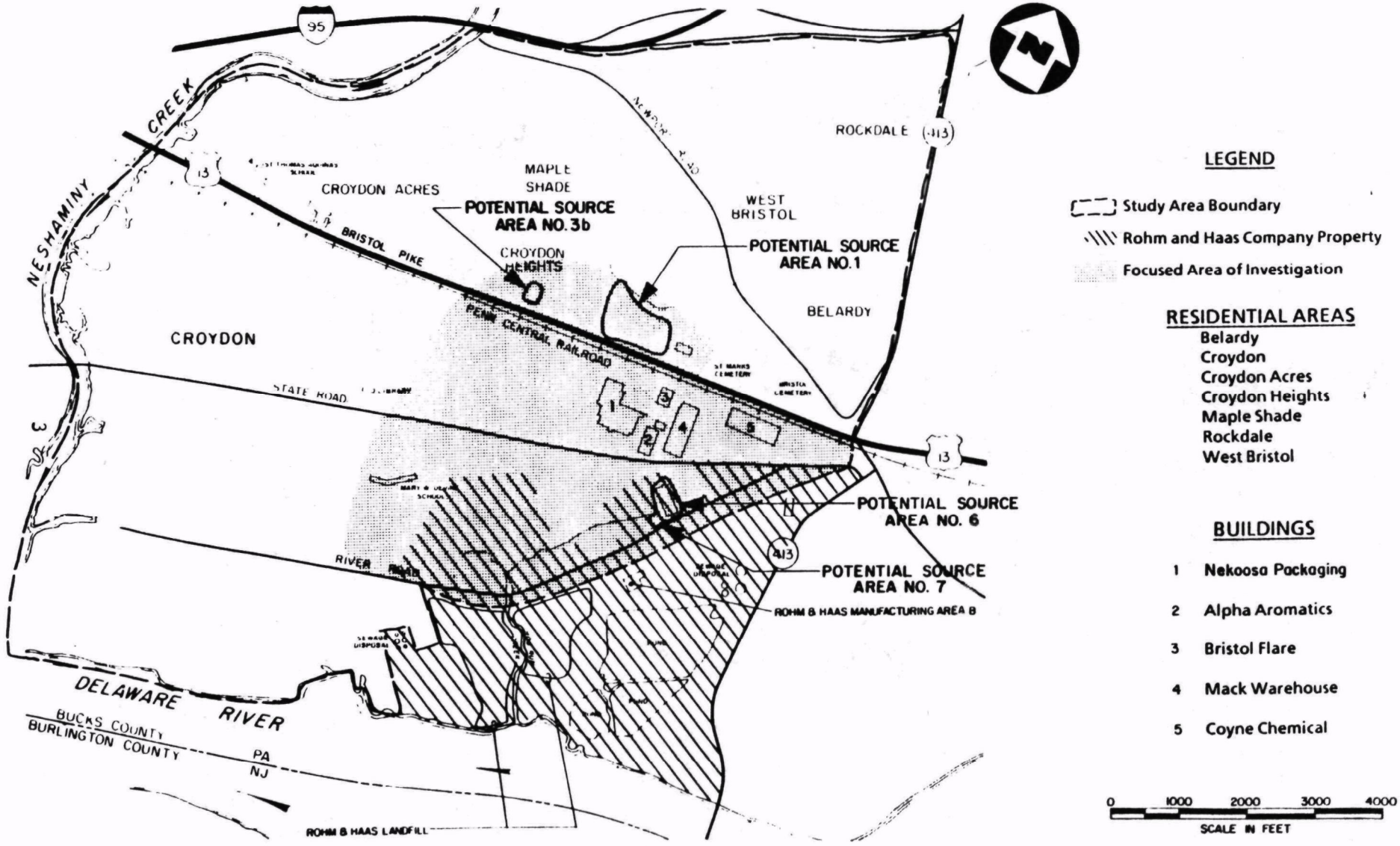
BASE MAP IS AN ENLARGEMENT OF A PORTION OF THE U.S.G.S. BEVERLY, PA - NJ QUADRANGLE (7.5 MINUTE SERIES, 1966, PHOTOREVISED 1973, CONTOUR INTERVAL 20 FEET) AND A PORTION OF THE BRISTOL, PA - NJ QUADRANGLE (7.5 MINUTE SERIES, 1955, PHOTOREVISED 1981, CONTOUR INTERVAL 20 FEET)

0 1000 2000 3000 4000

SCALE IN FEET

LOCATIO AP
CROYDON TCE SITE, KS COUNTY, PA

FIGURE 1



GENERAL ARRANGEMENT
CROYDON TCE SITE, BUCKS COUNTY, PA

FIGURE 2

Rohm & Haas Company is the largest employer in the area, employing approximately 1,200 people. Most of the other industries in the study area employ fewer than 50 people each, for a combined total of approximately 600 people.

The geology of the Croydon TCE Site consists of unconsolidated sand, gravel, silt, and clay deposits overlying metamorphic bedrock. Total thickness of the unconsolidated deposits ranged from 29 to 69 feet in the study area. Bedrock is described as the Wissahickon Schist and is the base rock in the area. The bedrock surface is irregular, with an overall regional slope to the southeast.

The site is located in the Delaware River Basin. On a regional and local basis, the Delaware River is the local discharge point for both ground water and surface water. Portions of the study area which are near to Neshaminy Creek and the Delaware River are within the boundary of the 100-year floodplain; however, the focused area of investigation is not within this boundary.

Ground water occurs in both the unconsolidated deposits and in the underlying bedrock. Within the study area, ground water was encountered at a depth of approximately 9 feet in the unconsolidated deposits. The two flow systems are not interconnected in the study area due to the presence of local clay layers and a substantial thickness of weathered bedrock (saprolite), which inhibit the movement of ground water between formations. Ground water elevations in the underlying bedrock aquifer are dependent on the depth of the saprolite layer between the two flow systems. In the vicinity of the site, the unconsolidated deposits are a source of domestic and industrial ground water supply. The bedrock ground water flow system is of minor importance to ground water supply in the vicinity of the site due to poor yield and the availability of ground water in the unconsolidated deposits.

Hog Run Creek and its tributaries (i.e., East Branch and West Branch) are located within the focused area of investigation. The tributaries emanate in the area between State Road and River Road and form Hog Run Creek just north of River Road. Hog Run Creek then flows southward and discharges into the Delaware River.

A larger stream, Neshaminy Creek, also discharges into the Delaware River. This stream constitutes the western border of the study area. Neshaminy State Park, which attracts over 750,000 visitors annually, is located at the confluence of Neshaminy Creek and the Delaware River.

A large variety of plant and animal species are found throughout the study area. Areas providing habitat include open fields, open water, woods, and freshwater tidal marshes. Open fields can

be found between Bristol Lanes and Hartwell Trucking (along Route 13) and along River Road. The largest wooded area is situated between State Road and River Road near Hog Run Creek and its tributaries. Tidal marshes are present along the Delaware River. The Delaware River, Neshaminy Creek, and Hog Run Creek provide open water for aquatic species and migratory birds. Five wetland areas, ranging in size from 0.2 acres to 6 acres are situated between State Road and River Road within the focused area of investigation. No endangered or threatened species of plant or animal life are known to be present in the study area.

As mentioned previously, 11 potential source areas, depicted in Figure 3, were identified within the focused area of investigation by the EPA Environmental Photographic Interpretation Center (EPIC) through analysis of historical photographs. All 11 potential source areas were studied during the Phase I RI; 4 of the 11 (Nos. 1, 3b, 6, and 7) were studied further during the Phase II RI as warranted by the findings of the Phase I RI. The remaining 7 potential source areas were ruled out as potential contamination sources by the findings of the Phase I RI.

An industrial landfill owned by Rohm & Haas Company is located south of River Road. This landfill which was operated from 1952 to 1975, is being studied by the Rohm & Haas Company under a Resource Conservation and Recovery Act (RCRA) corrective action order. Based on the findings of the Phase I RI, the landfill has been ruled out as the source of the TCE contamination in the Croydon community.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Croydon TCE Site was identified by EPA after a remedial investigation of the Rohm & Haas Site in Bristol Township which forms part of the southern boundary of the Croydon TCE Site. In 1983, Rohm & Haas conducted studies of its Bristol Township property, including the landfill, and released two reports: Report on Landfill Investigation, April 1984, and Landfill Investigation, February 1985. Based on these reports, EPA proposed the Rohm & Haas Site for the National Priorities List (NPL) in April 1985, thereby identifying the site for long-term remedial action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). After the RI of the Rohm & Haas Site, the site was reassigned to the RCRA program because the Rohm & Haas plant manages hazardous waste and is actively operating. As mentioned above, Rohm & Haas is currently investigating its industrial landfill, pursuant to a RCRA corrective action.

Rohm & Haas prepared 26 reports, which were compiled into 1 report entitled Landfill Remedial Investigation Report Addendum, March 1988. Of most interest was the Report on TCE in

Ground Water in the Vicinity of River Road, Bristol Township, March 1986, which suggested that a plume of TCE was emanating north of the Rohm & Haas property. EPA reviewed the report and concurred with Rohm & Haas' conclusion. Due to the uncertainty that many of the businesses in the area might use products containing TCE, EPA determined that a separate Remedial Investigation/Feasibility Study (RI/FS) was necessary to characterize the nature and extent of contamination, assess the public health and environmental risks associated with the contamination, and identify potential remedial alternatives.

In April 1985, a Hazard Ranking Score (HRS) of 31.60 was calculated for the Croydon TCE Site based on studies conducted primarily within the focused area of investigation. In September 1985, the Croydon TCE Site was listed on the NPL.

A potential responsible party (PRP) search of commercial and industrial facilities in the study area was conducted by Tech Law in May of 1986 for EPA. PRP searches are conducted to assist EPA in identifying owners/operators, transporters or generators who may have contributed to site contamination. Based on information gathered during the PRP search, CERCLA 104(e) information request letters were sent by EPA to area businesses that have used chemicals during past and present operations which may have contributed to area ground water contamination. Based on the responses to these information requests letters, EPA issued one General Notice Letter.

In August 1987, a Final Phase I RI/FS Work Plan was prepared by EPA's contractor, Ebasco Services, Incorporated. The Phase I field investigations began in September 1987. The findings of those field investigations and risk assessments were summarized in the final Phase I RI, which together with the Phase II RI/FS Work Plan, was submitted to EPA in August 1988. Because the ground water was contaminated with TCE above health-based and risk-based levels, a Focused FS was begun to identify response actions for an alternate water supply for those Croydon residents whose sole potable supply was contaminated ground water. A Record of Decision (ROD) was signed by EPA in December 1988, which resulted in providing public water to 11 residents within the identified ground water contaminant plume area.

The Phase II RI was conducted from September 1988 to October 1989. A Final Phase II RI Report was submitted to EPA by Ebasco Services, Incorporated in January 1990. Although numerous studies were conducted throughout the focused area of investigation during the Phase II RI in order to locate the source of TCE ground water contamination, no source could be positively confirmed ,however the ground water plume boundary was well defined. In January 1990, a Final FS was submitted to EPA which identified alternatives for remediating the ground water contamination at the site. This ROD identifies the response

action for addressing the ground water contamination at the Croydon TCE Site.

COMMUNITY RELATIONS

A Community Relations Plan (CRP) was prepared to identify the concerns of local residents and government officials regarding the Croydon TCE Site. The primary goals of the CRP are to establish and maintain open communication among federal, state, and local officials and Croydon residents. Several activities, described in the Final CRP, were conducted to meet these goals. These activities included the following:

- Onsite and telephone interviews with local residents in June and July 1987.
- Preparation of a fact sheet for the August 1987 public meeting.
- A public meeting at the Bristol Township Municipal Building in August 1987 was held to discuss the Phase I RI/FS Work Plan.
- Distribution of more than 450 well-survey questionnaires, which requested such information as whether the household operated a domestic well, and if so, the uses of the well water.
- A public meeting at the Bristol Township Municipal Building in December 1988 to hear comments on the proposed alternate water supply remedial action. Local residents and officials offered no criticism.
- A public meeting at the Bristol Township Municipal Building in May of 1990 to hear comments on the proposed ground water remedial action. Comments and questions by local residents and officials are presented in the Responsiveness Summary section of this ROD.

Although most of the residents continue to express a great deal of concern regarding the Rohm & Haas Site, none of the residents contacted during the onsite interviews were aware of the Croydon TCE Site. Public awareness of the Croydon TCE Site was minimal (prior to the Phase I RI/FS). However, during the course of the Croydon TCE Site Phase I RI/FS, the community became more aware that a separate investigation was being conducted to study other sources that might be the cause of the TCE ground water problem.

The EPA Community Relations Coordinator had met with various officials of the Mary Devine Elementary School during the fall of 1988, to update them on the Croydon TCE Site and address their concerns about nearby monitoring wells and soil sampling

activities. The school officials requested that they be included on EPA's mailing list.

In response to concerns raised by Croydon residents regarding the quality of the public water supply during the December 1988 public meeting, EPA sampled three households connected to the public water supply system. The analytical results were reviewed by an EPA toxicologist and were found to be in compliance with state and federal drinking water standards.

In summary, the community is concerned with environmental contamination and the associated potential risks. Most citizens' homes are connected to the public water supply system, thereby diminishing some of the concern to area residents.

SCOPE AND ROLE OF RESPONSE ACTION

This ROD addresses the second of two operable units at the site. The first operable unit addressed an alternate water supply. A ROD for the alternative water supply operable unit was signed in December 1988.

This operable unit addresses ground water that is contaminated with volatile organic compounds, primarily TCE in the community of Croydon, Pennsylvania. The contaminated ground water is a principal threat at this site because of the direct ingestion of drinking water from wells that contain TCE and other volatiles above health-based and risk-based levels. Although public water is currently being provided to the affected Croydon residents, future use of the aquifer is in jeopardy if no action is taken. In addition, because the aquifer is classified under the Ground Water Protection Strategy as Class IIa, some action is required to reduce the level of contamination to acceptable levels. The purpose of this response is to contain the migration of the ground water plume while attempting to reduce ground water contaminant levels. If the source or sources of the ground water contamination is depleted and only residual levels remain in the subsurface, the cleanup goals (which are identified later in this ROD) may be achieved within 30 years following implementation of the alternative.

SUMMARY OF SITE CHARACTERISTICS

The Phase I RI/FS included a hydrogeologic investigation, a residential well survey and sampling program, a surface water and sediment investigation, and a limited amount of surface soil sampling.

The findings of the Phase I field investigations are summarized below.

Hydrogeologic Investigation

The hydrogeologic investigation involved the sampling of 46 wells located such that EPA was able to evaluate the impact of the potential source areas on the ground water in both the shallow (approximately 20 feet) and deep (approximately 55 feet) portions of the unconsolidated aquifer. All samples were analyzed for Target Compound List (TCL) volatile organics. As a precaution, 10 samples were analyzed for base/neutral and acid extractable organics, target analyte list (TAL) inorganics, and selected geochemical parameters (e.g., sulfate, alkalinity).

The primary ground water contaminants are volatile organics, predominantly TCE. 1,1-dichloroethene, a chemical which results from the biological transformation of TCE, was also detected in excess of health-based criteria in a limited number of wells and often in the same well where TCE was detected.

The TCE ground water plume appears to originate from one or two potential source areas located north of U.S. Route 13. The plume is migrating in a south-southeast direction, based on data collected from static water levels in the wells. The highest concentrations of TCE were observed in wells located between State Road and River Road, specifically in the area where ground water discharges into the East Branch of Hog Run Creek. Although no Rohm & Haas monitoring wells located south of River Road were sampled as part of the Phase I RI, the TCE plume has probably migrated into the Delaware River since this body of water is the ultimate discharge point for all regional ground water and surface water. Studies conducted by Rohm & Haas indicate the presence of TCE in monitoring wells located near River Road by Manufacturing Area B and near the confluence of Hog Run Creek and the Delaware River.

Residential Well Investigation

As mentioned previously, more than 450 questionnaires were distributed to study area residents. Subsequently, forty residential wells were sampled and analyzed for TCL volatile organics. Some residential well samples were also analyzed for TCL base neutral and acid extractable organics, TAL inorganics, and geochemical parameters.

Residential well sampling data corroborated the results of the hydrogeologic investigation: residential well samples collected in areas where TCE was detected during the hydrogeologic investigation also exhibited elevated levels of TCE. Consistent with the hydrogeological data, residential wells located north of the focused area of investigation and west of Harris Avenue (south of U.S. Route 13) to Neshaminy Creek did not exhibit elevated levels of TCE.

Surface Water

Surface water samples were collected from Hog Run Creek and its tributaries (East and West Branches), Neshaminy Creek, and the Delaware River and analyzed for TCL organics and inorganics. TCE (maximum concentration of 6.1 micrograms per liter (ug/l)) and 1,1,1-trichlorethene (maximum concentration of 2.3 ug/l) were detected in the East Branch of Hog Run Creek and Hog Run Creek. These two contaminants are the only potential contaminants of concern. No organic contamination was detected in Neshaminy Creek, the Delaware River, or the West Branch of Hog Run Creek. Inorganic constituents were detected in surface water at levels comparable to background levels.

The presence of TCE and 1,1,1-trichloroethene in the surface water appears to be a result of ground water discharge. The East Branch of Hog Run Creek is located in the area where the highest concentrations of TCE and related constituents were detected in ground water. The West Branch of Hog Run Creek is situated in an area where no ground water contamination was detected; the West Branch of Hog Run Creek did not exhibit organic contamination.

Sediment

Sediment samples were collected from the same locations as the surface water samples. Inorganic constituents detected in the sediments were present at or below site background levels with the exception of metals of copper, lead, manganese, nickel, zinc, and cyanide. These metals were present at levels within the regional soil background ranges. Thus, no inorganic constituents were identified as potential contaminants of concern.

The primary organic contaminants in the sediments were the carcinogenic polynuclear aromatic hydrocarbons (PAHs). PAHs were detected in Neshaminy Creek, Hog Run Creek, and the East Branch of Hog Run Creek but not in background samples collected from Neshaminy Creek north of Interstate 95. PAHs were identified as chemicals of potential concern because of their carcinogenic risk factor. It should be noted, however, that PAHs are commonly found in industrial or urban areas; typical sources of PAHs include automobile or boat exhausts, fireplace exhausts, and open burning. Neshaminy Creek exhibited the highest levels of PAHs, due possibly to the numerous boats which use this creek. PAHs were also detected in Hog Run Creek and the East Branch of Hog Run Creek, possibly due to surface runoff from the roadways. No PAH compounds were detected in the surface waters, as expected because PAHs are not readily soluble in water, but tend to accumulate in sediment.

Two volatile organic contaminants, toluene and 1,2-dichloroethene, (maximum detection of 6 micrograms per kilogram

(ug/kg) and 17 ug/kg respectively) were detected in sediment samples collected from Hog Run Creek and the East Branch of Hog Run Creek, possibly due to migration of contaminants from ground water discharge. The absence of toluene and 1,2-dichloroethene from surface water may be due to volatilization into air or from the dilution effect of the surface water.

Soil

Soil samples were collected from the ball field adjacent to the Mary Devine Elementary School, an area near River Road across from Rohm & Haas' Manufacturing Area B, and residential property along River Road. Material from the Rohm & Haas Landfill was allegedly disposed of in these three areas. Potential contaminants of concern in soils (polychlorinated biphenyls (PCBs), Arochlor 1242, Arochlor 1016, and PAHs) were detected in all three sampling areas. The source of the PCBs is unknown; possible sources of PAHs may be surface runoff from roadways, automobile or dirt bike exhausts, or open fires. Concentration of the PAHs in soils is higher than that detected in the sediments.

Because the inorganic compounds present in surface soils were at or below regional background concentration levels, no inorganic compounds were selected as chemicals of potential concern.

As discussed above, the Phase I RI identified a TCE ground water plume emanating from an area north of U.S. Route 13. Two potential source areas were identified: Hartwell Trucking Company and adjacent property (No. 1); and the Sherwood Refinishing shop (No. 3b). Two EPA historical aerial studies identified two different source areas as "No. 3." Specifically, the second study designated as "No. 3" a tract which includes the Sherwood Refinishing Shop. For clarity in this ROD, this tract is designated "No. 3b."

Two other potential source areas, Nos. 6 and 7, were also investigated during the Phase II RI because of the highest levels of TCE ground water contamination were detected in their vicinity (along River Road across from Rohm & Haas Manufacturing Area B). A warehouse is located at Potential Source Area No. 6 and a car/truck repair facility is located at Potential Source Area No. 7. Photographs from 1940 to 1978 depict features such as standing liquids and stained soils, which may be associated with waste disposal. These features are no longer visible.

Another possible source of TCE contamination considered by EPA was (industrial) solvent disposal into sanitary sewer lines. The similarity of the configuration and flow patterns of the sewer lines along U.S. Route 13 and in the Croydon residential area to the pattern of TCE ground water contamination, suggested that

leaking sewer lines could be a potential source of TCE contamination.

Phase II RI objectives were developed following the evaluation of the Phase I data. The Phase II objectives were to:

- Investigate Potential Source Areas No. 1 and No. 3b to determine whether they are the source of the TCE ground water contamination.
- Investigate Potential Source Areas No. 6 and 7 to determine if they are contributing to the ground water contamination between the East Branch of Hog Run Creek and River Road, where some of the highest levels of TCE were observed in the ground water.
- Define the northern boundary of the TCE ground water plume.
- Determine whether the sewer lines along U.S. Route 13 are contaminated with TCE.
- Characterize the hydrogeology of the focused area of investigation.
- Confirm public health risks posed by the use of ground water within the study area.
- Confirm the presence or absence of PCBs in the three alleged dumping areas.
- Define the nature and extent of contamination in the Delaware River and the unnamed stream located north of U.S. Route 13.

The Phase II field investigations and findings are summarized below.

Hydrogeologic Investigation - The Phase II hydrogeologic investigation consisted of the installation of nine monitoring wells to further delineate the upper boundary of the ground water plume and to assess Potential Source Areas No. 1 and No. 3b. Ground water samples were collected from 52 monitoring wells to further characterize the plume boundary. Monitoring wells installed downgradient of Potential Source Areas No. 1 and No. 3b exhibited comparatively low levels of TCE; such low levels suggest that these areas may not be current sources of ground water contamination. This conclusion is supported by the fact that there is no appreciable contamination in the soils taken from these two areas. Table 1 provides the results of both Phase I and Phase II ground water sampling.

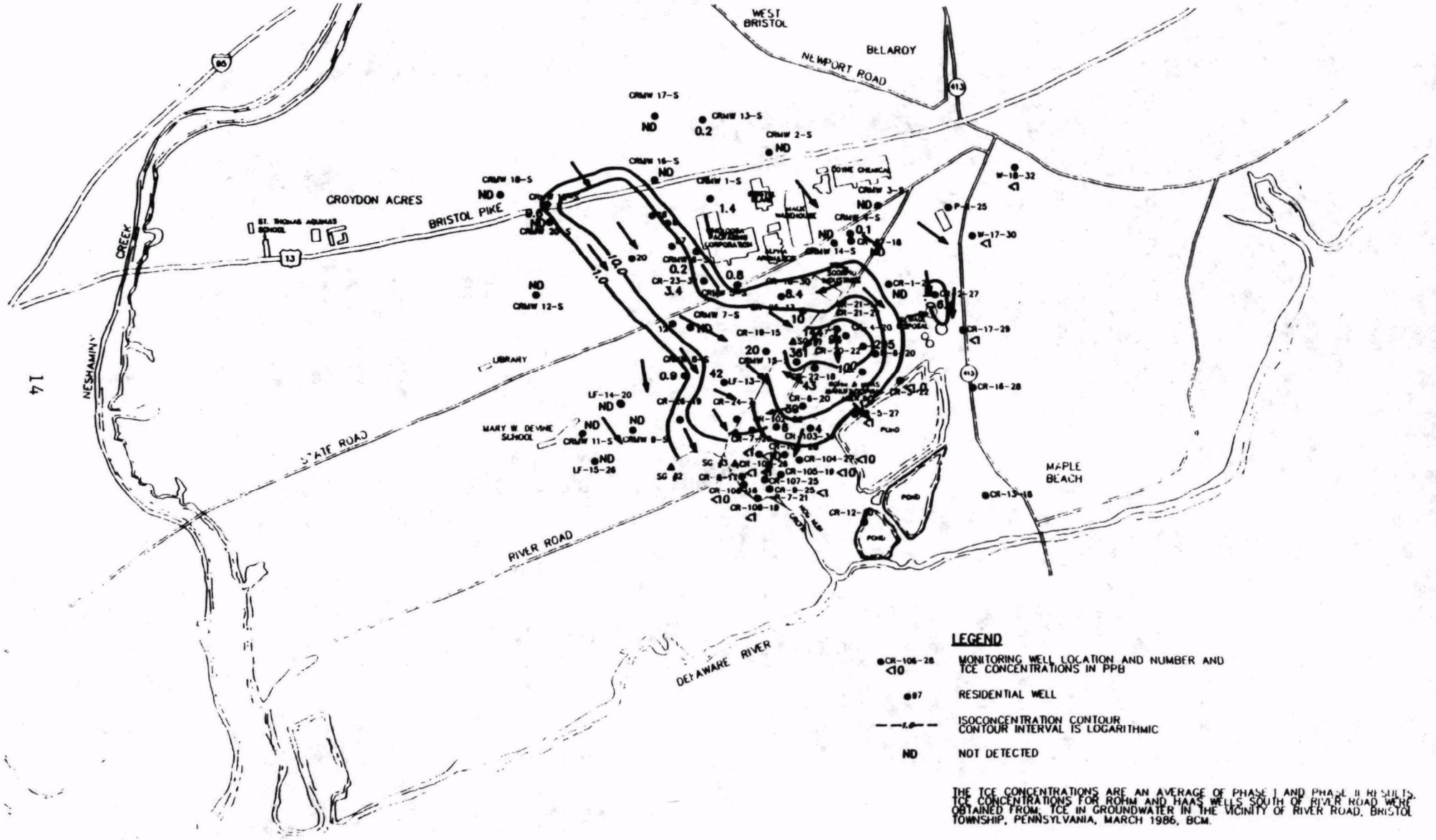
The boundary of the plume is described as follows: The northern boundary of the plume appears to have migrated from an area just north of U.S. Route 13. (Wells located one block north of U.S. Route 13 were not contaminated.) The southern boundary of the plume is just south of River Road. The eastern boundary is to the west of Route 413 and the western boundary is to the east of the ball field area. The highest levels of TCE (approximately 420 ug/l) were detected in the deeper monitoring wells, which monitor the bottom portion of the unconsolidated aquifer. The entire plume may consist of several separate ground water plumes (from separate sources) as evidenced by localized areas of high contamination within the entire 1.5-square-mile contaminated ground water plume. Figures 3 and 4 are isoconcentration maps of TCE concentrations detected in the shallow and deep monitoring wells, respectively.

The occurrence and distribution of TCE contamination within the study area does not pinpoint any obvious source of ground water contamination. Potential sources of contamination other than the potential source areas discussed thus far may include leaking septic tanks and/or random spills (i.e., midnight dumping) in the wooded portions of the study area between State Road and River Road. The relatively low levels of TCE may also reflect a past unidentifiable chemical spill or release.

Residential Well Investigation - In order to confirm the Phase I sampling results, seven residential wells were resampled and analyzed for TCL organics. The seven wells either exhibited elevated levels of TCE during the Phase I RI which indicated that they were located within the ground water plume, or exhibited low levels of TCE which indicated that they were located at the edge of the ground water plume. Table 2 summarizes these results.

Surface Water and Sediment Investigation - This investigation consisted of sampling and analysis of the Delaware River, an intermittent stream north of Potential Source Area No. 1, Hog Run Creek upstream from its discharge into the Delaware River, and a small intermittent stream which discharges into the East Branch of Hog Run Creek. These stations could not be sampled during the Phase I RI.

The analytical results indicate that the most significant surface water contamination is in the East Branch of Hog Run Creek where TCE was detected at approximately 6 ug/l. The contamination in Hog Run Creek upstream from its discharge into the Delaware River is only 0.4 ug/l. The source of the contamination in the East Branch appears to be ground water. The East Branch is located in the center of the contaminated ground water zone.

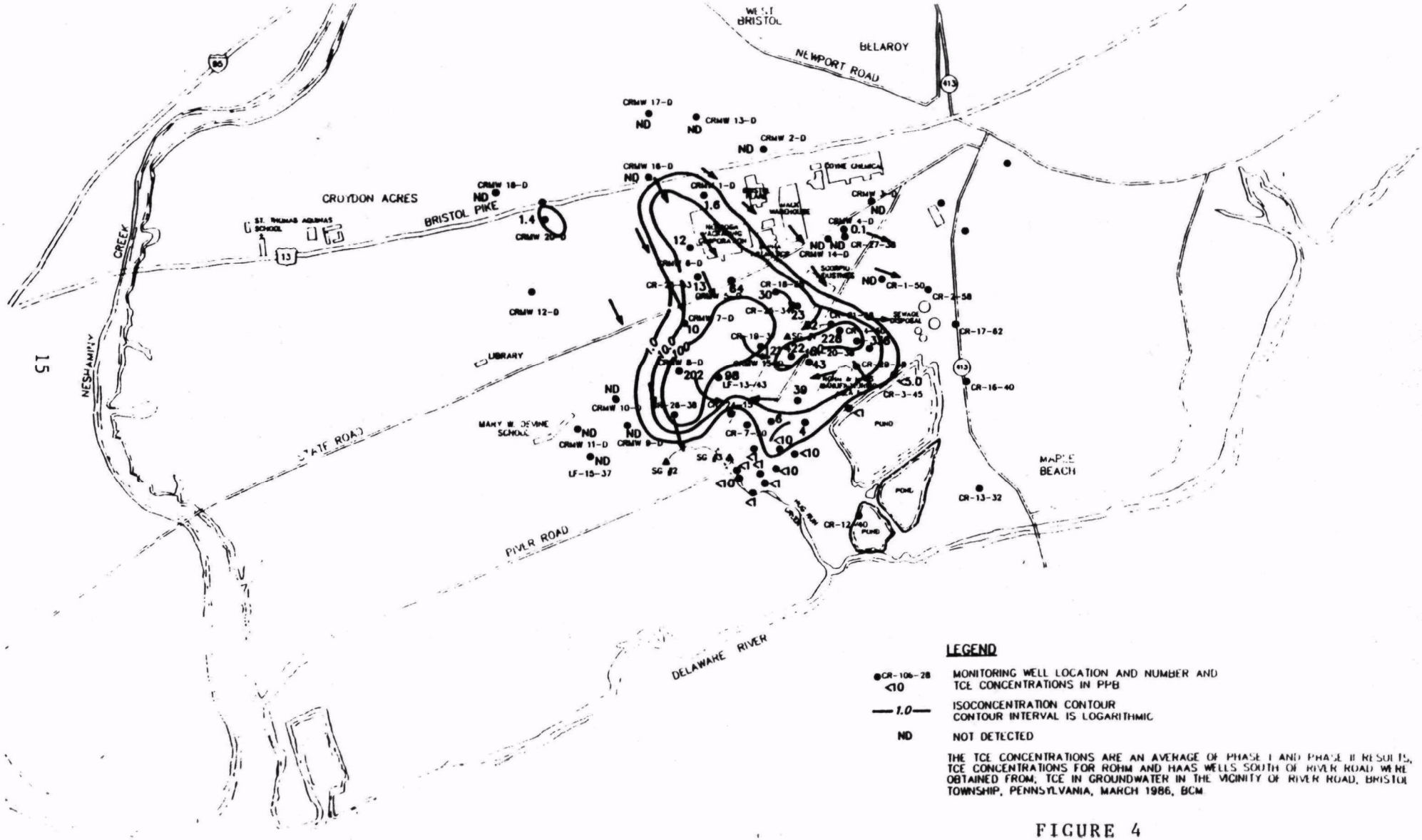


THE TCE CONCENTRATIONS ARE AN AVERAGE OF PHASE I AND PHASE II RESULTS. TCE CONCENTRATIONS FOR ROHM AND HAAS WELLS SOUTH OF RIVER ROAD WERE OBTAINED FROM, TCE IN GROUNDWATER IN THE VICINITY OF RIVER ROAD, BRISTOL TOWNSHIP, PENNSYLVANIA, MARCH 1986, BCM.

FIGURE 3

ISOCONCENTRATION MAP OF TCE IN THE SHALLOW MONITORING WELLS
CROYDON TCE SITE, BUCKS COUNTY, PA

0 1200 2400
SCALE IN FEET



LEGEND

●CR-106-28 <10	MONITORING WELL LOCATION AND NUMBER AND TCE CONCENTRATIONS IN PPB
—1.0—	ISOCONCENTRATION CONTOUR CONTOUR INTERVAL IS LOGARITHMIC
ND	NOT DETECTED

THE TCE CONCENTRATIONS ARE AN AVERAGE OF PHASE I AND PHASE II RESULTS. TCE CONCENTRATIONS FOR ROHM AND HAAS WELLS SOUTH OF RIVER ROAD WERE OBTAINED FROM, TCE IN GROUNDWATER IN THE VICINITY OF RIVER ROAD, BRISTOL TOWNSHIP, PENNSYLVANIA, MARCH 1986, BCM.

FIGURE 4

ISOCONCENTRATION MAP OF TCE IN THE DEEP MONITORING WELLS
CROYDON TCE SITE, BUCKS COUNTY, PA

0 1200 2400
SCALE IN FEET

TABLE 1

TCE CONCENTRATIONS IN GROUNDWATER
PHASE I AND PHASE II RESULTS
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA

Monitoring Well/ Residential Well	TCE Concentration (µg/l)	
	Phase I	Phase II
CR-1-22	NS	ND
CR-1-50	NS	ND
CR-18-30	6.8	10
CR-18-55	44	15.5
CR-19-15	22	18.6
CR-19-37	180	62.8
CR-21-17	NS	123.1
CR-21-27	NS	144.0
CR-21-35	NS	52.4
CR-23-32	4.0	2.9
CR-23-53	15	11.1
CR-24-15	ND	ND
CR-24-7	81	55.0
CR-25-13	NS	10.4
CR-25-34	NS	23.2
CR-26-19	NS	10.1
CR-26-38	300	424.4
CR-27-18	ND	ND
CR-27-38	ND	ND
LF-13-18	1.6	32.7
LF-13-43	3.2	76.9
LF-14-20	ND	ND
LF-15-26	ND	ND
LF-15-37	ND	ND

TABLE 1
TCE CONCENTRATIONS IN GROUNDWATER
PHASE I AND PHASE II RESULTS
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA
PAGE TWO

Monitoring Well/ Residential Well	TCE Concentration (µg/l)	
	Phase I	Phase II
MW1-D	0.6	ND
MW1-S	1.7	ND
MW2-D	ND	ND
MW2-S	ND	ND
MW3-D	ND	ND
MW3-S	ND	ND
MW4-D	0.3	ND
MW4-S	0.2	ND
MW5-D	80	48.5
MW5-S	0.5	1.0
MW6-D	14.3	9.8
MW6-S	2.3	2.2
MW7-D	ND	19.9
MW7-S	0.1	ND
MW8-D	220	128.3
MW8-S	1.2	0.6
MW9-D	ND	ND
MW9-S	ND	ND
MW10-D	ND	ND
MW11-D	ND	ND
MW11-S	ND	ND
MW12-D	ND	ND
MW12-S	ND	ND

TABLE 1
TCE CONCENTRATIONS IN GROUNDWATER
PHASE I AND PHASE II RESULTS
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA
PAGE THREE

Monitoring Well/ Residential Well	TCE Concentration (µg/l)	
	Phase I	Phase II
MW13-D	ND	ND
MW13-S	0.2	NS
MW14-D	ND	ND
MW14-S	ND	ND
MW15-D	420	424
MW15-S	320	403
MW16-D	---	ND
MW16-S	---	ND
MW17-D	---	ND
MW17-S	---	ND
MW18-D	---	ND
MW18-S	---	ND
MW19-S	---	9.6
MW20-D	---	1.4
MW20-S	---	ND

NS: Not sampled
ND: Not detected above instrument detection level
---: Well was constructed during Phase II RI

TABLE 2

TCE CONCENTRATIONS IN GROUNDWATER
PHASE I AND PHASE II RESULTS
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA

Monitoring Well/ Residential Well	TCE Concentration (µg/l)	
	Phase I	Phase II
RW1	60.9	62.3
RW2	0.94	1.0
RW21	97	150.7
RW25	20.2	10.7
RW26	11.7	4.6
RW32	5.3	1.8
RW34	12.3	18.6

Phase II sediment analyses did not detect any volatile contamination. However, one sample collected from the intermittent stream was contaminated with low levels of PAHs (less than 20 milligrams per kilogram (mg/kg) total PAHs), possibly due to runoff from local roads. Table 3 summarizes the findings of the Phase I and II surface water investigations.

Surface Soil Investigation - Three suspected dumping areas were resampled in order to confirm the presence of low levels of PCBs (less than 1 mg/kg), which were detected during the Phase I RI. Additionally, background samples and samples from the Rohm & Haas landfill, the alleged source area, were collected. The resampling detected no PCBs in the three suspected dumping areas. Pesticides and PAHs were detected, but background samples also exhibited these contaminants to a lesser degree. The presence of pesticides (less than 0.5 mg/kg) most likely results from past mosquito control measures undertaken in the study area. PAHs, common in urban settings such as this, may derive from open burning, the decomposition of organic matter, or roadway surface runoff.

Source Investigation (Potential Source Areas No. 1 and No. 3b) - A soil gas survey was carried out at Potential Source Areas No. 1 and No. 3b. After evaluating the soil gas data, test borings were drilled in areas in which TCE contamination was suspected. Samples collected from the test borings were analyzed for TCL organics and TAL inorganics. Six surface samples were also collected from Potential Source Area No. 3b to determine whether hazardous substances had been spilled on the ground surface, as reported by a local resident.

Contamination at Potential Source Area No. 1 is limited to a small area behind the garage of Hartwell Trucking Company. Elevated levels of TCE (25 mg/kg maximum) were detected in only 1 of the 7 boreholes. Because the soil contamination is above the water table and ground water near this borehole is not contaminated, it does not appear that the soil contamination present within this area is responsible for the ground water problem in the study area. However, if this area of soil contamination is not removed or treated, it may eventually contribute to the ground water contamination. The Pennsylvania Department of Environmental Resources (PADER) has been notified of this matter.

No significant surface or subsurface contamination was detected at Potential Source Area No. 3b. Although low levels of tetrachloroethene (PCE) (15 ug/kg maximum) were detected in surface soils, and samples obtained from a monitoring well adjacent to the Sherwood Refinishing Shop detected TCE concentrations of 9 ug/l, it is unlikely that these levels are responsible for the TCE ground water problem which encompasses an area of approximately 1.5 square miles.

TABLE 3

TCE CONCENTRATIONS IN STUDY AREA
SURFACE WATERS
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA

Sample Number	Sample Location	Concentration (µg/l)
SW-01	Neshaminy Creek - upstream of study area	ND
SW-02	Neshaminy Creek - adjacent to study area (north)	ND
SW-03	Neshaminy Creek - near docks	ND
SW-04	Neshaminy Creek - adjacent to study area (south)	ND
SW-05	Neshaminy Creek - near confluence with Delaware River	ND
SW-06	Delaware River - upstream	ND
SW-07	Delaware River - near Rohm & Haas Landfill	ND
SW-08	Delaware River - downstream of confluence with Hog Run Creek	ND
SW-09	Delaware River - upstream of confluence with Neshaminy Creek	ND
SW-10	West Branch of Hog Run Creek	ND
SW-11	East Branch of Hog Run Creek (upstream)	ND
SW-12	East Branch of Hog Run Creek (downstream)	6.1
SW-13	Hog Run Creek (upstream)	5.5
SW-14	Hog Run Creek (adjacent to Rohm & Haas Landfill)	2.3
SW-15	Pond behind VFW building (eastern bank)	2.4
SW-16	Pond behind VFW building (western bank)	2.4
SW-17	Intermittent stream in Rockdale	N.S
SW-18	Intermittent stream draining into the East Branch of Hog Run Creek	ND
SW-19	Intermittent stream near Potential Source Area No. 1 (eastern portion of stream)	ND
SW-20	Intermittent stream near Potential Source Area No. 1 (western portion)	ND
SW-21	Hog Run Creek prior to discharge into the Delaware River	0.4

ND Denotes not detected above analytical instrument detection levels.
NS Denotes not sampled due to lack of water.

Source Investigation (Potential Source Areas No.6 and No. 7) - The EPA Environmental Response Team augered 20 soil borings (approximately 40 to 50 feet deep) at or around Potential Source Areas 6 and 7 which are located upgradient from the ground water plume, where some of the highest levels of TCE were observed. A total of 118 soil and 8 ground water samples were collected and screened for volatile organics. A full gas chromatograph/mass spectrophotometer (GC/MS) analysis was performed on 96 of these samples for confirmatory purposes.

Potential Source Area No. 6 exhibited some soil and ground water contamination. Low levels of TCE (less than 0.1 milligrams per liter (mg/l)) were detected in soil samples collected from boreholes located on the property of No. 6 or southwest of the property. Samples collected from the mid- to bottom-portions of the boreholes exhibited higher levels of TCE soil contamination. This may suggest that the spill occurred several years ago, especially since the levels of TCE contamination in the soil are generally very low. Elevated levels of TCE (359 ug/l, maximum) were observed in ground water samples collected from Borehole Nos. 3 and 5, which are located just southwest of this potential source area. It is uncertain whether the elevated levels of TCE ground water contamination in the area near River Road can be attributed to the contamination in Potential Source Area No. 6.

Although the boundary of the plume is rather well defined, the source(s) of ground water contamination could not be identified conclusively. The occurrence and distribution of TCE contamination does not pinpoint any obvious source of contamination. The entire area of ground water contamination may consist of several separate ground water plumes as evidenced by localized areas of significant contamination. Contamination may be emanating from any of the following areas:

- Near Girard or Elm Avenue where small auto repair shops are located - Residential wells in this area have exhibited elevated levels of TCE.

- In the wooded area between State Road and River Road - Monitoring wells CR-26-38 (424 ug/l) and CR-24-7 (55 ug/l) in this area have exhibited TCE.

- Near Sherwood Refinishing (along U.S. Route 13) - Monitoring wells and a residential well in this area have exhibited TCE (18 ug/l, maximum).

Potential Source Areas No. 1 and No. 3b, which were thought to be sources of ground water contamination after completion of the Phase I RI, do not appear to be contributing to the ground water contamination.

The contaminants within the soil might eventually infiltrate the water table and impact the quality of ground water near Hartwell Trucking Company. At present, soil contaminated in Potential Source Area No.1 is above the water table and the ground water is not affected.

The relatively low levels (less than 0.5 mg/l maximum) of TCE contamination in the ground water may suggest that the initial release of TCE occurred many years ago and is essentially unidentifiable today. It is also possible that the releases may have occurred in more than one area of the site; the presence of "mini plumes" (areas of comparatively high levels of TCE) within the entire contaminated ground water zone supports this theory.

Sanitary Sewer Line Investigation - Six sewage samples from various locations along U.S. Route 13 and adjoining streets were collected to determine whether solvents were being disposed of into the sanitary sewer lines from local businesses and analyzed for TCE volatile organics.

TCE was not detected, however, low levels of 1,1,1-trichloroethene (4 ug/l) and xylene (4 ug/l) were observed at two locations. It is unlikely that ground water contamination at the site is attributable to the contamination of the sewer lines.

SUMMARY OF SITE RISKS

Human Health Risks

A base-line risk assessment was conducted using the data collected during the Phase I and Phase II RIs in accordance with the guidelines of the Superfund Health Evaluation Manual (EPA, 1986). Assumptions and calculations for potential adverse public health impacts posed by the presence of contaminants at the site are presented in Section 6 and Appendix G of the January 1990 Remedial Investigation Report for the Croydon TCE Site.

Household occupants located within the area of the TCE plume would be at risk if not connected to the public water supply system. Exposure pathways are ground water ingestion, inhalation of contaminants volatilized from ground water household use (i.e., showering or cooking), and dermal absorption of contaminants while bathing were found to be 2.0×10^{-3} for the plausible maximum risk level and 2.5×10^{-4} for the average risk level which is above the EPA excess lifetime cancer risk. Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation(e.g., 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-

year lifetime under the specific exposure conditions at a site. Table 4 outlines the average and plausible maximum risk levels (i.e., worst-case) for these exposure pathways.

Households that are located west or north of the TCE plume are not at risk because the plume is migrating in a south-southeast direction. No contamination was detected in residential wells along streets located north of the plume (High Street, Maple and Garfield Avenues). Samples collected from residential wells along streets located west of the plume (Linton, Emily, Keystone, and Summit Avenues) also did not indicate the presence of TCE or other volatiles at elevated levels (<1 ug/l).

There are no households located east or south of the plume within the study area.

Based on analyses of surface waters, sediments, and surface soils within the study area, exposures to these media by children or adults do not suggest the potential for adverse noncarcinogenic health risks. As shown on Table 4, incremental cancer risks calculated for several exposure routes to these same media are below or slightly higher than the lower EPA target risk of 10^{-7}.

Environmental Risks

Although little site-related contamination was detected in study area surface waters, plants and animals may be exposed in the future to chemicals of potential concern in the surface waters of the Croydon TCE Site because surface water contamination has been identified in Hog Run Creek and the East Branch of Hog Run Creek.

Aquatic species in the Delaware River are also potential receptors of contaminants from Hog Run Creek. Potential impacts on these species are likely to be negligible because of the low concentrations of volatiles detected in study area surface waters. In addition, concentrations of contaminants reaching the Delaware River will be reduced significantly by dispersion, volatilization, and dilution within the River. This was verified by the Phase II sample analyses in which no organics were detected in the Delaware River.

Terrestrial species are not likely to be receptors at the site, because few species are found in the areas of soil contamination due to the area's industrial and residential development. Those terrestrial species which inhabit the wooded areas around Hog Run Creek may be exposed to chemicals of potential concern detected in the surface water. Exposure to these chemicals via biomagnification in the food chain is unlikely, due to the extremely low levels of detected surface water contaminants.

PAHs were detected in site sediment samples. The maximum PAH concentrations were detected in the intermittent stream behind

TABLE 4

COMPARISON OF CARCINOGENIC RISKS
PHASE I AND PHASE II
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA

Exposure Scenario	Phase I		Phase II	
	Worst Case	Average Case	Worst Case	Average Case
Domestic Use of Groundwater (Inhalation and Ingestion)	2.2×10^{-3}	7.4×10^{-5}	2.0×10^{-3}	2.5×10^{-4}
Dermal Contact to Soils	3.4×10^{-6}	5.0×10^{-8}	8.8×10^{-7}	1.8×10^{-8}
Accidental Ingestion of Soils	9.9×10^{-7}	7.5×10^{-9}	1.2×10^{-6}	3.5×10^{-8}
Dermal Contact to Sediments	3.1×10^{-8}	2.1×10^{-9}	4.7×10^{-7}	6.8×10^{-8}
Exposure to Surface Waters (Dermal and Accidental Ingestion)	NA	NA	9.9×10^{-11}	1.5×10^{-11}

NA - Not assessed due to an incomplete data base.

Hartwell Trucking and along the Neshaminy Creek near State Road at 3,700 and 3,000 ug/kg, respectively. The ubiquitous nature of PAHs prevents linking PAHs specifically to activities by any particular industry within the study area. Moreover, the concentrations of PAHs detected in study area sediment samples are within the range of sediment concentrations believed to be associated with no or minimal biological effects, as reported by Chapman et al. (1987). Therefore, the sediment PAH concentrations observed at the Croydon TCE Site are unlikely to adversely impact aquatic life.

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 and the environment.

DESCRIPTION OF ALTERNATIVES

Remedial alternatives were developed during the FS for the ground water operable unit. With the exception of the "no action" alternative, which is always considered as a baseline for comparison against other alternatives, the development of alternatives was based on the results of the risk assessment, and applicable and relevant or appropriate requirements (ARARs). The proposed alternatives focused on (1) preventing migration of contaminants in ground water, (2) reducing the concentration of contaminants to acceptable levels, and (3) preventing exposure to ground water via institutional controls.

Listed below are the alternatives that were considered for remediating the ground water plume at the Croydon TCE Site. The description of these alternatives follows.

- Alternative No. 1: No action.
- Alternative No. 2: Ground water containment, physical/ chemical treatment, and discharge.
- Alternative No. 3: Ground water containment and offsite treatment.

Alternative No. 1: No Action

Estimated Capital Cost: $0
Annual O&M: $5,975
Present Worth: $92,000
Estimated Time to Complete: None

This alternative is required by the National Contingency Plan (NCP) as a baseline comparison to other alternatives. Under this alternative, no action would be taken to remediate ground water contamination in the study area. Seven wells would be

sampled annually for a period of 30 years and samples would be analyzed for TCE, tetrachloroethene, vinyl chloride, 1,1,1-trichloroethane, 1,1-dichloroethane, and 1,1-dichloroethene. The locations of the wells are shown in Figure 5. Ground water monitoring would aid in evaluating plume migration and what, if any, change in contaminant concentrations occurring over time.

This no action alternative may not be implementable because the aquifer is classified as Class IIa (i.e. current source of drinking water), which is expected to be returned to beneficial use wherever practicable.

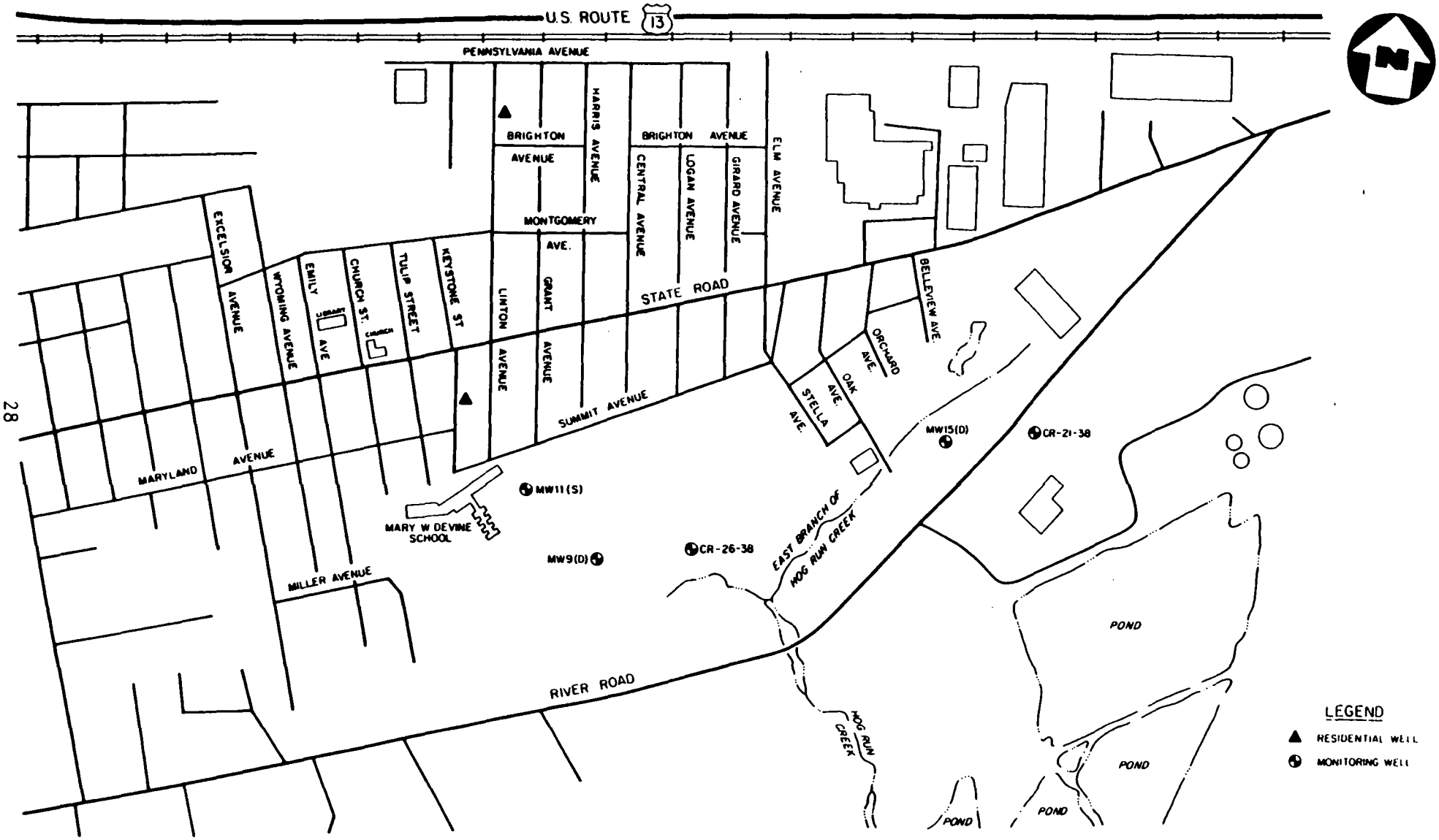
Unless additional releases of TCE into the aquifer occur, modeling studies estimate that natural attenuation will lead to the remediation of the site in about 120 years.

Alternative No. 2: Ground Water Containment, Physical/Chemical Treatment, and Discharge

Estimated Capital Cost: $514,531
Annual O&M Costs: $46,709
Present Worth: $1,232,000
Estimated Time to Complete: 30 years

This alternative would contain the further migration of the contaminant plume while attempting to restore ground water quality to acceptable levels promulgated under the Safe Drinking Water Act (SDWA). The SDWA has established maximum contaminant levels (MCLs) which are the maximum permissible levels of contaminants in water that are set based on health effect concerns. The MCLs for TCE and 1,1,-dichloroethene in drinking water are 5 ug/l and 7 ug/l, respectively. See 40 C.F.R. Section 141.61. All other site contaminants are below SDWA MCLs.

A component of this alternative is ground water extraction using extraction wells to lower the water table in order to halt the discharge of contaminated ground water to the East Branch of Hog Run Creek. The extracted ground water would then be pumped to a single treatment plant that would be constructed on the Croydon TCE Site. There are several effective physical/chemical treatment options for treating the contaminated ground water, including air stripping, steam stripping, carbon adsorption, and ultra violent (UV)/ozone. Air stripping has been selected as the representative physical/chemical option, however, this selection will not preclude the use of the other viable physical/chemical treatment options, if deemed appropriate during alternative design. Also, carbon adsorption might be needed as an ancillary treatment step for a by-product stream if air stripping, steam stripping, or UV/ozone were implemented. Treated water could be discharged to a Publicly Owned Treatment Works (POTW) or to an offsite or onsite surface water body. Of these viable discharge



PROPOSED GROUNDWATER MONITORING STATIC
CROYDON TCE SITE, BUCKS COUNTY, PA

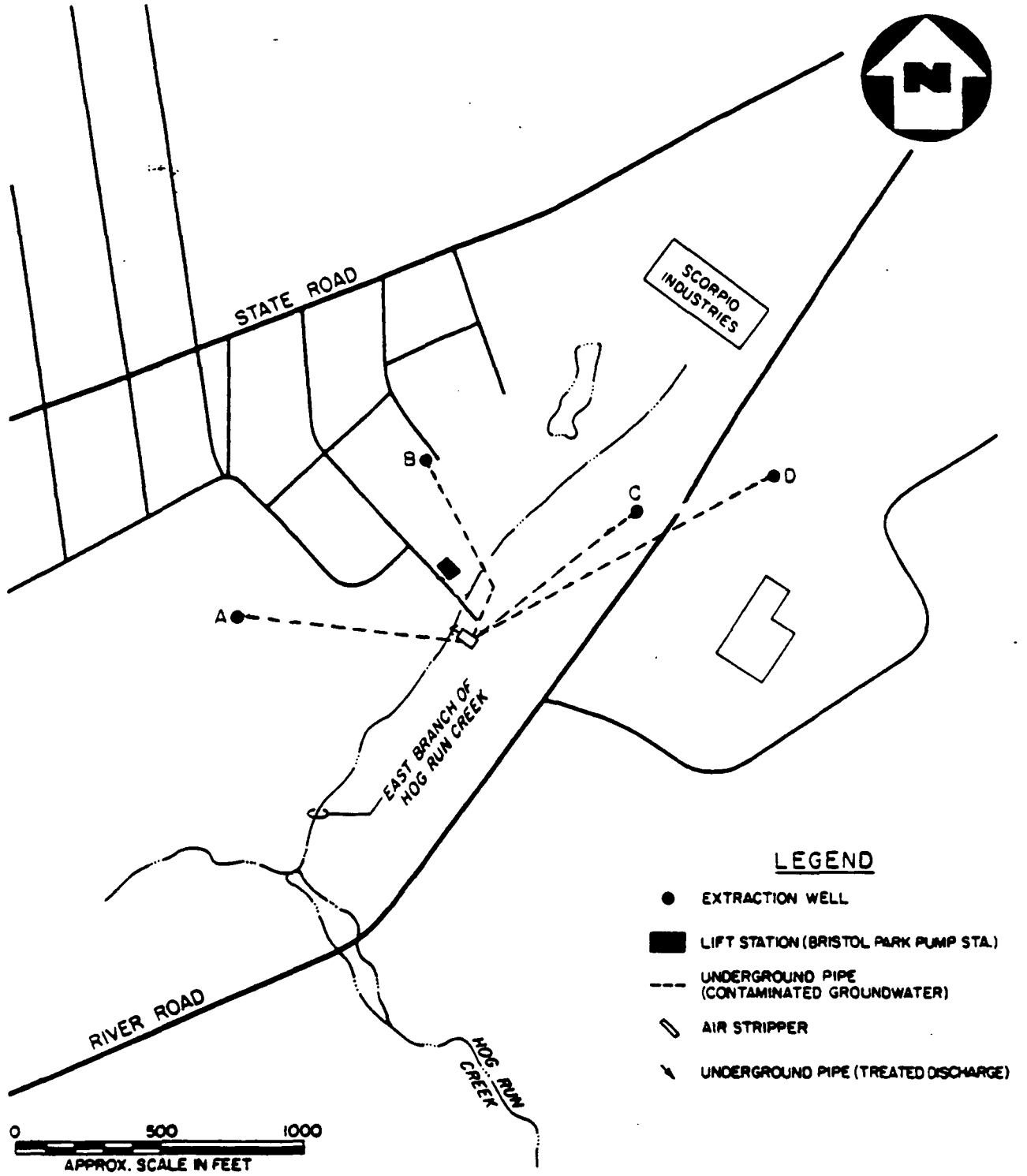
FIGU 5

options, discharge to an onsite surface water body has been selected. Because the discharge point is within the site boundary, a National Pollutant Discharge Elimination System (NPDES) permit would not be required. However, compliance with NPDES effluent concentration levels are required substantively but not administratively. In addition to actively remediating the ground water contamination, institutional controls which include ground water use restrictions within the area affected by the contaminant plume will also need to be implemented by state or local authorities. New wells should be prevented from being constructed, and existing wells should be sealed or not used for potable water supply.

Two ground water extraction scenarios (ES-1 and ES-2) were considered. ES-1 consists of four continuously pumping wells, located as shown in Figure 6. These particular locations and assumed pumping rates were selected so as to prevent migration of ground water from the Rohm & Haas Landfill to the study area as well as prevent additional contaminated ground water to migrate in the study area. ES-2 consists of phased pumping of four wells at the same locations shown in Figure 6. Based on the modeling results of ES-1, two modifications were made to ES-2: 1) the two wells located to the north of Hog Run Creek would be stopped after 20 years because the maximum concentration of TCE in that area was predicted to be lower than 5 ug/l; 2) the pumping rate of the well closest to the Rohm & Haas ponds was increased by 50 percent.

Due to the similarity in flow rates of the two scenarios, only one preliminary air stripping column design was developed. The air stripper was designed to meet NPDES effluent concentration levels based on surface water discharge to the East Branch of Hog Run Creek. Preliminary effluent limitations were conservatively set to achieve a TCE concentration of less than 1 ug/l for computer modeling design purposes, which is well below the MCL of 5 ug/l. TCE was chosen as the design indicator contaminant, because its concentration in ground water was found to be an order of magnitude greater than any other contaminant. The average observed TCE ground water concentration and the assumed pumping rate from each extraction well were used to estimate the influent concentrations of the Croydon TCE Site stripper via a mass balance.

The emission rates of volatile organics into the ambient air were also assessed; exhaust gases from the stripper are estimated to contain less than 140 ug/l of TCE by volume before undergoing treatment prior to its release to the atmosphere through an activated carbon filter. The carbon filter will have a minimum efficiency of approximately 98 percent, thereby limiting the TCE exhaust gas concentrations into the atmosphere well below the MCL of 5 ug/l. Periodic monitoring of air stripper exhaust gases to



OVERVIEW OF ALTERNATIVE NO. 2
CROYDON TCE SITE, BUCKS COUNTY, PA

FIGURE 6

ensure compliance with National Environmental Standards for Hazardous Air Pollutants (NESHAP) will be performed.

The computer model, previously discussed, was also used to determine the approximate time needed to achieve the remediation level of 5 ug/l for TCE. Based on a pumping rate of about 40 gallons per minute, the ground water MCL for TCE may be achieved in approximately 30 years. It should be noted that the model assumed no current sources of ground water contamination within, or in the vicinity of, the study area. As mentioned previously, no source has yet been definitively identified as an ongoing contributor to ground water contamination at the site.

Ground water monitoring as described in Alternative No. 1 (No Action), will also be performed.

Alternative No. 3: Ground Water Containment and Offsite Treatment

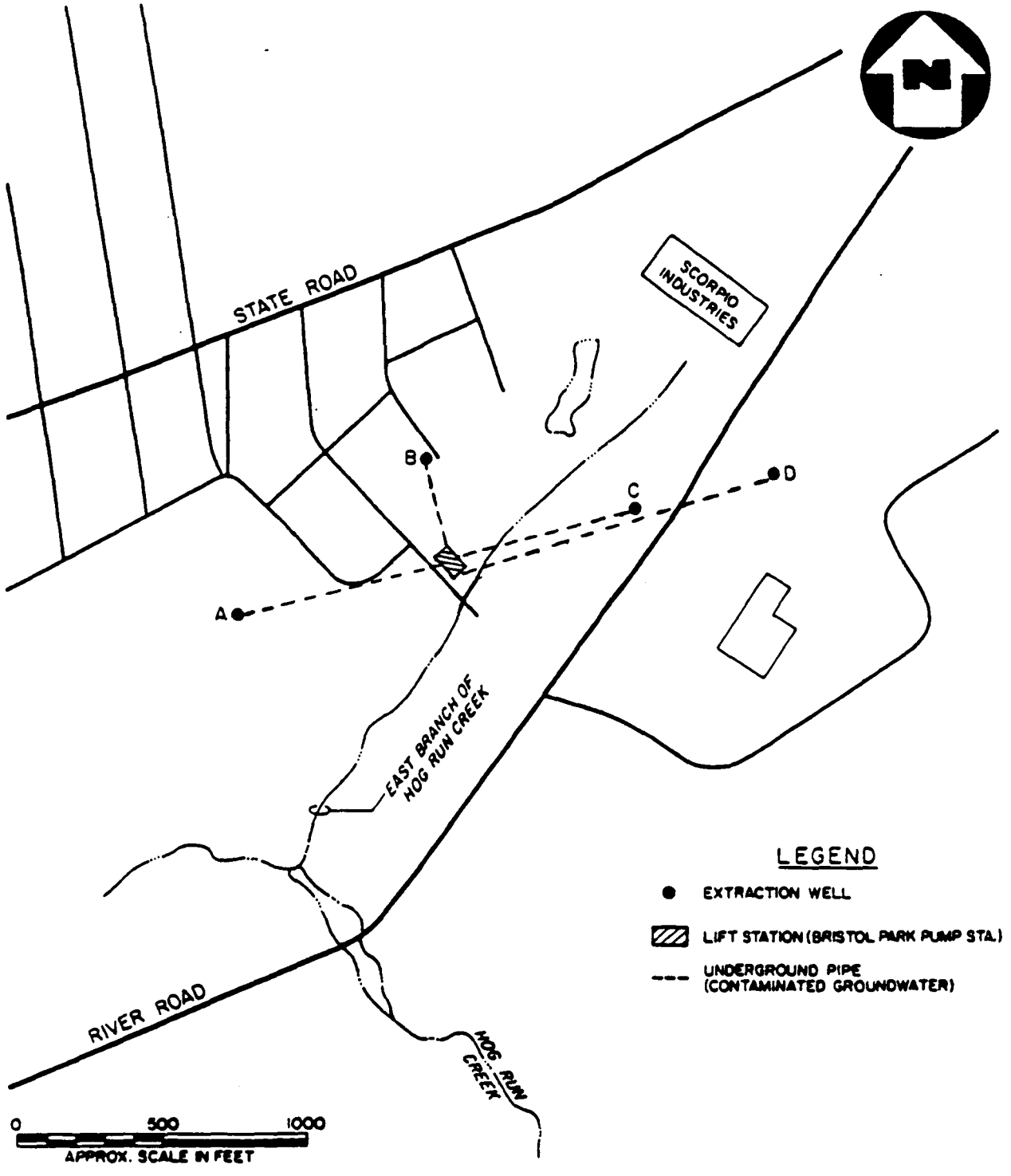
Estimated Capital Cost: $270,021
Annual O&M Costs
(years 0 to 20/years 21 to 30 years): $133,557/$83,100
Present Worth: $2,177,000
Estimated Time to Complete: 30 years

As outlined in Alternative No. 2, this alternative will also contain the ground water contaminant plume while attempting to restore the ground water aquifer to its beneficial use. Both Alternative No. 2 and Alternative No. 3 involve the same ground water pumping scheme, but differ in how and where the contaminated ground water would be treated. Under this alternative the extracted ground water would be transported via underground piping to the nearest sanitary sewer lift station for treatment at the POTW.

Contaminant concentrations and flow rates that can be accepted are based on the POTW requirements. Institutional controls as described in the previous alternative, will also need to be implemented.

The Bristol Township Authority, the owners of the POTW and sanitary sewer system, have given preliminarily approval for the discharge of 50 gallons per minute (gpm) of contaminated ground water with less than 1 mg/l VOCs into the Bristol Park Sanitary Sewer Lift Station. Figure 7 depicts the location of this lift station and a general diagram of Alternative No. 3.

As with all of the previous alternatives, ground water monitoring will also be performed.



OVERVIEW OF ALTERNATIVE NO. 3
CROYDON TCE SITE, BUCKS COUNTY, PA

FIGURE 7

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives identified were evaluated based on the following nine criteria:

- Overall protection of human health and the environment.
- Compliance with all Federal and state applicable or relevant and appropriate requirements (ARARs).
- Reduction of toxicity, mobility, or volume.
- Short-term effectiveness.
- Long-term effectiveness.
- Implementability.
- Cost.
- Community acceptance.
- State acceptance.

Table 5 describes these criteria.

A summary of the relative performance of the alternatives with respect to each of the nine criteria follows. This summary provides the basis for determining which alternative provides the "best balance" of tradeoffs with respect to the nine evaluation criteria.

Short-Term Effectiveness

Alternative No. 1 (No Action), will not result in any additional type of human or environmental risk since the only action involved with this alternative is long-term ground water monitoring. Workers involved with the sampling of these wells will be required to wear the appropriate protective clothing. No impact to the community is anticipated with the construction and implementation of either Alternative No. 2 (Ground Water Collection, Physical/Chemical Treatment, and Disposal) or Alternative No. 3 (Ground Water Collection and Offsite Treatment). Both of these alternatives involve the same pumping scheme, but differ in how (and where) the contaminated ground water is treated. The impact of ground water pumping may reduce the amount of water present in various wetlands throughout the study area (between State Road and River Road in the southeastern portion of the site).

Alternative No. 1 does not involve remediation, therefore it may take more than 120 years for the aquifer to cleanse itself via attenuation. This timeframe is based on modeling results that assume no further TCE loading into the aquifer. The timeframe for remediation of the aquifer, barring no further releases of TCE into the aquifer, has been estimated to be approximately 30 years for both Alternatives No. 2 and No. 3. Both of these alternatives will be equally effective in preventing the plume from migrating. The containment action will occur within a short period of time once pumping of the aquifer begins.

TABLE 5
GLOSSARY OF EVALUATION CRITERIA
CROYDON TCE SITE

- Overall Protection - The assessment against this criterion describes how the alternative, as a whole, protects and maintains protection of human health and the environment.

- Compliance with ARARs - The assessment against this criterion describes how the alternative complies with ARARs, or if a waiver is required and how it is justified. The assessment includes information from advisories, criteria, and guidance that the lead and support agencies is necessary and appropriate.

- Long-term Effectiveness and Permanence - The assessment of alternatives against this criterion evaluates the long-term effectiveness of alternatives in protecting human health and the environment after response objectives have been met.

- Reduction of Toxicity, Mobility, and Volume - The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies.

- Short-term Effectiveness - The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation period until response objectives have been met.

- Implementability - This assessment evaluates the technical and administrative feasibility of alternatives and the availability of required resources.

- Cost - This assessment evaluates the capital and O&M costs of each alternative.

- State Acceptance - This assessment reflects the state's (or supporting agency's) apparent preferences or concerns about alternatives.

- Community Acceptance - This assessment reflects the community's apparent preferences or concerns about alternatives.

Long-Term Effectiveness and Permanence

Alternative No. 1 would not be effective in reducing or containing the level of TCE contamination in the aquifer. Aquifer restoration would solely depend on natural attenuation, which may take as long as 120 years if no additional TCE enters the ground water aquifer. Under this alternative, state or local governments would have to ensure that ground water is not used as a potable water supply. Additionally, long-term monitoring will be required. Alternative No. 2 would be effective in containing the plume to the general site area, and would eventually lead to ground water restoration in about 30 years. This assumes, of course, that no additional TCE loading will occur. Alternative No. 3 would also be effective in containing the plume. Because this alternative differs from Alternative No. 2 only in the treatment aspects, it too will eventually lead to ground water restoration in about 30 years.

The technologies proposed for Alternative No. 2 are proven. Therefore, this alternative is expected to provide long-term effectiveness. The technologies for Alternative No. 3 involve pumping and discharging to the local POTW. This alternative is also expected to provide long-term effectiveness and reliability since it is anticipated that the local POTW will be operating for some time into the future in order to serve the needs of the local community.

Reduction of Toxicity, Mobility, and Volume

Alternative No. 1 does not result in any reduction in toxicity, mobility, or volume since no action is performed. Alternatives No. 2 and No. 3 would both result in containing the ground water plume to the general site area. Therefore, either alternative would reduce the mobility of the contaminants. Alternatives No. 2 and No. 3 would both result in a reduction of toxicity since they both employ effective treatment of TCE. Volume is not applicable to this site since the source of TCE is unknown and may be already depleted (volume reduction is usually associated with source control).

Implementability

Alternative No. 1 would be the easiest to implement because it only involves ground water monitoring. Existing onsite monitoring wells could be used for long-term monitoring. Ground water monitoring over the 30-year period would be the responsibility of state and/or local authorities.

The technologies proposed for Alternative No. 2 are commercially available and widely used in wastewater extraction/treatment. Negotiations with property owners will be required for the installations of extraction wells and the onsite treatment plant.

Additionally, piping of ground water to the onsite treatment plant will require coordination with local utility companies. Because the treated ground water would be discharged within the site boundary, no NPDES permit will be require, although NPDES effluent limitations would have to be met. Administrative controls (i.e., ground water monitoring) can be implemented by State and/or local authorities.

Alternative No. 3 can also be easily implemented. This alternative involves treatment of contaminated ground water at the local POTW. EPA's contractor and Bristol Township personnel have determined that the treatment plant has adequate capacity and could effectively treat the ground water without any pretreatment. Therefore, this alternative could be implemented. Ground water extraction via pumping wells would also be implementable. However, property access and locating underground utilities would need to be performed. It is anticipated that this would be easily achievable. Institutional controls (i.e., ground water monitoring) would be conducted by the State and/or local authorities.

Alternatives No. 2 and No. 3 are equally implementable.

Compliance With Applicable or Relevant and Appropriate Requirements (ARARs)

Under Alternative No. 1, chemical-specific ARARs would not be met in ground water, and contaminant concentrations would remain above health-based and risk-based levels. Both Alternatives No. 2 and No. 3 will attempt to meet all ARARs by reducing ground water contaminant levels to below MCLs in about 20 to 30 years, assuming that no further TCE will enter the aquifer.

Overall Protection of Public Health and Environment

Alternative No. 1 would not provide protection to the public health. In light of the fact that an alternative source of potable water is currently being provided to 11 households in Croydon that did not have access to public water and depended on ground water, there will be no direct exposure to ground water. Risks to the environment will be unchanged under Alternative No. 1. However, this risk is low based on data collected from onsite surface waters and sediments in which contaminant levels did not exceed Ambient Water Quality Criteria.

Alternative No. 2 is protective of the public health (future potential exposure) because it will prevent the migration of the contaminant plume and will reduce the toxicity of the plume over time. Institutional controls to restrict the use of ground water will also result in protecting the public health.

The remediation of ground water will result in reducing the level of contamination discharged to Hog Run Creek and its tributaries. However, continuous pumping of the ground water may impact the wetlands between State Road and River Road. This factor can not be fully evaluated until actual pumping begins, however, it is anticipated that the amount of standing water in the wetlands will be reduced to some degree.

Alternative No. 3 is protective of the public health (future potential exposure) because it will also prevent the migration of the contaminant plume and will reduce the toxicity of the plume over time. Institutional controls to restrict the use of ground water will also result in protecting the public health. The cleanup of the aquifer will result in reducing the level of contamination discharged to Hog Run Creek and its tributaries. As with Alternative No. 2, continuous pumping of the ground water may impact the amount of standing water in the wetlands between State Road and River Road.

Alternatives No. 2 and No. 3 will provide equal overall protection to the public health and environment.

Costs

Alternative No. 1 does not involve any capital costs since the existing monitoring wells can be used for long-term monitoring. Quarterly sampling of these wells and selected residential wells will result in low annual operation and maintenance (O&M) costs. The present worth cost of alternative No. 1 is $92,000.

Capital costs for Alternative No. 2 are the highest of the three alternatives since these costs include the onsite treatment plant. Capital costs for Alternative No. 3 are lower than Alternative No. 2 because no treatment plant is required to be constructed. Annual O&M costs for Alternative No. 2 are estimated to be $46,709 versus $133,557 for Alternative No. 3, thus the present worth cost of Alternative No. 3 ($2,177,000) is higher than that of Alternative No. 2 ($1,232,000).

State Acceptance

The Commonwealth of Pennsylvania, Department of Environmental Resources (PADER), has reviewed the information available for this site and has concurred with the remedy selected in this Record of Decision (ROD), which was described in detail at page 38. (See attached PADER concurrence Letter).

Community Acceptance

A public comment period for the Proposed Plan was held from May 2, 1990 to May 31, 1990. On May 18, 1990, a public meeting was held at the Bristol Township Municipal Building to discuss EPA's

preferred alternative as described in the Proposed Plan. Area residents, local and state officials were in attendance at the meeting.

Comments received during the public meeting and the public comment period are presented in the attached responsiveness summary.

SELECTED REMEDY

Alternative No. 2: Ground Water Containment, Physical/ Chemical Treatment and Discharge

This alternative involves installation of ground water extraction wells equipped with pumps. Ground water would be pumped to an air stripper to be constructed at the Croydon TCE Site. Treated ground water would be discharged to the East Branch of Hog Run Creek. Pumping would lower the water table; thus, wetland areas would no longer receive the same volume of ground water discharge. The impact to surrounding wetlands in the study area from the pumping of ground water would be studied during the design of the ground water pumping/treatment system. The possibility of dewatering wetland areas by significantly reducing the source of ground water recharge by lowering the water table during pumping is a concern. One possible solution to minimize potential harm to the wetlands would be to locate the effluent discharge point from the treatment facility at an upgradient location where it would recharge the potentially affected wetland areas.

The ground water extraction scenario consists of four wells at the locations indicated on Figure 6. The wells would intercept ground water, as determined by computer modeling simulations, previously discussed. The total pumping rate from all wells would be approximately 45 gallons per minute (gpm) for the first 20 years and 21 gpm for years 21-30 (two of the four wells are shut down after 20 years). It was assumed that the average depth of the extraction wells would be 48 feet and that the diameter of the wells would be 4 inches. One and one half horsepower pumps at each well were estimated to provide sufficient pumping capacity.

The pumping rate and well locations would also help to contain the migration of the TCE plume from the site area.

To treat the extracted ground water, an air stripper would be constructed at the Croydon TCE Site near the Bristol Park Pumping Station. Piping would be installed from the extraction wells to the air stripper. Based on the locations of the extraction wells and the pumping rates, it was estimated that 3,400 linear feet of 1-inch-diameter PVC pipe would be required from the extraction wells to the air stripper, assuming that the air stripper would

be constructed near the Bristol Park Pumping Station. All pipe would be underground. The air stripper would be a counter-current packed tower, in which air enters at the bottom and exhausts at the top, while the ground water flows down through the packing media. The packing material would be approximately 30 feet in height and 3 feet in diameter. The ground water is not expected to be excessively scale-forming; thus no pretreatment to prevent fouling of the air stripper would be required. Carbon adsorption may be required as an ancillary treatment step prior to discharge. Discharge piping would also be installed between the air stripper and the East Branch of Hog Run Creek. Approximately 200 linear feet of 3-inch-diameter pipe would be required from the stripper to this discharge point.

A vapor-phased carbon adsorption treatment device would be attached to the exhaust of the air stripping tower to prevent the release of volatile organic compounds to the atmosphere. The carbon filter would require minimal maintenance as the spent activated carbon would be periodically changed. Spent carbon would be taken offsite as a hazardous waste for treatment or disposal. The most cost effective means of dealing with the spent carbon would determine which of the two methods is selected. If disposal is selected, it would be in compliance with the RCRA land disposal restrictions (LDR).

Institutional controls, including ground water use restrictions in the affected area, would also be implemented by state or local authorities to prevent the use of contaminated ground water during remediation.

Ground water monitoring of selected existing residential and monitoring wells would be conducted annually for 30 years to confirm the extraction system captures the contamination and thus prevent further migration. For costing purposes, seven existing wells near the plume boundaries would be monitored for the following volatile organic compounds: TCE; tetrachloroethene; vinyl chloride; 1,1,1-trichloroethane; 1,1-dichloroethane; and 1,1-dichloroethene. Ground water levels would also be measured at the time of sampling. Additional sampling and analyses would be used to monitor the progress of the remedial activities. Also, for costing purposes, it was assumed that samples would be obtained from each of the four extraction wells semi-annually for 30 years. These samples would be analyzed for the same parameters as the samples from the residential and monitoring wells discussed above.

This alternative would reduce the risks posed by ground water contamination and migration. Once the ground water extraction and treatment systems are installed, the contaminated plume would slowly begin to recede from its current position, and the East Branch of Hog Run Creek may no longer discharge contaminated water to the Delaware River. A pumping time of 20 to 30 years

would be required to reduce aquifer TCE contaminant concentrations to 5 ug/l and 7 ug/l for 1,1-dichloroethene (the MCLs) or lower risk-based levels, assuming no additional releases of contaminants to the aquifer. This alternative would effectively act to contain the contaminant plume to the general site area.

Recent communications between EPA and the PADER have resulted in EPA recognizing that cleanup of ground water to background is a Pennsylvania ARAR (see Table 7). Background is not clearly defined, but for volatile organic limits in this ROD, we are establishing background as the current instrument detection limit of 1 ug/l. As described above, the ground water remediation model was run considering cleanup goals of the MCLs. Further reduction of the contaminants to limits of detection can be assumed to be possible with a longer period of ground water extraction. For the purposes of estimating costs for this ROD, EPA has assumed an additional 10 to 15 years would be necessary to reach background as defined by the instrument detection limits. This cleanup goal of 1 ug/l each for TCE and 1,1-dichloroethene are below the respective MCLs and are protective of human health and will meet all ARARs.

There would be no risks to the general public during implementation. Protective clothing would be needed for workers who might contact contaminated ground water.

The technologies proposed for collection and physical/chemical treatment are demonstrated and commercially available, and could be implementable within 1 year after the completion of the design phase. These systems are reliable if properly maintained. Obtaining access to residential locations is a concern, because pumping wells would need to be installed on private property in the study area. Underground piping between the wells and the air stripper and between the stripper and the East Branch of Hog Run Creek would need to be installed beneath private property and roadways in the residential area. Residential property would need to be restored, and road pavement would need to be replaced where the pipe trenches were excavated. It is likely that the proposed pipelines would cross existing utility lines buried beneath private property and roads in the community. The effluent discharge from the air stripper would require periodic monitoring to determine compliance with NPDES permit limits. Although a NPDES permit is not required for an onsite discharge, effluent limitations for such discharge must be met. Since the state has been delegated the NPDES program by EPA, PADER would set the discharge limits to Hog Run Creek for the ground water treatment facility.

Institutional controls would be implemented by state and local authorities.

The capital and annual costs for this alternative are approximately $514,531 and $46,709 respectively. Based on a discount rate of 5 percent, the net present value of this alternative is approximately $1,232,000. Table 6 summarizes the major capital and annual cost items.

STATUTORY DETERMINATION

Section 121 of SARA requires that the selected remedy

- Be protective of human health and the environment;
- Attain ARARs (or explain rationale for invoking a waiver);
- Be cost effective;
- Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable;
- Address whether the preference for treatment that reduces toxicity, mobility, or volume as a principal element is satisfied.

A description of how the selected remedy satisfies each of the above statutory requirements is provided below.

Protection of Human Health and the Environment

The selected remedy will protect human health and the environment through ground water extraction and treatment by reducing the future potential threat to human health from ingestion of contaminated ground water and reducing contaminated levels in the East Branch of Hog Run Creek, where contaminated ground water discharges to surface water. The selected remedy would also reduce further environmental degradation. Reduction of the TCE concentrations to the MCL of $\leq$ 5 ug/L would require 20 to 30 years. Reduction to background levels as required by the Pennsylvania ARAR for ground water would require an additional 10 to 15 years. Institutional controls would restrict ground water use until remediation of the aquifer is completed. It is not anticipated that the selected remedy will pose unacceptable short-term risks or cross-media impacts.

While Alternative No. 3 would also provide equal protection to human health, it would not provide equal protection to the environment. Uncontrolled air releases of volatile organic compounds would occur from the treatment of the contaminated ground water at the Bristol Township POTW which would create cross media impacts.

TABLE 6

ESTIMATED COSTS OF SELECTED REMEDY
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA

Components	Estimated Costs
CAPITAL COSTS	
1. Equipment	$104,320
2. Piping & instrumentation	83,588
3. Foundation & structural	18,000
4. Electrical	35,250
Subtotal	$241,158
5. Markups (labor, material and subcontracting) and contingencies	273,373
Total	$514,531
ANNUAL COSTS	
1. Energy (electric)	$ 3,054
2. Maintenance	16,900
3. Operator (8 hr/week)	12,480
4. Sampling, analysis, report preparation	14,275
Total	$46,709

Net present value (based on a 5 percent discount rate) = $1,232,000 for 30 years and $1,345,000 for 45 years.

Compliance with ARARs

The selected remedy of ground water extraction, treatment of the extracted ground water via air stripping, followed by carbon adsorption as an ancillary treatment step and onsite discharge will attempt to comply with all ARARS. Regulations in 40 C.F.R. Parts 122.44 and 125.3 require the use of best-available technology economically achievable (BAT) to control discharges of toxic and nonconventional pollutants, such as the volatile organics, to certain surface waters. Applicable federal and state water quality standards will be complied with under this response action. The aqueous discharge from the air stripper will be monitored for the mass of pollutant, the volume of effluent, and frequency of discharge as required in 40 C.F.R. 122.41. Monitoring requirements, including test methods, quality control, sample preservation, containers, and holding times in 40 C.F.R. Parts 122 and 136, are also applicable and will be adhered to.

The Pennsylvania ARAR for ground water for hazardous substances is that all ground water must be remediated to "background" quality as specified by 25 PA Code Section 75.264(n). The Commonwealth of Pennsylvania also maintains that the requirement to remediate to background is also found in other legal authorities.

Air stripper effluent will be discharged onsite to the East Branch of Hog Run Creek, therefore NPDES requirements will not be applicable. Even though a NPDES permit is not required, specific effluent discharge limits will be monitored and must be maintained by the treatment facility. The atmospheric emissions from the air stripper would be subject to air pollution control requirements. Based on preliminary estimates, these emissions would not exceed applicable standards. Since the treatment scheme was designed to meet applicable state and federal discharge and emission control requirements, all pertinent ARARs should be met by the selected remedy. A summary of the pertinent state and federal ARARs are listed in Table 7 and are identified as either action, chemical, or location specific.

Cost-Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its costs. The net present worth value of the selected remedy being $1,232,000 for the initial thirty years of operation, and a recalculated present worth cost of $1,345,000 which consists of an additional 15 year period in an attempt to reach background ground water levels. While Alternative No. 3 also affords a high degree of protection to human health and the environment, its present worth value is $2,177,000 for a thirty year period of operation. For comparison, if Alternative No. 3 were modified to

Table 7

ACTION-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Clean Water Act	40 C.F.R. Section 122.44(a)	Discharge of air stripper effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2 Best available technology economically achievable and best conventional pollution control tech. required to control toxic & nonconventional pollutants & conventional pollutants, respectively.
Clean Water Act	40 C.F.R. Section 122.44	Ambient Water Quality Standards for discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2

Table 7 (continued)

ACTION-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Clean Water Act	40 C.F.R. Sections 125.100, 125.104, 122.41(i), 136.1-136.4	Discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2 Best Management Program to prevent release of toxic constituents to surface waters.
Pennsylvania Clean Streams Law	25 PA Code Section 5	Discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2
Pennsylvania National Pollution Discharge Elimination System Regulations	25 PA Code Section 5	State Water Quality Standards for discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2
Pennsylvania Waste-water Treatment Regulations	25 PA Code Section 95	Discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2

Table 7 (continued)

ACTION-SPECIFIC ARARS

Standard, Requirements, Criteria, or Limitations	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Solid Waste Management Act	40 C.F.R. Section 268 (Subpart D)	Land-disposal restricted requirements for offsite disposal of carbon residue from ancillary carbon adsorption and vapor phase treatment of air stripper emissions.	yes/no	Alt. 2
Pennsylvania Hazardous Waste Management Regulations	25 PA Code Sections 75.264, 75.265	Offsite disposal of carbon residue from ancillary carbon adsorption and vapor phase treatment of air stripper emissions to a permitted treatment, storage, disposal facility.	yes/no	Alt. 2
Pennsylvania Hazardous Waste Management Regulations	25 PA Code Section 75.264(n)	Remediation of ground water to background levels.	yes/no	Alts. 2 & 3
Pennsylvania Hazardous Waste Management Regulations	25 PA Code Sections 75.264, 75.265	Onsite container storage of vapor phase treatment of air stripper emissions.	yes/no	Alt. 2

Table 7 (continued)

CHEMICAL-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Safe Drinking Water Act	40 C.F.R Section 141.61	Maximum contaminant levels for discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2
Clean Air Act	40 C.F.R. Part 61 (Subpart F)	National Emission Standards for Hazardous Air Pollutants (NESHAPs) for air stripper emissions.	yes/no	Alt. 2 TCE may bio-degrade to vinyl chloride (VC), for which a NESHAP is applicable. VC would be managed in accordance with the NESHAP.
Pennsylvania Water Quality Standards	25 PA Code Section 93	Site-specific limits for discharge of treatment system effluent to East Branch of Hog Run Creek.	yes/no	Alt. 2 Monthly avg. & max. daily avg. for TCE (3 & 6 ug/l); vinyl chloride (0.02 & 0.04 ug/l); & 1,1,1 - TCA (605 & 1210 ug/l).

Table 7 (continued)

CHEMICAL-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Pennsylvania Air Pollution Control Regulations	25 PA Code Sections 121.1-143.3	Site-specific limits for air stripper emissions.	yes/no	Alt. 2 Total volatile emissions not to exceed 4 tons/year or 1 pound/hour.

Table 7 (continued)

LOCATION-SPECIFIC ARARS

Standard, Requirement, Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Discussion
Fish and Wildlife Coordination Act	40 C.F.R. Section 6.302	Floodplain and fish and wildlife protection.	yes/no	Alts. 2 & 3
Pennsylvania Air Pollution Control Regulations	25 PA Code Sections 121.1-143.3	Site-specific limits for air stripper emissions.	yes/no	Alt. 2 Total volatile emissions not to exceed 4 tons/year or 1 pound/hour.

include an additional 15 years of operation in an attempt to reach background, the estimated present worth cost would be $2,370,000.

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

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the ground water operable unit at the Croydon TCE Site. Because the principle threat, the source of the ground water contamination, has not been identified, none of the alternatives including the selected remedy may achieve a permanent solution. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that this selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost also considering the statutory preference for treatment as a principal element and considering state and community acceptance. If, however, the source of the ground water contamination is depleted or consists only of residuals in the vadose zone (unsaturated soil layer above the level of ground water), the selected remedy may result in a permanent solution because the ground water will be treated to acceptable health- and risk-based action levels. Therefore, the statutory preference for remedies that employ treatment as a principal element is satisfied.

Reduction of Toxicity, Mobility, or Volume

The selected remedy reduces the mobility and volume of the contaminant plume, since ground water from outside the study area replaces water pumped from the aquifer and thereby causes the plume to decrease in size. The remedy's pumping would also lower the water table, such that the East Branch of Hog Run Creek would no longer discharge contaminants to surface water. Air stripping provided in the remedy would reduce contaminant concentrations and, therefore, toxicity, within the study area.

Schedule

The anticipated schedule is for the design to begin in the summer of 1990. Once the design is completed, a construction period of approximately one year will be required for the installation of the extraction wells and the ground water treatment facility.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R03-90/088	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Croydon TCE, PA
Second Remedial Action - Final

5. Report Date
06/29/90

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Croydon TCE site is in Bristol Township, Bucks County, Pennsylvania. A series of studies conducted by EPA beginning in 1984 led to the detection of VOC contamination in the ground water over a 3.5-square mile area referred to as the study area. The study area is predominantly residential with an estimated 3,000 residents. A small southeastern portion of the study area containing elevated levels of VOCs, particularly TCE, and numerous potential source areas have been identified and are referred to collectively as the "focused area of investigation." This smaller area is composed of the Croydon residential community and several manufacturing and commercial establishments. The study area is bordered on the south by the Delaware River. Neshaminy Creek, which borders the study area to the west, and Hog Run Creek, which flows through the focused area of investigation, both discharge to the river. Although the source of contamination has not been identified, the contaminant plume appears to be flowing south-southeast into the East Branch of Hog Run Creek and probably into the Delaware River. A 1988 Record of Decision (ROD) documented the provision of a public water supply to 11 residents within the identified ground water contaminant plume area. This 1990 ROD addresses the remediation of the ground water contamination at the site. The primary contaminants of concern affecting the ground water are VOCs including TCE and 1,1-DCE.
(See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision - Croydon TCE, PA
Second Remedial Action - Final
Contaminated Medium: gw
Key Contaminants: VOCs (TCE, 1,1-DCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 128
	20. Security Class (This Page) None	22. Price

RESPONSIVENESS SUMMARY
CROYDON TCE SUPERFUND SITE

RESPONSIVENESS SUMMARY
FOR THE
PROPOSED REMEDIAL ACTION
AT THE
CROYDON TCE SUPERFUND SITE
BRISTOL, PENNSYLVANIA

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Appendix A - Comments on the Proposed Remedial Action Plan for the Croydon TCE Superfund Site from Rohm & Haas

Appendix B - Comments on the Proposed Remedial Action Plan for the Croydon TCE Superfund Site from Unitech Engineers

RESPONSIVENESS SUMMARY
FOR THE PROPOSED REMEDIAL ACTION
AT THE CROYDON TCE SUPERFUND SITE
BRISTOL, PENNSYLVANIA

I. INTRODUCTION

In accordance with the U.S. Environmental Protection Agency's (EPA) community relations policy and guidance, the EPA Region III office announced a public comment period from May 2, 1990 to May 31, 1990, to obtain comments on Phase II of the Proposed Remedial Action Plan (PRAP) for the Croydon Trichloroethylene (TCE) Superfund site in Bristol Township, Bucks County, Pennsylvania. The Croydon TCE site encompasses a 1.5 mile area where a contaminated plume that poses a threat to residents who rely on groundwater as their sole source of potable water has been identified. On May 18, 1990, EPA and the Pennsylvania Department of Environmental Resources (DER) held a public meeting to receive public comments on the proposed remedy. Approximately 45 community residents and interested persons attended the meeting. Copies of the PRAP were distributed at the meeting and placed in the information repositories for the site.

Public comments received during the comment period are documented and summarized in this Responsiveness Summary. Section II, immediately following, summarizes the presentations made at the public meeting on May 18, 1990. Section III presents a summary of questions and comments expressed by the public at the May 18 public meeting. Appendices A and B cntain written comments. All questions and comments are grouped into general categories, according to subject matter. Each question or comment is followed by EPA's response.

II. SUMMARY OF MAY 18, 1990 MEETING PRESENTATIONS

A. Purpose of Meeting and Meeting Introduction

Leanne Nurse, the U.S. EPA Region III Community Relations Coordinator for the Croydon TCE Superfund site, welcomed meeting attendees. She explained that EPA and PADER were holding the meeting during the public comment period on the Proposed Remedial Action Plan (PRAP) for the Croydon TCE Superfund site. A secondary function of the meeting was to allow concerns about enforcement-related questions to be addressed by State staff members. She then introduced some guests present, as well as the speakers for the night.

Ms. Nurse explained the Superfund program itself. She stated that the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), was passed by Congress in 1980. That law authorized money to identify some of the worst hazardous waste sites in the country. These sites are evaluated for the kinds of substances that are present and the risks that they pose to the public. If they qualify, the sites are placed on the National Priorities List (NPL). Once on the NPL, the sites are eligible to receive Superfund money for cleanup.

Ms. Nurse further explained the remedial process at individual sites. She told attendees that once a site is listed on the NPL, a Remedial Investigation (RI) is undertaken. The Remedial Investigation involves a team of scientists evaluating the substances present at a site, the quantities which are present, and the risk posed to human health and the environment. During the Remedial Investigation, an Information Repository is set up to provide information about the site to the public in the site vicinity, and a Community Relations Plan is developed to involve the community in site activities. Once the Remedial Investigation is conducted, a Feasibility Study (FS) is begun to study the best ways to clean up contamination at the site and evaluate possible remedial actions for the site. At the conclusion of the Feasibility Study , the public is given an opportunity to comment on the PRAP for site cleanup during an advertised 30-day public comment period.

Ms. Nurse stated that this is where the Croydon TCE site currently is in the Superfund process. She explained that the purpose of the meeting was to present to the public several alternatives for the remediation of the site. She further explained that EPA and PADER would be soliciting input. At the end of May the comments would be studied and a Record of Decision (ROD) would be written in June. Once completed, the ROD would be presented to the public. She invited meeting attendees to comment on the proposed action.

She added that all comments made at the meeting were being recorded and a transcript would be made. Additionally, EPA will

prepare a Responsiveness Summary to summarize all comments received at the meeting and in writing, and EPA's responses to them. These become part of the final ROD, in which EPA states the next cleanup action for the site. Once this decision is made, it will be published in a local newspaper and the public will have another 30-day opportunity to comment on the Record of Decision.

B. Site Background and Proposed Plan

Jeffrey B. Winegar, P.E., the EPA Remedial Project Manager (RPM) for the Croydon TCE site, briefly explained the site layout and history, and the findings of the Remedial Investigation and the Feasibility Study (RI/FS).

Mr. Winegar explained that the Croydon Site Remedial Investigation was begun after the results of investigations at nearby the Rohm & Haas site were released in 1984. That study identified groundwater contamination which was originating north of the Rohm & Haas site, thus emanating from a separate source. EPA concurred with this conclusion of the 1984 study which led to the placement of the Croydon Site on the NPL in September 1985.

Mr. Winegar then explained that in 1986, Phase I of EPA's Remedial Investigation of the Croydon Site began. Through the use of historical aerial photography, investigators were able to detect potential sources of the groundwater contamination. Aerial photographs narrowed the study area to a 1.5 square mile area in Croydon. The Remedial Investigation identified groundwater contaminants to be trichloroethene (TCE), with a maximum concentration of 420 parts per billion; 1,1-dichloroethene at 160 parts per billion; and 1,2-dichloroethene at 16 parts per billion. Surface water contamination was concentrated in the east branch of Hog Run Creek with TCE at 6.1 parts per billion; and 1,1,1-trichloroethane at 2.3 parts per billion. These levels of TCE are well above the Maximum Contaminant Level allowed under the Safe Water Drinking Act for human ingestion. The investigation also found sediment contamination in the east branch of Hog Run Creek. The compounds found were toluene, 1,2-dichloroethene, and methylene chloride. Soils tested in the study area showed the presence of polychlorinated biphenyls (PCBs) at 590 parts per billion, which is low. The action level for PCBs is 50 parts per million.

Mr. Winegar added that an Endangerment Assessment was conducted as part of the Phase I Remedial Investigation to identify site risks and ways that people and the environment were exposed to site contaminants. This study found that domestic use of groundwater (ingestion and inhalation of contaminants) posed unacceptable risks to human health. However, skin contact with both soil near the Rohm & Haas property and sediments in Hog Run Creek did not pose unacceptable risks. The action taken as a result of these findings was to provide alternate water sources for residents whose wells were contaminated. EPA tested the water from the Bristol Borough at three locations, which all tested safe.

Based on those results, EPA connected residents to the city water lines; the final connection was completed several weeks ago.

Mr. Winegar told meeting attendees that, at the conclusion of Phase I of the Remedial Investigation, investigators had partially identified the groundwater contamination boundaries, but had not pinpointed the source or sources of contamination. As a result, a Phase II Remedial Investigation was conducted to better define the boundaries of the contamination and to locate the sources of contamination. The study focused on three potential sources: Sherwood Refinishing, Hartwell Trucking and its adjacent property, and Scorpio Industries. To monitor the potential sources, monitoring wells were placed upgradient and downgradient of all three properties. The wells installed varied in depth ranging from 55 to 112 feet. Because the levels of TCE were found to be minimal in the deeper wells, the study focused on the shallow aquifer which supplies potable water for area residents. Extensive soil testing was done using soil boring and soil gas technologies. The soil testing indicated conclusively that there was no threat to human health resulting from dermal contact. Phase II of the Remedial Investigation also sought to confirm or dispel public concerns raised during Phase I public meetings that material from the Rohm & Haas landfill had been used as fill in the Croydon area. Suspected areas were tested and were found to be clean.

Mr. Winegar stated that no definite source had been identifie at the end of the Phase II Remedial Investigation field study. The investigators next tested a theory that the properties in question were dumping TCE into the sewer lines. Following key manhole sampling, the only contaminants found were low concentrations of xylenes and tetrachloroethene, but no TCE or 1,1-dichloroethene were detected. Next, looking at the area around Scorpio Industries, investigators found numerous ground stains on the aerial photographs dating back to the 1950s. Soil borings were taken and, again, only low levels of TCE were found. However, when the samples were taken from groundwater level, the concentrations increased. This coincided with the Phase I results. The Hartwell Trucking property also was tested and seven locations were detected to have volatile contaminants. None of these concentrations, however, was the source of contamination.

Mr. Winegar concluded his presentation by stating that after the field investigations were completed, the Feasibility Study was conducted to identify and evaluate possible courses of action for the site. The Feasibility Study examined three potential alternatives: 1) take no action, which the National Contingency Plan (NCP) requires EPA to consider for comparison purposes; 2) perform groundwater extraction followed by air stripping and activated carbon treatment; and 3) perform groundwater extraction and discharge to the Bristol Township wastewater treatment facility. EPA is recommending alternative two because it best protects public health and the environment.

III. PUBLIC MEETING COMMENTS

This section contains questions and comments presented at the May 18, 1990, public meeting. Comments contained in this section are grouped according to subject discussed.

A. The Proposed Remedy for the Croydon TCE Site

1. **One commenter asked whether the proposed treatment system would allow EPA to distinguish if the current source of contamination would continue to affect groundwater.**

   EPA Response: Because past investigations have been unable to identify the source of contamination, this action will not be the final remedy at the Croyden site. The proposed remedy for this phase will pump and treat the contaminated groundwater for a period of time, after which EPA will evaluate whether it is decreasing the contamination. If concentrations of TCE are found to be diminishing, the contamination source is probably not a continuous source, but rather is a historic spill that is effectively being cleaned up.

2. **A commenter asked whether EPA would continue to look for the source of contamination during the two years it will take to get a groundwater treatment facility up and running.**

   EPA Response: The State is responsible for the continuous monitoring of the existing wells to see if the groundwater contamination is affecting other residences that use private wells. EPA will conduct annual sampling to see if the contamination is migrating to additional residential areas.

3. **A meeting attendee asked if residents who are in the contaminated area and are now hooked up to the city water lines are still using their wells. The attendee asked EPA to identify the 11 affected homes and tell how deep their wells are.**

   EPA Response: The residents whose wells EPA disconnected and whose homes EPA then connected to public water were told they could still use their wells for outside use such as watering and car washing. However, any internal use in the household is strictly prohibited, as is any cross-connection between their wells and the public water supply that EPA provided. The residential wells were above the saprolite layer and varied in depth from 20 to 65 feet. Mr. Jeffrey Winegar, the EPA Project Manager for the site, said he was not at liberty to disclose the identity of the 11 homes.

4. **Several commenters asked about the planned desi of the treatment plant and how it would impact t community. Some asked whether the plant will be placed in anyone's backyard, whether the level of noise and air pollution would be safe, and whether it would include several 40- to 50-foot stacks?**

EPA Response: EPA will take great care in selecting an appropriate site for the treatment plant. During the meeting that will be held when the plant design is 30 percent completed, a secure location should be presented and EPA will hold a Remedial Design briefing; site selection will take into account the public's views. The treatment plant will not be located in a residential area. The extraction wells may be located on property lines, but as yet no specific sites for the wells have been decided. The treatment system will be designed so that it does not emit gases and thus will present no health threat. It will require only one air stripping tower that will be 30 feet tall; no other stacks will be built. Additionally, the treatment plant will be equipped with muffler systems that effectively abate noise.

5. **One commenter asked to be shown the proposed location of the groundwater treatment plant.**

EPA Response: The present proposed location for the treatment plant is south of the East Branch of Hog Run Creek, off of Oak Street.

6. **A commenter asked whether a flood would affect the integrity of the extraction system and treatment facility.**

EPA Response: The treatment plant will be built above the 50-year historical flood line. The extraction wells would not be affected by a flood because they would have flush covers and be sealed. The treatment plant would only receive water through the underground piping system, which means that an increase flow in surface water would not affect the volume of water to be treated.

7. **One meeting attendee asked why EPA did not plan to locate the treatment facility on any of Rohm & Haas' property holdings in the area. The attendee stated that building the system in these locations would place it further away from residential areas.**

EPA Response: EPA will take that suggestion into consideration when choosing the final location of the treatment facility. However, EPA has no intention of

placing it in a densely populated area even though the exhaust gases pose no threat to the public.

8. **One commenter asked what will happen if EPA does not extend city water to his area and his well dries up due to the removal of groundwater by the extraction system.**

   EPA Response: EPA will construct a groundwater monitoring system using existing residential and monitoring wells to track the effect of water displacement on the areas within the extraction zones. If necessary, in consultation with the County and Township, EPA may implement restrictions on groundwater use. As the final design of the treatment system is developed, more study will be directed at the effects of the extraction system on local groundwater.

9. **Several commenters asked whether the treatment plant would produce any by-products and where such materials would be disposed.**

   EPA Response: The process by which TCE is precipitated out of the groundwater would produce a by-product that would be affixed to the activated carbon media in the air stripping tower. All the volatile compounds will be captured on the activated carbon media, which will then be sent out to be either regenerated, cleaned with high pressure steam, or burned. The ultimate decision is left to the contractor that will be selected to build and operate the system. Whatever method is chosen will be carefully monitored. If the by-product is landfilled, it would be taken to a landfill permitted under the Resource Conservation and Recovery Act (RCRA). If it is burned, it would go to an approved RCRA incinerator; because there are none in the area, the material would probably be taken out of State. Whatever method is chosen, the substance will be disposed of in compliance with Federal and State guidelines.

10. **A commenter asked whether the treatment plant will be used for other purposes.**

   EPA Response: No, it is a single-use facility that cannot be used for contamination from sources other than the Croydon TCE site. The function of the treatment system is to treat the highly concentrated area of the plume and to draw the contamination in towards the treatment plant and identify the source.

11. **One meeting attendee asked how long it will take to reach a final design, receive final approval, and begin operation.**

EPA Response: EPA anticipates that a Record of Decision will be signed in June 1990. The final design should b completed within six to eight months following signature The only necessary step in finalizing approval is State concurrence. A public briefing will be held at the 30-percent design stage. In early 1991, shortly after finalizing the design, bids will be taken for the construction contract. This generally takes an additional three to four months. Groundbreaking should take place in approximately 1 to 1-1/2 years from now and operation should commence in at least two years.

12. **One commenter asked how long the contamination would continue and what the long-term outcome is expected to be.**

EPA Response: Once the treatment plant is in place and operational, it will prevent the movement the plume; the extraction process also will change the configuration of the plume. If there is a specific source of contamination, the treatment system will create a "hallway of contamination" that will point to and indicate the source. It is not possible at this time to predict how long treatment will be needed; however, EPA is required under the Superfund law to return to the site at least every five years, or earlier if warranted, to evaluate the effectiveness of the treatment.

13. **Several commenters were concerned that the map EPA was presenting to show the potential site of the treatment facility did not show street names. They felt EPA should have supplied such information.**

EPA Response: At the 30-percent design stage meeting EPA should be able to provide the final proposed locations for the extraction wells and the treatment plant. At that time the public will have an opportunity to comment. Mr. Winegar apologized for the absence of street names.

14. **A commenter asked which of the three proposed alternatives EPA is recommending.**

EPA Response: The three alternatives considered for the site are as follows: 1) Take no action, as required by the NCP; 2) perform groundwater extraction followed by air stripping and activated carbon treatment; and 3) perform groundwater extraction and discharge to the Bristol Township wastewater treatment facility. EPA is recommending alternative two because it best protects public health and the environment

B. Cost of the Remedial Action for the Croydon TCE Site.

1. One commenter asked what the cost of the remedial action will be and how future costs were calculated.

EPA Response: EPA looks at capital costs, which are costs to build the plant; operation and maintenance costs, which are costs to operate the plant; and present worth, which is the amount of money that EPA needs to put aside to pay for construction and operation of the plant. The present worth for capital costs is just over &500,000; the present worth of the annual operating costs is estimated to be $46,000 per year for the next 30-year operation period. EPA calculates a 5 percent increase in costs for each operating year, then calculates the costs using the value of these costs based on 1990 terms. In this case, EPA will be budgeting to cover the first 10 years of operation with the State assuming the remaining operation which is estimated to be 20 years.

2. Several commenters asked who the responsible parties are and who will pay for the costs of the remedial action. They expressed the concern that the required money would be obtained from tax payers.

EPA Response: Superfund was established as a trust fund to clean up hazardous sites on an emergency basis. The intention is to identify potentially responsible parties (PRPs) and recover the costs of the response or get the PRPs to initiate the cleanup. It is EPA's policy to recover 100 percent of all past and future costs from the responsible parties. Superfund is funded through several different industrial levies, not individual tax payers. Unfortunately, in this instance the PRPs have yet to be identified. EPA hopes that the cleanup will point to the source so that action may be taken to identify the PRP(s) and recover costs.

C. Site History and Current Status

1. Several meeting commenters asked whether any wells had tested positive for TCE outside of EPA's designated site perimeters and asked what will happen if the plume is expanding. Another attendee added that his well, tested independently, had been found to be contaminated.

EPA Response: Of the wells tested outside the 1.5-mile radius, only one near Neshaminy Creek showed any contamination. EPA believes this was the result of a faulty laboratory test, because this well is not located in the area of identified groundwater contamination. The

State will continue to monitor wells in the area to ensure there are no wells being used with unsafe levels of TCE. If the plume expands, EPA will expand water services. Mr. Winegar, the Project Manager, asked who had tested the commenter's well and when the testing had been conducted; he said that he would check on the results and contact the individual.

2. **A commenter asked where the areas of highest concentrations of TCE are located.**

EPA Response: Sampling results show the TCE concentration in the lower portion of the shallow aquifer. The outer perimeter of the area of contamination contains concentrations of one part per billion; the concentrations increase toward the center of the contamination. The highest areas of concentration, to the north of the East Branch of Hog Run Creek, are 420 parts per billion. The treatment processes will place extraction wells in this area to draw out the contaminants.

3. **One commenter asked how the extraction wells will be constructed.**

EPA Response: The treatment system will initially require four extraction wells, each of which will be six to eight inches in diameter. The wells will be positioned to contain the plume and will reach down to the saprolite layer of the groundwater. TCE is known to sink since it is heavier than water; therefore, the highest concentrations have been found in the deeper wells. Underground piping will be installed which will transport the groundwater to the treatment plant where volatile compounds, including TCE, can be removed.

4. **Several commenters asked about the potential sources of contamination and whether EPA had conducted tests at Coyne Chemical.**

EPA Response: The currently identified potential sources of contamination are Sherwood Refinishing, Hartwell Trucking and its adjacent property, and Scorpio Industries. These are being investigated because each may have used the same chemicals that are currently causing groundwater contamination. Tests were conducted at Coyne Chemical as part of the Phase I Remedial Investigation and no evidence of contamination was found.

5. **One commenter asked what action EPA would take once the potential contaminators were identified. The commenter further asked whether these businesses would be permitted to continue normal**

operations, especially given their close proximity to a residential area.

EPA Response: Once the source or sources are identified, monitoring wells would be placed upgradient and downgradient of the properties. Soil boring samples and soil gas samples would be taken throughout the properties to detect if any illegal dumping was taking place. Legally, these business may continue to operate until conclusive evidence is available to take action. Their close proximity to residential areas constitutes a Township zoning issue and should be acted upon accordingly.

6. **Several commenters were concerned about possible soil contamination and the effects of eating vegetables and fruits grown within the site area.**

EPA Response: After extensive soil testing in the area, EPA found nothing wrong with the soil. There is no danger in eating foods grown in local gardens.

7. **One commenter asked how soil samples are obtained and how far into the soil they were taken.**

EPA Response: To test the risk of dermal contact, soil tests are conducted on the first six inches of soil. The first six inches represent the soil humans are most likely to come into contact with through ingestion and airborne particulates.

8. **A commenter asked if, in the case of Rohm & Haas, EPA had tested soil deeper due to objects buried deeper than six inches.**

The Rohm & Haas landfill is not included in this study; however, EPA has determined that Rohm & Haas did not contribute to the groundwater contamination that is affecting the Croydon area. The Rohm & Haas landfill falls under RCRA. Mr. Winegar offered to entertain questions about the Rohm & Haas study at the end of the meeting.

9. **A commenter asked if EPA had identified potential TCE polluters through historical data of former companies in the area.**

EPA Response: EPA conducted title and deed searches of the industrial-use properties, going back many years prior to the current ownership, to determine if any previous businesses had used processes requiring the use of TCE. No new PRPs were identified.

10. **One commenter asked whether EPA had notified residents living near the three identified potential sources of contamination of potential well contamination.**

EPA Response: Yes. One resident who lives next to the Sherwood Refinishing plant subsequently found that his well was contaminated. He has now been hooked up to the city water lines.

11. **One commenter was concerned about people who for years have been exposed to the contaminants through the use of their wells. The commenter asked when the first study had come out and whether someone could conduct an epidemiological test.**

EPA Response: The first study was completed in 1987, after a field investigation was conducted. After contamination was discovered in the sampled wells, the affected residents were notified by letter. They are definitely at risk if they were drinking the well water from 1960 through 1980. Unfortunately, if they want to be examined for possible adverse effects, they will have to bear the expense.

12. **One commenter asked if those people in the affected area who had hooked up to the city water lines before EPA knew of the contamination would have been hooked up had they waited, even though the first study indicating contamination came out in 1984.**

EPA Response: If EPA had discovered contamination in those wells, the connection to city water lines would have been covered by Superfund. However, EPA did not conduct the 1984 study; Rohm & Haas did. Because of the need to verify these results, EPA decided to conduct its own study during which sampling and analytical procedures were carried out to meet EPA's stringent requirements.

D. **General Comments**

1. **One commenter asked if the practice of oiling the streets to control dust, employed up to 1950, could have caused the TCE problem.**

EPA Response: The oil used for that purpose should have contained solvents allowing the oil to bond with the soil. Any possible water contamination would have resulted if the the substance contained in the oil was stripped from the oil and soil, thus allowing it to seep into groundwater. It is not a likely source of the current contamination.

2. **Several meeting attendees were concerned about the short public notice period and their inability to prepare for the meeting.**

EPA Response: EPA apologized for the delay in placing, a public notice about the meeting in the local paper. This occured because of a change in the scheduling of the Town Council meeting. This EPA meeting date was changed to avoid a conflict. EPA's customary practice is to announce the meeting at least two weeks in advance. Every effort will be made to follow normal public announcement procedures before future site meetings.

3. **A meeting attendee referred to a cleanup of underground tanks which was overseen by EPA in the area between the Hartwell and Sherwood properties. The attendee asked wether that that problem had contributed to the current contamination.**

EPA Response: EPA is aware of the cleanup which probably came under the jurisdiction of the EPA removal program. The cleanup would have included testing to ensure that the removal was effective.

4. **Another meeting attendee asked how EPA would be alerted to a midnight dumper since the soil in the area is sandy and the spill would migrate quickly.**

EPA Response: EPA has in place monitoring wells that go down to the saprolite area. These wells are deep enough to detect such fluctuations in contamination levels.

5. **One commenter felt that the stack at the treatment facility would only be transferring the problem to the air, which would be compounded by Rohm & Haas' proposed incineration facility.**

EPA Response: EPA is predicting 96 to 99 percent removal of TCE from stack emissions from the Croydon treatment plant. There is no health risk associated with the exhaust gases from the air stripping unit.

6. **One commenter asked when a site is designated as requiring no further action. The commenter asked whether the site is then considered to be "clean" and can be removed from the National Priorities List (NPL).**

EPA Response: The process for removing a site from the NPL is called deletion. Once a site has meet the relevant and appropriate requirements of Superfund to protect the public health and safety, a public hearing is held to decide on whether or not to remove the site from

the NPL. This is done only after the site is deemed clean after many years of monitoring its stability by EPA.

7. **A commenter asked whether homes in close proximity to Sherwood Refinishing or Dave's Furniture were in any danger from air pollution.**

EPA Response: Any danger posed from emissions is not covered under Superfund. The Township ordinances govern the level of current emissions.

E. Other Potential Sources of Contamination

1. **A commenter asked if EPA was aware of a pesticides facility that used to be located on River Road.**

   EPA Response: No, the current investigation was based on the historical aerial photographs that indicated ground stains as far back as 1950 as well as the stockpiling of drums and other debris. Mr. Winegar asked for an address which was given as 2901 River Road.

2. **One meeting attendee referred to a letter in the site information repository which recommended geophysical techniques be used on the Hartwell property. Additionally, the questioner expressed dismay that, with the current level of technology, the source of contamination could not be located.**

   EPA Response: EPA did conduct a magnetometer survey of the Hartwell property and the adjacent property. Through the technique of soil gas technology and soil borings, contamination of TCE was found. However, the contamination was 20,000 parts per billion at four to six feet below the ground surface. This has not reached the groundwater level. Because this spill could affect the groundwater in the future, EPA notified PADER of the site. PADER will take the appropriate action of notifying the property owner and getting him to clean the site. If the property owner does not take immediate action, the Superfund program would initiate cleanup.

3. **One commenter who lives near one of the monitoring wells near the Hartwell Trucking property was concerned about the safety of animals and children that played in the creek which also ran through the Hartwell property.**

   EPA Response: In order to be at risk, the children would need to come in direct contact with the identified "hot" spot on Hartwell property. They would have to intentionally inhale dirt or dig directly in the contaminated soil to come into skin contact with the contamination. Contact with the creek or sediments in the creek poses no threat to either humans or animals.

4. **One commenter informed EPA of a rumor that there was an illegal dump within the wetlands adjacent to the Scorpio property near Excelsior.**

   EPA Response: EPA did not test in that particular area because it was not identified as a potential source from the aerial photography.

APPENDIX A

COMMENTS ON THE PROPOSED REMEDIAL ACTION PLAN FOR THE CROYDON TCE SUPERFUND SITE FROM ROHM & HAAS

ROHM AND HAAS DELAWARE VAL . EY INC.
P O. GOX 219. BRISTOL. PA. 19007
(215) 785-8000

May 30, 1990

Mr. Jeff Winegar
Remedial Project Manager
U.S.EPA Region III
841 Chestnut Street
Philadelphia, PA 19107

Dear Mr. Winegar:

During the public hearing on the Croydon TCE Superfund Site a question was raised by Ms. Anna Rogers, Councilwoman of Bristol Township regarding notification of local authorities and other appropriate agencies of analytical results when the issue of potential TCE contamination was first discovered.

Dr. Paul Rosenstock of Rohm and Haas Company stated such notifications of the analytical results was made to the local government in 1984 -- a statement clearly questioned by Ms. Rogers.

Attached is a chronology of the correspondence and copies of those communications to the Bristol Township officials detailing the analytical results of individual homeowner's wells. You will note copies of all analysis were also sent to the Bucks County Health Department.

We would ask that the public record on this issue reflect these documents so as not to confuse or misrepresent the situation,

Sincerely,

Brian McPeak

cc: Councilwoman Anna Rogers

BMcP/dew
Attachments

ROHM AND HAAS DELAWARE VALLEY INC.

P O BOX 219. BRISTOL. PA. 19007
(215) 785-8000

May 24, 1990

Ms. Anna Rogers
Councilwoman
2501 Oxford Valley Road
Bristol Township Municipal Building
Levittown, PA 19057

Dear Ms. Rogers:

At the public hearing on the Croydon TCE Superfund site you publicly questioned the statement that Rohm and Haas had notified the local officials of the results of the monitoring of homeowner wells conducted in 1984. By the tone and manner of your comment, you raised publicly a question as to whether such notification indeed took place.

We have reviewed our files and found the following list of documents to be related to this issue and forwarded to your local government at that time.

October 13, 1983:

To:	Mr. Carmen Raddi, Acting Manager, Bristol Township
From:	Richard Grzywinski, P.E. - V.P. Betz, Converse, Murdoch
Subject:	Invitation to offer residents and businesses in Croydon a laboratory analysis of water provided for their private wells at Rohm and Haas' expense. Requested name & other information of residents requesting this service.

February 2, 1984:

To:	Mr. Robert Lewis, President Board of Supervisors
From:	Mr. Richard J. Grzywinski, P.E. - V.P. BCM Eastern, Inc. (formerly Betz, Converse, Murdoch)
Subject:	Analysis of residential wells The analytical results of water samples collected by BCM from nine Township residential wells in the Croydon area.
Copy to:	Bucks County Board of Health

February 16, 1984:

To:	Mr. Robert Lewis, President Board of Supervisors
From:	Richard J. Grzywinski, BCM Eastern, Inc.
Subject:	Final Analytical results for nine residential well in Croydon
Copy to:	Bucks County Board of Health

June 11, 1984:

To:	Mr. Robert Lewis, President Board of Supervisors
From:	Richard J. Grzywinski, BCM Eastern, Inc.
Subject:	Analysis of 4 additional residential wells in Croydon
Copy to:	Bucks County Department of Health

October 18, 1984:

To:	Mr. Robert Lewis, President Board of Supervisors
From:	Richard J. Grzywinski, BCM Eastern, Inc.
Subject:	Analysis of results from one residential well in Croydon
Copy to:	Bucks County Board of Health

August 7, 1984:

To:	Mr. Robert Lewis, President Board of Supervisors
From:	Richard J. Grzywinski, BCM Eastern, Inc.
Subject:	Analysis of results from one residential well in Croydon
Copy to:	Bucks County Board of Health

May 30, 1985:

To:	Mr. George Foster/Maple Beach Road
From:	Richard J. Grzywinski, BCM Eastern, Inc.
Subject:	Analysis of well
Copies to:	Bucks County Health Department Stanley Gawel, Bristol Township Manager

Each of the referenced letters included a packet of information which detailed the analytical results. They are also part of the previous studies on our site conducted by BCM and submitted to the U.S.E.P.A. with copies to Bristol Township.

Frankly as the list of references indicates, we fully informed all the agencies and local community. To suggest otherwise was grossly unfair. We are submitting this letter along with appropriate references to the U.S.E.P.A. so that the official proceedings and record of the public hearing will be complete. In the event you no longer have these files at the municipal building, you can call me at 785-8828 to discuss the matter, or contact the Bucks County Department of Health, which received copies of all the correspondence listed.

Sincerely,

Brian McPeak

cc: C. Raddi
J. Gallagher
A. Cipullo
C. Cini
V. Lattanzi
R. Lewis

P. Rosenstock, Rohm and Haas DVI
State Representative Anthony Melio

BMcP/dew

V 14 1985

BCM

Betz • Converse • Murdoch • Inc.

Consulting Engineers, Planners and Scientists

October 13, 1983

DEU DEPARTMENT

OCT 14 '83

JCB xc JMB HMR
DKE PAD PDR
WJF GCM T/F
AAK RJO xc File
WDR Tx 7671.
RAR

Mr. Carmen Raddi
Acting Manager
Bristol Township
2501 Oxford Valley Road
Levittown, PA 19057

Subject: Groundwater Analysis

Dear Mr. Raddi:

The Rohm and Haas Company has authorized BCM Eastern Inc. (BCM) to offer residents and businesses in Bristol Township a laboratory analysis of water provided from their private wells. This offer is made to any resident or business within an area bounded by China Lane (River Road), State Road, Elm Avenue and Cedar Avenue. The fees for the analyses are, of course, being paid for by Rohm and Haas Company.

Please provide me with the name, address, and phone number of any township resident or business within the delineated area who desires this service. In order to complete this work in a reasonable time frame, I ask that you provide BCM with this information by October 31, 1983.

Samples must be taken by a qualified BCM technician only. No samples other than those collected by a trained technician, using the prescribed EPA sampling methodology, can be included in the program.

Please call me at any time if you have any questions. I look forward to hearing from you by the end of the month.

Very truly yours,

Richard J. Grzywinski

Richard J. Grzywinski, P.E.
Vice President

pd
cc: P. D. Rosenstock, Rohm and Haas Company
G. A. Schnabel, Rohm and Haas Company

4

BCM Eastern Inc.
Engineers, Planners and Scientists
One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

February 2, 1984

NOV 14 1984

Mr. Robert Lewis, President
Board of Supervisors
Bristol Township
Bristol, PA 19007

Subject: Analysis of Residential Wells

Dear Mr. Lewis:

BCM Eastern Inc. (BCM) is pleased to provide you with the analytical results of the water samples collected by BCM from nine township residential wells (Table 1). The names and addresses of the well owners are presented in Table 2. The well locations are as provided to BCM by Bristol Township.

With one exception, concentrations of each of the parameters for which there is an associated U.S. Environmental Protection Agency Interim Primary Drinking Water Standard are within those standards. The exception is the nitrate concentration in well 6 which is 11.05 mg/l (milligrams per liter or ppm), which is 1.05 mg/l above the drinking water standard. Trichloroethylene (TCE) was detected in five of the wells.

Should you have any questions or require additional information, please do not hesitate to contact me.

Very truly yours,

Richard J. Grzywinski, P.E.
Vice President

pd
Attachments
cc: Bucks County Board of Health

ECM

Parameter	Units	Johnson Residence Orchard Avenue
Priority Pollutants - Base Neutral Organics (Continued)		
2,6-Dinitroteuene	ug/l	<10
Acenaphthene	ug/l	<10
2,4-Dinitrotoluene	ug/l	<10
Diethyphthalate	ug/l	<10
Fluorene	ug/l	<10
4-Chlorophenyl phenyl ether	ug/l	<10
diphenylamine-n-nitroso	ug/l	<10
1,2-Diphenylhydrazine (Azobenzene)	ug/l	<10
4-Bromophenyl phenyl ether	ug/l	<10
Hexachlorobenzene	ug/l	<10
Phenanthrene	ug/l	<10
Anthracene	ug/l	<10
Di-n-butyl Phthalate	ug/l	<10
Fluoranthene	ug/l	<10
Benzidine	ug/l	<10
Pyrene	ug/l	<10
Butybenzyphthalate	ug/l	<10
Benzo(a)anthracene	ug/l	<10
3,3'-Dichlorobenzidine	ug/l	<10
Chrysene	ug/l	<10
bis-(2-Ethylhexyl) phthalate	ug/l	29
Di-n-octyl phthalate	ug/l	<10
Benzo(b)fluoranthene	ug/l	<10
Benzo(k)fluoranthene	ug/l	<10
Benzo(a)pyrene	ug/l	<10
Indeno(1,2,3-c,d)pyrene	ug/l	<25
Dibenzo(a,h)anthracene	ug/l	<25
Benzo(g,h,i)perylene	ug/l	<25
Priority Pollutants - Acid Extractable Organics		
Phenol	ug/l	<25
2-Chlorophenol	ug/l	<25
2-Nitrophenol	ug/l	<25
2,4-Dimethylphenol	ug/l	<25
2,4-Dichlorophenol	ug/l	<25
p-Chloro-m-Cresol	ug/l	<25
2,4,6-Trichlorophenol	ug/l	<25
2,4-Dinitrophenol	ug/l	<250

ECM

Parameter	Units	Johnson Residence Orchard Avenue
CATEGORY 5		
Volatile Organics - EPA Method 601 (Continued)		
1,1,1-Trichloroethane	ug/l	4.8
Carbon tetrachloride	ug/l	<1.0
Bromodichloromethane	ug/l	<1.0
1,2-Dichloropropane	ug/l	<1.0
trans-1,3-Dichloropropylene	ug/l	<1.0
Trichloroethylene	ug/l	3.1
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropylene	ug/l	<1.0
Bromoform	ug/l	<1.0
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<1.0
Chlorobenzene	ug/l	<1.0
Volatile Organics - EPA Method 602		
Benzene	ug/l	<1.0
Toluene	ug/l	<0.1
Chlorobenzene	ug/l	<1.0
Ethylbenzene	ug/l	<1.0
1,2-Dichlorobenzene	ug/l	<1.0
1,3-Dichlorobenzene	ug/l	<1.0
1,4-Dichlorobenzene	ug/l	<1.0
Priority Pollutants - Base Neutral Organics		
N-Nitrosodimethylamine	ug/l	<10
bis-(2-Chloroethyl) ether	ug/l	<10
1,3-Dichlorobenzene	ug/l	<10
1,4-Dichlorobenzene	ug/l	<10
1,2-Dichlorobenzene	ug/l	<10
bis-(2-Chloroisopropyl) ether	ug/l	<10
Hexachloroethane	ug/l	<10
N-Nitrosodi-n-prophylamine	ug/l	<10
Nitrobenzene	ug/l	<10
Isophorone	ug/l	<10
bis-(2-Chloroethoxy) methane	ug/l	<10
1,2,4-Trichlorobenzene	ug/l	<10
Naphthalene	ug/l	<10
Hexachlorobutadiene	ug/l	<10
Hexachlorocyclopentadiene	ug/l	<10
2-Chloronaphthalene	ug/l	<10
Dimethyphthalate	ug/l	<10
Acenaphthylene	ug/l	<10

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Parameter	Units	Johnson Residence Orchard Avenue
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)		
Cellosolve acetate	mg/l	<0.1
Butyl cellosolve	mg/l	<0.1
Karathane	mg/l	<0.01
Lethane	mg/l	<0.001
DNCP	mg/l	<0.01
Dithane	mg/l	<0.02
2,4-D	ug/l	<1
2,4,5-TP	ug/l	<0.5
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS		
Antimony	mg/l	<0.15
Arsenic	mg/l	0.004
Beryllium	mg/l	<0.01
Cadmium	mg/l	<0.0005
Chromium	mg/l	0.003
Copper	mg/l	<0.03
Lead	mg/l	0.016
Mercury	mg/l	0.0004
Nickel	mg/l	<0.1
Selenium	mg/l	<0.001
Silver	mg/l	<0.001
Thallium	mg/l	<0.3
Zinc	mg/l	<0.01
Cyanide	mg/l	<0.005
Phenols	mg/l	0.009
CATEGORY 5		
Volatile Organics - EPA Method 601		
Chloromethane	ug/l	<1.0
Bromomethane	ug/l	<1.0
Vinyl chloride	ug/l	<1.0
Chloroethane	ug/l	<1.0
Methylene chloride	ug/l	<1.0
Trichlorofluoromethane	ug/l	<1.0
1,1-Dichloroethylene	ug/l	<1.0
1,1-Dichloroethane	ug/l	<1.0
trans-1,2-Dichloroethylene	ug/l	<1.0
Chloroform	ug/l	<1.0
1,2-Dichloroethane	ug/l	<1.0

ECM

TABLE 1

RESIDENTIAL WELL ANALYTICAL DATA
BRISTOL BOROUGH, PENNSYLVANIA

Parameter	Units	Johnson Residence (14) Orchard Avenue
CATEGORY 1 - INDICATOR PARAMETERS		
pH	Standard units	5.4
Specific conductance	umhos	86.6
BOD	mg/l	<6
COD	mg/l	15
TOC	mg/l	4
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS		
Ammonia (as N)	mg/l	<0.05
Boron	mg/l	<0.1
Chloride	mg/l	14.0
Fluoride	mg/l	<0.1
Iron	mg/l	0.05
Nitrate (as N)	mg/l	2.0
Phosphate, Total as P	mg/l	0.04
Sulfate	mg/l	<0.1
Sodium	mg/l	5.81
Potassium	mg/l	1.21
Barium	mg/l	<0.01
Manganese	mg/l	<0.02
Sulfide as S	mg/l	<1
Tin	mg/l	<1
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS		
Surfactants (MBAS)	mg/l	0.08
Oil and grease	mg/l	2
Methyl ethyl ketone	mg/l	<0.1
Isobutyl alcohol	mg/l	<0.1
N-butyl alcohol	mg/l	<0.1
Isopropyl alcohol	mg/l	<0.1
Ethanol	mg/l	<0.1
Butyl methacrylate	mg/l	<10
Methyl methacrylate	mg/l	<0.1
Ethyl acrylate	mg/l	<0.1
Butyl acrylate	mg/l	<0.1
Styrene	mg/l	<0.1
Acetone	mg/l	<0.1
Ethyl acetate	mg/l	<0.1

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Parameter	Units	Steele Residence*
Priority Pollutants - Acid Extractable Organics (Continued)		
4-Nitrophenol	ug/l	<25
4,6-Dinitro-o-Cresol	ug/l	<250
Pentachlorophenol	ug/l	<25
Priority Pollutants - Pesticides and PCBs		
Aldrin	ug/l	<10
Alpha-BHC	ug/l	<10
Beta-BHC	ug/l	<10
Gamma-BHC	ug/l	<10
Delta-BHC	ug/l	<10
Chlordane	ug/l	<10
4,4'-DDT	ug/l	<10
4,4'-DDE	ug/l	<10
4,4'-DDD	ug/l	<10
Dieldrin	ug/l	<10
Endosulfan I	ug/l	<10
Endosulfan II	ug/l	<10
Endosulfan Sulfate	ug/l	<10
Endrin	ug/l	<10
Endrin Aldehyde	ug/l	<10
Heptachlor	ug/l	<10
Heptachlor Epoxide	ug/l	<10
PCB-1242	ug/l	<10
PCB-1252	ug/l	<10
PCB-1221	ug/l	<10
PCB-1232	ug/l	<10
PCB-1248	ug/l	<10
PCB-1260	ug/l	<10
PCB-1016	ug/l	<10
Toxaphene	ug/l	<10

* 740 Church Street, Croyden, PA
Sampling Date: 08/13/84

Source: BCM Eastern, Inc., Project No. 00-4061-10

BCM

Parameter	Units	Steele Residence*
Priority Pollutants - Base Neutral Organics (Continued)		
2,6-Dinitroteuene	ug/l	<10
Acenaphthene	ug/l	<10
2,4-Dinitrotoluene	ug/l	<10
Diethyphthalate	ug/l	<10
Fluorene	ug/l	<10
4-Chlorophenyl phenyl ether	ug/l	<10
diphenylamine-n-nitroso	ug/l	<10
1,2-Diphenylhydrazine (Azobenzene)	ug/l	<10
4-Bromophenyl phenyl ether	ug/l	<10
Hexachlorobenzene	ug/l	<10
Phenanthrene	ug/l	<10
Anthracene	ug/l	<10
Di-n-butyl Phthalate	ug/l	<10
Fluoranthene	ug/l	<10
Benzidine	ug/l	<10
Pyrene	ug/l	<10
Butybenzyphthalate	ug/l	<10
Benzo(a)anthracene	ug/l	<10
3,3'-Dichlorobenzidine	ug/l	<10
Chrysene	ug/l	<10
bis-(2-Ethylhexyl) phthalate	ug/l	29
Di-n-octyl phthalate	ug/l	<10
Benzo(b)fluoranthene	ug/l	<10
Benzo(k)fluoranthene	ug/l	<10
Benzo(a)pyrene	ug/l	<10
Indeno(1,2,3-c,d)pyrene	ug/l	<25
Dibenzo(a,h)anthracene	ug/l	<25
Benzo(g,h,i)perylene	ug/l	<25
Priority Pollutants - Acid Extractable Organics		
Phenol	ug/l	<25
2-Chlorophenol	ug/l	<25
2-Nitrophenol	ug/l	<25
2,4-Dimethylphenol	ug/l	<25
2,4-Dichlorophenol	ug/l	<25
p-Chloro-m-Cresol	ug/l	<25
2,4,6-Trichlorophenol	ug/l	<25
2,4-Dinitrophenol	ug/l	<250

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Parameter	Units	Steele Residence*
CATEGORY 5		
Volatile Organics - EPA Method 601 (Continued)		
1,1,1-Trichloroethane	ug/l	<1.0
Carbon tetrachloride	ug/l	<1.0
Bromodichloromethane	ug/l	<1.0
1,2-Dichloropropane	ug/l	<1.0
trans-1,3-Dichloropropylene	ug/l	<1.0
Trichloroethylene	ug/l	<1.0
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropylene	ug/l	<1.0
Bromoform	ug/l	<1.0
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<1.0
Chlorobenzene	ug/l	<1.0
Volatile Organics - EPA Method 602		
Benzene	ug/l	<1.0
Toluene	ug/l	<1.0
Chlorobenzene	ug/l	<1.0
Ethylbenzene	ug/l	<1.0
1,2-Dichlorobenzene	ug/l	<1.0
1,3-Dichlorobenzene	ug/l	<1.0
1,4-Dichlorobenzene	ug/l	<1.0
Priority Pollutants - Base Neutral Organics		
N-Nitrosodimethylamine	ug/l	<10
bis-(2-Chloroethyl) ether	ug/l	<10
1,3-Dichlorobenzene	ug/l	<10
1,4-Dichlorobenzene	ug/l	<10
1,2-Dichlorobenzene	ug/l	<10
bis-(2-Chloroisopropyl) ether	ug/l	<10
Hexachloroethane	ug/l	<10
N-Nitrosodi-n-prophylamine	ug/l	<10
Nitrobenzene	ug/l	<10
Isophorone	ug/l	<10
bis-(2-Chloroethoxy) methane	ug/l	<10
1,2,4-Trichlorobenzene	ug/l	<10
Naphthalene	ug/l	<10
Hexachlorobutadiene	ug/l	<10
Hexachlorocyclopentadiene	ug/l	<10
2-Chloronaphthalene	ug/l	<10
Dimethyphthalate	ug/l	<10
Acenaphthylene	ug/l	<10

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Parameter	Units	Steele Residence*
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)		
Cellosolve acetate	mg/l	<0.1
Butyl cellosolve	mg/l	<0.1
Karathane	mg/l	<0.01
Lethane	mg/l	<0.001
DNCP	mg/l	<0.01
Dithane	mg/l	<0.02
2,4-D	ug/l	<0.05
2,4,5-TP	ug/l	<0.01
Total Xylenes	ug/l	<1.0
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS		
Antimony	mg/l	<0.16
Arsenic	mg/l	0.009
Beryllium	mg/l	<0.01
Cadmium	mg/l	<0.0005
Chromium	mg/l	<0.002
Copper	mg/l	<0.03
Lead	mg/l	<0.002
Mercury	mg/l	0.0004
Nickel	mg/l	<0.10
Selenium	mg/l	<0.001
Silver	mg/l	<0.001
Thallium	mg/l	<0.30
Zinc	mg/l	<0.011
Cyanide	mg/l	<0.005
Phenols	mg/l	0.002
CATEGORY 5		
Volatile Organics - EPA Method 601		
Chloromethane	ug/l	<1.0
Bromomethane	ug/l	<1.0
Vinyl chloride	ug/l	<1.0
Chloroethane	ug/l	<1.0
Methylene chloride	ug/l	<1.0
Trichlorofluoromethane	ug/l	<1.0
1,1-Dichloroethylene	ug/l	<1.0
1,1-Dichloroethane	ug/l	<1.0
trans-1,2-Dichloroethylene	ug/l	<1.0
Chloroform	ug/l	1.7
1,2-Dichloroethane	ug/l	<1.0

DIV

BCM Eastern Inc.
Engineers, Planners and Scientists

One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

October 18, 1984

Mr. Robert Lewis, President
Board of Supervisors
Bristol Township
Bristol, PA 19007

Subject: Analytical Results From the Steele Residential Well
BCM Project No. 00-4061-10

Dear Mr. Lewis:

BCM Eastern, Inc. (BCM) is pleased to provide you with the analytical results of the water sample collected by BCM from a well at the Steele residence at 740 Church Street, Croydon, Pennsylvania. The well is no longer used as a source of drinking water.

The concentration of each of the parameters for which there is an associated U.S. Environmental Protection Agency (USEPA) Interim Primary Drinking Water Standard is within standard. Iron and manganese concentrations exceed the USEPA secondary standards of 0.3 mg/l and 0.05 mg/l by 3.46 mg/l and by 0.49 mg/l, respectively.

Should you have any questions or require additional information, please do not hesitate to contact me.

Very truly yours,

Richard J. Grzywinski, P.E.
Vice President

pd
Enclosure
cc: Bucks County Board of Health

BCM

TABLE 1

STEELE RESIDENTIAL WELL ANALYTICAL DATA
BRISTOL BOROUGH, PENNSYLVANIA

Parameter	Units	Steele Residence* (15)
CATEGORY 1 - INDICATOR PARAMETERS		
pH	Standard units	5.6
Specific conductance	umhos	162
BOD	mg/l	<3
COD	mg/l	24.6
TOC	mg/l	6.9
Fecal Coliform	MPN/100 ml	<2
Total Coliform	MPN/100 ml	<2.2
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS		
Ammonia (as N)	mg/l	0.08
Chloride	mg/l	8.9
Fluoride	mg/l	<0.1
Iron	mg/l	3.76
Nitrate (as N)	mg/l	0.87
Phosphate, Total as P	mg/l	0.05
Sulfate	mg/l	37.5
Sodium	mg/l	16.6
Potassium	mg/l	2.22
Barium	mg/l	<0.01
Manganese	mg/l	0.54
Sulfide as S	mg/l	<1
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS		
Surfactants (MBAS)	mg/l	[illegible]
Oil and grease	mg/l	3.79
Methyl ethyl ketone	mg/l	<0.1
Isobutyl alcohol	mg/l	<0.1
N-butyl alcohol	mg/l	<0.1
Isopropyl alcohol	mg/l	<0.1
Ethanol	mg/l	<0.1
Butyl methacrylate	mg/l	<10.0
Methyl methacrylate	mg/l	<0.1
Ethyl acrylate	mg/l	<0.1
Butyl acrylate	mg/l	<0.1
Styrene	mg/l	<0.1
Acetone	mg/l	<0.1
Ethyl acetate	mg/l	<0.1

Parameter	Units	Well*			
		HFW	HGW	GBW	TKW
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS (Continued)					
4-Nitrophenol	ug/l	<25	<25	<25	<25
4,6-Dinitro-o-Cresol	ug/l	<250	<250	<250	<250
Pentachlorophenol	ug/l	<25	<25	<25	<25
PRIORITY POLLUTANTS - PESTICIDES AND PCBs					
Aldrin	ug/l	<10	<10	<10	<10
Alpha-BHC	ug/l	<10	<10	<10	<10
Beta-BHC	ug/l	<10	<10	<10	<10
Gamma-BHC	ug/l	<10	<10	<10	<10
Delta-BHC	ug/l	<10	<10	<10	<10
Chlordane	ug/l	<10	<10	<10	<10
4,4'-DDT	ug/l	<10	<10	<10	<10
4,4'-DDE	ug/l	<10	<10	<10	<10
4,4'-DDD	ug/l	<10	<10	<10	<10
Dieldrin	ug/l	<10	<10	<10	<10
Endosulfan I	ug/l	<10	<10	<10	<10
Endosulfan II	ug/l	<10	<10	<10	<10
Endosulfan Sulfate	ug/l	<10	<10	<10	<10
Endrin	ug/l	<10	<10	<10	<10
Endrin Aldehyde	ug/l	<10	<10	<10	<10
Heptachlor	ug/l	<10	<10	<10	<10
Heptachlor Epoxide	ug/l	<10	<10	<10	<10
PCB-1242	ug/l	<10	<10	<10	<10
PCB-1252	ug/l	<10	<10	<10	<10
PCB-1221	ug/l	<10	<10	<10	<10
PCB-1232	ug/l	<10	<10	<10	<10
PCB-1248	ug/l	<10	<10	<10	<10
PCB-1260	ug/l	<10	<10	<10	<10
PCB-1016	ug/l	<10	<10	<10	<10
Toxaphene	ug/l	<10	<10	<10	<10

* Well Owners and Locations:
HFW - H. Foster, River Road
HGW - H. Gaettner, 1414 State Road
GBW - G. Bosch, River Road
TKW - T. Karlinski, 1039 Anne Street

** Analysis subject to interference

Sampling dates: HFW - 02/07/84; HGW - 02/13/84; GBW - 03/05/84; TKW - 03/06/84

Source: BCM Eastern, Inc.

Parameter	Units	Well* HFW	HGW	GBW	TKW
CATEGORY 5 - VOLATILE ORGANICS - EPA METHOD 601 (Continued)					
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<0.1	<0.1
Carbon tetrachloride	ug/l	<1.0	<1.0	<0.1	<0.1
Bromodichloromethane	ug/l	<1.0	<1.0	<0.1	<0.1
1,2-Dichloropropane	ug/l	<1.0	<1.0	<0.1	<0.1
trans-1,3-Dichloropropylene	ug/l	<1.0	<1.0	<0.1	<0.1
Trichloroethylene	ug/l	1.4	<1.0	<0.1	0.8
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropylene	ug/l	<1.0	<1.0	<0.1	<0.1
Bromoform	ug/l	<1.0	<1.0	<0.1	<0.1
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<1.0	<1.0	3.8	<0.1
Chlorobenzene	ug/l	<1.0	<1.0	<0.1	<0.1
CATEGORY 6 - VOLATILE ORGANICS - EPA METHOD 602					
Benzene	ug/l	<0.1	<0.1	<0.1	<0.1
Toluene	ug/l	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	ug/l	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	ug/l	<0.2	<0.1	<0.1	<0.1
-Dichlorobenzene	ug/l	<0.3	<0.1	<0.1	<0.1
-Dichlorobenzene	ug/l	<0.2	<0.1	<0.1	<0.1
PRIORITY POLLUTANTS - BASE NEUTRAL ORGANICS					
N-Nitrosodimethylamine	ug/l	<10	<10	<10	<10
bis-(2-Chloroethyl) ether	ug/l	<10	<10	<10	<10
,3-Dichlorobenzene	ug/l	<10	<10	<10	<10
1,4-Dichlorobenzene	ug/l	<10	<10	<10	<10
1,2-Dichlorobenzene	ug/l	<10	<10	<10	<10
is-(2-Chloroisopropyl) ether	ug/l	<10	<10	<10	<10
exachloroethane	ug/l	<10	<10	<10	<10
N-Nitrosodi-n-prophylamine	ug/l	<10	<10	<10	<10
itrobenzene	ug/l	<10	<10	<10	<10
sophorone	ug/l	<10	<10	<10	<10
bis-(2-Chloroethoxy) methane	ug/l	<10	<10	<10	<10
,2,4-Trichlorobenzene	ug/l	<10	<10	<10	<10
aphthalene	ug/l	<10	<10	<10	<10
exachlorobutadiene	ug/l	<10	<10	<10	<10
Hexachlorocyclopentadiene	ug/l	<10	<10	<10	<10
-Chloronaphthalene	ug/l	<10	<10	<10	<10
imethyphthalate	ug/l	<10	<10	<10	<10
Acenaphthylene	ug/l	<10	<10	<10	<10

Parameter	Units	Well *			
		HFW	HGW	GBW	
PRIORITY POLLUTANTS - BASE NEUTRAL ORGANICS (Continued)					
2,6-Dinitroteuene	ug/l	<10	<10	<10	<10
Acenaphthene	ug/l	<10	<10	<10	<10
2,4-Dinitrotoluene	ug/l	<10	<10	<10	<10
Diethyphthalate	ug/l	<10	<10	<10	<10
Fluorene	ug/l	<10	<10	<10	<10
4-Chlorophenyl phenyl ether	ug/l	<10	<10	<10	<10
diphenylamine-n-nitroso	ug/l	<10	<10	<10	<10
1,2-Diphenylhydrazine (Azobenzene)	ug/l	<10	<10	<10	<10
4-Bromophenyl phenyl ether	ug/l	<10	<10	<10	<10
Hexachlorobenzene	ug/l	<10	<10	<10	<10
Phenanthrene	ug/l	<10	<10	<10	<10
Anthracene	ug/l	<10	<10	<10	<10
Di-n-butyl Phthalate	ug/l	<10	<10	<10	<10
Fluoranthene	ug/l	<10	<10	<10	<10
Benzidine	ug/l	<10	<10	<10	<10
Pyrene	ug/l	<10	<10	<10	<10
Butybenzyphthalate	ug/l	<10	<10	<10	<10
Benzo(a)anthracene	ug/l	<10	<10	<10	<10
3,3'-Dichlorobenzidine	ug/l	<10	<10	<10	<10
Chrysene	ug/l	<10	<10	<10	<10
bis-(2-Ethylhexyl) phthalate	ug/l	<10	<10	<10	<10
Di-n-octyl phthalate	ug/l	<10	<10	<10	120
Benzo(b)fluoranthene	ug/l	<10	<10	<10	<10
Benzo(k)fluoranthene	ug/l	<10	<10	<10	<10
Benzo(a)pyrene	ug/l	<10	<10	<10	<10
Indeno(1,2,3-c,d)pyrene	ug/l	<10	<10	<10	<10
Dibenzo(a,h)anthracene	ug/l	<25	<25	<25	<25
Benzo(g,h,i)perylene	ug/l	<25	<25	<25	<25
		<25	<25	<25	<25
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS					
Phenol	ug/l	<25	<25	<25	<25
2-Chlorophenol	ug/l	<25	<25	<25	<25
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS					
2-Nitrophenol	ug/l	<25	<25	<25	<25
2,4-Dimethylphenol	ug/l	<25	<25	<25	<25
2,4-Dichlorophenol	ug/l	<25	<25	<25	<25
p-Chloro-m-Cresol	ug/l	<25	<25	<25	<25
2,4,6-Trichlorophenol	ug/l	<25	<25	<25	<25
2,4-Dinitrophenol	ug/l	<250	<250	<250	<250

TABLE 1

RESIDENTIAL WELL ANALYTICAL DATA
BRISTOL BOROUGH, PENNSYLVANIA

Parameter	Units	Well* HFW	HGW	GBW	TKW
CATEGORY 1 - INDICATOR PARAMETERS					
pH	Standard units	6.2	8.3	5.9	6.7
Specific conductance	umhos	311.0	183	161	857
BOD	mg/l	14.0	<3	<3	<3
COD	mg/l	24.0	<4	<4	8
TOC	mg/l	7.0	<3	<1	1
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS					
Ammonia (as N)	mg/l	0.40	0.09	<0.05	0.36
Boron	mg/l	0.16	0.04	0.04	0.10
Chloride	mg/l	40.0	5.6	23.2	14.0
Fluoride	mg/l	0.03	0.34	0.13	0.09
Iron	mg/l	3.15	0.05	2.33	8.00
Nitrate (as N)	mg/l	3.50	<0.09	0.83	1.19
Phosphate	mg/l	<0.01	0.10	0.01	0.05
Sulfate	mg/l	45.0	1.25	21.5	248
Sodium	mg/l	18.8	42.1	15.9	14.8
Potassium	mg/l	224.0	1.63	1.77	79.5
Barium	mg/l	0.065	0.051	0.083	0.080
Manganese	mg/l	0.6	<0.02	0.08	3.7
Sulfide as S	mg/l	<1.0	<1.0	<1.0	<1.0
Tin	mg/l	<1.0	<1.0	<1.0	<1.0
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS					
Formaldehyde **	mg/l	0.39	<0.001	0.01	0.08
Surfactants (MBAS)	mg/l	0.041	0.032	0.05	0.22
Oil and grease	mg/l	3.0	2.0	2.0	<1.0
Methyl ethyl ketone	mg/l	<0.1	<0.1	<0.1	<0.1
Isobutyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1
N-butyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1
Isopropyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1
Ethanol	mg/l	<0.1	<0.1	<0.1	<0.1
Butyl methacrylate	mg/l	<10.0	<10.0	<10.0	<10.0
Methyl methacrylate	mg/l	<0.1	<0.1	<0.1	<0.1
Ethyl acrylate	mg/l	<0.1	<0.1	<0.1	<0.1
Butyl acrylate	mg/l	<0.1	<0.1	<0.1	<0.1
Styrene	mg/l	<0.1	<0.1	<0.1	<0.1
Acetone	mg/l	<0.1	<0.1	<0.1	<0.1
Ethyl acetate	mg/l	<0.1	<0.1	<0.1	<0.1

Parameter	Units	Well*			
		HFW	HGW	GBW	TW
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)					
Cellosolve acetate	mg/l	<0.1	<0.1	<0.1	<0.1
Butyl cellosolve	mg/l	<0.1	<0.1	<0.1	<0.1
Karathane	mg/l	<0.01	<0.01	<0.01	<0.01
Lethane	mg/l	<0.001	<0.001	<0.001	<0.001
DNCP	mg/l	<0.01	<0.01	<0.01	<0.01
Dithane	mg/l	<0.02	<0.02	NT	NT
2,4-D	mg/l	<1.0	<1.0	<1.0	<1.0
2,4,5-TP	mg/l	<0.5	<0.5	<0.5	<0.5
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS					
Antimony	mg/l	<0.15	<0.17	<0.15	<0.15
Arsenic	mg/l	0.001	<0.001	0.001	0.002
Beryllium	mg/l	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/l	<0.01	<0.01	0.21	1.14
Chromium	mg/l	<0.02	<0.02	<0.03	<0.03
Copper	mg/l	<0.03	<0.03	<0.03	<0.03
Lead	mg/l	0.003	0.005	<0.002	<0.002
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	mg/l	<0.1	<0.1	<0.1	<0.1
Selenium	mg/l	<0.001	<0.001	<0.001	<0.001
Silver	mg/l	<0.02	<0.02	<0.02	<0.02
Thallium	mg/l	<0.30	<0.30	<0.30	<0.30
Zinc	mg/l	1.28	<0.01	<0.01	1.69
Cyanide	mg/l	<0.005	<0.005	<0.005	<0.025
Phenols	mg/l	0.003	<0.002	<0.002	<0.002
CATEGORY 5 - VOLATILE ORGANICS - EPA METHOD 601					
Chloromethane	ug/l	<1.0	<1.0	<0.1	<0.1
Bromomethane	ug/l	<1.0	<1.0	<0.1	<0.1
Vinyl chloride	ug/l	<1.0	<1.0	9.4	<0.1
Chloroethane	ug/l	<1.0	<0.1	<0.1	<0.1
Methylene chloride	ug/l	5.7	5.9	2.2	1.7
Trichlorofluoromethane	ug/l	<1.0	<1.0	<0.1	<0.1
1,1-Dichloroethylene	ug/l	<1.0	<1.0	<0.1	<0.1
1,1-Dichloroethane	ug/l	<1.0	<1.0	<0.1	<0.1
trans-1,2-Dichloroethylene	ug/l	<1.0	<1.0	<0.1	<0.1
Chloroform	ug/l	1.1	<1.0	<0.1	<0.1
1,2-Dichloroethane	ug/l	<1.0	22.5	0.5	<0.1

BCM Eastern Inc.
Engineers, Planners and Scientists

One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

7671.9

June 11, 1984

NOV 14 1985

Mr. Robert Lewis, President
Board of Supervisors
Bristol Township
Bristol, PA 19007

Subject: Analysis of Residental Wells

Dear Mr. Lewis:

BCM Eastern Inc. (BCM) is pleased to provide you with the analytical results of the water samples collected by BCM from four township residential wells (Table 1). The names and addresses of the well owners are also presented in Table 1. Please note that only the HGW well is utilized for drinking purposes as the other wells are used for outdoor or lawn watering purposes.

With two exceptions, concentrations of each of the parameters for which there is an associated U.S. Environmental Protection Agency Interim Primary Drinking Water Standard are within those standards. The exceptions are the cadmium concentrations in the GBW and TKW wells which are 0.21 milligrams per liter (mg/l) (parts per million), and 1.14 mg/l, respectively. These concentrations are over the drinking water standard of 0.01 mg/l. Trichloroethylene (TCE) was detected in the HGW and TKW wells at concentrations below the Pennsylvania state guidance concentration of 4.5 micrograms per liter (ug/l) (parts per billion). Bis(2-Ethylhexyl) phthalate was found in the TKW well at a concentration of 120 ug/l.

Should you have any questions or require additional information, please do not hesitate to contact me.

Very truly yours,

Richard J. Grzywinski, P.E.
Vice President
Industrial Services

/jmk
Attachments
cc: Bucks County Department of Health
P. Rosenstock, Rohm and Haas
G. Schnabel, Rohm and Haas

Parameter	Units	Bristol Borough Supply Well (BBW) BCM Sample No. 14417 Sample Date: 10/14/83	USEPA Interi Primary Drink Water Standa
CATEGORY 1 - INDICATOR PARAMETERS			
pH	Standard units	6.0	
Specific Conductance	Umhos	484	
Biochemical Oxygen Demand	mg/l	<3.0	
Chemical Oxygen Demand	mg/l	4.0	
Total Organic Carbon	mg/l	41.0	
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS			
Boron	mg/l	0.18	
Iron	mg/l	0.16	
Manganese	mg/l	1.05	
Sodium	mg/l	35.7	
Tin	mg/l	<0.76	
Chloride	mg/l	59.7	
Fluoride	mg/l	0.035	2.4 - 1.4
Potassium	mg/l	5.80	
Ammonia (as N)	mg/l	0.1	
Nitrate (as N)	mg/l	3.32	10
Sulfate	mg/l	57.49	
Phosphate	mg/l	0.02	
Sulfide	mg/l	<1.0	
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS			
Formaldehyde	mg/l	<0.016	
Xylene (M&P)	mg/l	<0.02	
Xylene (O)	mg/l	<0.01	
2,4-D	ug/l	<1.0	100
2,4,5-TP	ug/l	<0.5	10
Oil and grease	mg/l	2.0	
Methyl Ethyl Ketone	mg/l	<0.1	
Isobutyl Alcohol	mg/l	<0.1	
N-Butyl Alcohol	mg/l	<0.1	
Isopropyl Alcohol	mg/l	<0.1	
Ethanol	mg/l	<0.1	
Butyl Methacrylate	mg/l	<10.0	
Methyl Methacrylate	mg/l	<0.1	
Ethyl Acrylate	mg/l	<0.1	
Butyl Acrylate	mg/l	<0.1	
Styrene	mg/l	<0.1	
Acetone	mg/l	<0.1	
Ethyl Acetate	mg/l	<0.1	
llosolve Acetate	mg/l	<0.1	
tyl Cellosolve	mg/l	<0.1	
Lethane	mg/l	<0.001	
Karathane	mg/l	<0.01	
ONCP	mg/l	<0.01	
Surfactants (MBAS)	mg/l	0.511	

Parameter	Units	Bristol Borough Supply Well (BBW) BCM Sample No. 14417 Sample Date: 10/14/83	USEPA Interi Primary Drink Water Standa
CATEGORY 4 - USEPA PRIORITY POLLUTANTS			
Category 4a - Inorganics			
Cyanide	mg/l	<0.005	
Antimony	mg/l	<0.15	
Arsenic	mg/l	0.004	0.05
Barium	mg/l	0.029	1.0
Beryllium	mg/l	<0.01	
Cadmium	mg/l	0.0006	0.01
Chromium	mg/l	<0.002	0.05
Copper	mg/l	<0.03	
Mercury	mg/l	<0.0002	0.002
Selenium	mg/l	<0.001	0.01
Silver	mg/l	<0.001	0.05
Nickel	mg/l	<0.1	
Lead	mg/l	<0.002	0.05
Thallium	mg/l	<0.30	
Zinc	mg/l	<0.01	
Category 4b - Volatile Organics			
Tetrachloroethylene	ug/l	42.0	
All others		Below Detection Limits	
Category 4b - Volatile Organics (Halogenated) *			
Methylene Chloride	ug/l	15.5	
Chloroform	ug/l	2.1	
Tetrachloroethylene	ug/l	5.0	
Category 4c - Base Neutrals		Below Detection Limits	
Category 4d - Acid Extractables		Below Detection Limts	
Category 4e - Pesticides PCBs		Below Detection Limits	
Dioxin (TCDD)		Below Detection Limits	
CATEGORY 5 - RADIOLOGICAL			
Gross Alpha Radioactivity	PCi/L	<2	15
Gross Beta Radioactivity	PCi/L	<3	
Total Radium	PCi/L	2.1 ± 1.5	

* Resampled January 12, 1984 for Category 4b, halogenated volatile organics
mg/l - milligrams per liter (parts per million)
mg/l - micrograms per liter (parts per billion)
Source: BCM Eastern Inc.

BCM Eastern Inc.
Engineers, Planners and Scientists
One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

DEU

FEB 16 84

JCB JMB
DKE PAD
WJF GCM
AAF RJO
WDR

February 16, 1984

FEB 14 1984

Mr. Fidel Esposito
Borough Manager
Bristol, PA 19007

Subject: Analysis of Bristol Borough Well No. 10

Dear Mr. Esposito:

BCM Eastern Inc. (BCM) is pleased to provide you with the attached final analytical results from the sample obtained by BCM from the Bristol Borough Well No. 10. Please note that the only revision to our February 2, 1984 report is the addition of the Lethane concentration, which was reported then as "N/A - analytical data not yet available".

Should you have any questions or require additional information, please do not hesitate to contact me.

Very truly yours,

Richard J. Grzywinski, P.E.
Vice President

pd
Attachments
cc: Bucks County Board of Health

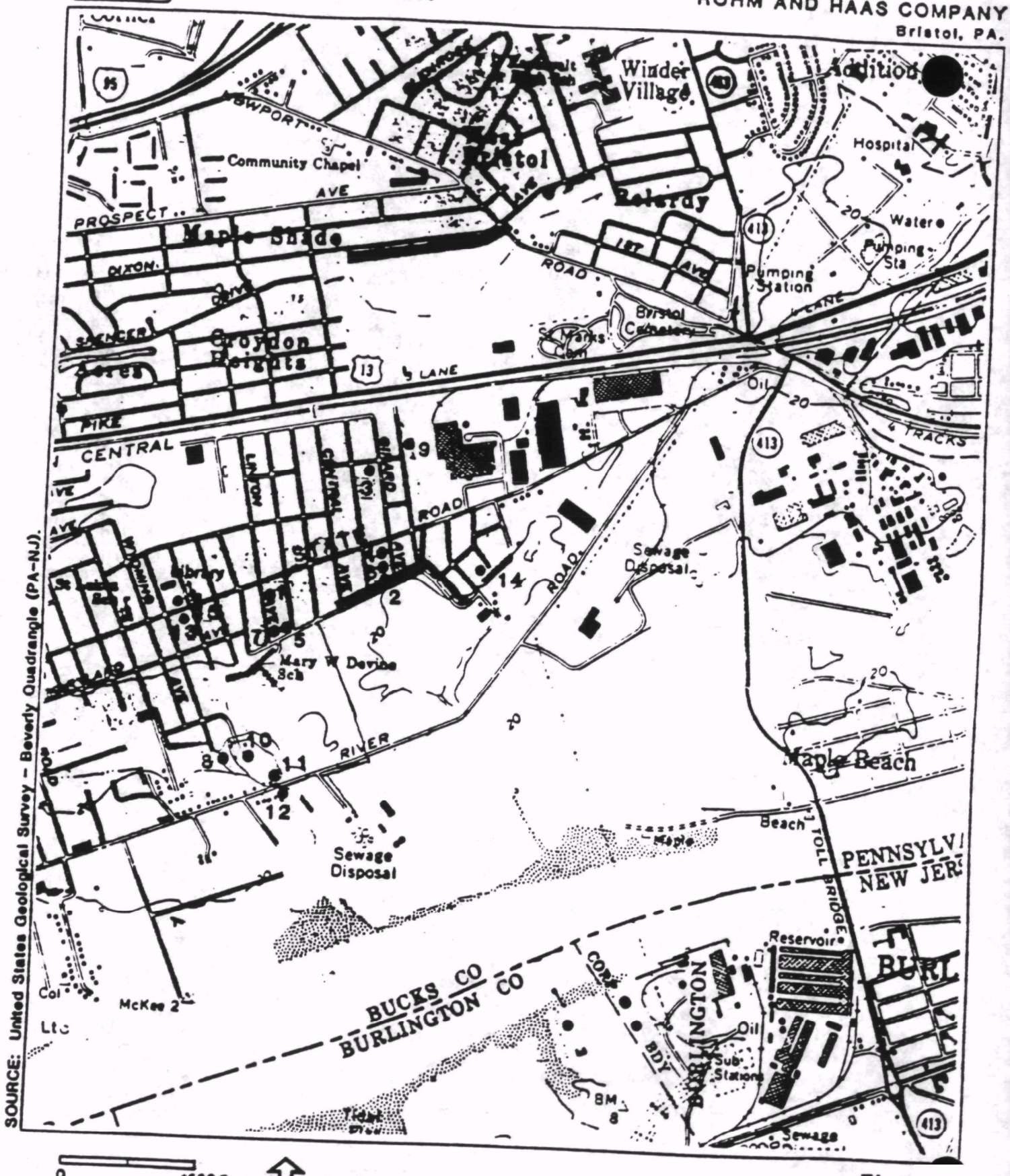
SUMMARY OF RESIDENTIAL WELLS
SAMPLED BY BCM

Map Number	Occupant	Address	Well Use*	Sampling Date
1	R. Rhodes	826 Linton Ave.	Household	11/11/83
2	Mrs. Clattenbury	822 Girard Ave.	Household	11/11/83
3	R. Whitman	2314 Brighton Ave.	Household	11/11/83
4	R. Offenback	814 Girard Ave.	Household	11/11/83
5	Mrs. O'Brien	1905 Summit Ave.	Household	11/11/83
6	Mrs. Eisenmann	818 Girard Ave.	Household	11/11/83
7	C. Rusk	1901 Summit Ave.	Household	11/11/83
8	C. Souder	1019 Emily Ave.	Lawn	11/11/83
9	J. Cochran	211 Elm Ave.	Household	11/11/83
10	T. Karlinski	1039 Anne Street	Lawn	03/06/84
11	H. Foster	River Road	Lawn	02/07/84
12	Mr. Bosch	River Road	Lawn	03/05/84
13	H. Gaettner	1414 State Road	Household	02/13/84
14	Mrs. Johnson	Orchard Ave.	Household	05/24/84
15	Mrs. Steele	740 Church Street	Household**	08/13/84

* Well use at time of sampling
** Well no longer used for household purposes at time of sampling

BCM Engineers, Planners and Scientists

ROHM AND HAAS COMPANY
Bristol, PA.



Figure

RESIDENTIAL WELL SAMPLING LOCATIONS

(BCM Project No. 00-4061-10)

TABLE 1

BRISTOL TOWNSHIP, PENNSYLVANIA
RESIDENTIAL WELL WATER ANALYTICAL DATA
FEBRUARY 2, 1984

Parameter	Well I.D.: / UCM Sample No: / Units	Well #1 14352	Well #2 14353	Well #3 14354	Well #4 14355	Well #5 14356	Well #6 14357	Well #7 14358	Well #8 14359	Well #9 14360	USEPA Interim Primary Drinking Water Standards
CATEGORY 1 - INDICATOR PARAMETERS											
pH	Standard units	5.3	5.5	5.8	5.4	5.3	5.4	5.5	5.7	5.4	
Specific Conductance	umhos	273	260	258	248	205	263	243	272	190	
BOD	mg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	
COD	mg/l	24	<4	28	16	8	8	<4	<4	4	
TOC	mg/l	11	7	6	6	5	6	7	6	4	
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS											
Ammonia (as N)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.15	
Boron	mg/l	0.09	0.14	0.09	0.07	0.10	0.20	0.08	0.08	0.09	
Chloride	mg/l	18.3	22.6	31.0	25.3	14.2	23.1	22.3	20.8	13.3	
Fluoride	mg/l	0.055	0.053	0.046	0.053	0.043	0.050	0.053	0.053	0.055	2.4 - 1.4
Iron	mg/l	0.16	0.09	0.09	0.05	0.05	0.16	0.023	0.051	0.019	
Nitrate (as N)	mg/l	2.85	8.0	1.61	8.95	4.82	(11.05)	5.35	5.25	3.65	10
Phosphate	mg/l	<0.01	<0.01	<0.01	<0.01	0.05	0.01	<0.01	0.01	<0.01	
Sulfate	mg/l	37.9	34.25	43.99	35.64	36.34	33.92	47.07	52.33	40.50	
Sodium	mg/l	16.1	13.5	17.4	12.2	8.9	14.1	11.9	13.5	11.5	
Potassium	mg/l	1.36	1.77	1.49	1.77	1.49	1.91	1.36	3.01	1.22	
Barium	mg/l	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
Manganese	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Sulfide as S	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS											
Formaldehyde	ug/l	0.016	<0.08	0.320	<0.016	<0.016	0.080	0.027	<0.016	0.080	
Xylenes (M&P)	ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Xylene (O)	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
2,4-D	ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	
2,4,5-TP	ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	100
Surfactants (MBAS)	mg/l	<0.022	0.040	<0.004	0.013	<0.016	0.025	<0.010	0.025	0.021	10
Methyl ethyl ketone	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Isobutyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	

ECM

Parameter	Units	Johnson Residence Orchard Avenue
Priority Pollutants - Acid Extractable Organics (Continued)		
4-Nitrophenol	ug/l	<25
4,6-Dinitro-o-Cresol	ug/l	<250
Pentachlorophenol	ug/l	<25
Priority Pollutants - Pesticides and PCBs		
Aldrin	ug/l	<10
Alpha-BHC	ug/l	<10
Beta-BHC	ug/l	<10
Gamma-BHC	ug/l	<10
Delta-BHC	ug/l	<10
Chlordane	ug/l	<10
4,4'-DDT	ug/l	<10
4,4'-DDE	ug/l	<10
4,4'-DDD	ug/l	<10
Dieldrin	ug/l	<10
Endosulfan I	ug/l	<10
Endosulfan II	ug/l	<10
Endosulfan Sulfate	ug/l	<10
Endrin	ug/l	<10
Endrin Aldehyde	ug/l	<10
Heptachlor	ug/l	<10
Heptachlor Epoxide	ug/l	<10
PCB-1242	ug/l	<10
PCB-1252	ug/l	<10
PCB-1221	ug/l	<10
PCB-1232	ug/l	<10
PCB-1248	ug/l	<10
PCB-1260	ug/l	<10
PCB-1016	ug/l	<10
Toxaphene	ug/l	<10
CATEGORY 5 - RADIOLOGICAL PARAMETERS		
Gross A - Radioactivity	PCi/l	<2
Gross B - Radioactivity	PCi/l	<3
Total Radium	PCi/L	<1

Source: BCM Eastern, Inc.

Parameter	Well I.D.: BCM Sample No: Units	Well #1 14352	Well #2 14353	Well #3 14354	Well #4 14355	Well #5 14356	Well #6 14357	Well #7 14358	Well #8 14359	Well #9 14360	USEPA Interim Primary Drinking Water Standards
CATEGORY 5 - VOLATILE ORGANICS - EPA METHOD 601											
Chloromethane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Bromomethane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Vinyl Chloride	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Chloroethane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Methylene Chloride	ug/l	2.8	2.5	1.6	1.6	1.8	2.3	2.0	1.8	0.7	
Trichlorofluoromethane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,1-Dichloroethene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,1-Dichloroethane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3 mg/l
Trans-1,2-Dichloroethene	ug/l	<0.1	<0.1	5.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	
Chloroform	ug/l	1.0	<0.1	1.5	3.7	0.9	2.0	0.4	0.8	0.6	
1,2-Dichloroethane	ug/l	0.5	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.4	30 mg/l
1,1,1-Trichloroethane	ug/l	<0.1	<0.1	10.9	<0.1	<0.1	<0.1	<0.1	1.1	7.8	10 mg/l
Carbon Tetrachloride	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3 mg/l
Bromodichloromethane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,2-Dichloropropane	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Trans 1,3-Dichloropropene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Trichloroethene	ug/l	1.2	0.6	30.1	<0.1	<0.1	0.3	<0.1	<0.1	22.1	
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or Cis-1,3-Dichloropropene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Bromoform	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<0.1	<0.1	2.9	<0.1	<0.1	<0.1	<0.1	0.3	2.3	
Chlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Ethylene Dichloride	ug/l	0.5	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.4	

Benzidine (World Health Organization 1984)

Benzo[a]pyrene 0.01 ug/l
Hexachlorobenzene 0.01 ug/l
Tetrachloroethylene 10 ug/l
Trichloroethylene 30 ug/l
1,1,1-Trichloroethane

Parameter	Well I.D.: / BCM Sample No: / Units	Well #1 14352	Well #2 14353	Well #3 14354	Well #4 14355	Well #5 14356	Well #6 14357	Well #7 14358	Well #8 14359	Well #9 14360	USEPA Interim Primary Drinking Water Standards
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)											
Isopropyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Ethanol	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Butyl methacrylate	mg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	
Methyl methacrylate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Ethyl acrylate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Butyl acrylate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Styrene	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Acetone	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Ethyl acetate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Cellosolve acetate	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Butyl cellosolve	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Karathane	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
DNCP	mg/l	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Ethylene Dichloride	ug/l	0.5	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.4	
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS											
Antimony	mg/l	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	<0.24	---
Arsenic	mg/l	0.002	0.002	0.001	0.001	<0.001	0.003	0.003	0.002	0.003	0.05
Beryllium	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---
Cadmium	mg/l	0.006	0.009	0.0069	0.0065	0.0021	0.0087	0.0068	0.0055	0.0039	0.01
Chromium	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05
Copper	mg/l	0.22	0.34	0.07	0.24	0.24	0.62	0.70	0.03	0.17	---
Lead	mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.05
Mercury	mg/l	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	0.0013	0.0009	<0.0002	0.0010	0.002
Nickel	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	---
Selenium	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
Silver	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05
Thallium	mg/l	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	---
Zinc	mg/l	0.04	0.04	0.04	0.08	0.06	0.06	0.09	0.02	---	
Cyanide	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	---	
Phenols	mg/l	0.003	0.003	0.004	0.003	0.002	0.002	0.004	0.002	0.002	---

TABLE 1

RESIDENTIAL WELL ANALYTICAL DATA
BRISTOL BOROUGH, PENNSYLVANIA

Parameter	Units	Well* HFW (11)	HGW (13)	GBW (12)	TKW (10)
CATEGORY 1 - INDICATOR PARAMETERS					
pH	Standard units	6.2	8.3	5.9	6.7
Specific conductance	umhos	311.0	183	161	857
BOD	mg/l	14.0	<3	<3	<3
COD	mg/l	24.0	<4	<4	8
TOC	mg/l	7.0	<3	<1	1
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS					
Ammonia (as N)	mg/l	0.40	0.09	<0.05	0.36
Boron	mg/l	0.16	0.04	0.04	0.10
Chloride	mg/l	40.0	5.6	23.2	14.0
Fluoride	mg/l	0.03	0.34	0.13	0.09
Iron	mg/l	3.15	0.05	2.33	8.00
Nitrate (as N)	mg/l	3.50	<0.09	0.83	1.19
Phosphate	mg/l	<0.01	0.10	0.01	0.05
Sulfate	mg/l	45.0	1.25	21.5	248
Sodium	mg/l	18.8	42.1	15.9	14.8
Potassium	mg/l	224.0	1.63	1.77	79.5
Barium	mg/l	0.065	0.051	0.083	0.080
Manganese	mg/l	0.6	<0.02	0.08	3.7
Sulfide as S	mg/l	<1.0	<1.0	<1.0	<1.0
Tin	mg/l	<1.0	<1.0	<1.0	<1.0
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS					
Formaldehyde **	mg/l	[illegible]	<0.001	0.01	0.08
Surfactants (MBAS)	mg/l	0.04	0.032	0.05	0.22
Oil and grease	mg/l	3.0	2.0	2.0	<1.0
Methyl ethyl ketone	mg/l	<0.1	<0.1	<0.1	<0.1
Isobutyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1
N-butyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1
Isopropyl alcohol	mg/l	<0.1	<0.1	<0.1	<0.1
Ethanol	mg/l	<0.1	<0.1	<0.1	<0.1
Butyl methacrylate	mg/l	<0.1	<0.1	<0.1	<0.1
Methyl methacrylate	mg/l	<10.0	<10.0	<10.0	<10.0
Ethyl acrylate	mg/l	<0.1	<0.1	<0.1	<0.1
Butyl acrylate	mg/l	<0.1	<0.1	<0.1	<0.1
Styrene	mg/l	<0.1	<0.1	<0.1	<0.1
cetone	mg/l	<0.1	<0.1	<0.1	<0.1
hyl acetate	mg/l	<0.1	<0.1	<0.1	<0.1
		<0.1	<0.1	<0.1	<0.1

Parameter	Well I.D.: BCM Sample No: Units	Well #1 14352	Well #2 14353	Well #3 14354	Well #4 14355	Well #5 14356	Well #6 14357	Well #7 14358	Well #8 14359	Well #9 14360	USEPA Interim Primary Drinking Water Standards
CATEGORY 6 - VOLATILE ORGANICS - EPA METHOD 602											
Benzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Guidelines (World Health Organization)
Toluene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 ug/l
Chlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Ethyl Benzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,2-Dichlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,3-Dichlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
1,4-Dichlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	

NOTES:

1. Sampling date - November 11, 1983
2. All samples unfiltered and from outside spigot
3. Source: BCM Eastern, Inc.
4. N/A - Data not yet available

Parameter	Units	Well* HFW	HGW	GBW	TKW
CATEGORY 5 - VOLATILE ORGANICS - EPA METHOD 601 (Continued)					
1,1,1-Trichloroethane	ug/l	<1.0	<1.0	<0.1	<0.1
Carbon tetrachloride	ug/l	<1.0	<1.0	<0.1	<0.1
Bromodichloromethane	ug/l	<1.0	<1.0	<0.1	<0.1
1,2-Dichloropropane	ug/l	<1.0	<1.0	<0.1	<0.1
trans-1,3-Dichloropropylene	ug/l	<1.0	<1.0	<0.1	<0.1
Trichloroethylene	ug/l	1.4	<1.0	<0.1	0.8
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropylene	ug/l	<1.0	<1.0	<0.1	<0.1
Bromoform	ug/l	<1.0	<1.0	<0.1	<0.1
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<1.0	<1.0	3.8	<0.1
Chlorobenzene	ug/l	<1.0	<1.0	<0.1	<0.1
CATEGORY 6 - VOLATILE ORGANICS - EPA METHOD 602					
Benzene	ug/l	<0.1	<0.1	<0.1	<0.1
Toluene	ug/l	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	ug/l	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	ug/l	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	ug/l	<0.2	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	ug/l	<0.3	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	ug/l	<0.2	<0.1	<0.1	<0.1
PRIORITY POLLUTANTS - BASE NEUTRAL ORGANICS					
N-Nitrosodimethylamine	ug/l	<10	<10	<10	<10
bis-(2-Chloroethyl) ether	ug/l	<10	<10	<10	<10
1,3-Dichlorobenzene	ug/l	<10	<10	<10	<10
1,4-Dichlorobenzene	ug/l	<10	<10	<10	<10
1,2-Dichlorobenzene	ug/l	<10	<10	<10	<10
bis-(2-Chloroisopropyl) ether	ug/l	<10	<10	<10	<10
Hexachloroethane	ug/l	<10	<10	<10	<10
N-Nitrosodi-n-prophylamine	ug/l	<10	<10	<10	<10
Nitrobenzene	ug/l	<10	<10	<10	<10
Isophorone	ug/l	<10	<10	<10	<10
bis-(2-Chloroethoxy) methane	ug/l	<10	<10	<10	<10
1,2,4-Trichlorobenzene	ug/l	<10	<10	<10	<10
Naphthalene	ug/l	<10	<10	<10	<10
Hexachlorobutadiene	ug/l	<10	<10	<10	<10
Hexachlorocyclopentadiene	ug/l	<10	<10	<10	<10
2-Chloronaphthalene	ug/l	<10	<10	<10	<10
Dimethyphthalate	ug/l	<10	<10	<10	<10
Acenaphthylene	ug/l	<10	<10	<10	<10

Parameter	Units	Well* HFW	HGW	GBW	TKW
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)					
Cellosolve acetate	mg/l	<0.1	<0.1	<0.1	<0.1
Butyl cellosolve	mg/l	<0.1	<0.1	<0.1	<0.1
Karathane	mg/l	<0.01	<0.01	<0.01	<0.01
Lethane	mg/l	<0.001	<0.001	<0.001	<0.001
DNCP	mg/l	<0.01	<0.01	<0.01	<0.01
Dithane	mg/l	<0.02	<0.02	NT	NT
2,4-D	mg/l	<1.0 <1000	<1.0	<1.0	<1.0
2,4,5-TP	mg/l	<0.5 <500	<0.5	<0.5	<0.5
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS					
Antimony	mg/l	<0.15	<0.17	<0.15	<0.15
Arsenic	mg/l	0.001	<0.001	0.001	0.002
Beryllium	mg/l	<0.01	<0.01	<0.01	<0.01
Cadmium	mg/l	<0.01	<0.01	0.21	1.14
Chromium	mg/l	<0.02	<0.02	<0.03	<0.03
Copper	mg/l	<0.03	<0.03	<0.03	<0
Lead	mg/l	0.003	0.005	<0.002	<0.
Mercury	mg/l	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	mg/l	<0.1	<0.1	<0.1	<0.1
Selenium	mg/l	<0.001	<0.001	<0.001	<0.001
Silver	mg/l	<0.02	<0.02	<0.02	<0.02
Thallium	mg/l	<0.30	<0.30	<0.30	<0.30
Zinc	mg/l	1.28	<0.01	<0.01	1.69
Cyanide	mg/l	<0.005	<0.005	<0.005	<0.025
Phenols	mg/l	0.003	<0.002	<0.002	<0.002
CATEGORY 5 - VOLATILE ORGANICS - EPA METHOD 601					
Chloromethane	ug/l	<1.0	<1.0	<0.1	<0.1
Bromomethane	ug/l	<1.0	<1.0	<0.1	<0.1
Vinyl chloride	ug/l	<1.0	<1.0	9.4	<0.1
Chloroethane	ug/l	<1.0	<0.1	<0.1	<0.1
Methylene chloride	ug/l	5.7	5.9	2.2	1.7
Trichlorofluoromethane	ug/l	<1.0	<1.0	<0.1	<0.1
1,1-Dichloroethylene	ug/l	<1.0	<1.0	<0.1	<0.1
1,1-Dichloroethane	ug/l	<1.0	<1.0	<0.1	<0.1
trans-1,2-Dichloroethylene	ug/l	<1.0	<1.0	<0.1	<0.1
Chloroform	ug/l	1.1	<1.0	<0.1	<0.1
1,2-Dichloroethane	ug/l	<1.0	22.5	0.5	<0.1

Parameter	Units	Well*			
		HFW	HGW	GBW	TKW
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS (Continued)					
4-Nitrophenol	ug/l	<25	<25	<25	<25
4,6-Dinitro-o-Cresol	ug/l	<250	<250	<250	<250
Pentachlorophenol	ug/l	<25	<25	<25	<25
PRIORITY POLLUTANTS - PESTICIDES AND PCBs					
Aldrin	ug/l	<10	<10	<10	<10
Alpha-BHC	ug/l	<10	<10	<10	<10
Beta-BHC	ug/l	<10	<10	<10	<10
Gamma-BHC	ug/l	<10	<10	<10	<10
Delta-BHC	ug/l	<10	<10	<10	<10
Chlordane	ug/l	<10	<10	<10	<10
4,4'-DDT	ug/l	<10	<10	<10	<10
4,4'-DDE	ug/l	<10	<10	<10	<10
4,4'-DDD	ug/l	<10	<10	<10	<10
Dieldrin	ug/l	<10	<10	<10	<10
Endosulfan I	ug/l	<10	<10	<10	<10
Endosulfan II	ug/l	<10	<10	<10	<10
Endosulfan Sulfate	ug/l	<10	<10	<10	<10
Endrin	ug/l	<10	<10	<10	<10
Endrin Aldehyde	ug/l	<10	<10	<10	<10
Heptachlor	ug/l	<10	<10	<10	<10
Heptachlor Epoxide	ug/l	<10	<10	<10	<10
PCB-1242	ug/l	<10	<10	<10	<10
PCB-1252	ug/l	<10	<10	<10	<10
PCB-1221	ug/l	<10	<10	<10	<10
PCB-1232	ug/l	<10	<10	<10	<10
PCB-1248	ug/l	<10	<10	<10	<10
PCB-1260	ug/l	<10	<10	<10	<10
PCB-1016	ug/l	<10	<10	<10	<10
Toxaphene	ug/l	<10	<10	<10	<10

* Well Owners and Locations:
HFW - H. Foster, River Road
HGW - H. Gaettner, 1414 State Road
GBW - G. Bosch, River Road
TKW - T. Karlinski, 1039 Anne Street

** Analysis subject to interference

Sampling dates: HFW - 02/07/84; HGW - 02/13/84; GBW - 03/05/84; TKW - 03/06/84

Source: BCM Eastern, Inc.

Parameter	Units	Well *			
		HFW	HGW	GBW	TKW
PRIORITY POLLUTANTS - BASE NEUTRAL ORGANICS (Continued)					
2,6-Dinitroteuene	ug/l	<10	<10	<10	<10
Acenaphthene	ug/l	<10	<10	<10	<10
2,4-Dinitrotoluene	ug/l	<10	<10	<10	<10
Diethyphthalate	ug/l	<10	<10	<10	<10
Fluorene	ug/l	<10	<10	<10	<10
4-Chlorophenyl phenyl ether	ug/l	<10	<10	<10	<10
diphenylamine-n-nitroso	ug/l	<10	<10	<10	<10
1,2-Diphenylhydrazine (Azobenzene)	ug/l	<10	<10	<10	<10
4-Bromophenyl phenyl ether	ug/l	<10	<10	<10	<10
Hexachlorobenzene	ug/l	<10	<10	<10	<10
Phenanthrene	ug/l	<10	<10	<10	<10
Anthracene	ug/l	<10	<10	<10	<10
Di-n-butyl Phthalate	ug/l	<10	<10	<10	<10
Fluoranthene	ug/l	<10	<10	<10	<10
Benzidine	ug/l	<10	<10	<10	<10
Pyrene	ug/l	<10	<10	<10	<10
Butybenzyphthalate	ug/l	<10	<10	<10	<10
Benzo(a)anthracene	ug/l	<10	<10	<10	<10
3,3'-Dichlorobenzidine	ug/l	<10	<10	<10	<10
Chrysene	ug/l	<10	<10	<10	<10
bis-(2-Ethylhexyl) phthalate	ug/l	<10	<10	<10	120
Di-n-octyl phthalate	ug/l	<10	<10	<10	<10
Benzo(b)fluoranthene	ug/l	<10	<10	<10	<10
Benzo(k)fluoranthene	ug/l	<10	<10	<10	<10
Benzo(a)pyrene	ug/l	<10	<10	<10	<10
Indeno(1,2,3-c,d)pyrene	ug/l	<25	<25	<25	<25
Dibenzo(a,h)anthracene	ug/l	<25	<25	<25	<25
Benzo(g,h,i)perylene	ug/l	<25	<25	<25	<25
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS					
Phenol	ug/l	<25	<25	<25	<25
2-Chlorophenol	ug/l	<25	<25	<25	<25
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS					
2-Nitrophenol	ug/l	<25	<25	<25	<25
2,4-Dimethylphenol	ug/l	<25	<25	<25	<25
2,4-Dichlorophenol	ug/l	<25	<25	<25	<25
p-Chloro-m-Cresol	ug/l	<25	<25	<25	<25
2,4,6-Trichlorophenol	ug/l	<25	<25	<25	<25
2,4-Dinitrophenol	ug/l	<250	<250	<250	<250

NOV 14 1985

BCM

BCM Eastern Inc.
Engineers, Planners and Scientists

One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

August 7, 1984

DEU DEPARTMENT

AUG 7 '84

JCB XL JMB ___ HMR ___
DKE ___ PAD ___ PDR ___
WJF ___ GCM ___ T/F ___
AAF ___ RJO ___ F/A XL
JMCK XL WDR ___ T 7671.9
E Friedel XL RAR ___

Mr. Robert Lewis, President
Board of Supervisors
Bristol Township
Bristol, PA 19007

Subject: Analysis of Residential Wells

Dear Mr. Lewis:

BCM Eastern, Inc. (BCM) is pleased to provide you with the analytical results of the water sample collected on May 24, 1984 by BCM from the supply well at the Alex Johnson residence on Orchard Lane.

Should you have any questions or require additional information, please do not hesitate to contact me.

Very truly yours,

Richard J. Grzywinski

Richard J. Grzywinski, P.E.
Vice President

pd
Enclosure
cc: Bucks County Department of Health
P. Rosenstock, Rohm and Haas
G. Schnabel, Rohm and Haas
A. Johnson, Resident of Bristol Township

ECM

Parameter	Units	Johnson Residence Orchard Avenue
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)		
Cellosolve acetate	mg/l	
Butyl cellosolve	mg/l	<0.1
Karathane	mg/l	<0.1
Lethane	mg/l	<0.01
DNCP	mg/l	<0.001
Dithane	mg/l	<0.01
2,4-D	ug/l	<0.02
2,4,5-TP	ug/l	<1
		<0.5
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS		
Antimony	mg/l	<0.15
Arsenic	mg/l	0.004
Beryllium	mg/l	<0.01
Cadmium	mg/l	<0.0005
Chromium	mg/l	0.003
Copper	mg/l	<0.03
Lead	mg/l	0.016
Mercury	mg/l	0.0004
Nickel	mg/l	<0.1
Selenium	mg/l	<0.001
Silver	mg/l	<0.001
Thallium	mg/l	<0.3
Zinc	mg/l	<0.01
Cyanide	mg/l	<0.005
Phenols	mg/l	0.009
CATEGORY 5		
Volatile Organics - EPA Method 601		
Chloromethane	ug/l	<1.0
Bromomethane	ug/l	<1.0
Vinyl chloride	ug/l	<1.0
Chloroethane	ug/l	<1.0
Methylene chloride	ug/l	<1.0
Trichlorofluoromethane	ug/l	<1.0
1,1-Dichloroethylene	ug/l	<1.0
1,1-Dichloroethane	ug/l	<1.0
trans-1,2-Dichloroethylene	ug/l	<1.0
Chloroform	ug/l	<1.0
1,2-Dichloroethane	ug/l	<1.0
		<1.0

TABLE 1

RESIDENTIAL WELL ANALYTICAL DATA
BRISTOL BOROUGH, PENNSYLVANIA

Parameter	Units	Johnson Residence Orchard Avenue
CATEGORY 1 - INDICATOR PARAMETERS		
pH	Standard units	5.4
Specific conductance	umhos	86.6
BOD	mg/l	<6
COD	mg/l	15
TOC	mg/l	4
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS		
Ammonia (as N)	mg/l	<0.05
Boron	mg/l	<0.1
Chloride	mg/l	14.0
Fluoride	mg/l	<0.1
Iron	mg/l	0.05
Nitrate (as N)	mg/l	2.0
Phosphate, Total as P	mg/l	0.04
Sulfate	mg/l	<0.1
Sodium	mg/l	5.81
Potassium	mg/l	1.21
Barium	mg/l	<0.01
Manganese	mg/l	<0.02
Sulfide as S	mg/l	<1
Tin	mg/l	<1
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS		
Surfactants (MBAS)	mg/l	0.08
Oil and grease	mg/l	2
Methyl ethyl ketone	mg/l	<0.1
Isobutyl alcohol	mg/l	<0.1
N-butyl alcohol	mg/l	<0.1
Isopropyl alcohol	mg/l	<0.1
Ethanol	mg/l	<0.1
Butyl methacrylate	mg/l	<10
Methyl methacrylate	mg/l	<0.1
Ethyl acrylate	mg/l	<0.1
Butyl acrylate	mg/l	<0.1
Styrene	mg/l	<0.1
Acetone	mg/l	<0.1
Ethyl acetate	mg/l	<0.1

EQM

Parameter	Units	Johnson Residence Orchard Avenue
Priority Pollutants - Base Neutral Organics (Continued)		
2,6-Dinitrotoluene	ug/l	<10
Acenaphthene	ug/l	<10
2,4-Dinitrotoluene	ug/l	<10
Diethyphthalate	ug/l	<10
Fluorene	ug/l	<10
4-Chlorophenyl phenyl ether	ug/l	<10
diphenylamine-n-nitroso	ug/l	<10
1,2-Diphenylhydrazine (Azobenzene)	ug/l	<10
4-Bromophenyl phenyl ether	ug/l	<10
Hexachlorobenzene	ug/l	<10
Phenanthrene	ug/l	<10
Anthracene	ug/l	<10
Di-n-butyl Phthalate	ug/l	<10
Fluoranthene	ug/l	<10
Benzidine	ug/l	<10
Pyrene	ug/l	<10
Butybenzyphthalate	ug/l	<10
Benzo(a)anthracene	ug/l	<10
3,3'-Dichlorobenzidine	ug/l	<10
Chrysene	ug/l	<10
bis-(2-Ethylhexyl) phthalate	ug/l	29
Di-n-octyl phthalate	ug/l	<10
Benzo(b)fluoranthene	ug/l	<10
Benzo(k)fluoranthene	ug/l	<10
Benzo(a)pyrene	ug/l	<10
Indeno(1,2,3-c,d)pyrene	ug/l	<25
Dibenzo(a,h)anthracene	ug/l	<25
Benzo(g,h,i)perylene	ug/l	<25
Priority Pollutants - Acid Extractable Organics		
Phenol	ug/l	<25
2-Chlorophenol	ug/l	<25
2-Nitrophenol	ug/l	<25
2,4-Dimethylphenol	ug/l	<25
2,4-Dichlorophenol	ug/l	<25
p-Chloro-m-Cresol	ug/l	<25
2,4,6-Trichlorophenol	ug/l	<25
2,4-Dinitrophenol	ug/l	<250

ECMi

Parameter	Units	Johnson Residence Orchard Avenue
CATEGORY 5		
Volatile Organics - EPA Method 601 (Continued)		
1,1,1-Trichloroethane	ug/l	4.8
Carbon tetrachloride	ug/l	<1.0
Bromodichloromethane	ug/l	<1.0
1,2-Dichloropropane	ug/l	<1.0
trans-1,3-Dichloropropylene	ug/l	<1.0
Trichloroethylene	ug/l	3.1
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropylene	ug/l	<1.0
Bromoform	ug/l	<1.0
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<1.0
Chlorobenzene	ug/l	<1.0
Volatile Organics - EPA Method 602		
Benzene	ug/l	<1.0
Toluene	ug/l	<0.1
Chlorobenzene	ug/l	<1.0
Ethylbenzene	ug/l	<1.0
1,2-Dichlorobenzene	ug/l	<1.0
1,3-Dichlorobenzene	ug/l	<1.0
1,4-Dichlorobenzene	ug/l	<1.0
Priority Pollutants - Base Neutral Organics		
N-Nitrosodimethylamine	ug/l	<10
bis-(2-Chloroethyl) ether	ug/l	<10
1,3-Dichlorobenzene	ug/l	<10
1,4-Dichlorobenzene	ug/l	<10
1,2-Dichlorobenzene	ug/l	<10
bis-(2-Chloroisopropyl) ether	ug/l	<10
Hexachloroethane	ug/l	<10
N-Nitrosodi-n-prophylamine	ug/l	<10
Nitrobenzene	ug/l	<10
Isophorone	ug/l	<10
bis-(2-Chloroethoxy) methane	ug/l	<10
1,2,4-Trichlorobenzene	ug/l	<10
Naphthalene	ug/l	<10
Hexachlorobutadiene	ug/l	<10
Hexachlorocyclopentadiene	ug/l	<10
2-Chloronaphthalene	ug/l	<10
Dimethyphthalate	ug/l	<10
Acenaphthylene	ug/l	<10

ECM

Parameter	Units	Johnson Residence Orchard Avenue
Priority Pollutants - Acid Extractable Organics (Continued)		
4-Nitrophenol	ug/l	<25
4,6-Dinitro-o-Cresol	ug/l	<250
Pentachlorophenol	ug/l	<25
Priority Pollutants - Pesticides and PCBs		
Aldrin	ug/l	<10
Alpha-BHC	ug/l	<10
Beta-BHC	ug/l	<10
Gamma-BHC	ug/l	<10
Delta-BHC	ug/l	<10
Chlordane	ug/l	<10
4,4'-DDT	ug/l	<10
4,4'-DDE	ug/l	<10
4,4'-DDD	ug/l	<10
Dieldrin	ug/l	<10
Endosulfan I	ug/l	<10
Endosulfan II	ug/l	<10
Endosulfan Sulfate	ug/l	<10
Endrin	ug/l	<10
Endrin Aldehyde	ug/l	<10
Heptachlor	ug/l	<10
Heptachlor Epoxide	ug/l	<10
PCB-1242	ug/l	<10
PCB-1252	ug/l	<10
PCB-1221	ug/l	<10
PCB-1232	ug/l	<10
PCB-1248	ug/l	<10
PCB-1260	ug/l	<10
PCB-1016	ug/l	<10
Toxaphene	ug/l	<10
CATEGORY 6 - RADIOLOGICAL PARAMETERS		
Gross A - Radioactivity	PCi/l	<2
Gross B - Radioactivity	PCi/l	<3
Total Radium	PCi/L	<1

* Analysis subject to interference

Source: BCM Eastern, Inc.

BCM

TABLE 1

RESIDENTIAL WELL ANALYTICAL DATA
BRISTOL BOROUGH, PENNSYLVANIA

Parameter	Units	G. B. Foster Well	G. B. Foster Pool
CATEGORY 1 - INDICATOR PARAMETERS			
pH	Standard units	6.0	6.4
Specific conductance	umhos	89	132
BOD	mg/l	<3	5
COD	mg/l	<4	63
TOC	mg/l	2	6
TOH	ug/l	23.3	28.8
CATEGORY 2 - NON-PRIORITY POLLUTANT INORGANICS			
Ammonia (as N)	mg/l	<0.05	<0.05
Chloride	mg/l	3.3	7.5
Fluoride	mg/l	0.11	0.11
Iron	mg/l	<0.04	0.87
Nitrate (as N)	mg/l	0.52	<2.0
Phosphate, Total as P	mg/l	0.05	0.12
Sulfate	mg/l	24.0	<2.0
Sodium	mg/l	<0.71	3.75
Potassium	mg/l	1.06	7.46
Barium	mg/l	0.026	0.035
Manganese	mg/l	<0.02	0.23
Sulfide as S	mg/l	<1	<1
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS			
Surfactants (MBAS)	mg/l	<0.03	0.05
Oil and grease	mg/l	<1	<1
Methyl ethyl ketone	mg/l	<0.1	<0.1
Isobutyl alcohol	mg/l	<0.1	<0.1
N-butyl alcohol	mg/l	<0.1	<0.1
Isopropyl alcohol	mg/l	<0.1	<0.1
Ethanol	mg/l	<0.1	<0.1
Butyl methacrylate	mg/l	<10	<10
Methyl methacrylate	mg/l	<0.1	<0.1
Ethyl acrylate	mg/l	<0.1	<0.1
Butyl acrylate	mg/l	<0.1	<0.1
Styrene	mg/l	<0.1	<0.1
Acetone	mg/l	<0.1	<0.1
Ethyl acetate	mg/l	<0.1	<0.1

file

BCM Eastern Inc.
Engineers, Planners and Scientists
One Plymouth Meeting • Plymouth Meeting, PA 19462 • Phone: (215) 825-3800

May 30, 1985

Mr. George Foster or Jonn Delancey
Maple Beacn Road
Bristol, PA 19007

Subject: Well and Pool Water Chemistry
Analytical Results
BCM Project No. 00-4061-10

Dear Sirs:

BCM Inc. (BCM) is pleased to provide you with the analytical results for the water sample collected by BCM from your well and pool on March 8, 1985.

The concentration of each of the parameters for wnich there is an associated U.S. Environmental Protection Agency (USEPA) Interim Primary Drinking Water Standard is within standard. The pool iron and manganese concentrations exceed the USEPA Interim Secondary Drinking Water Standards of 0.3 mg/l and 0.05 mg/l, respectively. However, these secondary standards correspond to aesthetic (taste, color) rather than human health considerations.

Should you have any questions or require additional information, please do not hesitate to contact me.

Very truly yours,

Richard J. Grzywinski, P.E.
Senior Vice President

/pd
Enclosure
cc: Bucks County Board of Health
Stan Gawel, Bristol Township Manager

BCM

Table 1 (Continued)

Parameter	Units	G. B. Foster Well	G. B. Foster Pool
CATEGORY 5			
PRIORITY POLLUTANTS - PURGEABLE HALOCARBONS (Continued)			
1,1,1-Trichloroethane	ug/l	<1.0	<1.0
Carbon tetrachloride	ug/l	<1.0	<1.0
Bromodichloromethane	ug/l	<1.0	<1.0
1,2-Dichloropropane	ug/l	<1.0	<1.0
trans-1,3-Dichloropropylene	ug/l	<1.0	<1.0
Trichloroethylene	ug/l	<1.0	<1.0
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropylene	ug/l	<1.0	<1.0
Bromoform	ug/l	<1.0	<1.0
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	ug/l	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0
bis (Chloromethyl) ether	ug/l	<1.0	<1.0
PRIORITY POLLUTANTS - PURGEABLE AROMATICS			
Benzene	ug/l	<1.0	<1.0
Toluene	ug/l	<1.0	<1.0
Chlorobenzene	ug/l	<1.0	<1.0
Ethylbenzene	ug/l	<1.0	<1.0
1,2-Dichlorobenzene	ug/l	<1.0	<1.0
1,3-Dichlorobenzene	ug/l	<1.0	<1.0
PRIORITY POLLUTANTS - BASE NEUTRAL ORGANICS			
N-Nitrosodimethylamine	ug/l	<10	<10
bis-(2-Chloroethyl) ether	ug/l	<10	<10
1,3-Dichlorobenzene	ug/l	<10	<10
1,4-Dichlorobenzene	ug/l	<10	<10
1,2-Dichlorobenzene	ug/l	<10	<10
bis-(2-Chloroisopropyl) ether	ug/l	<10	<10
Hexachloroethane	ug/l	<10	<10
N-Nitrosodi-n-prophylamine	ug/l	<10	<10
Nitrobenzene	ug/l	<10	<10
Isophorone	ug/l	<10	<10
bis-(2-Chloroethoxy) methane	ug/l	<10	<10
1,2,4-Tricholobenzene	ug/l	<10	<10
Naphthalene	ug/l	<10	<10

BCM

Table 1 (Continued)

Parameter	Units	G. B. Foster Well	G. B. Foster Pool
CATEGORY 3 - NON-PRIORITY POLLUTANT ORGANICS (Continued)			
Cellosolve acetate	mg/l	<0.1	<0.1
Butyl cellosolve	mg/l	<0.1	<0.1
Karathane	mg/l	<0.01	<0.01
Lethane	mg/l	<0.001	<0.001
DNCP	mg/l	<0.01	<0.01
2,4-D	ug/l	<0.1	<0.1
2,4,5-TP	ug/l	<0.1	<0.1
Xylenes	ug/l	<1.0	<1.0
CATEGORY 4 - PRIORITY POLLUTANTS - METALS, CYANIDE, PHENOLS			
Antimony	mg/l	0.25	0.25
Arsenic	mg/l	<0.002	<0.002
Beryllium	mg/l	<0.01	<0.01
Cadmium	mg/l	<0.0005	<0.0005
Chromium	mg/l	0.003	<0.001
Copper	mg/l	0.09	<0.03
Lead	mg/l	0.011	0.004
Mercury	mg/l	<0.0002	<0.002
Nickel	mg/l	<0.1	<0.1
Selenium	mg/l	<0.001	<0.001
Silver	mg/l	<0.0005	<0.0005
Thallium	mg/l	<0.3	<0.3
Zinc	mg/l	0.01	0.02
Cyanide	mg/l	<0.005	<0.005
Phenols	mg/l	<0.002	0.007
CATEGORY 5			
PRIORITY POLLUTANTS - PURGEABLE HALOCARBONS			
Chloromethane	ug/l	<1.0	<1.0
Bromomethane	ug/l	<1.0	<1.0
Vinyl chloride	ug/l	<1.0	<1.0
Chloroethane	ug/l	<1.0	<1.0
Methylene chloride	ug/l	<1.0	<1.0
Trichlorofluoromethane	ug/l	<1.0	<1.0
1,1-Dichloroethylene	ug/l	<1.0	<1.0
1,1-Dichloroethane	ug/l	<1.0	<1.0
trans-1,2-Dichloroethylene	ug/l	<1.0	<1.0
Chloroform	ug/l	<1.0	<1.0
1,2-Dichloroethane	ug/l	<1.0	<1.0

BCM

Table 1 (Continued)

Parameter	Units	G. B. Foster Well	G. B. Foster Pool
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS (Continued)			
2,4-Dichlorophenol	ug/l	<25	<25
p-Chloro-m-Cresol	ug/l	<25	<25
2,4,6-Trichlorophenol	ug/l	<25	<25
2,4-Dinitrophenol	ug/l	<250	<250
4-Nitrophenol	ug/l	<25	<25
4,6-Dinitro-o-Cresol	ug/l	<250	<250
Pentachlorophenol	ug/l	<25	<25
PRIORITY POLLUTANTS - PESTICIDES AND PCBS			
Aldrin	ug/l	<0.5	<0.1
Alpha-BHC	ug/l	<0.5	<0.1
Beta-BHC	ug/l	<0.5	<0.1
Gamma-BHC	ug/l	<0.5	<0.1
Delta-BHC	ug/l	<0.5	<0.1
Chlordane	ug/l	<2.5	<0.5
4,4'-DDT	ug/l	<0.5	<0.1
4,4'-DDE	ug/l	<0.5	<0.1
4,4'-DDD	ug/l	<0.5	<0.1
Dieldrin	ug/l	<0.5	<0.1
Endosulfan I	ug/l	<0.5	<0.1
Endosulfan II	ug/l	<0.5	<0.1
Endosulfan Sulfate	ug/l	<0.5	<0.1
Endrin	ug/l	<0.5	<0.1
Endrin Aldehyde	ug/l	<0.5	<0.1
Heptachlor	ug/l	<0.5	<0.1
Heptachlor Epoxide	ug/l	<0.5	<0.1
PCB-1242	ug/l	<5.0	<1.0
PCB-1252	ug/l	<5.0	<1.0
PCB-1221	ug/l	<5.0	<1.0
PCB-1232	ug/l	<5.0	<1.0
PCB-1248	ug/l	<5.0	<1.0
PCB-1260	ug/l	<5.0	<1.0
PCB-1016	ug/l	<5.0	<1.0
Toxaphene	ug/l	<5.0	<1.0

Sampling Date: 03/08/85
Source: BCM Inc (00-4061-10)

BCM

Table 1 (Continued)

Parameter	Units	G. B. Foster Well	G. B. Foster Pool
PRIORITY POLLUTANTS - BASE NEUTRAL ORGANICS (Continued)			
Hexachlorobutadiene	ug/l	<10	<10
Hexachlorocyclopentadiene	ug/l	<10	<10
2-Chloronaphthalene	ug/l	<10	<10
Dimethyphthalate	ug/l	<10	<10
Acenaphthylene	ug/l	<10	<10
2,6-Dinitroteuene	ug/l	<10	<10
Acenaphthene	ug/l	<10	<10
2,4-Dinitrotoluene	ug/l	<10	<10
Diethyphthalate	ug/l	<10	<10
Fluorene	ug/l	<10	<10
4-Chlorophenyl phenyl ether	ug/l	<10	<10
diphenylamine-n-nitroso	ug/l	<10	<10
1,2-Diphenylhydrazine (Azobenzene)	ug/l	<10	<10
4-Bromophenyl phenyl ether	ug/l	<10	<10
Hexachlorobenzene	ug/l	<10	<10
Phenanthrene	ug/l	<10	<10
Anthracene	ug/l	<10	<10
Di-n-butyl Phthalate	ug/l	<10	<10
Fluoranthene	ug/l	<10	<10
Benzidine	ug/l	<10	<10
Pyrene	ug/l	<10	<10
Butybenzyphthalate	ug/l	<10	<10
Benzo(a)anthracene	ug/l	<10	<10
3,3'-Dichlorobenzidine	ug/l	<10	<10
Chrysene	ug/l	<10	<10
bis-(2-Ethylhexyl) phthalate	ug/l	<10	<10
Di-n-octyl phthalate	ug/l	<10	<10
Benzo(b)fluoranthene	ug/l	<10	<10
Benzo(k)fluoranthene	ug/l	<10	<10
Benzo(a)pyrene	ug/l	<10	<10
Indene(1,2,3-c,d)pyrene	ug/l	<25	<25
Dibenzo(a,h)anthracene	ug/l	<25	<25
Benzo(g,h,i)perylene	ug/l	<25	<25
PRIORITY POLLUTANTS - ACID EXTRACTABLE ORGANICS			
Phenol	ug/l	<25	<25
2-Chlorophenol	ug/l	<25	<25
2-Nitrophenol	ug/l	<25	<25
2,4-Dimethylphenol	ug/l	<25	<25

REF.FILE: BT-1

UEI

UNITECH ENGINEERS
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May 24, 1990

FEDERAL EXPRESS 1835664353

Mr. Jeff Winegar (3HW22)
Remedial Project Manager
U. S. EPA - Region III
841 Chestnut Street
Philadelphia, PA 19107

Reference: Proposed Plan for Croydon TCE Site,
Bristol Township, Bucks County, Pennsylvania

Dear Mr. Winegar:

Your presentation of the proposed remedial alternative to eventually eliminate the long term TCE contamination in your specifically described area was exceptionally informative. As the Environmental Engineers for Bristol Township we presented a short summary report to the Bristol Township Sewer Authority members on the 22 May, 1990, regarding the objectives of the most effective processes that EPA is considering to remove established TCE deposits from the ground water network which underlies a specific area in the Township delineated in your slide presentation. We also presented a review and explanation of the proposed air stripping process in conjunction with an activated carbon scrubber to remove the volatiles released from the groundwater. The main objective of the carbon filters is to prevent TCE from entering the atmosphere within the Croydon Area.

After completing our overview of the proposed superfund options to remove TCE from the designated groundwater network, the members voiced an objection to the proposed location of the air stripping tower and strongly recommended that it be located at the Authority's wastewater treatment facility located on River Road. It seems logical that this location could serve to protect the equipment, but more importantly would be conveniently monitored by the plant personnel on a daily basis rather than an appointed contractor who would visit the proposed site on a periodic schedule, thus leaving the air stripping system unmanned and would be subject to vandalism.

APPENDIX B

COMMENTS ON THE PROPOSED REMEDIAL ACTION PLAN FOR THE CROYDON TCE SUPERFUND SITE FROM UNITECH ENGINEERS

In conclusion, I would like to point out to the U. S. EPA office that the Croydon Area of Bristol Township is a socio-economic depressed area, as well as other areas within the Township. Therefore, any financial help from the federal agency such as fee's for maintenance and operation of the proposed ground water renovation facility that could be located at their wastewater treatment facility would certainly assist the Sewer Authority in eliminating a budget short fall which they are experiencing to date.

The Bristol Township Sewer Authority's chairman would like to schedule a meeting with the EPA to discuss in detail about this recommended alternative at the earliest convenient time possible. Please advise us accordingly.

If you have any questions regarding this matter, please do not hesitate to contact us.

Very truly yours,

UNITECH ENGINEERS, INC.

S. J. Campbell, P.E.

SJC/lal
Enclosures:
cc: Harry Fawkes, Chairman, BTA
James Gallagher, Township Executive
Carmen Raddi, Township Manager
Betti Bogan, Office Manager, BTA

The Authority also voiced an additional objection to the proposed location of the process equipment and its proximity to the Township residences. They feel that the process location at the Bristol Township wastewater treatment facility could best serve the township residences to eliminate the exposure of volatile chlorinated hydrocarbons, noise pollution and the aesthetics. In consideration of this recommendation it will also assist the township financially if supplemental dollars from the contractual management of the groundwater renovation process proposed by the EPA could be diverted to the Township for the same services by the sewer authority.

In considering the above recommended alternative, a transfer pump could be eliminated if located at the Authority's sewage treatment plant (STP) because the renovated groundwater from the Air Stripper could be transferred by gravity to the STP's chlorine contact basin's outfall (See Exhibit #1). This concept will also provide dilution of the STP's effluent constituents such as BOD, COD, TSS and Free Ammonia. The present outfall lines from the STP to the Delaware River Estuary is 1200 ft long.

The C.I.P. (outfall line) is 36 inches in diameter. Using Manning's equation, the existing first section of the outfall line will transfer 22.6 MGD at an existing slope of 0.29% (See Exhibit #2 for detailed hydraulic profile of the outfall line). This water quality change certainly will be beneficial to the river, when compared to the proposed method of discharging renovated groundwater into Hogs Run Creek. The discharge into Hogs Run Creek will foster the erosion of the creek bed and will contribute additional suspended solids loading to the Delaware River Estuary, since the Creek is a tributary of the river.

In an effort for you to visualize the concept recommended above we have attached a plot plan (Exhibit #1) of the existing wastewater treatment facility and the placement of the air stripper, carbon scrubber and the air blower on a concrete pad. The process equipment would be located very near to the chlorine contact basin outfall line going to the river. The relative hydraulic capacities of the effluent line going to the river have been documented by the attached exhibit sited above. Also because of the depth and location of the effluent line the treated groundwater could be transferred by gravity to chlorine contact wet well. Using this location concept places the process in a real remote area, coupled with the fact that the EPA will meet with reduced opposition from the Bristol Township residences, the Council members and its Executive.

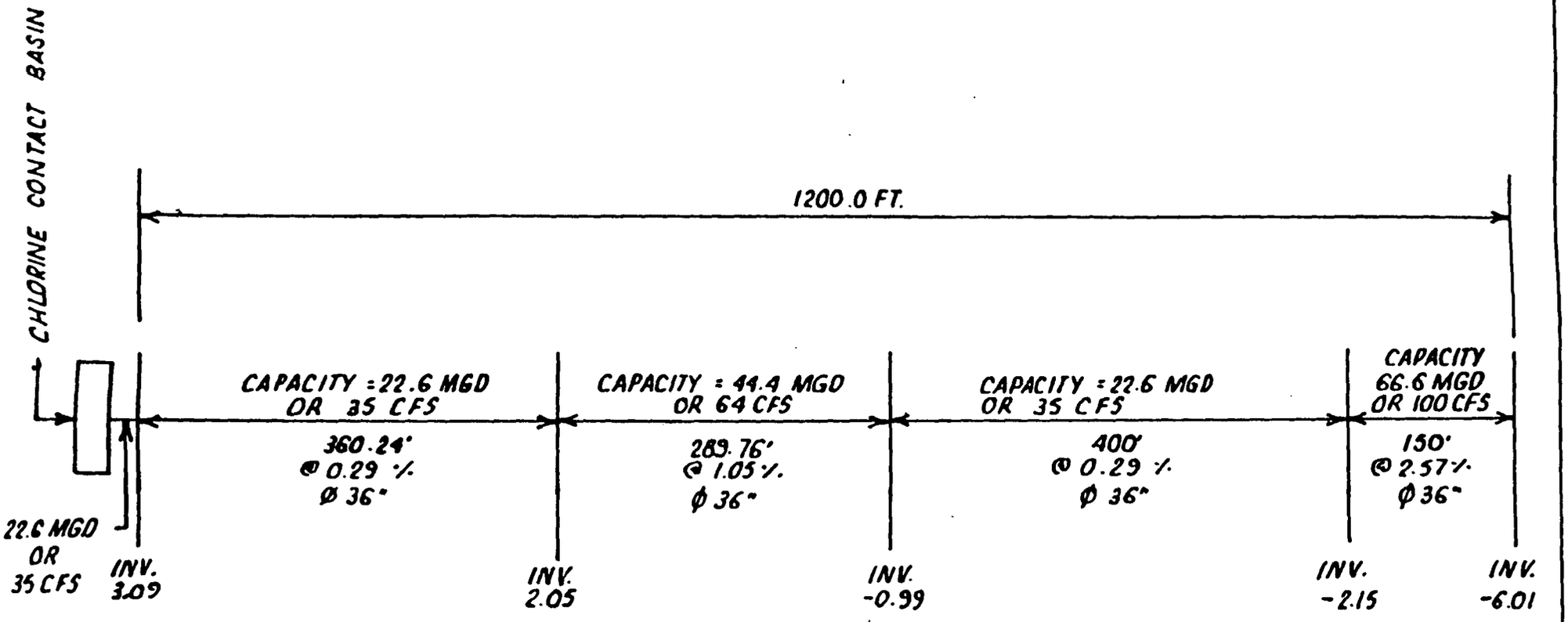

EXHIBIT 2

BRISTOL TOWNSHIP
WASTEWATER TREATMENT EFFLUENT LINE

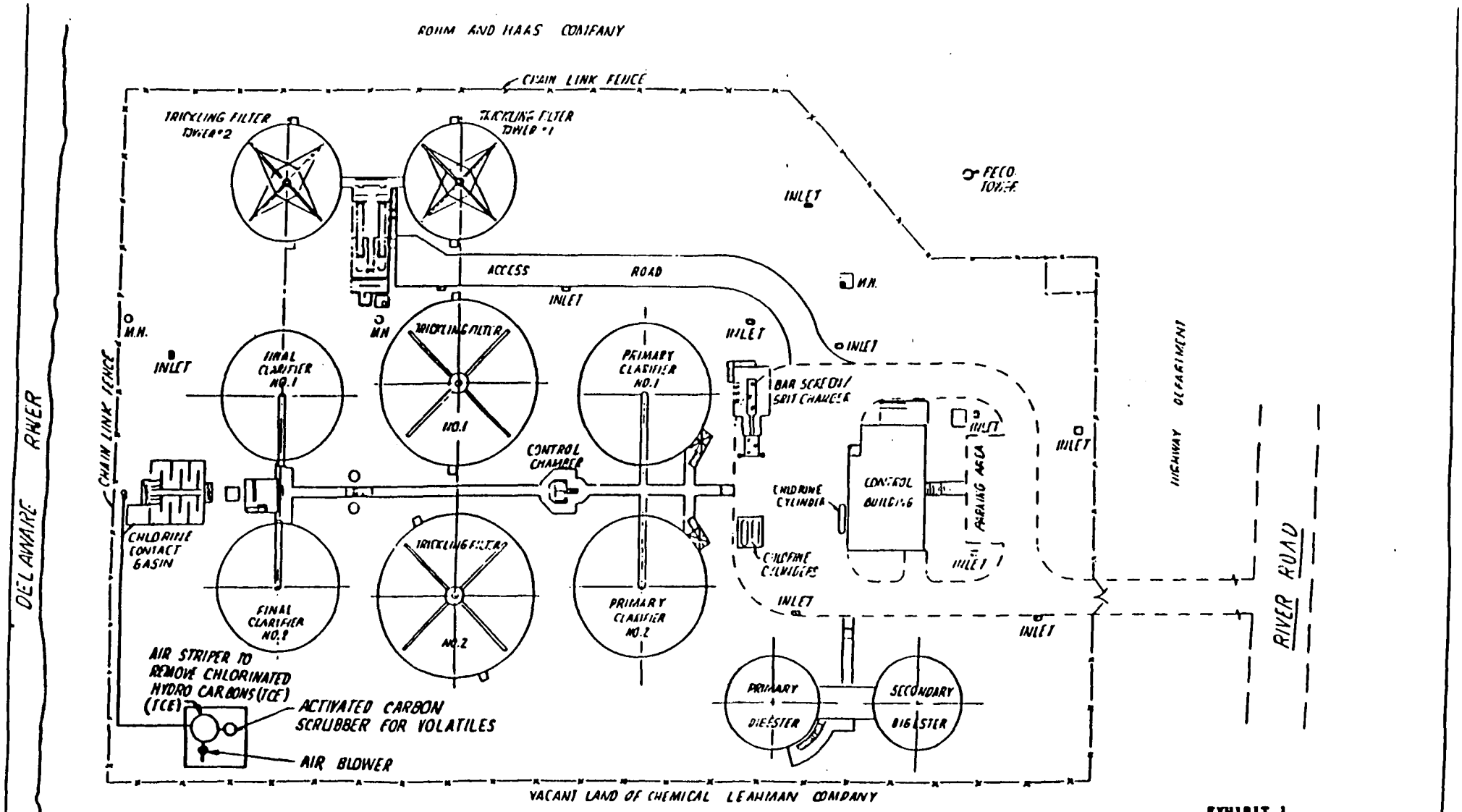

EXHIBIT 1

PROPOSED LOCATION OF AIR STRIPPER FOR GROUNDWATER RENOVATION

BRISTOL TOWNSHIP WASTEWATER TREATMENT PLAN
BRISTOL TOWNSHIP, PENNSYLVANIA
NO SCALE

CROYDON TCE SITE OU2
ADMINISTRATIVE RECORD FILE * **
INDEX OF DOCUMENTS

III. REMEDIAL RESPONSE PLANNING

1. Letter to Mr. John J. Camerlingo, Jr., from Mr. Jeffrey Winegar, U.S. EPA, re: Sampling of Monitoring Wells, 8/30/88. P. 300001-300004.

2. Letter to Ms. Barbara King, from Mr. Jeffrey Winegar, U.S. EPA, re: Transmittal of comments of the data package of water samples, 2/3/89. The comments are attached. P. 300005-300006.

3. Letter to Mr. Abraham Ferdas, U.S. EPA, from Mr. Stephen D. Von Allmer, Department of Health & Human Services, re: Transmittal of a Preliminary Health Assessment, 4/10/89. P. 300007-300011. The Health Assessment is attached.

4. Letter to Telford Industrial Development Authority, from Mr. Jeffrey Winegar, U.S. EPA, re: Phase two of an evaluation of contaminated media, 7/31/89. P. 300012-300020. A transmittal letter with a Right of Entry form, a handwritten telephone conversation memorandum and two certified mail receipts are attached.

5. Letter to Mr. Stanley Skwarlo, from Mr. Jeffrey Winegar, U.S. EPA, re: Phase two of an evaluation of contaminated media, 7/31/89. P. 300021-300027. A sampling location map, two Right of Entry forms and two certified mail receipts are attached.

* Administrative Record File available 4/30/90

** Further documentation for the Croydon TCE OU2 Administrative Record can be found in the Croydon TCE OU1 Record.

Note: Company or organizational affiliation is identified in the index only when it appears in the record.

6. Letter to Mr. Paul D. Rosenstock, Rohm & Haas, Delaware Inc., from Mr. Jeffrey Winegar, U.S. EPA, re: Phase two of an evaluation of contaminated media, 7/31/89. P. 300028-300032. A sampling location map, a Right of Entry form and two certified mail receipts are attached.

7. Letter to Mr. Jeffrey B. Winegar, from Mr. Paul D. Rosenstock, Rohm & Haas Delaware Valley Inc., re: Transmittal of a Right of Entry form, 8/7/89. P. 300033-300034. The Right of Entry form is attached.

8. Letter to Mr. Stanford S. Hunn, from Ms. Denise Parkinson, U.S. EPA, re: Certification ofInsurance and Indemnification, 8/16/89. P. 300035-300035.

9. Letter to Mr. Stanford S. Hunn, from Ms. Janet E. Sharke, U.S. EPA, re: Change of party conducting response work, 9/27/89. P. 300036-300036.

10. Letter to Mr. Jeffrey B. Winegar, U.S. EPA, from Mr. R. Thomas Numbers, BCM Engineers, re: Request for analytical results, 12/14/89. P. 300037-300037.

11. Letter to Mr. Thomas Numbers, BCM Engineers, from Mr. Jeffrey B. Winegar, U.S. EPA, re: Transmittal of a potential source area investigation report, 12/22/89. P. 300038-300038.

* 12. Report: Final Phase II, Remedial Investigation Report, prepared by EBASCO Services Incorporated, 1/90. P. 300039-300496.

13. Report: Final Feasibility Study Report, prepared by EBASCO Services Incorporated, 1/90. P. 300497-300712.

14. Report: Declaration for the Record of Decision, (no author), (undated), P. 300713-300764. A previous index and a letter regarding the remedy for the site is attached.

15. Updated Cost Information, Croydon TCE Site, Atlernative #2, Phase II FS, (undated). P. 300765-300773.

* Maps for Monitoring Wells are part of the Final Phase II, Remedial Investigation Report. These maps are located on the sixth floor at U.S. EPA Region III, 841 Chestnut Street, Philadelphia, PA.

V. COMMUNITY INVOLVEMENT/CONGRESSIONAL CORRESPONDENCE/ IMAGERY

1. Letter to Mr. Jack Kelly, U.S. EPA, from J.G. Rooney, Hudson GEOTECH International, re: Concerns of groundwater contamination, 2/12/86. P. 500001-500001.

2. Letter to Mr. J. G. Rooney, Hudson GEOTECH International, from Mr. Bruce P. Smith, U.S. EPA, re: Information request under FOIA, 3/3/86. P. 500002-500003. The request is attached.

3. Letter to Mr. Jim Rooney, Hudson GEOTECH, from Mr. Jack Kelly, U.S. EPA, re: Transmittal of report on Groundwater contamination, 5/9/86. P. 500004-500004.

4. Freedom of Information Act Request, to the U.S. EPA, from Mr. Robert Martineau Jr., Skadden, Arps, Slate, Meagher & Flom, re: Request for site information, 6/11/87. P. 500005-500007.

5. Handwritten letter to Mr. Jack Kelly, U.S. EPA, from Mr. Harry Foster, re: Request for a copy of TCE testing, 7/7/86. P. 500008-500008.

6. Letter to Mr. Harry Foster, from Mr. Jack Kelly, U.S. EPA, re: Tranmsittal of the TCE Investigation Report, 7/17/86. P. 500009-500009.

7. Letter to Mr. Robert J. Martineau, Jr., Skadden, Arps, Slate, Meagher & Flom, from Mr. William A. Hagel, U.S. EPA, re: Transmittal of FOIA request, 7/22/87. P. 500010-500015. The previous formal request is attached.

8. Newspaper Article from the Bristol Pilot, entitled "EPA Moves Ahead on Croydon Cleanup," 7/30/87. P. 5000016-500016.

9. Newspaper Article from the Bucks County Courier Times, entitled "EPA plans to find TCE source in Croydon," 8/87. P. 500017-500017.

10. Newspaper Article from the ADVISOR, entitled "EPA Moves Ahead on Croydon Cleanup," 8/4/87. P. 500018-500018.

11. Public Meeting Summary, Croydon TCE Site, 8/20/87. P. 500019-500029.

12. Newspaper Article from the Bucks County Courier Times, entitled "Tests to Chart Croydon Water Contamination," 8/21/87. . 500030-500031.

13. Letter to Ms. Mary Blakinger, Bucks County Courier Times, from Mr. Charles L. Kleeman, U.S. EPA, re: Transmittal of FOIA request, 10/16/87. P. 500032-500034. The formal request is attached.

14. Report: Final Community Relations Plan, Croydon TCE Site, prepared by EBASCO Services Incorporated, 2/18/88. P. 500035-500054.

15. Letter to Mr. Jeffrey B. Winegar, U.S. EPA, from Ms. Babara King, Croydon Civic Association, re: Appreciation for water sampling, 2/15/89. P. 500055-500059. Two newspaper articles are attached.

16. Newspaper Article from the Bucks County Courier Times, entitled "Clean Water for Croydon Families," 6/16/89. P. 500060-500060.

17. U.S. EPA, Public Notice, Croydon TCE Site, (undated). P. 500061-500061.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

Deputy Secretary
Environmental Protection

717-787-5028

June 29, 1990

Mr. Edwin B. Erickson
Regional Administrator
US EPA, Region III
841 Chestnut Building
Philadelphia, PA 19107

Re: Record of Decision (ROD) Concurrence
Croyden TCE, Bristol Twp., Bucks Co.
Operable Unit II - Groundwater Containment

Dear Mr. Erickson:

The Record of Decision for Operable Unit II will address the containment, treatment, and discharge of the contaminated groundwater plume.

The major components of the selected remedy include:

1. Construction and long-term operation of four pumping/extraction wells, located in positions to adequately contain the migration of the contaminant plume.

2. Treatment of the extracted groundwater via air stripping, followed by carbon absorption as an ancillary treatment step.

3. On-site discharge of the treated groundwater to the East Branch of Hog Run Creek.

I hereby concur with the EPA's proposed remedy, with the following conditions:

* EPA will assure that the Department is provided an opportunity to fully participate in any negotiations with responsible parties.

* The Department will be given the opportunity to concur with decisions related to the design of the remedial action, to assure compliance with DER design specific ARARs.

* The Department's position is that its design standards are ARARs pursuant to SARA Section 121, and we will reserve our right to enforce those design standards.

* The Department will reserve our right and responsibility to take independent enforcement actions pursuant to state and federal law.

* This concurrence with the selected remedial action is not intended to provide any assurances pursuant to SARA Section 104(c)(3).

If you have any questions regarding this matter please do not hesitate to contact me.

Sincerely,

Mark M. McClellan
Deputy Secretary
Environmental Protection