United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R02-85/016
September 1985

EPA

Superfund Record of Decision:

Goose Farm, NJ

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA/ROD/R02-85/016	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE SUPERFUND RECORD OF DECISION Goose Farm, NJ		5. REPORT DATE September 27, 1985
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460		13. TYPE OF REPORT AND PERIOD COVERED Final ROD Report
		14. SPONSORING AGENCY CODE 800/00
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

The Goose Farm site is located approximately two miles northeast of the Town of New Egypt in Plumsted Township, Ocean County, New Jersey. The Goose Farm was used as a hazardous waste disposal site from the mid 1940's to the mid 1970's by a manufacturer of polysulfide rubber and solid rocket fuel propellant. The majority of wastes were dumped into a pit dug through the fine sand. The dimensions of the pit were approximately 100 x 300 x 15 feet. Lab packs, 55 gallon drums, and bulk liquids were dumped into the pit. Investigations have found contaminated soils containing volatile, acid and base/neutral organic pollutants throughout the disposal area. In addition, sampling shows contamination of ground water up to 570 ppm total priority pollutants and contamination of the surface water up to 1100 ppb total volatile organics.

The recommended remedial alternative for this site is expected to be implemented in a phased manner. First, the contaminated soil and ground water underlying the site will be flushed. The ground water will be recovered using a well-point system and will be treated onsite prior to reinjection into the soil. Following soil flushing and ground water recovery and treatment, extensive testing will be conducted to determine the need to cap the site. In addition, during and after soil flushing and ground water recovery and treatment activities, extensive testing will be conducted to determine the extent of PCB contamination in the former drum pit area. Test data will (see separate sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Goose Farm, NJ Contaminated Media: soil, gw, sw Key contaminants: VOCs, toluene, ethylbenzene, trichloroethylene (TCE), PCBs		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report) None	21. NO. OF PAGES 108
	20. SECURITY CLASS (This page) None	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

INSTRUCTIONS

1. **REPORT NUMBER**
Insert the EPA report number as it appears on the cover of the publication.

2. **LEAVE BLANK**

3. **RECIPIENTS ACCESSION NUMBER**
Reserved for use by each report recipient.

4. **TITLE AND SUBTITLE**
Title should indicate clearly and briefly the subject coverage of the report, and be displayed prominently. Set subtitle, if used, in smaller type or otherwise subordinate it to main title. When a report is prepared in more than one volume, repeat the primary title, add volume number and include subtitle for the specific title.

5. **REPORT DATE**
Each report shall carry a date indicating at least month and year. Indicate the basis on which it was selected *(e.g., date of issue, date of approval, date of preparation, etc.)*.

6. **PERFORMING ORGANIZATION CODE**
Leave blank.

7. **AUTHOR(S)**
Give name(s) in conventional order *(John R. Doe, J. Robert Doe, etc.)*. List author's affiliation if it differs from the performing organization.

8. **PERFORMING ORGANIZATION REPORT NUMBER**
Insert if performing organization wishes to assign this number.

9. **PERFORMING ORGANIZATION NAME AND ADDRESS**
Give name, street, city, state, and ZIP code. List no more than two levels of an organizational hierarchy.

10. **PROGRAM ELEMENT NUMBER**
Use the program element number under which the report was prepared. Subordinate numbers may be included in parentheses.

11. **CONTRACT/GRANT NUMBER**
Insert contract or grant number under which report was prepared.

12. **SPONSORING AGENCY NAME AND ADDRESS**
Include ZIP code.

13. **TYPE OF REPORT AND PERIOD COVERED**
Indicate interim final, etc., and if applicable, dates covered.

14. **SPONSORING AGENCY CODE**
Insert appropriate code.

15. **SUPPLEMENTARY NOTES**
Enter information not included elsewhere but useful, such as: Prepared in cooperation with, Translation of, Presented at conference of, To be published in, Supersedes, Supplements, etc.

16. **ABSTRACT**
Include a brief *(200 words or less)* factual summary of the most significant information contained in the report. If the report contains a significant bibliography or literature survey, mention it here.

17. **KEY WORDS AND DOCUMENT ANALYSIS**
(a) DESCRIPTORS - Select from the Thesaurus of Engineering and Scientific Terms the proper authorized terms that identify the major concept of the research and are sufficiently specific and precise to be used as index entries for cataloging.

(b) IDENTIFIERS AND OPEN-ENDED TERMS - Use identifiers for project names, code names, equipment designators, etc. Use open-ended terms written in descriptor form for those subjects for which no descriptor exists.

(c) COSATI FIELD GROUP - Field and group assignments are to be taken from the 1965 COSATI Subject Category List. Since the majority of documents are multidisciplinary in nature, the Primary Field/Group assignment(s) will be specific discipline, area of human endeavor, or type of physical object. The application(s) will be cross-referenced with secondary Field/Group assignments that will follow the primary posting(s).

18. **DISTRIBUTION STATEMENT**
Denote releasability to the public or limitation for reasons other than security for example "Release Unlimited." Cite any availability to the public, with address and price.

19. & 20. **SECURITY CLASSIFICATION**
DO NOT submit classified reports to the National Technical Information service.

21. **NUMBER OF PAGES**
Insert the total number of pages, including this one and unnumbered pages, but exclude distribution list, if any.

22. **PRICE**
Insert the price set by the National Technical Information Service or the Government Printing Office, if known.

Abstract - continued

determine the need to remediate PCB-contaminated soil. If such remediation is deemed necessary, a supplementary Record of Decision will be prepared. Total capital cost for the selected remedial alternative is estimated to be $3,014,000 with no O&M costs.

Record of Decision
Remedial Alternative Selection

Site

Goose Farm, Plumsted Township, New Jersey

Documents Reviewed

I am basing my decision primarily on the following documents describing the analysis of cost-effectiveness of remedial alternatives for the Goose Farm site.

- Goose Farm Remedial Investigation Report and Feasibility Study (RI/FS), Elson T. Killam Associates, Inc., July 1985;
- Staff summaries and recommendations.
- Responsiveness Summary dated September 1985.

Description of Selected Remedy

1. Flush the contaminated soil and groundwater underlying the site. The groundwater would be recovered using a wellpoint system and treated on-site prior to reinjection into the soil. Currently, it is estimated that recovering and flushing ten pore volumes will be required to remove the mobile contaminants from the soil and groundwater. Pilot studies to be conducted during design will optimize the required treatment system components.

2. Following soil flushing and groundwater recovery and treatment, conduct an extensive testing program to determine the need to cap the site.

3. During and after soil flushing and groundwater recovery and treatment activities, conduct an extensive testing program to determine the extent of PCB contamination in the former drum pit area. Based on this program, determine the need, if any, to remediate PCB-contaminated soil.

Declarations

Consistent with the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) and the National Contingency Plan (40 CFR Part 300), I have determined that flushing of the contaminated soil in conjunction with groundwater recovery and treatment, evaluating the need to cap the site, and testing for PCB contamination in the drum pit area constitute the selected remedial alternative for the Goose Farm site.

I have determined that implementation of this alternative will provide protection of public health, welfare and the environment. The State of the New Jersey has been consulted and agrees with the proposed remedy.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites. Flushing of the contaminated soil and recovery and treatment of underlying groundwater in conjunction with evaluating the need to cap the site and testing for PCB contamination in the drum pit area is more cost-effective than other remedial action alternatives, and is necessary to protect public health, welfare and the environment.

September 27, 1985
Date

Christopher J. Daggett
Regional Administrator

Summary of Remedial Alternative Selection

Goose Farm
Plumsted, New Jersey

Site Location and Description

The Goose Farm site is located approximately two miles northeast of the Town of New Egypt in Plumsted Township, Ocean County, New Jersey. The site lies approximately one mile north of the intersection of county routes 528 and 539. Both solid and liquid hazardous wastes in bulk, 55 gallon drums, 5 gallon pails and lab packs were disposed of at the four acre site.

The site which has been previously excavated contains little natural revegetation and is gently sloped. The site is located adjacent to a pine/oak forest and a small stream which flows north into Lahaway Creek. A vicinity map and site location map are presented in Figures 1 and 2, respectively.

Site History

The Goose Farm was used as a hazardous waste disposal site from the mid 1940's to the mid 1970's by a manufacturer of polysulfide rubber and solid rocket fuel propellant. The majority of wastes were dumped into a pit dug through the fine sand. The dimensions of the pit were approximately 100 by 300 and 15 feet deep. Lab packs, 55 gallon drums, and bulk liquids were dumped into this pit.

In January 1980, during an investigation of pesticide contamination of local potable wells, the Plumsted Township Sheriff's office informed the New Jersey Department of Environmental Protection (NJDEP) of the existence of the Goose Farm site as well as several other disposal sites in the area. From February to June 1980, the NJDEP conducted an investigation of the site. The investigation included the installation and sampling of 17 monitoring wells, and metal detection and resistivity surveys. The results of this work indicated that a contaminant plume originated in the waste pit area and migrated north toward a nearby stream. During the next phase of the investigation the NJDEP installed and sampled 34 additional wells. The data indicated that a contaminant plume less than 140 feet wide and approximately 35 feet deep, which is the approximate depth of a cemented sand seam encountered in the Vincentown Formation, underlays the site.

In September 1980, the NJDEP proceeded with remedial activities at the site in an attempt to eliminate the discharge of contaminants to the nearby stream. Approximately 5,000 containers of waste were removed from the waste pit area as well as an estimated 9,000 gallons of bulk liquids.

These wastes were disposed of off-site. Another component of the cleanup included the installation of a wellpoint collection and spray irrigation system downgradient of the disposal area and upgradient of the stream. The wellpoint collection system created a central hydrologic drain of groundwater through recovery headers, thus preventing further contamination of surface water by contaminated groundwater seepage.

Following the collection and treatment of groundwater, the effluent was sprayed on the surface downgradient of the main recovery header, and reinjected in the ground, thereby creating a reverse flow of groundwater to further contain the plume. A second spray irrigation system was located north of the disposal pit to handle additional flow. In March 1981, the operation of this flushing and treatment system was terminated after treatment of approximately 7,800,000 gallons of contaminated water.

A final component of past remedial activities included the excavation of contaminated soil. Following testing of the soil, approximately 3,500 tons were classified as grossly contaminated. This soil, and an additional 12 drums of PCB waste, were transported off-site for disposal.

In September 1982, EPA approved the NJDEP Cooperative Agreement Application for the Goose Farm site. Federal funds in the amount of $189,000 were provided to complete RI/FS for the site. Subsequently, the State procured Elson T. Killam Associates to undertake the work necessary to complete the RI/FS.

Effectiveness of Initial Remedial Activities

The groundwater recovery and treatment system at the Goose Farm site commenced operation on September 17, 1980. A total volume of 7,800,000 gallons of contaminated groundwater was treated prior to cessation of cleanup activities on March 20, 1981. Approximately 200 wells were installed to recover groundwater and reinject treated water in two pneumatic systems used during site cleanup. The groundwater treatment system included the following unit operations:

- vapor scrubbing to remove volatile organics
- sedimentation with polymer addition for heavy metal removal
- carbon adsorption
- effluent aeration

During the treatment plant operation, total organic carbon (TOC) was used to monitor the contamination. The NJDEP established an effluent criterion of 100 mg/l of TOC for the system. In February 1981, a 21 day treatment plant study was conducted in which analyses of additional chemical compounds were performed. The results of this study indicated that the treatment system was virtually 100 percent effective in removing both toluene and benzene. However, methylene chloride removal was poor (approximately 60 percent). In order to remediate this problem, effluent aeration was added to the overall treatment system. The total organic removal efficiency during the evaluation averaged approximately 50 percent. Due to the lack of comprehensive data during the six months of operation of the treatment plant, a detailed evaluation of the effectiveness of the treatment system cannot be performed.

Due to limited data, it is difficult to assess the overall impact on groundwater recovery and treatment operation. Many of the monitoring wells sampled in 1980 have been destroyed. However, a comparison of the limited data from previous sampling events and samples obtained during the remedial investigation field activities was included in the remedial investigation report. The general trend in concentrations of specific volatile organic contaminants seems to be downward. This can be considered to be a result of the previous remedial action undertaken at the Goose Farm site.

Site Geology

The Goose Farm site is located in the Atlantic Coastal Plain physiographic province. This province is characterized by unconsolidated deposits consisting of alternating layers of clay, silt, sand, and gravel that outcrop in parallel northeast-southwest striking lands and dip gently to the southeast. Surficial deposits at the site are of the Kirkwood formation. The Kirkwood, in turn, is underlain by the Manasquan and Vincentown formations.

The Kirkwood formation is composed of a lower dark silty layer and upper sandy layer in the outcrop area. Downdip the formation consists of thick clay and sand beds. The Kirkwood is the most developed aquifer in Ocean County, primarily in the coastal area.

The Manasquan formation consists of upper fine sand to clay and a lower glauconitic clay. This formation is not considered an important aquifer in Ocean County.

The Vincentown formation consists of an upper calcite-clay and sand member and a lower glauconitic sand member. It is utilized by typically low yielding domestic wells in its outcrop area.

Underlying the Vincentown are the Hornerstown sand, Red Bank sand, Neversink, Mount Laurel sand, Marshalltown formation, Englishtown formation, Merchantville formation, Woodbury clay, and the Raritan and Magothy formations.

REMEDIAL INVESTIGATION ACTIVITIES AND RESULTS

Remedial Investigation Activities:

The remedial investigation of the Goose Farm site included the following activities undertaken by the State's consultant Elson T. Killam and Associates.

- Collection of ten soil samples obtained from soil borings drilled in the former disposal area and priority pollutant analyses plus 40 tentatively identified compounds (TICs) of all samples.

- Drilling of two monitoring wells in the Vincentown formation and priority pollutant analyses plus 40 TICs of the two samples obtained from these wells.

- Collection of one leachate sample and priority pollutant analyses plus 40 TICs of this sample.

- Collection of one sediment and two surface water samples obtained from the adjacent stream and priority pollutant analyses plus 40 TICs of these samples.

- Collection of six potable well samples from private wells downgradient and in the vicinity of the site and priority pollutant analyses plus 40 TICs of all samples.

- Collection of five samples from existing monitoring wells and priority pollutant analyses plus 40 TICs of all samples.

These investigative activities were supplemented by work performed by Wehran Engineers, a consultant for the Morton-Thiokol Corporation. This work included installation of additional monitoring wells, collection of groundwater and subsurface soil samples, and priority pollutant analyses of all samples. This work was supervised by the NJDEP staff.

The results of the remedial investigation work conducted on the Goose Farm site indicated that significant levels of groundwater contamination and soil contamination remain at the site.

Soil Contamination

Laboratory analyses of subsurface soils indicated that significant levels of soil contamination remain in the disposal pit area. The size of the contaminated area is estimated to be 15,500 square yards. The depth of the contamination generally ranges from the surface to twelve feet.

Contaminated soils contain volatile, acid and base/neutral organic priority pollutants along with non-priority organic pollutants in all fractions. Volatile contaminants such as toluene, ethylbenzene, methylene chloride and trichloroethylene were detected in high concentrations, with toluene measured up to 640 ppm.

Other non-volatile organic priority pollutants found in the acid and base/neutral fractions included: Bis (2-chloroethoxy) methane, bis (2-chloroisopropyl) ether and PCB-1254, with concentrations up to 160 ppm.

Priority pollutant and non-priority pollutant polynuclear aromatic hydrocarbons (PAHs) were detected in numerous soil samples. The physical properties of these PAHs include very low solubility in water and low vapor pressure, both indicating low mobility and high resistance to biodegradation.

Overall, the highest levels of compounds were found between zero and 12 feet below the surface in the 15,500 square yard area considered contaminated. The soil concentrations outside this area are generally under 0.1 ppm total priority pollutants. Significant portions of the highly contaminated area contain concentrations of priority pollutants greater than 100 ppm. During the initial remedial activities contaminated soil was excavated from the drum pit area. The highly contaminated soil was transported off-site for disposal while the less contaminated soil was redeposited in the pit.

Groundwater and Surface Water Contamination

Analyses of groundwater and surface water at the Goose Farm site shows that contamination of groundwater up to 570 ppm total priority pollutants and contamination of the surface water up to 1100 ppb total volatile organics currently exists. Groundwater (including leachate) and surface water around the site contain high levels of volatile organic contamination. Toluene, acrylonitrile, benzene, methylene chloride, 1,2-dichloroethene and trichloroethylene were detected at high levels. Appendix B shows the concentration of each contaminant.

Potable water samples collected from wells approximately 2,000 feet downgradient of the site showed low levels of volatile organic contamination. Methylene chloride was detected in levels up to 17 ppb, however, this compound was also detected in trip blank samples. Another volatile, 1,1,2,2-tetracloroethylene was detected at 23 ppb in one potable well. This chemical was not detected in any other samples obtained at the site.

Establishing Remedial Objectives

The evaluation of the results of the remedial investigation provided the basis for establishing remedial action objectives. The objectives for the Goose Farm site include source control as well as prevention of contaminant migration.

Remedial action objectives for source control are used to stop the spread of contamination at the source. The area of contaminated soil around the former disposal pit area is considered the source. Once contamination leaving the former disposal pit area is controlled, more effective remedial actions for migration control can be implemented.

The remedial action objectives for source control set for the Goose Farm site are noted below:

- Remove, treat or contain contaminants
- Control general migration pathways
- Control release of volatile compounds in air
- Control water infiltration
- Control soil erosion
- Control direct contact

The principal objective in management of migration is to mitigate the potential contamination of potable water supplies. A secondary goal of migration management is to prevent the movement of contaminants to other areas where exposure to these compounds through direct contact may occur.

Screening of Remedial Action Technologies

For the Goose Farm site, the candidate general technologies developed in response to the established remedial objectives include:

- Containment
- Collection and on-site groundwater treatment
- In situ treatment
- On-site disposal
- Off-site disposal

These general technologies can be further defined as follows.

- Containment; capping, grading, revegetation, diversion of surface run-off, groundwater barriers (both vertical and horizontal)
- Collection and Treatment of Groundwater; wellpoints, deep wells, recharge, biological, physical/chemical treatment
- In-Situ Treatment; hydrolysis, oxidation, reduction, soil aeration, solvent flushing, neutralization, polymerization, permeable treatment beds, chemical dechlorination.
- On-Site Disposal; construction of a RCRA landfill, excavation, backfilling
- Excavation and Off-Site Disposal; excavation followed by off-site landfilling, incineration

Prior to evaluating complete alternatives, some of the technologies were screened out on the basis of cost, waste compability, time required to achieve goals, unproven technology or other considerations. The technologies that were eliminated and the reasons for elimination were as follows:

- Collection and Treatment of Groundwater; deep wells are more costly than wellpoints, and the depth of the confining layer is such that deep wells are not required.
- In-Situ Treatment; Neutralization and polymerization are not appropriate due to the chemical make-up of the waste.

Remedial Alternatives

Following the screening of remedial technologies, eight remedial action alternatives were developed. A description of these alternatives, their present worth cost and their effectiveness in meeting the established remedial objectives are discussed below. Appendix A includes a cost comparison of alternatives as well as a brief description of the advantages and disadvantages of each alternative.

Alternative 1

This alternative involves the off-site disposal of 62,000 cubic yards (CY) of contaminated soil, with regrading and revegetation. The plume recovery and treatment system would require 1,200 linear feet of header piping with 120 wellpoints. The recovered plume water would be treated via clarification and activated carbon, and its effluent reinjected into the soil. Treatment of ten pore water volumes was estimated to be needed to remove the mobile contaminants from the soil and groundwater. The present worth cost of this alternative is $45,326,400.

This alternative would be effective in controlling the source material and preventing the migration of contaminants. It also attains applicable and relevant Federal public health and environmental standards.

Alternative 2

This alternative involves limited off-site disposal of 10,000 CY of contaminated soil, with soil flushing and groundwater recovery and treatment to remove the remaining pollutants in the remaining 52,000 CY of contaminated soil and in the underlying contaminated groundwater. The recovered water will be treated via clarification and activated carbon and its effluent reinjected into the soil. It was estimated that extraction of ten pore volumes of water would be required to remove the mobile contaminants from the soil and groundwater. The groundwater recovery system would require 800 linear feet of header, and 80 wellpoints. The present worth cost of this alternative is $9,451,600.

This alternative would be effective in controlling the source material and preventing the migration of contaminants. It also attains applicable and relevant Federal public health and environmental standards.

Alternative 3

For this alternative, an on-site landfill would be constructed for the encapsulation of 62,000 CY of contaminated soil. The landfill would be constructed in accordance with current RCRA requirements. The landfill would have a double lined bottom with leachate recovery and would be sealed along the top. The groundwater plume would be recovered via a wellpoint system, treated via clarification and activated carbon and discharged. It was estimated that treatment of ten pore volumes would be required to remove the mobile contaminants from the aquifer. The total present worth cost of this alternative is $3,303,600.

The implementation of this alternative would be effective in controlling the source material and preventing the migration of contaminants. This alternative attains applicable and relevant Federal public health and environmental standards.

Alternative 4

This alternative would not require any soil excavation. A soil flushing and groundwater recovery system consisting of 800 linear feet of header piping, 80 wellpoints, and two pumps would be constructed and operated for approximately 18 months. This duration represents flushing, recovering and treating ten pore volumes. The recovered water would be treated via clarification and activated carbon, and reinjected into the soil. Following the soil flushing and groundwater cleanup, an evaluation would be made of the need to cap the site to minimize the migration of any residual contaminants. The estimated total present worth cost of this alternative is $2,814,500.

The implementation of this alternative would be effective in controlling the source material and preventing the migration of contaminants. This alternative attains applicable and relevant Federal public health and environmental standards.

Alternative 5

No excavation would be required for this alternative. A soil flushing and groundwater recovery system consisting of 800 linear feet of header piping, 80 wellpoints, and two pumps would be constructed and operated. Nutrients and oxygen sources would be added to the soil to enhance the cleanup. Since the nutrients might enhance the treatment system's efficiency, it is expected that less than 10 pore volumes of flushing and recovery would be required. The recovered plume water would be treated via clarification and activated carbon, and reinjected into the soil. Following the soil flushing and groundwater cleanup, an evaluation would be made of the need to cap the site to minimize the migration of any residual contaminants. The estimated present worth cost or this alternative is $2,814,500.

The implementation of this alternative would be effective in controlling the source material and preventing the migration of contaminants. This alternative attains applicable and relevant Federal public health and environmental standards.

Alternative #6

For this alternative, the contaminated soil would be contained in-place. Slurry walls would be constructed around the area of contaminated soil. The bottom of the contaminated area would be sealed via grouting. To encapsulate the contaminated soil, a clay cap would be constructed on top. The groundwater plume would recovered via a wellpoint system, treated via clarification and activated carbon and discharged. It is estimated that treatment of ten pore volumes would be required to remove the contaminants from the aquifer. The present worth cost of this alternative is $18,534,100:

This alternative would be effective in the short-term for controlling the source material and preventing the migration of contaminants. However, since the integrity of the grout seal is uncertain, this alternative cannot be considered an effective long-term remedial action. As such, alternative does not attain applicable and relevant public health and environmental standards, but would reduce the present threat posed by the site.

Alternative #7

For this alternative, soil flushing would be performed to remove the mobile contaminants from the soil. Water would be injected into the soil to create a flushing action. The contaminated water would be recovered via a shallow wellpoint system, treated via clarification and activated carbon and reinjected. It is estimated that treatment of ten pore volumes would be required to remove the mobile contaminants from the soil. The present worth cost of this alternative is $1,521,800.

This alternative would be effective in controlling the source material. However, since no remediation is recommended for the contaminated groundwater, migration of contaminants would still be possible. Therefore, this alternative does not attain applicable and relevant Federal public health or environmental standards.

Alternative #8

This alternative, referred to as "No Action", does not include any remediation measures for the site. However, it does include a long-term monitoring program for the groundwater underlying the site. Approximately 30 groundwater samples per year would need to be obtained and analyzed for priority pollutants monitor the water quality of the groundwater. The present worth cost of this alternative is $603,300.

Enforcement

The State of New Jersey and EPA have identified Morton - Thiokol Inc. as a potentially responsible party. A Cost Recovery Action has recently been filed by EPA in an attempt to recover monies spent on the initial cleanup measures and the remedial investigation and feasibility study. Currently, the State of New Jersey is negotiating with Morton-Thiokol for the long term remedial clean-up of the site. These negotiations are expected to continue until after this Record of Decision is formally executed.

Evaluation of Alternatives

Alternative 1 includes excavation of soil and off-site disposal of all contaminated soil as well as groundwater remediation. This alternative meets the goals of preventing the migration of contaminants and controlling the source material. However, this alternative is far more costly than the other effective alternatives, and provides only a slight, if any, additional benefit compared to other less expensive alternatives. Therefore, excavation to background, in this case, is not cost-effective. In the National Contingency Plan, cost-effective is described as the lowest cost altternative that is technically feasible and which effectively mitigates and minimizes damages and provides protection of the public health, welfare and the environment. Based on the above, this alternative is not recommended as the remedial action.

Alternative 2 includes partial soil excavation and off-site disposal in conjunction with soil flushing, groundwater remediation and evaluation of the need for site capping. This alternative would be effective in controlling source material and preventing the migration of contaminants. However, the present worth cost of implementing this alternative would be three times more than other effective alternatives. Therefore, this alternative was eliminated from consideration.

Alternative 3 includes construction of an on-site RCRA landfill for disposal of contaminated soil and groundwater remediation. Although this alternative would be effective in the short term in controlling the source material and preventing migration of contaminants, its long term reliability would be doubtful. Many of the characteristics of the site make the location of a RCRA landfill inappropriate. For example, the predominant geology is sandy type soil with a rapidly flowing aquifer close to the surface. Due to these factors and the fact that the cost of this alternative is slightly higher than others, this alternative was eliminated from consideration.

Alternative 4 includes soil flushing, groundwater remediation and further evaluations for site capping and PCB remediation. Alternative 5 is similar; however, its soil flushing would be enhanced using in-situ biological methods. Both of these alternatives would be effective in controlling the source material and preventing further migration of contaminants. However, the use of nutrients in Alternative 5 could make this alternative more complex from an operational standpoint than Alternative 4. Both of these alternatives have a present worth cost estimate of $2,814,500. Pilot studies would be performed during the design phase to determine the effectiveness of each of the two soil flushing options and treatment options.

Alternative 6 includes the construction of an in-place containment system, to encapsulate the contaminated soil, and groundwater remediation. This alternative would be somewhat effective in meeting the remedial objectives. The cost of this alternative is estimated to be $18,534,000. This cost is far greater than other alternatives considered to be more effective in controlling the source and preventing further migration of contaminants. Therefore, this alternative is not recommended as the remedial action.

Alternative 7 includes soil flushing to remove the mobile contaminants. Water would be injected into the soil via shallow wells, thus creating a flushing action. The water would be recovered, treated and reinjected into the soil. Therefore, this alternative would not be effective in controlling the migration of contaminants.

Alternative 8 is the "No Action" alternative and would include long-term monitoring of the groundwater. Obviously, this alternative would not meet the established remedial objectives of controlling the source material and preventing migration of contaminants. The implementation of the "No Action" alternative will not prevent further migration of pollutants from contaminated soil remaining on-site. Furthermore, exposure to the public of these contaminants at near surface locations will not be eliminated. For these reasons, and since this alternative would not provide adequate protection of public health, welfare and the environment, it was eliminated from consideration.

Recommended Alternative

According to 40 CFR Part 300.68 (J), cost-effective is described as the lowest cost alternative that is technically feasible and reliable and which effectively mitigates and minimizes damages and provides protection of public health, welfare and the environment. A cost comparison of remedial alternatives is presented in Appendix A. Evaluation of the remedial alternatives leads to the conclusion that Alternative 4 is the most cost effective alternative that achieves the established remedial objectives. Figure 3 shows a layout of the proposed remedial action.

This alternative includes the construction of 800 linear feet of header piping and 80 wellpoints to be used in a groundwater recovery and soil flushing system. The recovered water from the system would be treated via clarification and activated carbon prior to being reinjected to the soil. Currently, it is estimated that the soil flushing and groundwater recovery system would require 18 months of operation. This duration represents flushing, recovering and treating approximately ten pore volumes. Continuous sampling will be performed during soil flushing and groundwater remediation operations. If a steady state of contamination removal is achieved prior to the recovery and treatment of ten pore volumes, the Soil Contamination Evaluation Methodology (SOCEM) model or a similar model will be used to evaluate whether alternate concentration limits are appropriate.

The SOCEM model is a simplified procedure used for characterizing the threat that contaminated soil may pose to groundwater at hazardous waste sites. Its methodology assists the user in determining the percent reduction in soil contaminant concentrations (i.e. source strength) required to achieve appropriate health based water quality levels at a groundwater receptor.

During the design phase, pilot studies will be performed to optimize the operation of the flushing and treatment system. These tests may include use of nutrients and oxygen sources. The results of these pilot studies may indicate that the addition of nutrients and oxygen sources can reduce the number of pore volume flushes necessary to remove the contaminants from the the soil and groundwater, as suggested by Alternative 5. If so, they may be used in the remedial action, if their use is determined to be cost-effective.

Another component of the remedial action includes testing for PCB contamination in the former drum pit area. This testing will be performed prior to, during, and after the soil flushing, groundwater recovery and treatment operation. The results of the PCB testing will be used to determine if any additional remediation is required. If such remediation is deemed necessary, a supplementary Record of Decision will be prepared that will clearly delineate selected additional remedial actions.

The final component of the cleanup will include an evaluation of the need to cap the site. This determination will be made after testing the soil upon completion of the soil flushing program and evaluating the properties of residual contaminants. The actual design of the cap, if needed, will be based on the Hydrologic Evaluation of Landfill Performance (HELP) model or a similar model.

The HELP model is a two dimensional hydrologic model of water movement across, into, and through landfills. The model provides an approximation of leachate which may be generated at the site under specified conditions. The model accepts climatologic, soil, and landfill design input data. The model takes into account such variables as surface storage, runoff, infiltration, percolation, evaporation, soil moisture storage and lateral drainage.

Although long-term monitoring will be required, the extent of such monitoring has not yet been determined. After the final supplemental remedial action decisions have been made (i.e. potential capping and PCB remediation) a long-term monitoring program will be finalized.

Cost Summary of Recommended Alternative

Remedial Measure Component	Total Cost Present Worth
1. Soil flushing and treatment	$1,171,000
2. Groundwater recovery and treatment	994,000
3. Engineering and Contingency	649,000
4. Additional PCB Soil Testing and Cap Evaluation	200,000
TOTAL	$3,014,000

Community Relations

A public meeting was held by the New Jersey Department of Environmental Protection (NJDEP) on February 7, 1984 to discuss the initiation of a Remedial Investigation/Feasibility Study (RI/FS) for the Goose Farm site. Notification of the meeting was accomplished through press releases sent to all newspapers listed in th Goose Farm Community Relations Plan and mailings to all parties listed in the "Contacts" section of the plan. An information package, including an agenda, fact sheet, overview of the community relations program at Superfund hazardous waste sites, and the steps involved in a major hazardous waste site cleanup, was given to all attendees at the beginning of meeting. The meeting was attended by approximately 30 people in addition to the local township officials and NJDEP representatives. After the initial presentation by the contractor, E.T. Killam, the meeting was opened for public discussion. A summary of the questions and responses is included in the Responsiveness Summary.

A second public meeting was held by NJDEP on August 16, 1984 to discuss the results of the RI/FS at Pijak Farm and Spence Farm and the status of the RI/FS at Goose Farm. Notification of the meeting was accomplished through press releases sent to local newspapers and mailings to local and state officials, as well as to NJDEP's list of concerned citizens. An information package including the agenda and fact sheet was handed out to all attendees as they entered. Approximately 30 people attended. When the meeting was opened to general discussion, there were only a few questions asked specifically about Goose Farm. Several questions that are generic to these three Plumsted Township Superfund sites were also posed at this meeting. A discussion of questions and responses are included in the Responsiveness Summary.

A third public meeting was held by NJDEP on July 25, 1985 to discuss the results of the RI/FS at Goose Farm. Notification of the meeting was accomplished through press releases sent to local newspapers and mailings to local and state officials, as well as to NJDEP's list of concerned citizens. The Draft Feasibility Study was available for public review and comment, beginning on July 26, 1985, at four repositories: the Ocean County Library in Toms River, the Plumsted Township Municipal Building, the New Egypt Library and NJDEP's Hazardous Site Mitigation Administration in Trenton. There was a 30-day public comment period. An information package including the agenda and fact sheet was handed out to all attendees as they entered. Approximately 40 people attended. The results of the remedial investigation were presented and the remedial action alternatives for long-term site remediation.

NJDEP and their consultant, tentatively recommended that in-situ soil flushing and groundwater remediation be the selected alternative. The meeting was then opened for discussion during which time there were several questions posed by local officials and concerned citizens. These questions and responses are summarized in the Responsiveness Summary.

Only one public comment was received from Archer & Greiner, attorneys for Morton-Thiokol. This letter included a substantive critique of E.T. Killam's methodologies and proposal for site remediation. The contents of their letter and the NJDEP response have been considered in this Record of Decision. These documents have been included in the Responsiveness Summary.

Consistency With Other Environmental Laws

The soil flushing and groundwater recovery and treatment operation will require obtaining an NJPDES permit from the New Jersey Department of Environmental Protection (or technical compliance with permit requirements) for the discharge of the treated effluent. The proposed treatment system will be designed to meet the effluent limits established in the discharge permit. Following the completion of the soil flushing and groundwater remediation, an evaluation will be made to determine the need, if any, to remediate PCB contaminated soil. Should it be determined that PCB excavation and removal is required, the waste will be manifested for transport from the site to a secure facility in accordance with RCRA and TSCA requirements. The final component of the remedial action may include the construction of a cap over the site. This cap would be designed using the HELP or a similar model.

Operable Units

The recommended remedial alternative includes distinct individual components. Therefore, it is expected that the remedial action will proceed in a phased manner. The initial phase will include obtaining soil samples from the disposal pit area and testing for PCB contamination. Testing will also be performed during and after the soil flushing and groundwater recovery and treatment operation. An evaluation of the results of this testing will determine the extent of further remediation if any, for PCB hotspots. Any PCB remediation would follow the groundwater and soil remediation. Finally, an evaluation will be made to determine the need to cap the site to minimize the migration of any residual contaminants. If determined to be necessary, the cap could be designed using the HELP model or any similar model. Soil samples will be collected before, during and after the soil flushing and groundwater treatment phase. The analyses of these samples will be used to calibrate and run the model.

Operation and Maintenance

Upon completion of the recommended remedial action, monitoring of the site will be conducted to evaluate the quality of the local groundwater.

Future Actions

Schedule	Date
- Final Record of Decision	September 1985
- Continue negotiation with potential responsible parties	September 1985
- Obligate Design Funds (if necessary)	Pending CERCLA Reauthorization
- Amend Cooperative Agreement (if necessary)	Pending CERCLA Reauthorization
- Initiate Remeidal Action Design	Pending CERCLA Reauthorization

APPENDIX A
ALTERNATIVE COMPARISON

ALTERNATIVE COMPONENT	CAPITAL	COSTS (1,000) ANNUAL O&M	TOTAL PRESENT WORTH	ALTERNATIVE ADVANTAGES	ALTERNATIVE DISADVATAGES
1. Excavation and Disposal (62,000 CY)	33,480	-	33,480	Complete Removal Low Technology	High cost Potential spills
Site Regrade/Revegetate	392	-	392	Restores land	in removal.
Plume Pump/Treatment	994	-	994	to use.	Potential losses
Engineering/Contingencies	10,460	-	10,460		from landfill. Use of landfill
Total Alternative 1	45,326	-	45,326		capacity.
2. Excavation and Disposal (10,000 CY)	5,400	-	5,400	Lower Cost	Potential spills Potential land-
Soil Flush and Treat (12 mo)	651	-	651		fill losses.
Site Regrade/Revegetate	225	-	225		Residuals on site
Plume Pump/Treatment	994		994		Use of landfill
Engineering/Contingency	2,181	-	2,181		capacity.
Total Alternative 2	9,451	-	9,451		
3. On-Site Landfill Construction With Post Closure Care	1,264	39	1,631	No transportation.	Potential loss from fill.
Plume Pump/Treatment	994	-	994	No off-site	Permanent loss
Engineering/Contingency	678	-	678	landfill.	of land use.
Total Alternative 3	2,936	-	3,303	Lower Cost.	
4. Soil Flush/Treat (18 mos)	1,171	-	1,171	Low Cost. Less	Permanent loss
Plume Pump/Treatment	994	-	994	Disposal volume	of some land
Engineering/Contingency	649	-	649	(carbon sludges)	uses. Residual PNA's.
Total Alternative 4	2,814		2,814		

APPENDIX A

ALTERNATIVE COMPARISON

ALTERNATIVE COMPONENT	CAPITAL	COSTS (1,000) ANNUAL O&M	TOTAL PRESENT WORTH	ALTERNATIVE ADVANTAGES	ALTERNATIVE DISADVATAGES
5. In-Situ Biological Soil Treatment	Same Costs As Alt. 4			Destruction of Biodegradables. Less Landfill volume required.	Residual PNA's Permanent loss of some land uses.
6. In Place Encapsulation Slurry Wall	262	-	262	Least loss of Land Use off site	High cost. Permanent loss of land use. Risk of Landfill failure.
Capping, Revegetation, etc.	123	52.1	614		
Base Grouting	12,500	-	12,500		
Plume Pump/Treatment	994	-	994		
Engineering/Contingencies	4,164	-	4,164		
Total Alternative 6	18,043	-	18,043		
7. Soil Flush and Treat (18 mos)	1,171	-	1,171	Lower Cost than Alt. 4	Longer period until clean surface water.
Engineering/Contingency	351	-	351		
Total Alternative 7	1,522	-	1,522		
8. No Action/Monitoring	-	64	603	None	Cannot be implemented.
Total Alternative 8	-	64	603		

APPENDIX B

TABLE 1
VOLATILE ORGANIC POLLUTANT SUMMARY
SURFACE AND GROUNDWATER

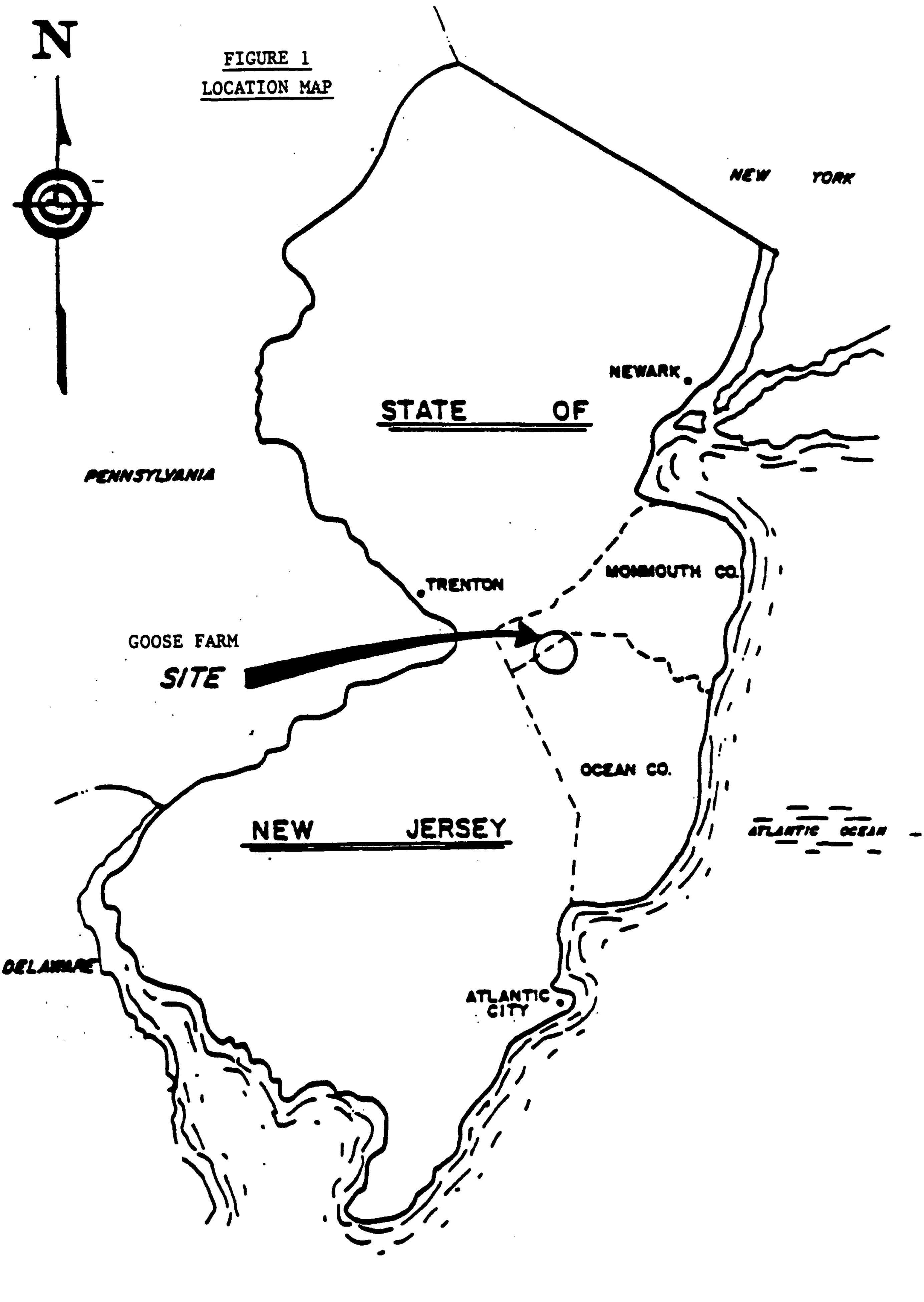
Compound	Shallow Well Average(*)	Leachate	Upstream Surface Water	Downstream Surface Water	Potable Water Values
Methylene Chloride	167,675	6,300	10	1,100	17 11 6.5
Benzene	3,258	12,000	BDL	BDL	BDL
Toluene	3,243	2,200	BDL	BDL	BDL
Trans 1,2 Dichloroethylene	28	440	BDL	19	BDL
Trichloroethylene	63	310	BDL	14	BDL
Acrylonitrile	1053	BDL	BDL	BDL	BDL

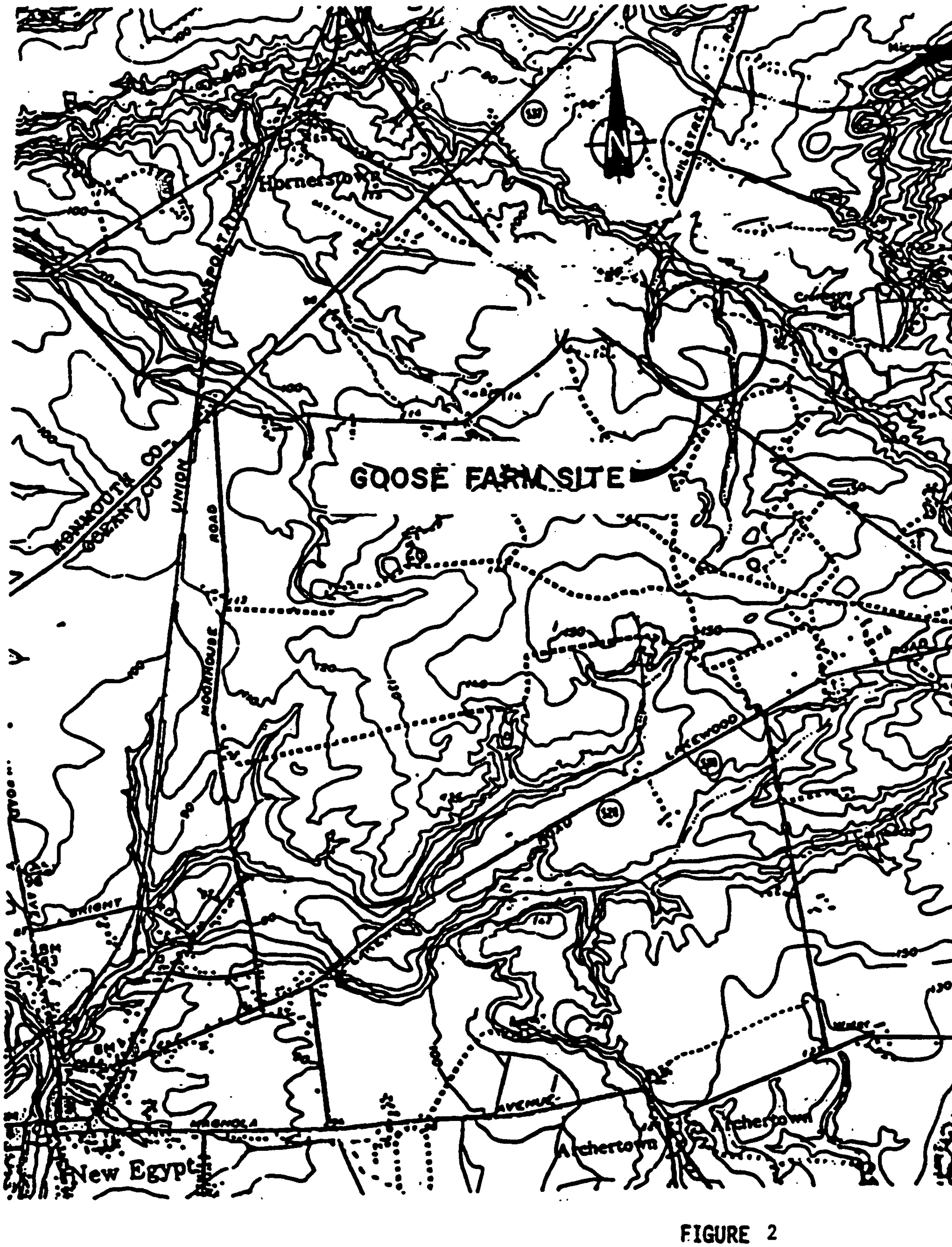
* Value of zero used on samples below detection limit for average calculations.

BDL = Below Detection Limits

All concentrations in parts per billion

FIGURE 1
LOCATION MAP





VICINITY MAP

FIGURE 2
GOOSE FARM
PLUMSTED TOWNSHIP, NEW JERSEY

SCALE: 1" = 2,000'
SOURCE: U.S.G.S. TOPO MAPS

Elson T. Killam Associates, Inc.
Environmental and Hydraulic Engineers

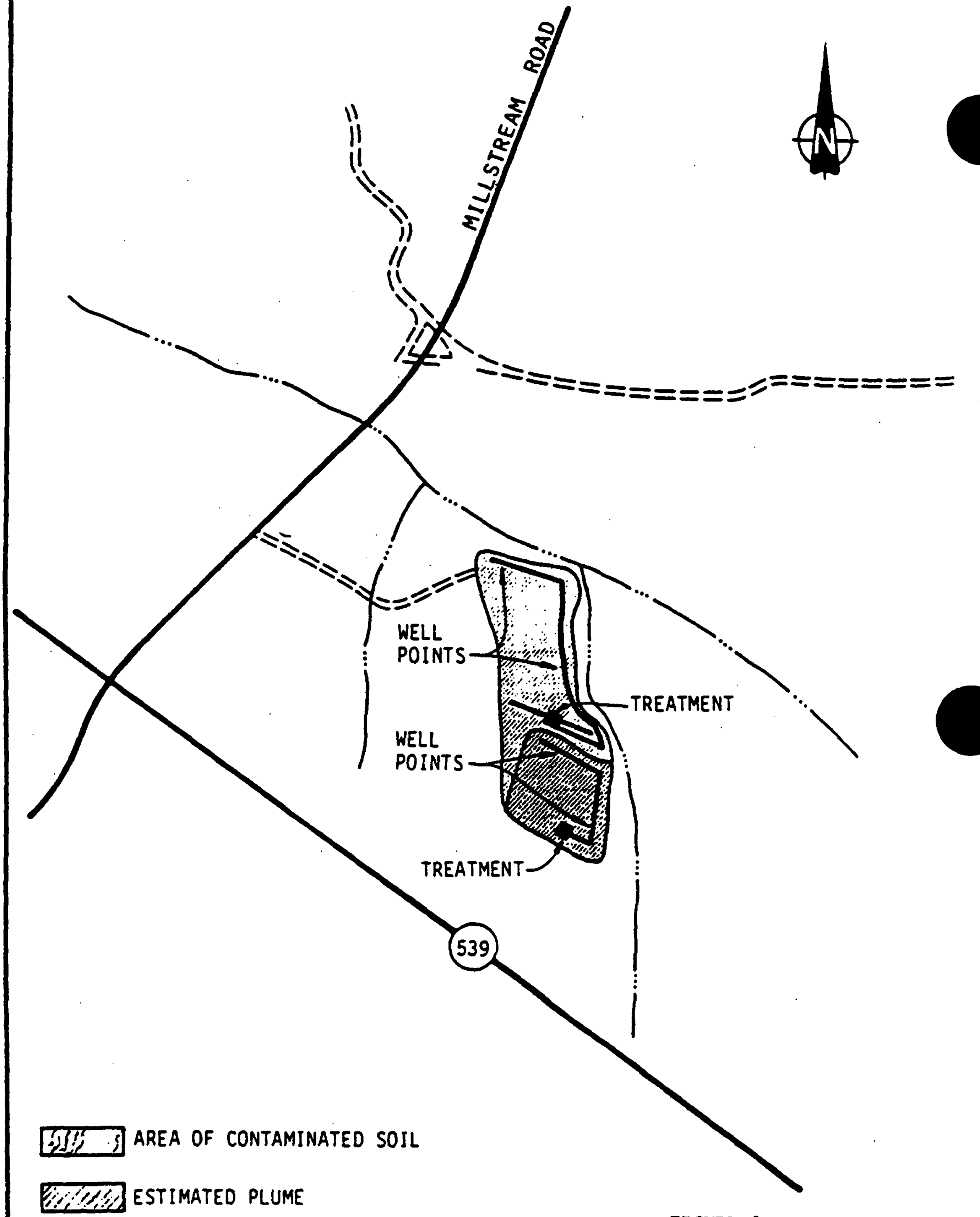


FIGURE 3

GOOSE FARM
PLUMSTED TOWNSHIP, NEW JERSEY

RECOMMENDED ALTERNATIVE 4

Elson T. Killam Associates, Inc.
Environmental and Hydraulic Engineers

RESPONSIVENESS SUMMARY:

Completion of Feasibility Study

Goose Farm

Plumsted Township

Ocean County

New Jersey

Responsiveness Summary:
Completion of Feasibility Study
Goose Farm
Plumsted Township
Ocean County

A public meeting was held by the New Jersey Department of Environmental Protection (NJDEP) on February 7, 1984 to discuss the initiation of the Remedial Investigation/Feasibility Study (RI/FS) for the Goose Farm site. Notification of the meeting was accomplished through press releases sent to all newspapers listed in the Goose Farm Community Relations Plan and mailings to all parties listed in the "Contacts" section of the plan. An information package, including an agenda, fact sheet, overview of the community relations program at Superfund hazardous waste sites, and the steps involved in a major hazardous waste site cleanup, was given to all attendees at the beginning of the meeting. (See attendance sheet, Attachment A.) The meeting was attended by approximately 30 people in addition to the local officials and NJDEP representatives. (See Attachment B.) After the initial presentation by NJDEP's contractor, E.T. Killam, the meeting was opened for discussion.

There were three questions asked by citizens with regard to sampling activities and one question about the aquifer underlying the site. These questions and responses were as follows:

Q: Have polychlorinated biphenols (PCBs) been found on site?

Yes, PCBs have been found at Goose Farm.

Q: Will you test for changes at Goose Farm since the cleanup from two years ago?

NJDEP sampled the site in January 1983; however, results were not conclusive.

Q: What are you testing for when you sample ground water?

The full spectrum of contaminants, i.e. 129 known priority pollutants plus 40 unknown pollutants.

Q: Will you give out maps of the aquifers underlying the site?

A. Farro stated that these maps would be included in the Draft Feasibility Study which would be available upon its completion. In addition, G. Singer wrote to one concerned citizen to inform him that the shallow aquifer probably flows in a south-southeasterly direction, discharging into a nearby stream and marsh. Data indicating the direction of flow for the deeper aquifer would be available upon completion of the Feasibility Study.

Additional questions or comments during this first meeting were not of major significance.

A second public meeting was held by NJDEP on August 16, 1984 to discuss the results of the RI/FS at Pijak Farm and Spence Farm and the status of the RI/FS at Goose Farm. Notification of the meeting was accomplished through press releases sent to local newspapers and mailings to local and state officials, as well as to NJDEP's list of concerned citizens. An information package including the agenda and fact sheet was handed out to all attendees at the beginning of the meeting. (See Attachment C.) Approximately 30 people attended. (See attendance sheet, Attachment D.) When the meeting was opened for general discussion there were only a few questions asked specifically about Goose Farm. Several questions that are generic to these three Plumsted Township Superfund sites were also posed at the meeting. These questions and responses were as follows:

Q: What is the status of the study at Goose Farm?

The field work has been completed and we expect to have data in approximately two weeks. We should have a public meeting to discuss the RI/FS at the end of October, 1984.

Q: What direction does the water flow from Goose Farm?

North.

Q: Last time my well was tested, there were traces of mercury detected.

We see traces of mercury all over the state. When we resample, there's usually no evidence of mercury. We sent the second round of test samples to a different laboratory and we did not find any mercury in the second set of samples.

Q: What is the danger of drinking water with trace chemicals?

It depends on the type of compounds. The drinking water standards for volatiles are 100 ppb.

Q: What about responsible party pursuit?

There is presently an active case being pursued. It is possible that there may still be a private party cleanup.

Q: Has anyone done a history of what Thiokol was dumping?

We have an alleged list.

Q: I'm looking at land in this area. What is the possibility of additional contamination?

It's a difficult question to answer. This is always a potentiality but given the amount of testing that has been done in this area it's highly unlikely.

Q: How excessive is excessive and how low is low?

We use these terms based on guidelines that now exist, however, we don't really know. We don't leave anything behind that may adversely impact human health.

Q: Will there be restrictions on land use of these sites (Spence, Pijak, Goose) after cleanup?

It's possible that these sites could be used again?

Q: Will land owners of these sites be paid or will Superfund buy their land?

A claim against the New Jersey Spill Fund is a possibility.

Q: Do you recommend a certain well depth that might be pollution free in the future? Will there be criteria or guidelines for establishing the best well depth?

NJDEP's Division of Water Resources is looking into this issue now.

Q: What do I ask for if I want to have my water tested?

This is a critical consumer issue because landowners may have to pay for this testing in the future. If you think you have a problem with your water contact the Ocean County Health Department.

Q: Did you change any limits for construction at approximately 1,000 feet from the sites?

That land use issue has not been addressed by NJDEP. It is a local issue.

* * *

A third public meeting was held by NJDEP on July 25, 1985 to discuss the results of the RI/FS at Goose Farm. Notification of the meeting was accomplished through press releases sent to local newspapers and mailings to local and state officials, as well as to NJDEP's list of concerned citizens. An information package including the agenda and fact sheet was handed out to all attendees at the begining of the meeting. (See Attachment E.) Approximately 40 people attended. (See Attendance sheet, Attachment F.) The contractor (J. Shirk of E.T. Killam) discussed the results of the RI/FS and presented the following remedial action alternatives for long-term site remediation:

1. Off-site disposal (removal of 62,000 cubic yards of soil to a RCRA facility), regrading, revegetation and recovery, treatment and recharge of contaminated ground water.

2. Partial off-site disposal (removal of 10,000 cubic yards of soil), soil flushing, treatment and recharge for 52,000 cubic yards of soil, recovery, treatment and recharge of contaminated ground water.

3. On-site construction, monitoring and long-term maintenance of a RCRA hazardous waste landfill for 62,000 cubic yards of soil, regrading and revegetation of excavated area, recovery, treatment and recharge of contaminated ground water.

4. In-situ (in-place) soil flushing with treatment and recharge for removal of priority pollutants, recovery, treatment and recharge of contaminated ground water.

5. In-situ soil flushing with treatment and recharge for removal of priority pollutants, injection of nutrients for in-situ biological oxidation and recovery, treatment and recharge of contaminated ground water.

6. Containment of wastes with slurry wall and block displacement containment, long-term monitoring, recovery, treatment and recharge of contaminated ground water.

7. In-situ soil flushing with treatment and recharge for removal of priority pollutants, no plume treatment.

8. No current action except annual monitoring.

The contractor presented Alternative #4 as the recommended alternative.

The meeting was then opened for discussion during which time there were several questions asked by local officials and concerned citizens. These questions and responses are summarized below:

Q: Will this land be usable in the future?

The Goose Farm site (approximately two acres) will not be usable for agricultural or residential purposes. Surrounding properties will not be impacted.

Q: How long will it take the chemicals to decompose?

It depends on the selected alternative. With Alternative #4, there will be passive usage almost immediately.

Q: What chemicals were found on site?

Solvents in ground water, not many metals, polynuclear hydrocarbons, PCBs, and non-priority pollutants.

Q: What types of solvents were found?

A mixture of chlorinated and non-chlorinated solvents; specifically methylene chloride (at 10-100 ppm in soil).

Q: What about the well serving the house on Goose Farm?

There are no problems with that well. Ground water is moving in a northwesterly direction.

Q: Is the deep aquifer contaminated?

No contaminants were found in the Mt. Laurel which is very deep (100-160 feet).

Q: What is the perimeter of the contamination?

Contaminants are migrating toward the stream which seems to be a cut-off for the upper aquifer (i.e. Kirkwood at 10-20 feet). No contaminants are migrating west, south or east.

Q: Are all monitoring wells at the same depth?

No, there are deep and shallow test wells.

Q: Is the stream also contaminated?

The portion directly adjacent to the site is contaminated; however, contaminants have not reached 300 feet downstream.

Q: What is the time frame for site cleanup?

We have already discussed this with the Responsible Party and we hope the cleanup will be expeditious. After total removal, there will be a five-year monitoring period. If nothing shows up after five-years, there will not be further action.

Q: What about fire hazard in the columns, given the high concentrations of solvents?

This is not likely because the carbon filters will be tested on a regular basis.

Q: With Alternative #4, can 100% of the runoff be captured?

Yes.

The Draft Feasibility Study was made available for public review and comment, beginning on July 26, 1985, at four repositories: the Ocean County Library in Toms River, the Plumsted Township Municipal Building in New Egypt, the New Egypt Library and NJDEP's Hazardous Site Mitigation Administration in Trenton. There was a 30-day public comment period.

Only one public comment was received (on August 26, 1985) from Archer & Greiner, attorneys for Morton-Thiokol. This is a substantive critique of E.T. Killam's methodology and proposals for site remediation, as well as Morton-Thiokol's recommended approach. (See Attachment G for these comments.) Currently, a response is being developed by the NJDEP technical staff in conjunction with its legal staff. This response will be forthcoming upon its completion.

HS82:rlk
Enclosures

Attachment A.

N.J. Department of Environmental Protection
Division of Waste Management
Hazardous Site Mitigation Administration

Feasibility Studies for the
Goose Farm, Pijak Farm and Spence Farm
Hazardous Waste Sites

Tuesday, February 7, 1984
7:30 p.m.
Plumsted Township Municipal Building
New Egypt, N.J.

Agenda

1. Opening Remarks on Community input in Superfund Program and introduction of DEP members - G. Singer

2. Overview of situation and introduction of contractor, Elson T. Killam Associates, Inc. of Millburn, N.J. - A. Farro

3. Presentation consultants Elson T. Killam Associates, Inc. - E. Killam

4. Questions and Answers

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
HAZARDOUS SITE MITIGATION ADMINISTRATION
CN 028. Trenton, N.J. 08625

MARWAN M. SADAT P.E.
DIRECTOR

JORGE H. BERKOWITZ, PH.D
ADMINISTRATOR

FACT SHEET

FEASIBILITY STUDIES FOR GOOSE FARM, PIJAK FARM, AND SPENCE FARM

(PLUMSTED TOWNSHIP, OCEAN COUNTY)

TO DETERMINE REMEDIAL ACTION ALTERNATIVES

These sites are all located in Plumsted Township (Ocean County) within a twenty-square mile area, sections of which have been used for disposal of drummed and free flowing liquid waste. Investigation, which included the installation of monitoring wells, has revealed aquifer, groundwater and surface water organic chemical contamination. Each of these sites has been placed on the National Priorities List by the U.S. Environmental Protection Agency (USEPA) and is eligible for Superfund money for remedial action.

An immediate removal operation has already been completed at the Goose Farm site. This consisted of the excavation of all containers and several thousand tons of contaminated soil and debris during the period of August, 1980 to February, 1982. In addition, a water treatment system was installed to remove gross contamination from the soil and groundwater. Further investigation is required to evaluate present hydrogeological conditions and residual contamination.

The present studies are being conducted by Elson T. Killam Associates, Inc., environmental and hydraulic engineers of Millburn, New Jersey. Funding for these projects in the amount of $608,535 ($451,500 for Pijak Farm and Spence Farm, $157,035 for Goose Farm) has been provided by the USEPA as part of the Superfund program.

For 2/7/84 Public Meeting
at Plumsted Township
Municipal Building
New Egypt, N.J.

FACT SHEET

REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES

PLUMSTED TOWNSHIP, NEW JERSEY

Remedial Investigations/Feasibility Studies have been started at the Spence Farm and Pijak Farm Sites east of New Egypt on Route 528. These studies are being funded by the New Jersey Department of Environmental Protection (NJDEP) and the U. S. Environmental Protection Agency (USEPA) and managed by the NJDEP Hazardous Site Administration.

The objectives of the Spence Farm and Pijak Farm investigations and studies are:

- To determine the location and amount of hazardous materials on site.
- To determine the rate at which hazardous materials are leaving the site in groundwater, surface water and air.
- To develop alternatives for control of these materials.
- To select the best control methods for the site.
- To prepare conceptual designs of the selected alternative.

The schedule for these activities is:

- Begin Drilling Monitoring Wells - February 1984.
- Begin Sampling - Groundwater, Soil, Wastes, Surface Water, Private Wells - March 1984.
- Present Report on Sampling Results - May 1984.
- Present Report on Possible Alternatives - June 1984.
- Present Selected Plan for Remedial Action - July 1984.

The nature and extent of remedial action for the Spence Farm and Pijak Farm sites will be based on the hazardous materials found in the detailed sampling program.

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WASTE MANAGEMENT

HAZARDOUS SITE MITIGATION ADMINISTRATION

A Community Relations Program at Superfund Hazardous Waste Sites

As part of the federal/state program of cleanup of hazardous waste sites, a Community Relations Program is conducted to receive local input and to advise local residents and officials about the planned remedial actions at the three major stages of the cleanup: 1) feasibility study 2) engineering design and 3) removal/treatment/construction. Local briefings and public meetings are conducted with elected officials and residents and generally take place at:

1) The commencement of a feasibility study so that local concerns can be addressed early in the process.

2) The completion of a feasibility study to discuss the alternative courses of remedial action. There is a 30-day comment period after public presentation of the alternatives.

3) The engineering design stage to carry out the mandates of the selected remedial alternative.

4) The commencement of the removal/treatment/construction stage to advise of the expected physical remedial action.

5) The completion of the remedial action.

In addition to the more formal activities outlined above, there is generally informal communication with local officials and residents. Depending upon whether the New Jersey Department of Environmental Protection (DEP) or the U.S. Environmental Protection Agency (EPA) has the lead in remedial action at a site, community relations activity is conducted by the relevant state or federal agency.

In New Jersey at DEP, the Community Relations Program is conducted by Grace Singer, Community Relations Program Manager (609) 984-3081. At Region II, EPA, the contact person is Lillian Johnson (212) 264-2515.

STEPS INVOLVED IN A MAJOR HAZARDOUS WASTE SITE CLEANUP INVOLVING EPA AND SUPERFUND MONIES

Site Identified and Referred (1)	Initial Site Investigation (2)	Secure Site (3)	Site Analysis Evaluation and Assessment (4)
Prioritization (5)	Remedial Action Master Plan and Determination of Lead (6)	Community Relations Plan Activated (7)	Signing of Contract of Cooperative Agreement (8)
Hiring of Contractor for Feasibility Study (9)	Preparation of Feasibility Study (10)	Selection of Remedial Action Alternative (11)	Hiring of Contractor for Design (12)
Hiring of Construction or Removal Contractor and Cleanup (13)	Cleanup Evaluation (14)	Contractor Audit and Close out (15)	

NJDEP
1/84

Attachment B.

N.J. Department of Environmental Protection
Division of Waste Management
Hazardous Site Mitigation Administration
Public Meeting to Discuss Feasibility Studies
for Goose Farm, Pijak Farm and Spence Farm
Hazardous Waste Superfund Sites
Plumsted Township, Ocean County, New Jersey
Tuesday, February 7, 1984
7:30 p.m.
Plumsted Township Municipal Building
31 Main Street
New Egypt, New Jersey

NAME	AFFILIATION	ADDRESS
[illegible] Capotti		412 Buttonwood St Mt Holly NJ
Robert Capotti		412 Buttonwood St Mt Holly NJ
Sharon Singer		1005 S. Hooper Ave, Toms [redacted]
[illegible] McElliott		[illegible] PA 19067
[illegible] Elliott		RD#1 Box 231 New Egypt NJ
K. [illegible]	[illegible] Farm	234 [illegible]
[illegible]		[illegible]
Kurt Tomlusch	interested in Local Property	45 Martha Ave Fallsington PA 19054
Mike [illegible]		71 Evergreen Rd New Egypt
Tina Havens	Department of environmental Protection	106-9 Weightstown
Leonard A. Grillello		RD#1 246 A1 Highbridge Rd [redacted] N.J
~~Joe Przywara~~	~~Ocean Co Health~~	~~Box 2191 Toms River N.J 08754~~
[illegible]	[illegible]	609-758-2216 57 Main N.E. N.J

NAME	AFFILIATION	ADDRESS
14. Kenneth H. Potter		15 Magnolia Ave New Egypt NJ 08533
15. John F Makai		237 High Bridge Rd New Egypt
16. JERRY PERREAULT		FISCHER RD. NEW EGYPT 08533
17. Leslie M Rade		28 Linda [illegible] New Egypt NJ
18. Fran Rader	"	"
19. 4/7 Elmer Kaufman	Municipal Planning Board Ocean County Planning Board [illegible]	Lakewood Road New Egypt
20. Harry [illegible] Hoff		38 [illegible] Rd
21. [illegible] Cooper		[illegible] NJ
22. [illegible]	"	
23. Carol [illegible]	The New Egypt Press	
24. Eleanor [illegible]	"	
25. [illegible]	Asbury Park Press	
26.		
27.		
28.		
29.		
30.		

Attachment C.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
HAZARDOUS SITE MITIGATION ADMINISTRATION
CN 028, Trenton, N.J. 08625

MARWAN M. SADAT, P.E.
DIRECTOR

JORGE H. BERKOWITZ, Ph.D.
ADMINISTRATOR

Public Meeting

to discuss

Feasibility Studies

at

Goose Farm, Pijak Farm, and Spence Farm
Thursday, August 16, 1984
7:00 p.m.
Plumsted Township Municipal Building
31 Main Street
New Egypt, N.J.

AGENDA

1)	Opening remarks and introduction of DEP staff	Dr. Jorge Berkowitz, Administrator Hazardous Site Mitigation Administration, NJDEP
2)	Overview of current situation and introduction of contractor	Mr. Dave Henderson, Site Manager Hazardous Site Mitigation Administration, NJDEP
3)	Presentation: Feasibility Studies at Goose, Pijak, and Spence Farms	Mr. Jim Shirk, E.T. Killam Associates, Inc.
4)	Questions and Answers	

FACT SHEET

Public Meeting
on
Results of Remedial Investigation/Feasibility Study
at
Pijak Farm
Plumsted Township
Ocean County
August 16, 1984

Site Description: The Pijak Farm site is located approximately 2 miles northeast of New Egypt, about 1,000 feet south of County Route 528, and 1,300 feet west of Fisher Road. The contaminated area, covering roughly one acre, was used for the surface dumping of drums and free-flowing liquid hazardous waste from around 1962 until the early or mid-1970's. The site is situated adjacent to Stony Ford Brook which joins the Crosswicks Creek, a tributary of the Delaware River. The underlying ground water aquifers provide a potable water supply for the surrounding area. Both ground water and soil sampling have indicated organic chemical contamination.

Background: The site was first identified as a waste disposal site by the New Jersey Department of Environmental Protection (NJDEP) in February, 1980. In March of that year, NJDEP recommended the denial of a permit to construct 43 single-family homes on site. Observation wells were installed by NJDEP in June, 1980. Also in June, several surface water samples were analyzed. In July, 1981 the United States Environmental Protection Agency (USEPA) Environmental Photographic Interpretation Center completed an evaluation of time sequential aerial photography spanning the years 1940-1979. A Cooperative Agreement between USEPA and NJDEP was signed in September, 1982 to commit $330,000 for a Remedial Investigation/Feasibility Study (RI/FS). The contract to conduct the RI/FS was awarded to E.T. Killam Associates, Inc. of Millburn, N.J. by NJDEP in December, 1983.

Status: A Draft Feasibility Study was completed in August, 1984 and the remedial action alternatives are presently being evaluated by NJDEP and USEPA. There is a 21-day comment period, beginning August 17, 1984, during which the Draft Feasibility Study will be available at the following repositories: Plumsted Township Municipal Building, Ocean County Library in Toms River, and the NJDEP, Hazardous Site Mitigation Administration in Trenton.

Over...

Summary of Remedial Investigation/Feasibility Study
Pijak Farm, Plumsted Township

I. Remedial Investigation

A. Scope of Work: The remedial investigation included the following activities:

- Construction of 11 monitoring wells;
- Excavation of 8 test pits;
- Sampling and analysis of deep and shallow soil samples;
- Sampling and analysis of 5 waste samples; and
- Sampling and analysis of 15 ground water, surface water and sediment samples.

B. Results: The outcome of the remedial investigation indicated that:

- Wastes were disposed of at the site by surface dumping rather than by burial (except for 4,000 cubic yards of buried wastes);
- Most waste containers were opened intentionally or have rusted and the contents dispersed;
- Principal contamination on site is found in waste containers and soils, although ground water at Monitoring Well 2-S was found to be contaminated;
- Most organic pollutants found were not priority pollutants (only minor concentrations of priority pollutants were found); and
- Review of available data on toxicity for these non-priority organic pollutants indicated that the greatest potential for adverse health and environmental effects were found in soil rather than in water.

II. Feasibility Study

The principal remedial objectives were removal of surface wastes, construction of a temporary dam to control sediment loss, and control of direct access to the site.

Long Term Recommendations:

- Removal of wastes and contaminated soils;
- Pumping out contaminated ground water at Monitoring Well 2-S;
- Regrading and revegetating the site to eliminate sediment loss and direct contact with contaminated material; and
- Continue monitoring ground water for volatile priority pollutants.

NJDEP
9/84

FACT SHEET

Public Meeting
on
Results of Remedial Investigation/Feasibility Study
at
Spence Farm
Plumsted Township
Ocean County
August 16, 1984

Site Description: Spence Farm is one of seven "Plumsted" sites in the vicinity of Ocean and Monmouth Counties. It is located approximately 1.5 miles northeast of New Egypt in Plumsted Township. The site is about 750 feet north of County Route 528 and 7,000 feet east of Moorehouse Road. From the 1950's until the early 1970's, drummed and bulk liquid waste was disposed of in an on-site lagoon, a swamp area, as well as scattered locations throughout a 30-acre low lying wooded area adjacent to two adjoining tributaries of Crosswicks Creek. Sampling and analysis of ground water, surface water, and the underlying aquifer has revealed organic chemical contamination.

Background: Monitoring wells were installed by the New Jersey Department of Environmental Protection (NJDEP) in June, 1980. In July 1981, the United States Environmental Protection Agency (USEPA) Environmental Photographic Interpretation Center completed an evaluation of time sequential aerial photography which covered the time period of 1940-1979. A Field Investigation Team completed a site evaluation in October, 1981. In March 1981, the USEPA released a Remedial Action Master Plan for Spence Farm. On September 30, 1982 the NJDEP entered into a Cooperative Agreement with the USEPA to commit $320,000 for a Remedial Investigation/Feasibility Study (RI/FS). In November 1983, NJDEP awarded the contract for the RI/FS to E. T. Killam Associates, Inc., of Millburn, N.J.. Field work commenced in December, 1983.

Status: A Draft Feasibility Study was completed in August, 1984 and the remedial action alternatives are presently being evaluated by NJDEP and USEPA. There is a 21-day comment period, beginning August 17,1984, during which the Draft Feasibility Study will be available at the following repositories: Plumsted Township Municipal Building, Ocean County Library in Toms River, and the NJDEP, Hazardous Site Mitigation Administration in Trenton.

Over...

Summary of Remedial Investigation/Feasibility Study
Spence Farm, Plumsted Township

I. Remedial Investigation

A. Scope of Work: The remedial investigation included the following activities:

- Construction of 15 monitoring wells;
- Excavation of 15 test pits;
- Sampling and analysis of 14 deep and shallow soil samples;
- Sampling and analysis of 6 waste samples;
- Sampling and analysis of 19 ground water, surface water and sediment samples; and
- Sampling and analysis of 6 potable water supply wells.

B. Results: The outcome of the remedial investigation indicated that:

- Wastes were disposed of at the site by surface dumping rather than by burial;
- Most waste containers were opened intentionally or have rusted and the contents dispersed;
- Principal contamination is found in waste containers and soils, with limited contamination of ground water and surface water;
- Most organic pollutants found were not priority pollutants, (only minor concentrations of priority pollutants were found); and
- Review of available data on toxicity for these non-priority organic pollutants indicates that the compounds with the greatest potential for adverse health and environmental effects were found in soil rather than in water.

II. Feasibility Study

The principal remedial objectives were removal of surface wastes, construction of a temporary dam to control the loss of sediment, and control of direct access to the site.

A. Immediate Recommendation:

- Removal of surface wastes including drums, laboratory packs, and contaminated soil.

B. Long Term Recommendations:

- Regrading the site to eliminate erosion of less contaminated soils in order to prevent direct contact with more contaminated materials; and
- Continue monitoring ground water for volatile priority pollutants.

NJDEP
8/84

FACT SHEET

Public Meeting
on
Status of Remedial Investigation/Feasibility Study
at
Goose Farm
Plumsted Township
Ocean County
August 16,1984

Site Description: Goose Farm is one of seven "Plumsted" sites in the area of Ocean and Monmouth Counties. The site is located off Route 539, approximately one mile north of the intersection of Routes 539 and 528. It is immediately adjacent to a stream which is a tributary of the Crosswicks Creek. Goose Farm is in a rural, agricultural area at the edge of a pine/oak forest. During the late 1960's and early 1970's an excavated portion of the site was used for the disposal of bulk liquid and drummed wastes. Contamination of soil, ground water, and surface water at the site has been documented. The contamination poses a potential threat to the two shallowest aquifers which underlie the area: the Kirkwood and the Vincentown formations.

Background: Initial remedial action transpired from August, 1980 until February, 1982 and entailed the excavation of all containers, as well as several thousand tons of contaminated soil and debris. A water treatment system was installed to remove gross contamination from the soil and ground water. The New Jersey Department of Environmental Protection (NJDEP) entered into a Cooperative Agreement with the United States Environmental Protection Agency (USEPA) on September 23, 1982 to commit $210,000 for the performance of a Remedial Investigation/Feasibility Study (RI/FS). A contract for the RI/FS was awarded by NJDEP to E.T. Killam Associates, Inc. of Millburn, N.J. in December, 1983. Site access was secured via a Court Order and field work was initiated in February, 1984.

Status: The feasibility study is presently underway. The field work has been completed and included the following activities: 22 soil borings; construction of 2 monitoring wells; and sampling of 4 monitoring wells, 6 potable water wells, surface water, sediment and leachate. The study is expected to be completed by December, 1984.

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WASTE MANAGEMENT

HAZARDOUS SITE MITIGATION ADMINISTRATION

A Community Relations Program at Superfund Hazardous Waste Sites

As part of the federal/state program of cleanup at hazardous waste sites, a Community Relations Program is conducted to receive local input and to advise local residents and officials about the planned remedial actions at the three major stages of the cleanup: 1) remedial investigation/feasibility study 2) engineering design and 3) removal/treatment/construction. Local briefings and public meetings are conducted with elected officials and residents and generally take place at:

1) The commencement of a remedial investigation/feasibility study so that local concerns can be addressed early in the process.

2) The completion of a feasibility study to discuss the alternative courses of remedial action. There is a 30-day comment period after public presentation of the alternatives during which the feasibility study is available in local repositories.

3) The engineering design stage to carry out the mandates of the selected remedial alternative.

4) The commencement of the removal/treatment/construction stage to advise of the expected physical remedial action.

5) The completion of the remedial action.

In addition to the more formal activities outlined above, there is generally informal communication with local officials and residents. Depending upon whether the New Jersey Department of Environmental Protection (DEP) or the United States Environmental Protection Agency (EPA) has the lead in remedial action at a site, community relations activity is conducted by the relevant State or Federal agency.

In New Jersey, the DEP Community Relations Program is conducted by Grace Singer, Community Relations Program Manager (609) 984-3141/4892. At Region II, EPA, the contact person is Lillian Johnson, Community Relations Coordinator (212) 264-2515.

HS45:ms
5/84

STEPS INVOLVED IN A MAJOR HAZARDOUS WASTE SITE CLEANUP

(1) Site Identified and Referred	(2) Initial Site Investigation	(3) Secure Site	(4) Site Analysis Evaluation and Assessment
(5) Prioritization	(6) Determination of Lead	(7) Community Relations Plan Activated	(8) Signing of Contract or Cooperative Agreement
(9) Hiring of Contractor for Remedial Investigation/Feasibility Study	(10) Preparation of Feasibility Study	(11) Selection of Remedial Action Alternative	(12) Hiring of Contractor for Engineering Design
(13) Hiring of Construction/ Removal Cleanup Contractor	(14) Cleanup Evaluation	(15) Contractor Audit and Close out	

New Jersey Department of Environmental Protection

Attachment D.

N.J. Department of Environmental Protection
Division of Waste Management
Hazardous Site Mitigation Administration
Public Meeting to Discuss Feasibility Studies
for Goose Farm, Pijak Farm and Spence Farm
Hazardous Waste Superfund Sites
Plumsted Township, Ocean County, New Jersey
Thursday, August 16, 1984
7:00 p.m.
Plumsted Township Municipal Building
31 Main Street
New Egypt, New Jersey

NAME	AFFILIATION	ADDRESS
Robert Caprutti		412 Buttonwood Street Mt. Holly, NJ
Margaret A. Chesnut	Reporter New Egypt Press	RD#1 Box 56B Cream Ridge, NJ
George King	NJDEP	Upper Freehold
[illegible]		[illegible]
[illegible]		[illegible]
Richard [illegible]	NJDEP	Trenton NJ [illegible]
[illegible]	EPA	[illegible]
[illegible]	Plumsted OEM	[illegible]
[illegible]	[illegible]	[illegible]
Rita & Baruch Brandenburg		Lakewood, N.J. 08701
Dina Werner		Bricktown N.J. 0[illegible]3
Dorothy Fox	Property owners	New Egypt
[illegible] Fox		

No.	NAME	AFFILIATION	ADDRESS
14.	Deborah Coombe	The Star-Ledger	
15.	John Haas	Ocean County Planning Bd	
16.	Denise Saltz	Allentown [illegible]	
17.	Douglas Elliott		229 Valley Dr Morrisville PA
18.	Gerald G Conoboy	NOVE	12 Heather Ln Trenton
19.			
20.			
22.			
23.			
24.			
25.			
26.			
27.			
28.			
30.			

N.J. Department of Environmental Protection
Division of Waste Management
Hazardous Site Mitigation Administration
Public Meeting to Discuss Feasibility Studies
for Goose Farm, Pijak Farm and Spence Farm
Hazardous Waste Superfund Sites
Plumsted Township, Ocean County, New Jersey
Thursday, August 16, 1984
7:00 p.m.
Plumsted Township Municipal Building
31 Main Street
New Egypt, New Jersey

NAME	AFFILIATION	ADDRESS
Kurt Tomlinson	Property Owner	45 Martha Ave Fallsington, PA 19054
[illegible]	Property owner	RD 1 box 112-A Cream Ridge
[illegible] Friman	property Owner	20 Meetinghouse Rd
[illegible] Krause	Property owner	20 Brown Ln New Egypt
[illegible]	High Bridge [illegible]	New Egypt [illegible]
Joe Przywara	Twp Planning Board / [illegible] Health Dept	[illegible] New Egypt
M/M [illegible]	[illegible] property owner 758-2669	RR1 [illegible] New Egypt 08533
[illegible]	[illegible]	[illegible]
9.		
10.		
11.		
12.		
13.		

N.J. Department of Environmental Protection
Division of Waste Management
Hazardous Site Mitigation Administration
Public Meeting to Discuss Feasibility Studies
for Goose Farm, Pijak Farm and Spence Farm
Hazardous Waste Superfund Sites
Plumsted Township, Ocean County, New Jersey
Thursday, August 16, 1984
7:00 p.m.
Plumsted Township Municipal Building
31 Main Street
New Egypt, New Jersey

NAME	AFFILIATION	ADDRESS
[illegible]	[illegible]	56 Main St New Egypt
Paul E Elliott		RD#1 Box 231 New Egypt
George [illegible]		[illegible]
[illegible]		[illegible]
Ann M. [illegible]		[illegible] Rd, Cream Ridge, N.J
Mr & Mrs [illegible]		27 [illegible] Rd New Egypt

Attachment E.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
HAZARDOUS SITE MITIGATION ADMINISTRATION
CN 028, Trenton, N.J. 08625

MARWAN M. SADAT, P.E.
DIRECTOR

JORGE H. BERKOWITZ, PH.D.
ADMINISTRATOR

**Public Meeting
to discuss
Feasibility Study Results**

for

**Goose Farm
Thursday, July 25, 1985
7:00 p.m.
Plumsted Township Municipal Building
31 Main Street
New Egypt, NJ**

AGENDA

1.	Opening remarks and introduction of DEP staff	Dr. Jorge Berkowitz, Administrator Hazardous Site Mitigation Administration NJDEP
2.	Overview of current status and introduction of contractor	Mr. David Henderson, Site Manager Hazardous Site Mitigation Administration NJDEP
3.	Presentation: Remedial Action Alternatives for Goose Farm	Mr. James Shirk E. T. Killam Associates, Inc.
4.	Questions and Answers	

FACT SHEET

Public Meeting
on
Results of Remedial Investigation/Feasibility Study
at
Goose Farm
Plumsted Township
Ocean County
July 25, 1985

Site Description: Goose Farm is one of seven "Plumsted" sites in the area of Ocean and Monmouth Counties. The site is located off Route 539, approximately one mile north of the intersection of Routes 539 and 528. It is immediately adjacent to a stream which is a tributary of the Crosswicks Creek. Goose Farm is in a rural, agricultural area at the edge of a pine/oak forest. During the late 1960s and early 1970s, an excavated portion of the site was used for the disposal of bulk liquid and drummed wastes. Contamination of soil, ground water, and surface water at the site has been documented.

Background: Initial remedial action transpired from August, 1980 until February, 1982 and entailed the excavation of all containers, as well as several thousand tons of contaminated soil and debris. A water treatment system was installed to remove gross contamination from the soil and ground water. The New Jersey Department of Environmental Protection (NJDEP) entered into a Cooperative Agreement with the United States Environmental Protection Agency (USEPA) on September 23, 1982 to commit $210,000 for the performance of a Remedial Investigation/Feasibility Study (RI/FS). A contract for the RI/FS was awarded by NJDEP to E.T. Killam Associates, Inc. of Millburn, NJ in December, 1983. Site access was secured via a Court Order and field work was initiated in February, 1984.

Status: A Draft Feasibility Study was completed in July, 1985 and the remedial action alternatives are presently being evaluated by NJDEP and USEPA. There is a 30-day public comment period, beginning July 26, 1985 during which the Draft Feasibility Study will be available at the following repositories: Plumsted Township Municipal Building, New Egypt Library, Ocean County Library in Toms Rivers, and the NJDEP, Hazardous Site Mitigation Administration in Trenton.

Over...

Goose Farm
Summary of Feasibility Study Results

Following is a brief description of the remedial action alternatives for long-term site remediation.

Alternative 1: Off-site disposal (removal of 62,000 cubic yards of soil to a RCRA facility), regrading, revegetation and recovery, treatment and recharge of contaminated ground water.

Alternative 2: Partial off-site disposal (removal of 10,000 cubic yards of soil), soil flushing, treatment and recharge for 52,000 cubic yards of soil, recovery, treatment and recharge of contaminated ground water.

Alternative 3: On-site construction, monitoring and long-term maintenance of a RCRA hazardous waste landfill for 62,000 cubic yards of soil, regrading and revegetation of excavated area, recovery, treatment and recharge of contaminated ground water.

Alternative 4: In-situ (in-place) soil flushing with treatment and recharge for removal of priority pollutants, recovery, treatment and recharge of contaminated ground water.

Alternative 5: In-situ soil flushing with treatment and recharge for removal of priority pollutants, injection of nutrients for in-situ biological oxidation and recovery, treatment and recharge of contaminated ground water.

Alternative 6: Containment of wastes with slurry wall and block displacement containment, long-term monitoring, recovery, treatment and recharge of contaminated ground water.

Alternative 7: In-situ soil flushing with treatment and recharge for removal of priority pollutants, no plume treatment.

Alternative 8: No current action except annual monitoring.

7/85
NJDEP

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WASTE MANAGEMENT

HAZARDOUS SITE MITIGATION ADMINISTRATION

A Community Relations Program at Superfund Hazardous Waste Sites

As part of the federal/state program of cleanup at hazardous waste sites, a Community Relations Program is conducted to receive local input and to advise local residents and officials about the planned remedial actions at the three major stages of the cleanup: 1) remedial investigation/feasibility study 2) engineering design and 3) removal/treatment/construction. Local briefings and meetings are conducted with elected officials and residents and generally take place at:

1) The commencement of a remedial investigation/feasibility study so that local concerns can be addressed early in the process.

2) The completion of a feasibility study to discuss the alternative courses of remedial action. There is a 30-day comment period after public presentation of the alternatives during which the feasibility study is available in local repositories.

3) The engineering design stage to carry out the mandates of the selected remedial alternative.

4) The commencement of the removal/treatment/construction stage to advise of the expected physical remedial action.

5) The completion of the remedial action.

In addition to the activities outlined above, there is generally ongoing communication with local officials and residents as required. Depending upon whether the New Jersey Department of Environmental Protection (DEP) or the United States Environmental Protection Agency (EPA) has the lead in remedial action at a site, community relations activities are conducted by the relevant State or Federal agency.

In New Jersey, the DEP Community Relations Program is directed by Grace Singer, Chief, Office of Community Relations (609) 984-3081. At Region II, EPA, the contact person is Lillian Johnson, Community Relations Coordinator (212) 264-2515.

HS45:js
4/85

STEPS INVOLVED IN A MAJOR HAZARDOUS WASTE SITE CLEANUP

(1) Site Identified and Referred

(2) Initial Site Investigation

(3) Secure Site

(4) Site Analysis Evaluation and Assessment

(5) Prioritiz tion

(6) Determination of Lead

(7) Community Relations Plan Activated

(8) Signing of Contract or Cooperative Agreement

(9) Hiring of Contractor for Remedial Investigation/Feasibility Study

(10) Preparation of Feasibility Study

(11) Selection of Remedial Action Alternative

(12) Hiring of Contractor for Engineering Design

(13) Hiring of Construction/Removal Cleanup Contractor

(14) Cleanup Evaluation

(15) Contractor Audit and Close out

Attachment F.

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
HAZARDOUS SITE MITIGATION ADMINISTRATION
Public Meeting to Discuss Results of
Remedial Investigation/Feasibility Study
at

GOOSE FARM
PLUMSTED TOWNSHIP
OCEAN COUNTY
JULY 25, 1985
7:00 P.M.

NAME	AFFILIATION	ADDRESS
Charles [illegible]	Mayor	RD #1 Box 106 New Egypt NJ
Kenneth [illegible]	Planning Board	[illegible]
John M. [illegible]	(As of 28 Aug 85) Home Owner	22A Inman Rd.
[illegible]	[illegible]	56 [illegible] St. New Egypt
Paul E. Elliott	Homeowner	RD #1 Box 231 New Egypt NJ
Cynthia Taylor	Homeowner	RR1 139A Rt. 539, New Egypt, NJ
[illegible]	Homeowner	25 [illegible] Rd New Egypt NJ
Michael [illegible]	Homeowner	71 [illegible] Rd New Egypt
[illegible] E. Cairns	Homeowner	(P.O. Box 161 N.E. NJ) Cairns Dr. Cream Ridge NJ
Ann Sinceskie	Homeowner	7 Postel Road Cream Ridge, N.J.
Lois Knudsen	Homeowner	26 Brown Lane New Egypt, NJ
Timothy [illegible]	"	Cream Ridge NJ
John M. Grose	Asbury Park Press	44 Princeton Ave. Brick Twp, NJ

NAME	AFFILIATION	ADDRESS
14. Charlotte Trainor	Homeowner	Box 217-5 Hopkins Rd New Egypt
15. Robert Caporitti	Concerned Citizen	412 Buttonwood St, Mt. Holly
16. Cathy Carroll	Ocean County Observer	202 Prospect Ave #4 Pine Beach
17. [illegible]	WJBI...	Toms River, NJ.
18. Kevin P. Monaghan	NJDEP - ORC	L+I BLdg Trenton NJ
19. L A Grillette	Homeowner	240-1 Highbridge Rd, NE NJ
20. Maria van Ouwerkerk	NJDEP - HSMA	428 E State st. Trenton
21. Bob Willy	IT Corp	Carteret N.J.
22. Bruce Tibbetts	Plumsted OEM	Plumsted NJ
23. JIM NASH	EPA-OHMSETT	LEONARDO NJ.
24. [illegible]	Homeowner	New Egypt
25. [illegible]	Homeowner	New Egypt
26. [illegible]	I live downstream and don't want to drink [illegible]	[illegible]
27. William R Challender	Deputy Director Plumsted OEM	12 Evergreen Rd New Egypt NJ.
28. [illegible]	Attorney Township of Plumsted	P.O. BOX 366 Toms River, N.J. 087
29. Don Lynch	EPA	
30. Joseph A Gallos	Ocean County Health Dept	

NAME	AFFILIATION	ADDRESS

DeMeo, Councilman

32\. Schroeder, Councilman

33\. A. Hendrickson, State Legislature

34\. Adeline Hendrickson - West Creek

35.

36.

37.

38.

39.

40.

41.

42.

43.

44.

45.

46.

47.

Attachment G.

ARCHER & GREINER

A PROFESSIONAL CORPORATION
COUNSELLORS AT LAW
ONE CENTENNIAL SQUARE
P.O. BOX 3000
HADDONFIELD, N. J. 08033-0968
609 · 795·2121
DEX 609 · 795·0574

August 26, 1985

8/27

copies → Len R.
Dave H
Manny M
Maya V.C.
File Goose Farm

Dr. Jorge Berkowitz
New Jersey Department of
Environmental Protection
Division of Waste Management
32 E. Hanover Street
Trenton, New Jersey 08628

Re: Morton Thiokol, Inc. - Goose Farm

Dear Dr. Berkowitz:

Enclosed are Morton Thiokol's (MTI) comments on the Goose Farm RI/FS as prepared by AWARE Incorporated. As you know, these comments have been prepared and produced within thirty days, and therefore, may need further amplification and discussion. Nonetheless, in that short period of time, AWARE Incorporated has identified many glaring deficiencies in the State contractors' (TRIA) reports. Among these are:

1. Failure to establish guideline performance standards for the remedial actions. With no target, it is impossible to understand what TRIA was attempting to achieve.

2. The chosen alternative has no technical basis in fact for the duration of time the alternative is to be operated. As a result, the cost is unquestionably wrong and other alternatives are the lower cost solution.

3. Other unconsidered alternatives, such as on-site containment by slurry walls and minimum groundwater pumping, appear to be better ultimate solutions.

These and other technical issues are discussed in the attachment. We note that the State's draft report also found fault with our previously provided Goose Farm study as performed by Wehran Engineering.

22221

Each of the problems noted are explicitly covered in the Wehran report and we are left to wonder if the State's contractorsever saw the finished report. In addition, a telephone call would have resolved many of the concerns raised.

MTI has evaluated other remedial paths without any guidance or agreement from NJDEP as to acceptable residual levels or which chemicals found are of greatest significance. We desire to discuss with your office this issue as well as the advantages of the alternatives we have independently evaluated. Perhaps after understanding our respective positions, MTI will be in a position to consider undertaking the ultimate remedy at this site.

As you know, MTI has in good faith proceeded with these extensive activities even though MTI is a defendant in litigation filed by the State involving this very site. We hope that a similar good faith review of our client's submission will result in substantial reconsideration by the State of its own contractors' reports. We stand ready to meet with appropriate state representatives in order to address any of these issues, and because of our ongoing litigation, we submit these comments and the attached report without prejudice to any of MTI's existing rights.

Very truly yours,

Edward C. Laird

EDWARD C. LAIRD

ECL:jas
Encl.

AWARE

consultants in environmental management

August 21, 1985

Edward C. Laird, Esq.
Archer & Greiner
One Centennial Square
Haddonfield, New Jersey 08033

RE: Initial comments on Goose Farm RI/FS

Dear Ed:

The attached report contains our initial comments on the Remedial Investigation/Feasibility Study completed for the Goose Farm site by NJDEP's consultant, TRIA.

The most striking feature of the RI/FS is its failure to diligently search out a truly cost-effective remedial option for the Goose Farm site. Furthermore, it is a markedly unquantitative RI/FS which has resulted in selection of a remedial alternative which can not stand up to detailed technical scrutiny.

The attached report also contains our initial thoughts concerning more appropriate remedial options for the Goose Farm site. Development of these alternative remedial options is only preliminary at this juncture, yet even at this level of evaluation, it is clear that these containment-based alternatives are worthy of further consideration.

If you have any questions on the attached report, please do not hesitate to contact us.

Very truly yours,

AWARE Incorporated

Robert D. Mutch Jr.

Robert D. Mutch, Jr., P.HG., P.E.
Vice President

/cs
Encl.
cc: A. Slesinger

80 Airport Road • West Milford, New Jersey 07480 • Phone (201) 728-1940

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

A remedial investigation/feasibility study (RI/FS) has been completed for the Goose Farm site in Plumsted Township, New Jersey. The RI/FS was undertaken by a consortium of three consultants under contract to the New Jersey Department of Environmental Protection, Division of Waste Management, Hazardous Site Mitigation Administration. The consortium performing the work is termed TRIA and consists of Elson T. Killam and Associates, Inc. (ETK), Geomet Technology, Inc. (GTI), and Leggette, Brashears and Graham, Inc. (LBG). Elson T. Killam acts as prime contractor for the project. The work of TRIA is embodied in three documents:

1. Draft II, Task 2-Remedial Investigation, Volume 1 - Main Report, July 12, 1985

2. Draft II, Task 2-Remedial Investigation, Volume 2 - Appendix A, June 1985

3. Draft II, Feasibility Study, July 12, 1985

AWARE Incorporated has been retained by Morton-Thiokol to review the Goose Farm RI/FS and to comment on its adequacy, its thoroughness, and the reasonableness of its conclusions and cost estimates. In performing this evaluation, a number of other documents have also been consulted. These include the following:

1. Wehran Engineering, Supplemental Investigation of the Goose Farm Site, May 1985

2. Wehran Engineering, Analytical Results, Groundwater Monitoring Wells, Goose Farm Site, March 1985.

3. Wehran Engineering, Analytical Results, Soil Samples - Volume 1, Goose Farm Site, March 1985

4. Wehran Engineering, Analytical Results, Soil Samples - Volume 2, Goose Farm Site, March 1985

5. Wehran Engineering, Analytical Results, Soil Samples - Volume 3, Goose Farm Site, March 1985

6. Wehran Engineering, Analytical Results, Soil Samples - Volume 4, Goose Farm Site, March 1985.

7. FMC Aquifer Remediation Systems, Site Assessment Report for the Goose Farms Hazardous Waste Site, June 27, 1985

In addition to the above-referenced reports, AWARE has also reviewed much of the earlier information developed as part of the past remedial efforts, has visited the site on numerous occasions, and has participated as a subcontractor to Wehran Engineering in the preparation of the above-referenced Wehran Engineering documents.

2.0 GENERAL COMMENTS ON THE RI/FS

Without question, the most striking feature of the feasibility study is its failure to mount a diligent search for a truly cost-effective remedy for the Goose Farm site. It is this lack of diligence which will run like a thread through most of the comments contained herein regarding the remedial investigation/feasibility study of the Goose Farm site. The feasibility study looks at only eight remedial alternatives for the Goose Farm site, only two more than the minimum six alternatives mandated by the National Contingency Plan. Further, the alternative remedial programs are given only a cursory evaluation and are developed in a purely conceptual manner.

Remedial objectives or performance goals are stated in only the most conceptual terms. No effort has been made to quantitatively set performance standards and objectives for the remedial programs. Remedial objectives are the starting point for a feasibility study. Once set, the feasibility study becomes an engineering evaluation and search for the most cost-effective way of attaining those goals. Without quantitative standards, a feasibility study flounders for lack of direction. The Goose Farm RI/FS suffers from its failure to set performance objectives

The remedial investigation is similarly unquantitative. The RI fails to generate enough new data or to use older data to generate isoconcentration contour maps depicting contaminant levels on the site. No estimates are made of the amount of contaminated groundwater in the plume of contamination. No estimates are made of the amount of groundwater flow within the plume. The stratigraphy of the site has been largely ignored in terms of its impact on groundwater flow. Illustrative of this rather casual regard for site stratigraphy is the indiscriminate grouping of permeability tests regardless of formation. The consultants failed to differentiate between true soil contamination and groundwater-borne contamination. No estimates were made of the degree of retardation of the various contaminants in the groundwater system. This latter deficiency of the RI/FS is especially critical since the recommended remedial plan involves soil contamination flushing and plume recovery and treatment. The retardation factor (R) will dictate the rate of flushing of contamination from the plume.

It is also perplexing that in a site where soil flushing and groundwater recovery are recommended why a computer model is not utilized in the development of feasible remedial alternatives. Even a relatively simple two-dimensional hydrologic model would be immensely helpful in conceptualizing and testing various remedial strategies. The place for computer modeling of groundwater-related remedial options is in the feasibility study, not the subsequent engineering design. The computer model can not only test out and evaluate the effectiveness of various groundwater recovery and recharge options, but can often lead one through trial and error to unusually cost-effective remedial options. It is believed that the absence of computer modeling in the Goose Farm feasibility study has been a serious omission.

Failure to develop a quantitative understanding and depiction of hydrogeologic and contamination conditions at the Goose Farm site has led to the selection of a remedial alternative which seems incapable of meeting any reasonable set of performance objectives and certainly not in the time frame projected in the RI/FS. The remedial plan optimistically envisions an 18-month period of soil flushing and plume recovery and treatment, after which presumably the aquifer and site would be sufficiently renovated. As will be demonstrated subsequently, it is our belief that this plan is seriously flawed for all but the most relaxed of performance standards. The flaw lies in the fact that the consultants have assumed that the soil and groundwater contaminants will either be flushed relatively rapidly from the system, within the 18-month period, or will be permanently bound up in the soils. This is an unrealistic and, in fact, a dangerous assumption. In reality, the Goose Farm soils and groundwater contain a complex suite of organic and inorganic contaminants whose retardation factors and, consequently, times of flushing span the mobility spectrum. By underestimating the complexity of the source, TRIA has recommended a remedial plan the success of which hinges on relatively rapid soil flushing and aquifer renovation. As the subsequent calculations will show, flushing of this aquifer system will not be rapid. In fact, the calculations indicate that flushing will take not months but many years, even decades.

TRIA also assumes that treatment can be effected by means of a granulated activated carbon system. It also appears that this assumption is optimistic given the character of the soil and groundwater contamination. The probable inadequacies of a simple GAC plant will be addressed in later sections of this document.

3.0 SPECIFIC COMMENTS ON THE RI

The following specific comments are made regarding the remedial investigation portion of the Goose Farm RI/FS. Most of the comments relate one way or another to the unquantitative nature of the remedial investigation.

1. The RI fails to present an isoconcentration contour map of the plume of groundwater contamination. An isoconcentration contour map of this type depicts the distribution of contaminant levels within the plume. The RI does not even delineate the full spatial extent of the plume. TRIA states "The areal limits of contaminated groundwater cannot be accurately defined because of the limited number of samples." (Appendix A, page 41). It is difficult to fathom why in a remedial investigation of a National Contingency List site sufficient samples cannot be taken to define at least the spatial boundaries of the plume, if not the distribution of contaminants within the plume. It's not a matter of budgetary limitations since cost-effective analytical plans can be developed employing a combination of indicator analyses to define the boundaries of the plume and more specific analyses to define the severity of the plume (Clarke, 1984).

2. Nowhere in the RI is the total volume of groundwater within the plume estimated. An indirect reference to plume volume is made on page I-11 of the feasibility study although it appears to be in error. TRIA states on page I-11 that "Total pollutants may range from 10,000 to 30,000 lbs. in groundwater (an average of 20 to 60 ppm total priority pollutants)." This calculation is based on a total volume of groundwater of 60 million gallons. Our estimate of the total volume of groundwater in the plume is approximately 14 million gallons. It seems likely that TRIA neglected to multiply the volume of the plume by the specific yield in order to obtain the actual volume of groundwater since the two numbers differ by a factor of approximately 0.25.

3. No effort was made to estimate the volume of groundwater flow within the plume. Utilizing TRIA's figures for average permeability and hydraulic gradient, it appears that the flow in the plume is approximately 8,000 gallons per day.

4. The stratigraphy of the site has been largely ignored in regard to its impact upon hydrogeologic conditions. An example of this is the way TRIA indiscriminately groups field permeability tests together, irrespective of the formation tested. The upper and lower Kirkwood, Manasquan, and Vincentown formations have different hydrogeologic properties which have not been taken into account in the RI. Many of the wells employed in the field permeability tests are screened across more than one geologic formation, thereby prohibiting differentiation of individual formation permeabilities.

5. TRIA failed to differentiate between true soil contamination and groundwater contamination. In a plume of groundwater contamination, a

certain amount of contaminant partitioning between groundwater and the aquifer skeleton invariably takes place. However, the resultant contamination of the aquifer skeleton cannot be compared to areas of true soil contamination where wastes have directly contacted soils, often coating them with pellicular film of non-aqueous phase liquid (NAPL).

6. The remedial investigation did not consider the mobility of the Goose Farm contaminants in the groundwater system. Retardation factors for the Goose Farm contaminants were not estimated. In the case of organic compounds, retardation factors can be estimated on the basis of organic content of the aquifer. Determination of aquifer organic content is a relatively simple and inexpensive analysis which in our judgment should have been included in the RI. Understanding the retardation of the principal Goose Farm contaminants would have enabled the remedial measures to be evaluated with a better conceptual understanding of contaminant mobility—a critical criteria when aquifer remediation and soil flushing is being considered.

7. TRIA fails to utilize the Wehran Engineering-generated geologic and hydrogeologic data for reasons which are difficult to comprehend. TRIA states, "First, the geologic information provided for the soil borings was insufficient to allow correlation of particular samples and analytical results to specific geologic formations. It is not known whether soil or water samples are from the Kirkwood, Manasquan, or Vincentown formations." The basis for this statement is difficult to understand since the Wehran Engineering boring logs clearly define the geologic formation and provide not only a detailed Burmister description of the lithology but also, where appropriate, geologic information such as the presence and type of shell fragments encountered.

   TRIA also states that "Second, information was not provided about the geology, drilling, and construction of the monitor wells." As stated above, information was contained in the Wehran Engineering boring logs regarding the geology encountered at each boring location. Moreover, the boring logs clearly show and describe the drilling technique and the specific nature of the well construction.

   TRIA further states that "The formation(s) in which the wells are screened are unknown." Clearly as indicated above, this is not the case.

   TRIA also states that "Third, groundwater samples were analyzed only for indicator parameters and are, therefore, not able to be directly correlated with specific contaminants identified by TRIA." It should be noted that the objective of the Wehran wells was to define the western boundary of the plume. Therefore, an analytical protocol consisting of indicator parameters was judged by NJDEP and Wehran to be appropriate. The fact that the analytical results cannot be "directly correlated with specific contaminants identified by TRIA" is a moot point. Had TRIA employed a rational program of indicator analyses in their analytical program, perhaps the spatial extent of the Goose Farm plume would be better defined within the TRIA RI.

TRIA also states that "Lastly, there was no description of sampling procedure utilized by Wehran in the collection of samples." Again, this is not the case for on page 2-4 of the Supplemental Investigation Report issued by Wehran Engineering, Wehran states that samples were collected in accordance with established NJDEP approved procedures.

On page 36 of Appendix A of the TRIA RI they state "The background soil sample collected by Wehran was found to contain a significant level of contamination. However, no location for the sample was provided which eliminates the formulation of any useful conclusions." Once again, this statement is inaccurate since the location of the background soil sample is shown on Figure 1 of Wehran Engineering's "Supplemental Investigation of the Goose Farm Site" report dated May 1985.

8. The State has analyzed for many compounds ("+40") which are not priority pollutants. As in previous efforts undertaken by DEP, many of the nonpriority pollutants detected may not be anthropogenic in origin. These analyses only further complicate the selection of appropriate performance standards. We believe the priority pollutant list is an adequate analytical base for this site.

4.0 SPECIFIC COMMENTS ON THE FS

The following more specific comments are offered in connection with the TRIA Feasibility Study.

4.1 Absence of Quantitative Remedial Objectives

The RI/FS fails to set forth quantitative remedial objectives. In the feasibility study, remedial action objectives for source control are stated as follows:

"1. Remove, treat, or contain contaminants.

2. Control general migration pathways.

3. Control release of volatile compounds in air.

4. Control water infiltration.

5. Control soil erosion.

6. Control direct contact."

Insofar as management of migration is concerned, the RI/FS states that "the principal objective in management of migration is to mitigate contamination of potable water supplies. Secondary goals of migration management are to stop the general movement of contaminants to other areas which may cause a danger to public health, welfare or the environment through direct or indirect contact."

These remedial action objectives do not speak to the <u>degree</u> of control required at the Goose Farm site. In fact these remedial objectives are not specific to the Goose Farm site at all, but could apply to any waste disposal site. Remedial objective #2 calls for control over "general migration pathways". Nowhere in the RI/FS are the migration pathways quantitatively evaluated as to their current risk to public health and the environment or, as important, as to what would be an acceptable level of risk for each pathway. Table I-2 of the TRIA RI presents exposure limits for typical Goose Farm contaminants. It presents the 10^{-6} cancer risk and EPA SNARLS for water and permissable exposure levels for air. The information in this table does not represent remedial goals. A remedial objective must address not only the permissable concentration, but where in the system the permissable concentration must not be exceeded. For example, one remedial objective might be to maintain water quality in the unnamed stream below some prescribed level of contamination such as the EPA SNARLS or the 10^{-6} cancer risk. Another remedial objective might be to maintain groundwater quality at certain points in the aquifer system below these same levels. Remedial objectives of this type provide a target for the feasibility study to home in on. Given a quantifiable target, remedial engineers can then evaluate the myriad of remedial technologies capable of attaining those remedial objectives. In the absence of such quantifiable remedial objectives, the feasibility study flounders for lack of direction. This has clearly been the case in the Goose Farm RI/FS. Remedial alternatives have been developed along with associated cost estimates without any definition of the degree to which they are expected to remediate site conditions. How can an 18-month aquifer renovation period be estimated without some concept of the acceptable degree of aquifer remediation which will be required? In short, it can't.

4.2 Evaluation of Recommended Remedial Alternative #4

The following comments are offered regarding the technical merits and projected costs of TRIA's recommended remedial program.

4.2.1 Technical Evaluation

As stated earlier, the technical merits of TRIA's Alternative #4 seem questionable. Its success hinges on what can best be considered the optimistic belief that the Goose Farm contaminants will fall into one of two categories: those which will be rapidly flushed from the soils, and those which will remain permanently bound to the soil matrix. The plan envisions an 18-month period of soil flushing and plume treatment, after which presumably the highly mobile contaminants will have been flushed from the soil and the aquifer and the remaining contaminants will remain bound to the aquifer skeleton.

Although the effectiveness of this option hinges on the rates of contaminant flushing and aquifer remediation, the RI/FS does not contain even preliminary estimates of these mechanisms. The sole reference to flushing times mentions achieving a ten-pore volume exchange of groundwater. The RI made no effort to measure the aquifer's natural organic content from which estimates of organic contaminant mobility can be drawn. TRIA has apparently simply guessed at the amount of flushing required to remove contaminants. As the succeeding evaluation will indicate, it appears that their unsupported estimate of flushing times is seriously in error. As a result, the aquifer remediation and soil flushing project would not be completed in the 18 months contended by TRIA. Rather, in all likelihood, it would be forced to operate for many years, even decades, before adequately remediating the aquifer and the soil contamination.

Naturally, the performance standards established for the aquifer remediation project will to a large degree dictate how long the system must run. It is evident that in the absence of concrete performance standards and a reasonable estimate of contaminant mobility in the Goose Farm soil system, the duration of the soil flushing and remedial project are indeterminate. Similarly, the costs of this remedial alternative could correspondingly escalate to the point of placing it in an unfavorable position with respect to other remedial alternatives as illustrated in Section 6.0 of this report.

In the following section of this report, a preliminary assessment of the likely flushing times for various contaminants is undertaken.

Estimates of Flushing Time

Numerous field and laboratory studies have demonstrated the importance of adsorption in the transport of organic contaminants through soil and groundwater systems. Adsorption of a contaminant to soil can occur through a variety of processes including physical adsorption, chemisorption (formation of chemical bonds between the material and the soil), hydrogen bonding, and ion exchange. The degree to which a particular contaminant is adsorped in soil or in an aquifer depends on the nature of the contaminant itself and the properties of the formation. The degree to which contaminants are retarded in their migration in groundwater systems is a critical factor in the evaluation and design of aquifer remediation efforts. Some compounds will be very tenaciously held by the soil matrix, becoming essentially immobile. Others will be strongly retarded in their passage through the aquifer, moving at only a small fraction of the rate of groundwater flow. Still other contaminants, particularly the lower molecular weight, volatile organic contaminants move relatively rapidly through the groundwater system—often nearly as fast as the groundwater, itself. However, even the volatile organics themselves exhibit a substantial degree of variation in their mobility in aquifer systems.

The degree to which a chemical or solute is retarded with respect to the flow of groundwater in an aquifer system is defined as its Retardation Factor, R, where:

$$R = \frac{\text{groundwater velocity}}{\text{solute velocity}}$$

The retardation factor can be used to estimate flushing times of contaminants from aquifers. It can be considered as being roughly equivalent to the number of pore volume exchanges necessary to extract a particular contaminant from the groundwater system. It should be noted that the Retardation Factor (R) refers to the retardation of solutes in a plume of dissolved groundwater contamination. In areas of severe soil contamination other factors also come into play which will be subsequently discussed.

It can be shown that:

$$R = 1 + (p/n)K_d \qquad (1)$$

Where: p = bulk solids density

n = porosity

K_d = soil/water distribution coefficient

The ratio of the bulk solids density to the porosity (p/n) typically falls in the range from 4 to 10, and for the purposes of this evaluation can be considered as roughly 5. K_d is a distribution coefficient which provides a measure of the extent to which a material partitions between a soil matrix and the groundwater.

Karickhoff, et al (1979) have shown that the adsorption of organic compounds in soil systems is very strongly controlled by the fractional organic content of the soil (f_{oc}) to the extent that other soil properties play minor roles. The term K_{oc} represents the adsorption coefficient referenced to the soil's organic content, rather than its total mass. Karickhoff and his coworkers have developed the following relationship:

$$K_{oc} = \frac{K_d}{f_{oc}} \qquad (2)$$

The fact that the retardation coefficient for organic compounds can be correlated to a soil's organic content is particularly useful since numerous authors have been able to demonstrate correlations between K_{oc} and several commonly known properties of chemicals. In particular, water solubility (S) and octanol/water partition coefficient (K_{ow}) have been shown to correlate well with K_{oc}. (Kenaga and Goring, 1978; Karickhoff et al., 1979; Chiou, et al., 1979).

In consideration of the preliminary nature of this assessment the following empirical relationship developed by Karickhoff will be utilized throughout the analysis:

$$K_{oc} = 0.63\ K_{ow} \qquad (3)$$

Utilizing equations 1, 2, and 3, it is possible to estimate the retardation factors for the organic compounds found at the Goose Farm site. The method is illustrated in the following sample calculations for methylene chloride.

<u>Sample Calculation</u>

Chemical contaminant: Methylene Chloride

Octanol/water partition coefficient (K_{ow}) = 18

Using equation (3)

$K_{oc} = 0.63\ K_{ow}$

$K_{oc} = 0.63(18) = 11$

From equation (2)

$K_d = f_{oc}\ K_{oc}$

Where: f_{oc} = 0.5% or 0.005 (estimated)

$K_d = 0.005\ (11) = 0.055$

and from equation (1)

$R = 1 + p/n\ K$

Where: p/n = 5

$R = 1 + 5\ (0.055)$

R = 1.28

Retardation Factor (R) of Methylene Chloride is 1.28.

Table 1 presents the estimated retardation factors (R) for the principal organic priority pollutants found at the Goose Farm site. In the calculation, it has been estimated that the average organic content of the formations through which the plume is migrating is 0.5 percent.

The above analysis reflects the mobility of individual compounds in the groundwater system. In evaluating these situations one must also consider the synergistic effects of multiple chemicals migrating in the same groundwater system, such as is the case at Goose Farm. It has been well documented, for instance, that the solubility and hence the mobility of many relatively insoluble compounds can be greatly enhanced by the presence of dissolved concentrations of organic solvents in groundwater. The high concentrations of organic solvents in the Goose Farm soils and groundwater are likely enhancing the mobility of many of the otherwise relatively immobile base neutral extractables, and acid extractables. It is difficult to quantify the impact of this mechanism of contaminant migration, yet it may be a significant factor in the observed presence of base neutral extractables, and acid extractables, well beyond the confines of the disposal pit.

It must also be emphasized that the preceeding analysis of retardation factors applies only to activity occurring within the plume of dissolved contamination. In the zones of severe soil contamination such as the disposal pit the above-described mechanisms are inadequate to fully predict retardation. In those areas, the soils have been overwhelmed by the organic compounds and are often coated with a pellicular film of the materials. Where this is the case, as it appears to be in the disposal pit, it can require 30, 40, or more pore volume exchanges of groundwater to leach even the relatively mobile compounds from the soil.

The importance of this analysis of retardation factors lies in the fact that retardation factors can be roughly correlated with the number of pore volume exchanges necessary to flush an aquifer free of contaminants. In this case, one pore volume equals the approximate volume of groundwater within the plume. It is estimated that the Goose Farm plume contains approximately 14 million gallons of groundwater. This estimate is based upon the areal dimensions of the plume which are roughly 500 feet by 500 feet, an average depth of approximately 30 feet, and an average porosity of 0.25. It can therefore be roughly estimated that an organic contaminant such as 1,2-Dichloropropane with a retardation value of 4 would require removal of approximately 4 pore volumes or 56,000,000 gallons of groundwater. Similarly, Ethylbenzene would require withdrawal of 325,000,000 gallons of groundwater. The diversity of retardation factors exhibited by the Goose Farm contaminants will manifest itself in the progressive release of contaminants having successively higher retardation factors during the course of the groundwater recovery program. Since many of the retardation factors are high, yet not so high as to render the contaminants totally immobile, a tremendous amount of groundwater will

TABLE 1

Estimated Retardation Factors (R)
for Principal Goose Farm Contaminants

Chemicals	K_{ow}	Calculated Using Karickhoff, et al Empirical Correlations		
		K_{oc}	K_d	R
Volatile Priority Pollutants				
Acrylonitrile	0.7244	0.46	0.0023	1.01
Acrolein	1	0.63	0.0032	1.02
Methylene Chloride	18	11	0.055	1.28
1,2-Trans-Dichloroethylene	30	19	0.095	1.47
1,2-Dichloroethane	30	19	0.095	1.475
1,1-Dichloroethane	62	39	0.20	2.0
Benzene	89-135	71*	0.36*	2.8*
1,1,1,-Trichloroethane	150	95	0.48	3.4
1,2-Dichloropropane	190	120	0.6	4.0
Trichloroethylene	195	123	0.61	4.1
Toluene	490	309	1.54	8.7
Ethylbenzene	1,410	888	4.44	23.2
Base Neutral Extractables				
Bis(2-Chloroethoxy) Methane	18	11.34	0.057	1.3
Bis(2-Chloroethyl) Ether	38	23.95	0.12	1.6
Bis(2-Chloroisopropyl) Ether	380	239.5	1.2	7.0
Naphthalene	2,340	1,474	7.37	37.9
Fluorene	15,100	9,513	47.6	239
Acenaphthene	21,380	13,469	67.4	338
Phenanthrene	28,000	17,640	88.2	442
Anthracene	28,200	17,766	88.83	445
Chrysene	407,000	25,641	128	642
Di-N-Butyl Phthalate	158,489	99,848	499	2,497
Pyrene	209,000	131,670	658.4	3,293
Fluoranthene	214,000	134,820	674	3,372
Butyl Benzyl Phthalate	63,100-631,000	218,641*	1,093*	5,467*
Benzo (A) Anthracene	408,000	257,040	1,285	6,426
Benzo (A) Pyrene	1,100,000	693,000	3,465	17,326
Benzo (B) Fluoroanthene	3,715,352	2,340,672	11,703	58,518
Benzo (K) Fluoroanthene	6,918,310	4,358,535	21,793	108,964
Benzo (GHI) Perylene	17,000,000	10,710,000	53,550	267,751
Indeno (1,1,2-c,d) Pyrene	45,700,000	28,791,000	143,955	719,776
Bis(2-Ethylhexyl) Phthalate				
Acid Extractables				
Phenol	29	18.3	0.09	1.457

Chemicals	K_{ow}	K_{oc}	K_d	R
<u>Pesticides</u>				
PCB-1242	380,000	239,400	1,197	5,986
PCB-1254	1,070,000	674,100	3,370	16,851
PCB-1248	1,300,000	819,000	4,095	20,476

Note: K_{ow} = Octanol/Water Partition Coefficient
K_{oc} = Soil/Water Partition Coefficient Referenced to Organic Content
K_d = Soil/Water Partition Coefficient
R = Retardation Factor
* = Mean Value

have to be pumped to purge the contaminancs from the ..uifer. In the absence of quantitative performance standards (and naturally a more detailed analysis of contaminant flushing) it is impossible to predict with any degree of accuracy the time period over which a groundwater recovery and treatment system would operate at the Goose Farm site. However, at a pumping rate of 100,000 gallons per day, one pore volume exchange could be realized every 140 days provided induced stream water infiltration is negligible. Comparing this figure with the retardation factors provided in Table 1 indicates that a groundwater recovery and treatment facility on this site could run for many decades, possibly even 100 years, depending upon the performance standards established.

As noted earlier, two other factors must be kept in mind. First, the mobility of otherwise relatively immobile compounds will be enhanced by the presence of organic solvents. This will cause these relatively immobile compounds to be flushed more rapidly from the soil system. Second, the rates of flushing in the areas of severe soil contamination cannot be predicted by retardation factors alone. The shear mass of contaminants in this area plays a more important role in dictating flushing times. The combined effect of these two phenomena is to increase the number and amount of contaminants flushed from the aquifer at intermediate times--some of the highly mobile contaminants appearing later than predicted and some of the relatively immobile compounds being leached more rapidly.

The TRIA groundwater recovery system is proposed to consist of a vacuum wellpoint system as indicated in Figure V-1. The vacuum wellpoints are to be aligned along the eastern and northern boundaries of the plume adjacent to the creeks into which the plume discharges. Because of the proximity to the creeks, induced infiltration of stream water into the groundwater recovery system will make up a significant portion of that system's flow. This induced surface water infiltration couild potentially account for between 30 and 70 percent of the total flow of the wellpoint system. It will depend upon the system's geometry and flow rates, aquifer properties, and stream bed and flow characteristics. Obviously, inducing this significant in-flow of uncontaminated water into the system has several negative side effects. First, it would necessitate increasing the hydraulic capacity of both the well point system and the groundwater treatment plant. More important, however, it will serve to throw the remedial project out of hydrologic balance. Alternative #4 is intended to operate as an essentially "closed-loop" system. Recovered contaminated groundwater is intended to be treated and returned to the aquifer near the northern end of the disposal pit (see Figure V-1 of the Feasibility Study). The aquifer within the plume has a finite capacity to store and conduct groundwater. The continuous addition of surface water into the system will eventually overwhelm the aquifer, potentially causing one or more of several problems. First, the groundwater could rise to excessive levels in the recharge area, possibly reaching the ground surface, causing obvious problems. Second, the potentiometric highs caused by the recharge system could serve to expand the plume laterally beyond its present boundaries.

The concept of recharging at the rear of the plume to accelerate aquifer renovation is quite good. However, where surface water is being induced to flow into the groundwater collection system, it is usually necessary to discharge a comparable amount of water beyond the "closed loop" recharge/discharge system in order to maintain a hydrologic balance. Once again, it is evident that a computer model could have been extremely useful in conceptualizing the groundwater recovery remedial options.

The TRIA-recommended remedial option envisions accelerated soil flushing as a means to enhance the migration of leachable constituents to the groundwater recovery system. However, the means proposed to achieve this soil flushing will be at best partially effective. It is proposed that a wellpoint system consisting of 80 wellpoints be utilized to inject water back into the contaminated soil zone in the vicinity of the disposal pits. A sketch of the proposed system is presented in Figure V-1 of the feasibility study. A wellpoint system of this type will effectively flush only those soils in its immediate vicinity. Such a recharging wellpoint system will create a potentiometric ridge along its alignment and accelerate flushing only within the confines of the potentiometric ridge and the underlying saturated zone. Contaminants in the unsaturated zone more than a few tens of feet from the recharge system will likely be completely unaffected. Even contaminants in the unsaturated zone in the immediate vicinity of the wellpoint recharge system may be unaffected depending upon the resultant height of the potentiometric ridge. The TRIA RI/FS provides no quantification of the impact of the proposed soil flushing system upon the groundwater table or with regard to its effectiveness. Clearly this is another example of where a computer model could have been a great asset to the feasibility study process. With the computer model, the effectiveness of various soil flushing systems could be quantitatively evaluated.

A more effective approach to soil flushing would be some form of surface application system such as a recharge basin or spray irrigation. In this way, contact between the recharging water and the soil contaminants can be maximized through the region of soil contamination.

<u>Groundwater Treatment Considerations</u>

In Alternative #4, it is proposed that groundwater be treated with gravity clarification and granular activated carbon adsorption. TRIA assumes that ten pore volumes of the contaminated plume will need to be treated during an 18-month period. A total of 140 million gallons (approximately 260,000 gpd) of groundwater will need to be treated. Aside from the previusly described problems of contaminant flushing, several concerns arise with respect to the treatment method as well.

1. Gravity Clarification

   Gravity clarification with a hydraulic detention of approximately 2 to 3 hr is effective in removing suspended solids. However, most groundwaters have very low suspended solids. Hence, from this standpoint, gravity clarification is <u>not needed</u>. Furthermore, most of the chemical constituents (e.g. heavy metals, hardness, etc.) contained in groundwater are in soluble forms which are not susceptible to gravity settling In this respect, therefore, gravity clarification is not effective. If there is a need to remove heavy metals using some type of chemical precipitation, then gravity clarification is required to remove the precipitated metals. But, heavy metal concentrations in State Wells #095 and #107 are either lower than primary drinking water standards (e.g. mercury) or not regulated (e.g. zinc). Consequently, gravity clarification is not needed under Alternative #4.

2. Granular Activated Carbon (GAC) Adsorption

Although most of the organics in the plume water are highly adsorbable, GAC alone is not cost-effective in removing 400-500 mg/l BOD (FMC, 1985), which is characteristic of the core of the plume.. Moreover, considering the high concentration of many organics (e.g., 560,000 ppb methylene chloride, 9500 ppb benzene, etc.), GAC treatment would be very expensive if stringent effluent limitations of less than 50 ppb each VOC and total VOC $\leq$ 100 ppb are to be met. (Once again, the feasibility study is haunted by lack of performance standards.)

3. Air Stripping

Air Stripping is not proposed in Alternative #4. Because most of the organics found in the plume water are highly volatile (e.g. methylene chloride, dichloroethylene, trichloroethylene, acrylonitrile, benzene, etc.), air stripping prior to to carbon adsorption would significantly reduce the VOC loading to the carbon treatment, and therefore would considerably lower treatment cost.

Based upon the above critique, a treatment train of air stripping followed by PACT (powdered activated carbon in activated sludge) should be considered. However, the feasibility of air stripping vis-a-vis local air quality control standards would have to be confirmed.

The achievable effluent concentrations and sizing of the treatment system were not addressed in the Killam report. These would have to be confirmed through a series of treatability studies on the actual plume water.

4.2.2 Cost Evaluation

The estimated construction costs of TRIA's Alternative #4 modified to reflect the suggested alternative treatment scheme is presented in Table 2. The construction costs apparently do not differ appreciably from those estimated by TRIA. However, in the TRIA cost estimates no differentiation was made between construction costs and operational and maintenance costs.

It is estimated that the annual operation and maintenance costs for the groundwater treatment plant will amount to approximately $394,000. This includes $200,000 a year general O & M for the treatment plant, $139,000 per year for sludge disposal, and $55,000 for groundwater monitoring.

TABLE 2
Estimated Cost of Alternative No. 4

Item	Units	Quantity	Unit Price	Estimated Cost
Groundwater Recovery & Recharge System	LS	1	$ 349,000	$ 349,000
Soil Flushing & Recovery System	LS	1	383,000	383,000
Groundwater Treatment Plant (AS, PACT)	LS	1	1,350,000	1,350,000
SUBTOTAL				$2,022,000
Engineering, Permitting, & Contingencies @ 30%				607,000
TOTAL				$2,629,000

4.3 Evaluation of Remaining TRIA Alternatives

The following brief comments are offered regarding the remaining seven TRIA alternatives.

4.3.1 Technical Evaluation

Alternative #1

The National Contingency Plan mandates that the feasibility study consider a total removal option. In the case of Alternative #1, complete removal would encompass not only the contaminated soils in the waste disposal pit, but apparently much of the contaminated aquifer as well. In essence, this alternative would involve removal and reconstruction of the aquifer with clean fill--a rather extreme method of aquifer remediation. This alternative has several negative aspects which remove it from serious consideration. These are:

1. The extreme cost.

2. The nationwide shortage of landfill capacity for the 62,000 cubic yards of waste resulting from this alternative.

3. The current regulatory reluctance to send wastes off-site to sites which may potentially become future Superfund sites.

Alternative #2

Alternative #2 shares the same disadvantageous aspects as Alternative #1, although to a lesser degree.

Alternative #3

This alternative calls for the on-site disposal of the 62,000 cubic yards of contaminated soil in a RCRA hazardous waste landfill. Although technically feasible, this alternative is considerably more costly than some of the in-situ management alternatives presented in Section 5.0 of this report. In addition, there would remain a risk of failure which could prompt still another remedial investigation/feasibility study the future. The risk of failure, that is leakage from the facility, wo. always remain since RCRA guidelines and site considerat: s would mandate construction of the landfill above the groundwater table. Consequently, there would always be an outward hydraulic gradient across the liners. The difficulty in obtaining the necessary permits to construct such a facility in the coastal plain of New Jersey should also not be overlooked.

Alternative #5

Alternative #5 involving in situ biological treatment is a variation of Alternative #4, discussed previously. The success of the in situ biological treatment depends upon the ability of the stimulated bacteria to degrade the contaminants in situ without need for their extraction and above-ground treatment. The technology of in situ biological treatment appears very promising. Whether it is applicable to the specific conditions of the Goose Farm site would have to await a more detailed treatability study.

In situ biological treatment could be performed in conjunction with a soil flushing and groundwater recovery system such as that proposed in Alternative #4 by TRIA or in conjunction with the containment options described within Section 5 of this document.

Alternative #6

Alternative #6 is the only containment-based alternative evaluated by TRIA. It involves a rather unusual approach to in situ management, specifically the application of "base grouting". Base grouting is a procedure to develop a horizontal low-permeability horizon beneath a waste disposal site. Subsurface cutoff walls are then keyed into this low-permeability horizon to form a containment "vessel". Base grouting, however, is a highly questionable procedure insofar as the integrity of the final product is concerned. No specification is given within the RI/FS as to the specific nature of the base grouting technology considered.

Apparently no consideration was given to utilization of the Hornerstown Sand aquitard as a strata into which subsurface cutoff walls could be keyed. Wehran Engineering conduoted a rather extensive analysis of the Hornerstown Sand aquitard beneath the Goose Farm site. The results of that analysis are published within their May 1985 report. Wehran Engineering estimates that the "upper shell layer (of the Hornerstown Sand formation) has a permeability on the order of 1.0×10^{-7} cm/sec." It is therefore clear that the Hornerstown Sand aquitard is capable of being advantageously exploited as a relatively low-permeability aquitard into which subsurface cutoff walls could be founded. Yet, the TRIA FI/FS gives no consideration to this advantageous feature of the site. In fact, TRIA seems to ignore the presence of the Hornerstown Aquitard altogether. On page III-2 of the feasibility study they state in connection with Alternative #6 that "the bottom grouting is required, however, by the permeability of the lower Kirkwood, Manasquan, and Vincentown formations at the site." It is difficult to understand the reasoning for this oversight since not only is the Hornerstown Sand aquitard a well-recognized aquitard in the New Jersey coastal plain, but at this site it is well within the reach of conventional slurry trench construction methods.

Alternatives #7 and #8

Alternatives #7 and #8 are not truly in contention as potential remedial measures for the Goose Farm site. Alternative #7 fails to address the contaminants within the plume and Alternative #8 is the no-action alternative.

4.3.2 Cost Evaluation

The following general comments are offered regarding certain common characteristics of the TRIA remedial alternatives.

1. As has been previously described, it is our belief that the difficulty and time required to flush the soils and remediate the aquifer at the Goose Farm site have been seriously underestimated. Employing the principles previously described, it is our contention that soil flushing times and aquifer remediation times are likely to take anywhere from a decade to more than a hundred years, depending upon the performance standards established for the project.

2. Aside from being unrealistically low, the projected cost of plume pumping and treatment is the same in Alternatives 1, 2, 3, 4 and 6, in spite of substantial differences in the amount of aquifer requiring remediation in each alternative. How could the aquifer remediation costs be the same when in Alternatives 1 and 3, 62,000 cubic yards of the most highly contaminated material will be removed from the aquifer, while in Alternative 4, the recommended solution, no source control is contemplated. Similarly, in Alternative 2, 10,000 cubic yards of highly contaminated soils, representing the disposal pit, are to be removed for off-site disposal. Yet, the cost for plume management in this alternative is again the same as Alternative 4, which involves no source control. In Alternative 6, a slurry trench cutoff wall and bottom grouting is proposed to contain presumably the most highly contaminated soils. Yet, no impact on plume cleanup costs is projected. Surely some benefit is to be accrued from these highly capitally-intensive source control efforts insofar as the duration and costs of the aquifer remediation program is concerned?

3. The cost of contaminated soil excavation and disposal is estimated at $540 per cubic yard. The derivation of this figure is not provided in the RI/FS. This figure seems rather high in light of similar waste excavation and disposal efforts in New Jersey and elsewhere.

4. The RI/FS report provides very little technical information concerning the eight evaluated remedial programs. The estimated pumping rates of the soil flushing or groundwater recovery systems are not provided. The cost of the groundwater treatment plant is not broken out and separated from the cost of the groundwater recovery system or the operational costs associated with the system. The depths and proposed alignment of the slurry trench cutoff wall in Alternative 6 is not provided. Nor is there any explanation of the base grouting technique. In reading the report one does not know whether "base grouting" refers to the "block fracturing technique" or some other form of pressure grouting. The derivation of the immense $12,500,000 cost of base grouting is also not provided within the RI/FS.

Specific Comments

Alternative #1

Although the unit cost of excavation and disposal ($540 per cubic yard) seems high, it is not clear whether TRIA has included in their estimate provisions for management of groundwater during the excavation operation. Groundwater management during excavation could be a significant factor in the cost estimates and may account for the rather high unit price for excavation and disposal.

Alternative #2

The general comments and specific comments made in regard to Alternative #1 also apply with respect to Alternative #2.

Alternative #3

It appears that TRIA's estimates of the cost to construct an on-site landfill may be low. Table 3 contains an approximate cost estimate for a 67,000 cubic yard hazardous waste secure landfill conforming with EPA's guidelines published following the 1984 reauthorization of the Resource Conservation and Recovery Act. In accordance with those guidelines, the landfill design includes a primary and secondary liner, a primary leachate collection system above the primary liner, and a leachate collection/ detection system between the two liners. In further compliance with the referenced EPA guidelines, the base liner has been assumed to be constructed of 3 feet of compacted clay with a maximum permeability of 1X10-7 centimeters per second. The primary liner has been assumed to be a composite liner consisting of 80 mil high density polyethylene (HDPE) atop a two-foot $1X10^{-7}$ liner of compacted clay. The landfill's final cover would consist of a composite cap of 20 mil PVC atop one foot of 1X10-7 centimeters per second compacted clay overlain by a one-foot sand drainage layer and one and one-half feet of top soil. TRIA's estimates of annual operating costs, presumably consisting of leachate treatment, final cover maintenance, and environmental monitoring, appear reasonable.

Alternative #4

Since Alternative #4 is the recommended remedial option, the costs of this option have been evaluated in greater detail in Section 4.2.2 of this report.

Alternative #5

Insufficient information existed at the time of this report to estimate the costs associated with in situ biological treatment. Additional studies by FMC are under consideration by Morton-Thiokol.

Alternative #6

Alternative #6 is the only TRIA alternative which gives consideration to containment of contaminated source areas. Unfortunately, Alternative #6 contemplates base grouting of 5 acres. Base grouting is not only enormously

TABLE 3
COST ESTIMATE
ON-SITE RCRA LANDFILL

ITEM	UNITS	QUANTITY	UNIT PRICE	ESTIMATED COST
1. SITE PREPARATION	L.S.	1	$50,000.00	$50,000
2. BERMS	C.Y.	26,200	$12.65	$331,430
3. SECONDARY LINER	C.Y.	40,400	$12.65	$511,060
4. LEAK DET. SYSTEM				
-SAND	C.Y.	7,000	$7.00	$49,000
-COLLECT. PIPES	L.F.	4,150	$0.75	$3,113
-GEOTEXTILE	S.F.	172,000	$0.15	$25,800
-COLLECTION SUMP	L.S.	1	$20,000.00	$20,000
5. PRIMARY LINER				
-CLAY	C.Y.	17,500	$12.65	$221,375
-80 HDPE	S.F.	187,500	$1.00	$187,500
6. LEACHATE C.S.				
-SAND	C.Y.	7,400	$7.00	$51,800
-COLL. PIPES	L.F.	4,270	$0.75	$3,203
-GEOTEXTILE	S.F.	186,000	$0.15	$27,900
-COLL/STORAGE	L.S.	1	$75,000.00	$75,000
MONITORING WELLS	UNIT	4	$2,500.00	$10,000
8. FINAL CAP				
-CLAY	C.Y.	10,200	$12.65	$129,030
-20 MIL PVC	S.F.	210,000	$0.27	$56,700
-SAND	C.Y.	8,300	$7.00	$58,100
-DRAIN. PIPE	L.F.	4,500	$0.75	$3,375
-TOPSOIL	C.Y.	14,700	$9.00	$132,300
-HYDROSEED	S.F.	222,000	$0.08	$17,760
SUBTOTAL				$1,964,445
ENGINEERING,PERMITTING, AND CONTINGENCIES			30.00%	$589,334
TOTAL				$2,553,779

expensive, i. remains an inherently difficult undertaking. Because of the unseen subterranean nature of the work, the integrity of a base-grouted zone is always in question. Apparently no consideration was given to utilizing the Hornerstown Sand aquitard as a confining layer into which to key subsurface cutoff walls. Exploitation of the Hornerstown Sand aquitard as part of an in situ management approach for the Goose Farm site is discussed in some detail in Section 5 of this report. The inclusion of the rather questionable base grouting technique in Alternative #6 increases the cost of this alternative by $16,250,000. As a result, it drives the apparent cost of in-place encapsulation beyond the range of reason. Yet, as will be described in Section , there are numerous other in situ management alternatives for the Goose Farm site which are in fact more cost effective than the alternatives presented within the TRIA RI/FS and, moreover, possess a higher degree of reliability.

Alternatives #7 and #8

Neither Alternative #7 or #8 are in serious consideration because in the case of Alternative #7 the plume is left unmanaged and in the case of Alternative #8 no remedial efforts are involved.

5.0 PRELIMINARY ASSESSMENT OF OTHER REMEDIAL OPTIONS

The fact that the soil flushing and aquifer remediation remedial alternatives proposed by TRIA will be a more time consuming and therefore more costly undertaking than estimated, demands that containment options be given a closer examination. A closer look at containment options ia also indicated by the observed properties of the Hornerstown Sand aquitard beneath the Goose Farm site. The TRIA RI/FS makes little effort to consider the many containment options available. The single containment option TRIA considered (Alternative #6) involved the highly questionable and costly practice of base grouting. No consideration was given in the TRIA RI/FS to utilization of the Hornerstown Sand aquitard as part of an in-situ management approach. In so doing, it appears they have overlooked some very attractive and cost-effective remedial alternatives.

Subsurface cutoff walls can play a variety of roles in the remediation of hazardous waste sites (Mutch, 1984). In the case of waste disposal sites, cutoff walls can be used to hydraulically isolate the waste disposal site. In the same manner cutoff walls have been used to isolate subterranean zones of soil contamination. In groundwater recovery and treatment programs, cutoff walls have also been used to minimize or prevent induced infiltration from adjacent surface water bodies. Cutoff walls have also been used to partially or completely enclose a plume of groundwater contamination, thus halting its spread and allowing groundwater recovery and treatment efforts to proceed at a more relaxed pace.

Each of the above-described common usages of subsurface cutoff walls has potential application at the Goose Farm site. A subsurface cutoff wall could be employed to encircle the former disposal pit and the highly contaminated soils in its immediate vicinity. Alternatively, a subsurface cutoff wall could be utilized to completely enclose both the waste disposal pit and the plume of groundwater contamination. Finally a subsurface cutoff wall, possibly even a relatively shallow cutoff wall penetrating to the Manasquan Formation rather than the Hornerstown Sand aquitard, could be utilized to minimize induced infiltration from the adjacent stream.

It must be emphasized at this point that cutoff walls do not form completely impermeable barriers to groundwater flow. Rather, in the proper hydrogeologic setting and under the proper design and construction conditions, they can very effectively minimize groundwater flow. This is not to suggest, however, that leakage from a waste disposal site encircled by subsurface cutoff walls need be inevitable. Many waste disposal sites have been remediated by a combination of circumferential subsurface cutoff walls and internal leachate collection systems to <u>reverse</u> hydraulic gradients across the cutoff wall. In other words, by lowering the potentiometric surface within the waste disposal site to elevations less than the potentiometric levels in the surrounding and underlying aquifers, seepage will be induced to flow into the waste disposal site rather than vice versa. This remedial concept has been employed in the remediation of numerous waste disposal sites including several sites on the National Priority List. Several of the National Priority List sites employing this technique include the Monroe Township Landfill in Middlesex County, NJ

(Mutch 1983); the South Brunswick Landfill in Middlesex County, NJ; and the Hooker "S" Area Landfill in Niagara Falls, NY (Amos, 1985).

In the containment options for the Goose Farm Site discussed subsequently, it is this concept which is employed. This concept results in essentially 100 percent abatement of contaminant release from the site. A properly undertaken risk assessment may demonstrate that such a high level of abatement is not required. In which case, it may be possible to omit the hydraulic gradient reversal and allow some nominal amount of leakage to ultimately leave the site's confining envelope. However, at this juncture, we have assumed the more conservative remedial approach.

Since in every application of subsurface cutoff walls there will be some groundwater flow through the cutoff wall itself and beneath the cutoff wall, prediction of the amount of flow occurring by each of these mechanisms is critical to evaluation and design of a subsurface cutoff wall. In each of the subsequently discussed additional remedial options, the estimated amount of groundwater inflow has been estimated.

The following additional remedial options seem worthy of further consideration. In order to avoid confusion and to be consistent with the TRIA feasibility study, the numbering of these additional remedial options begins with Alternative #9.

5.1 Description of Additional Remedial Alternatives

Alternative #9

Alternative #9 would include the following elements:

1. A circumferential cutoff wall around the waste disposal pit and plume of groundwater contamination. The approximately 2,000 ft. long slurry trench cutoff wall would lie along the creeks on the eastern and northern sides of the plume, along the western edge of the plume, and just south of the southern edge of the waste disposal pit. The slurry trench cutoff wall would key into the Hornerstown aquitard at an average depth of approximately 65 feet.

2. An interior leachate/groundwater collection system would be constructed to lower the potentiometric surface within the cutoff wall enclosure to a level below the potentiometric levels in the adjacent Kirkwood/Vincentown and the underlying Mt. Laurel Aquifer.

3. Collected leachate would be managed either by trucking to an off-site wastewater treatment plant such as DuPont's Deepwater, New Jersey facility or by an on-site treatment plant. This decision would have to await the findings of a treatability study and economic analysis.

It is crucial in any containment-based remedial action that the amount of leakage be estimated. In a conventional containment approach where leakage would be outward, it is necessary to know the amount of leakage in order to estimate the degree of effectiveness of the remedial option and to undertake a risk assessment. In an "intragradient" containment option, such as Alternative #9, the estimation of inward leakage allows for proper planning of leachate management alternatives. In the case of Alternative #9, leakage into the cutoff wall enclosure can be expected from three mechanisms:

(a) Infiltration of precipitation
(b) Inflow of groundwater through the cutoff wall, itself
(c) Upward leakage through the Hornerstown Sand aquitard.

Infiltration of Precipitation

It has been estimated that groundwater recharge on the Goose Farm Site, given the nature of the surficial soils and absence of vegetation, is probably on the order of 15 inches per year. Over the 6.1 acre area of the cutoff wall enclosure this would amount to a total of 2,482,000 gallons of groundwater recharge per year or approximately 6,800 gallons per day on an average basis. It should be noted however that groundwater recharge will vary significantly seasonally and the design must be able to accommodate these seasonal fluctuations.

Leakage Through the Cutoff Walls

Under natural conditions, it has been assumed that there is a five foot differential in the potentiometric levels of the combined Kirkwood/Vincentown aquifer in the deeper Mt. Laurel/Wenonah Aquifer. Therefore, in order to lower the potentiometric surface within the cutoff wall enclosure to a level at least two foot below the potentiometric level in the Mt. Laurel/Wenonah Aquifer, it will be necessary to lower the interior potentiometric surface approximately seven feet. This will create a seven foot head differential across the subsurface cutoff walls. The hydraulic gradient would therefore be 7/3, or 2.33, assuming a three-foot thick slurry trench cutoff wall. Seepage through the 130,000 square foot cutoff wall having a permeability of 1×10^{-7} cm/sec would therefore be approximately 645 gallons per day.

Leakage Upward Through Hornerstown Sand Aquitard

The upper shell layer of the Hornerstown Sand aquifer is approximately eight feet in thickness. Wehran Engineering estimates its permeability at approximately 1×10^{-7} cm/sec. Conservatively assuming that the two-foot gradient is entirely dissipated across the upper shell layer, the hydraulic gradient would be 0.25. Upward leakage through the Hornerstown Sand aquitard would therefore be approximately 140 gallons per day.

The total leakage into the cutoff wall enclosure will be the sum of the above three mechanisms or approximately 7,600 gallons per day.

The estimated costs of Alternative #9 are presented in Table 4. The total construction costs of Alternative #9, including engineering, permitting, and contingencies, is $2,242,500. Annual operating costs would consist primarily of leachate treatment costs. Annual costs for leachate management amount to approximately $40,000 per year. Adding in costs for routine monitoring, one can assume that the annual operating costs would be approximately $95,000 per year.

Alternative #10

Alternative #10 would include the following elements:

1. A circumferential cutoff wall around the waste disposal pit and plume of groundwater contamination. The approximately 2,000 ft. long slurry trench cutoff wall would lie along the creeks on the eastern and northern sides of the plume, along the western edge of the plume, and just south of the southern edge of the waste disposal pit. The slurry trench cutoff wall would key into the Hornerstown aquitard at an average depth of approximately 65 feet.

2. A cap would be constructed over the cutoff wall enclosure area to minimize infiltration of precipitation. The cap would consist of 12 inches of compacted clay with a maximum permeability of 1×10^{-7} cm/sec, covered by a 20 mil PVC liner. Above the liner a drainage layer would be constructed using 4-inch perforated pipe placed in 12 inches of coarse sand. The drainage layer would be covered with 18 inches of topsoil and hydroseeded

to minimize erosion.

3. An interior leachate/groundwater collection system would be constructed to lower the potentiometric surface within the cutoff wall enclosure to a level below the potentiometric levels in the adjacent Kirkwood/Vincentown and the underlying Mt. Laurel Aquifer.

4. Collected leachate would be managed either by trucking to an off-site wastewater treatment plant such as DuPont's Deepwater, New Jersey facility or by an on-site treatment plant. This decision would have to await the findings of a treatability study.

Leakage Estimate

Leakage into the cutoff wall enclosure under Alternative #10 would be the same as that occurring in Alternative # 9 with the exception of infiltration of precipitation. The composite clay/geomembrane cap should essentially eliminate infiltration of precipitation into the cutoff wall enclosure. Recognizing the limitations of any containment options, we have conservatively assumed a leakage rate of 100 gallons per day. Total leakage under this option would therefore be approximately 885 gallons per day.

The costs of Alternative #10 are presented in Table 5. The annual operating costs for Alternative #10 are lower, since infiltration of precipitation is essentially eliminated. Annual costs for leachate treatment would be approximately $25,000 per year. Adding in costs for site monitoring and routine maintenance, the total annual operating costs are probably on the order of $80,000.

5.2 In-Situ Biological Treatment Applications

Possible variations of Alternatives #9 and #10 would involve the application of in-situ biological treatment processes to treat the contaminants within the cutoff wall enclosure. The cutoff walls offer the advantage of allowing the in-situ biological treatment to proceed at a more relaxed pace since plume migration would be controlled. The closed loop in-situ biodegradation processes could operate without concern of induced surface water infiltration or loss of partially treated effluent from the treatment zone. It is difficult to say at this juncture how effective in-situ biological treatment would be given the complex suite of organic and inorganic compounds found at the Goose Farm site. However, results in other areas of the country have been very promising. In-situ biological treatment is a particularly attractive treatment method for contaminants which tend to remain in the soil or are only slowly flushed from the groundwater system since treatment occurs in the subsurface without the need of bringing the contaminants to the surface for conventional treatment.

The advantage of incorporating in-situ biological treatment with the containment options is that eventually collection and treatment of groundwater from within the cutoff wall should no longer be necessary. A treatability study in conjunction with the establishment of quantitative performance standards would permit a determination of the time required to reach this point.

6.0 CONCLUSIONS

It is our contention that the most serious deficiency of the TRIA RI/FS is its failure to mount a truly diligent search for a cost effective remedial option for the Goose Farm site. The remedial options which are looked at are few in number and poorly developed. Both the RI and FS portions of the document are strikingly unquantitative. Remedial objectives are not set forth other than in the most conceptual terms. The plume of groundwater contamination—essentially the entire focus of the RI/FS— is not even mapped, either in terms of its spatial extent or the distribution of contaminants within the plume. No estimate is provided of the quantity of contaminated groundwater within the plume. No effort was made to estimate the retardation of the principal contaminants in the groundwater system. The influence of site stratigraphy on the hydrogeologic conditions of the site was largely overlooked. No effort was made to differentiate and define the hydrogeologic properties of the different geologic formations found beneath the site. The Hornerstown Sand aquitard--a well known low permeability aquitard in the coastal plain of New Jersey--was entirely ignored in considering containment-based options.

It is our suggestion that in light of the apparent unlikelihood of flushing the contaminants from the aquifer in the time period projected by TRIA, other remedial options, specifically containment options, be further evaluated.

Table 6 contains a comparative analysis of selected Goose Farm remedial options. Specifically the table provides a comparison of Alternatives 4, 9, and 10. Alternative #4 has been evaluated for several different durations of the groundwater recovery and treatment system and soil flushing systems. Durations of 2, 3, 4, 5, 10, 20, and 30 years have been utilized in the assessment. Table 6 contains an estimate of the initial construction costs, the annual O & M costs, and the present worth value of the total annual O & M costs over the appropriate duration of operation. The last column of Table 6 gives the true total cost of the remedial option representing the sum of the initial construction costs and the present worth value of the annual O & M costs.

Since Alternative #4 has a relatively high annual operation and maintenance cost, the "total cost" of this alternative is very sensitive to the duration of the groundwater recovery and soil flushing program. The present worth value of the annual O & M costs varies from a low of $702,000 in the event the recovery program only operated for two years to $4,433,000 for a 30 year operational period. Alternative #4 is only competitive with Alternatives 9 and 10 in the event the groundwater recovery and treatment and soil flushing system operates no longer than two years. The total cost of Alternative #4 escalates rapidly as the duration of the groundwater recovery and soil flushing system increases. Should that system have to operate for five years, the total cost of Alternative #4 exceeds $4 million. Operated for 10 years, the costs exceed $5 million. The preceding analysis of contaminant mobility and flushing times indicates that for all but the most relaxed of performance standards it could take many years, probably decades, to adequately renovate

TABLE 6
Comparative Analysis of Selecteu Goose Farm Remedial Options

Alternative	Construction Cost	Annual O & M Costs	Duration O & M Costs (yrs.)	Present Worth of Total Annual O & M Costs	Total Cost
Alternative No. 9	$2,242,500	$95,000	30	$1,068,750	$3,311,250
Alternative No. 10	2,412,085	80.000	30	900,000	3,312,085
Alternative No. 4	2,629,000	394,000	2	702,000	3,331,000
Alternative No. 4	2,629,000	394,000	3	1,017,000	3,646,000
Alternative No. 4	2,629,000	394,000	4	1,304,000	3,933,000
Alternative No. 4	2,629,000	394,000	5	1,572,000	4,201,0[illegible]
Alternative No. 4	2,629,000	394,000	10	2,644,000	5,273,000
Alternative No. 4	2,629,000	394,000	20	3,869,000	6,498,000
Alternative No. 4	2,629,000	394,000	30	4,433,000	7,062,000

TABLE 4

Alternative No. 9
Construction Cost

Item	Units	Quantity	Unit Cost	Est. Cost
Slurry Cutoff Wall	SF	130,000	$ 9	$1,170,000
Leachate CS				
- well points	EA	120	25	3,000
- piping	LF	1,300	5	6,500
- pumps	LS	3	4,000	12,000
- installation	LF	1,300	45	58,500
- storage facility	LS	1	150,000	150,000
Groundwater Treatment Plant	LS	1	325,000	325,000
SUBTOTAL				$1,725,000
Engineering, Permitting, and Contingencies 30.0%				517,500
TOTAL				$2,242,500

the aquifer. Consequently, the true cost of Alternative #4 is probably in excess of $5 million, thus putting it in very unfavorable position with respect to Alternatives 9 and 10.

The complex suite of inorganic and organic compounds within the Goose Farm hydrogeologic system demand that in-situ containment options be given a closer evaluation. In-situ management alternatives such as Alternatives 9 and 10, may offer a more effective and more reliable means of remedying the groundwater contamination problems at the Goose Farm site. Moreover, these alternatives could be used in conjunction with in-situ biological treatment methods to eventually degrade the majority of the contaminants and obviate the need for long-term maintenance and monitoring of the remedial plan.

BIBLIOGRAPHY

Chiou, C.T., L.J. Peters, and V.H. Freed, "A Physical Concept of Soil-Water Equilibria For Nonionic Organic Compounds", Science 206, 1979.

Kenaga, E. E., and C.A.I. Goring, "Relationship Between Water Solubility, Soil-Sorption, Octanol-Water Partitioning, and Bioconcentration of Chemicals in Biota", ASTM Third Aquatic Toxicology Symposium New Orleans, LA, 1978.

Karickhoff, W., D. S. Brown, and T. A. Scott. Water Res., 13, 241, 1979.

Lyman, W. J., W. F. Reehl, and D. H. Rosenblatt. Handbook of Chemical Property Estimation Methods, McGraw Hill Book Company, 1982.

Mutch,Jr., R. D., "Subsurface Cutoff Walls: Design Considerations in the Application of Ground-Water Recovery Programs", Proceedings of International Water Conference of ESWP, 44th Annual Meeting, October 24-26, 1983, Pittsburgh, Pennsylvania.

Mutch, Jr., R. D., G. DiPippo and J. Hearty, "Environmental Cleanup of the Monroe Township Landfill", Proceedings of the ASCE National Conference on Environmental Engineering, Atlanta, Georgia, July 1981.

Water Related Environmental Fate of 129 Priority Pollutants, USEPA 440/4-79-029a, b., December 1979.

FMC Aquifer Remediation Systems, Site Assessment Report for the Goose Farms Hazardous Waste Site, June 27, 1985.

Wehran Engineering, Supplemental Investigation of the Goose Farm Site, May 1985

Wehran Engineering, Analytical Results, Groundwater Monitoring Wells, Goose Farm Site, March 1985

Wehran Engineering Analytical Results. Soil Samples - Volume 1, Goose Farm Site, March 1985

Wehran Engineering Analytical Results, Soil Samples - Volume 2, Goose Farm Site, March 1985

Wehran Engineering Analytical Results, Soil Samples - Volume 3, Goose Farm Site, March 1985

Wehran Engineering Analytical Results, Soil Samples - Volume 4, Goose Farm Site, March 1985.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
32 E. Hanover St., CN 028, Trenton, N.J. 08625

DR. MARWAN M. SADAT, P.E.
DIRECTOR

LINO F. PEREIRA, P.E.
DEPUTY DIRECTOR

1985

Edward C. Laird, Esq.
Archer & Greiner
One Centennial Square
P.O. Box 3000
Haddonfield, NJ 08033-0968

RE: Morton Thiokol, Inc.
Goose Farm RI/FS

Dear Mr. Laird:

This will acknowledge receipt of your letter of August 26, 1985 to Dr. Berkowitz and the comments prepared by Aware, Inc. relating to the Goose Farm RI/FS. The Department, along with USEPA Region II has developed a Draft Record of Decision (ROD) which outlines the actions to be taken at Goose Farm. The comments submitted by Morton Thiokol and the public were taken into consideration in the formulation of the ROD.

Please be advised that Morton Thiokol's comments were considered despite the fact that they were dated and submitted to the Department after the expiration of the 30 day public comment period.

To start, I would like to point out that Morton Thiokol appears to have, at least in part, misunderstood the purpose of the State's RI/FS. The RI/FS was intended to generally determine the condition of the Goose Farm Site and suggest alternatives for remedial action. Following the selection of an alternative, a detailed design will be developed in order to define the specifics of the chosen alternative. Additional data will be gathered during the design phase as needed. Your comments raise some issues that are to be addressed during the design phase.

Response to Specific Comments on the RI:

1. While the full spatial extent of the plume has not been determined, it is wholly unnecessary to make such a determination in order to find that plume management is required. Additional data concerning the spatial extent of the plume will be developed as needed during the design phase. In any event, such additional data would not alter our selection of the chosen remedial action alternative.

2. Although the total volume of ground water within the plume has not been determined, such a determination is not required at this juncture and would not affect the Department's selection of a remedial action alternative. We intend to gather all additional necessary data to make such estimates during the design phase.

We disagree that no effort was made to establish the volume of groundwater flow within the plume. In fact, all data required for such a determination was included within the RI/FS and was considered.

4. Subsequent to the issuance of the Draft RI/FS, a Supplement to Volume II, Appendix A was provided to the Department by its consultant. This supplemental information provided an additional analysis of the stratigraphy of the site and its impact upon hydrogeologic conditions. I have enclosed this new information with this letter. This information in no way affected our choice of the remedial action alternative.

5. While it is true that contaminant partitioning between ground water and the aquifer skeleton can occur, more than sufficient data exists to establish beyond question that true soil contamination and ground water contamination exist.

6. While it is true that retardation factors were not estimated in the RI/FS, we do not believe that such estimates are necessary and would certainly not alter the Department's selection of a remedial action alternative. We intend to determine actual retardation factors by treatability studies during the design phase.

7. Subsequent to the issuance of the Draft RI/FS, a Supplement to Volume II - Appendix A was provided to the State by its consultant. This supplement provided additional analysis based in part upon work done by Wehran Engineering, including the Wehran geologic and hydrogeologic data from soil borings (see attached Supplement).

8. We disagree that the priority pollutant list is an adequate analytical base for the site. Due to the nature of Thiokol's operation, priority pollutants were not expected to be the only types of contaminants found at the Goose Farm site, and indeed, numerous non-priority pollutant organics not associated with the natural environment were found.

9. We disagree with your assertion that a computer model is in any way necessary in the selection of a remedial action alternative. We believe that more than enough data exists to properly support our choice of the selected alternative.

<u>Specific Comments on the FS</u>:

We disagree that it is necessary to quantitatively define remedial objectives at this time. Ground water quality will be continuously monitored and compared to then existing ground water standards. In the absence of such standards the Department will employ Ames testing and other bioassay techniques to assess risk and determine whether adequate remediation has been accomplished. We agree that in light of the absence of concrete quantitative objectives, our estimate of an 18 month aquifer remediation process could vary. However, we must point out that there are numerous factors which will influence the amount of time required to achieve the desired remediation. Many of these factors cannot be adequately defined prior to additional treatability testing, pump tests and other studies to be performed during the design phase.

In conclusion, we appreciate Morton Thiokol's comments, and encourage your continued participation in striving to achieve a solution to the problems at Goose Farm. Although many of the issues raised are more appropriately addressed during the design phase, we expect to continue our dialogue with you at that time. Morton Thiokol's proposed alternatives are not wholly inconsistent with the chosen alternative and we may further consider your proposals upon the completion of additional studies at the site.

We invite you to contact us regarding the possibility of your performing the remedial work as finally designed.

Very truly yours,

Dr. Marwan M. Sadat, P.E.
Director

RMT:kep