MEMORANDUM

SUBJECT: Recommendation of Selected Remedial Activities at Westinghouse Case Sites

FROM: Valdas V. Adamkus
Regional Administrator

TO: Lee M. Thomas
Assistant Administrator for Solid Waste & Emergency Response

Issue: Regional recommendation of final remedial actions to be undertaken by Westinghouse Electric Corporation pursuant to a proposed Consent Decree at Neal's Landfill, Neal's Dump, Lemon Lane Landfill, Bennett's Dump, Winston-Thomas Treatment Plant and Anderson Road Landfill in and around Bloomington, Indiana.

Background: On January 4, 1983, the United States filed a civil action against Westinghouse pursuant to Section 7003 of the Resource Conservation and Recovery Act and Sections 104, 106 and 107 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 alleging an imminent and substantial endangerment due to the improper disposal of PCBs at two sites in the Bloomington area. During the fall of 1983 Westinghouse expressed its interest in negotiating a settlement of that suit as well as of a civil action filed by the City of Bloomington for improper PCB disposal at two of the sites owned by the City. Since that time, the United States, the State and the City have been engaged in discussions with Westinghouse and have now reached an agreement on the remedy to be included in a proposed settlement. That remedial plan is set forth in the Remedial Summaries attached to this memorandum.
The State of Indiana has been consulted and agrees with the remedy. Settlements have been reached between EPA and the responsible party based on the selected remedy.

Lee M. Thomas
Assistant Administrator for Solid Waste and Emergency Response
DEC 4, 1994

Date
Analysis Reviewed

I am basing my decision on the following documents describing the analysis of remedial alternatives for the above sites in the Bloomington, Indiana area.

1. Summary of Remedial Alternatives Selection (6 documents for each of the six listed sites above).

2. Memorandum dated 8/3/84 from Val V. Adamkus to Lee M. Thomas on "Recommended Action of Selected Remedial Activities at Westinghouse sites".


5. Enforcement Record of Decision, Remedial Alternative Selection, Neal's Dump, signed by Gene A. Lucero 7/22/84.

In addition, I have discussed the issues involved in this case with my staff and considered their recommendations.
Description of Selected Alternatives

1. Excavation of PCB contaminated waste from Neals Landfill, Neal's Dump, Lemon Lane Landfill, Bennett's Quarry, Winston Thomas Sewage Treatment Plant, Anderson Road-Landfill.

2. Excavation of PCB contaminated sediments from Conard's Branch, Richland Creek, Clear Creek, Stout's Creek and Salt Creek.

3. Treatment of PCB contaminated surface water to effluent standard for granulated activated carbon.

4. Design, construction and operation of an incinerator that will meet all RCRA and TSCA requirements.

5. Destruction of excavated waste in the incinerator using municipal refuse from the Bloomington area and other auxiliary fuel; proper disposal of incinerator ash.

6. Interim remedial measures to stabilize the sites until the incinerator is permitted and excavation can begin.

7. Storage of PCB contaminated wastes removed during the interim remedial measures in compliance with TSCA technical requirements.

8. Closure and post closure activities.

9. Ground-water monitoring and provision for providing alternate water where private wells are threatened.

Declarations

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan, I have determined that the above remedy for the Westinghouse sites listed above is a cost-effective remedy that provides adequate protection of public health, welfare and the environment. In addition, the action will require further operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities are a part of the approved action.
Discussion: The remedial plan incorporated in the proposed settlement includes the excavation of PCB contaminated materials at all sites and the incineration of that material in a State and Federally approved facility built by Westinghouse. Westinghouse has agreed to do whatever is necessary to obtain all permits and to guarantee proper performance of the incinerator. The agreement would also include interim remedial controls for each of the sites such as capping, fencing, drainage controls and surface removals. In addition, Westinghouse would be required to remove and incinerate sediment from several streams contiguous to the sites. The proposed agreement would require Westinghouse to properly close each site and undertake post-closure monitoring for a period of up to thirty years. The details of the remedial activities for each site are fully outlined in the attached summary documents. All experts hired for consultation on the case have reviewed the remedial proposal and agree on its appropriateness.

The Waste Management Division and the Office of Regional Counsel have jointly reviewed the proposed remedial settlement and have reached agreement that it is the remedy of choice for these sites. Both of these offices strongly support the proposed settlement which involves excavation and incineration of virtually all PCBs at these sites. The Waste Management Division and Office of Regional Counsel hereby recommend that this proposed remedial settlement be accepted as the most appropriate resolution of the PCB contamination problems in the Bloomington area.
Recommendation: Region V of the U.S. EPA recommends that the remedial activities outlined in the attached summary documents and incorporated in the proposed settlement be accepted by the United States.

VALDAS V. ADAMKUS
REGIONAL ADMINISTRATOR
Region V, United States
Environmental Protection Agency
Enforcement Record of Decision
Remedial Alternative Selection

Site: Neal's Landfill, Bloomington, Indiana

Analysis Reviewed:

I have reviewed the following documents describing the need for and analysis of the costs and effectiveness of remedial alternatives at the Neal's Landfill site in Bloomington, Indiana.

1). Remedial Investigation/Feasibility Study - Neal's Landfill Bloomington, IN
   Daily & Assoc. - July 1983


In addition, I have discussed the issues involved in this case with my staff and considered their recommendations.

Description of Selected Option

The remedial alternative selected by Region 5 has the following features.

- Excavation of all PCB contaminated wastes and disposal pursuant to TSCA regulations
- Permanent cover and revegetation of landfill site after removal of wastes
- Removal of contaminated stream sediments
- Posting of stream, Public Notice, and Monitoring of aquatic life
- Temporary PCB Treatment Facility

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan, I have determined that the removal option described above (System A) for the Neal's Landfill site is a cost-effective remedy, and that it effectively mitigates and minimizes damage to, and provides adequate protection of public health, welfare, and the environment.

______________________________
Gene A. Lucero, Director
Office of Waste Programs Enforcement
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: 19 JUL 1983

SUBJECT: Recommendation of Final Remedial System for Neal's Landfill—
U.S. v. Westinghouse Electric Corporation - ACTION MEMORANDUM

FROM: Valdas V. Adamkus
Regional Administrator

TO: Gene Lucero, Director
Office of Waste Programs Enforcement (WH 527)

Issue: Regional recommendation of final remedy for Neal's Landfill to be
sought in ongoing civil litigation against Westinghouse Electric
Corporation (hereinafter Westinghouse) to be communicated to the
Federal District Court and the Defendant Westinghouse by July 22,
1983.

Background: On January 4, 1983, the United States filed a civil action
against Westinghouse pursuant to Section 7003 of the Resource
Conservation and Recovery Act and Sections 104, 106, and 107
of the Comprehensive Environmental Response Compensation and
Liability Act of 1980 alleging imminent and substantial
endangerment due to improper disposal of PCBs at two sites
near Bloomington, Indiana. Since the filing of the lawsuit,
the U.S. EPA has been engaged in developing a plan for final
remedial measures to be sought at Neal's Landfill. The final
remedy selected by the Region is being sent via this memorandum
to U.S. EPA Headquarters for concurrence.

Discussion: The remedial engineer involved in the litigation has developed
a Remedial Investigation/Feasibility Study for Neal's Landfill
which outlines the elements and costs for several final remedial
alternatives for that site. The opinions of the hydrogeology,
geology and toxicology experts retained for the litigation
as to their ability to support the listing of alternatives
and selection of a specific system were solicited. Those
experts supported the range of alternatives reviewed and
agreed that the alternative preliminarily selected by the
Region addresses the environmental, public health and welfare
concerns present at and near the site. In addition, the
criteria listed in Section 300.68 of the National Contingency
Plan were examined in developing the listing of alternatives
and in initial selection of the remedy to be recommended.

The Waste Management Division and the Office of Regional Counsel
have jointly reviewed the alternatives outlined in the Remedial
Investigative/Feasibility Study and have reached agreement on
the final remedy to be sought in the civil litigation. Both
of those offices support the selection of System A which entails
removal and proper disposal of the waste from the site, capping
the Landfill, treatment of groundwater containing residual contamination after the waste removal, and a program for removal of sediments from nearby streams, posting those streams and a publicity campaign to warn local citizens not to fish in those streams. The Waste Management Division and the Office of Regional Counsel hereby recommend that this remedial system be selected as the appropriate resolution to be sought in the litigation.

Recommendation: Region V of the U.S. EPA recommends that System A be selected as the final remedy the United States will seek in the civil litigation against Westinghouse. I would appreciate expedited consideration of this recommendation.

[Signature]

VALDAS V. ADAMKUS
REGIONAL ADMINISTRATOR
Region V, United States Environmental Protection Agency

Attachment
Three alternative systems were developed which address the leakage of PCB contaminants from the landfill, the off-site contaminated soils, and the off-site contaminated aquatic life in Conard's Branch and Richland Creek. In addition, the ground water movement under the site in and near the base of the waste was evaluated with respect to possible response action. All alternative systems were developed with the expectation that contaminant levels were to be reduced to 1.0 parts per million of PCB in soils and 0.1 parts per billion in surface and ground waters.

The three alternatives are:

System A.  Removal of all wastes from the landfill site; installation of a permanent cover over the base of the landfill and exposed bedrock; removal of contaminated stream sediments from Conard's Branch and Richland Creek, surface water drainage control and revegetation; public announcement and posting of Conard's Branch and Richland Creek; and treatment of water transporting residual contaminants left in soil overburden and in the fractured bedrock. Present worth of System A - $47,846,000.

System B.  Installation of a permanent cover over the landfill (waste remains in place); construction of a deep interceptor trench to intercept and control the water table and storm flows affecting the landfill; treatment of ground water discharged from beneath the landfill; removal of contaminated stream sediments in Conard's Branch and Richland Creek; public announcement and posting of Conard's Branch and Richland Creek; surface water drainage control and revegetation; and additional security fencing. Present worth of System B - $23,152,000.

System C.  Installation of a permanent cover over the landfill (waste remains in place); treatment of ground water discharged from beneath the landfill; removals of contaminated stream sediments in Conard's Branch and Richland Creek; public announcement and posting of Conard's Branch and Richland Creek; surface water drainage control and revegetation; and additional security fencing. Present worth of System C - $15,373,000.
Enforcement Record of Decision
Remedial Alternative Selection

Site: Neal's Dump, Bloomington, Indiana

Analysis Reviewed: I have reviewed the following documents describing the need for, and analysis of costs and effectiveness of remedial alternatives at the Neal's Dump site near Bloomington, Indiana.

1. Remedial Alternatives Assessment - Neal's Dump Bloomington, IN, Daly & Assoc. - July 1983

In addition, I have discussed the issues involved in this case with my staff and have considered their recommendations.

Description of Selected Option:

The remedial alternative selected by Region 5 has the following features:

- Permanant Capping of Site
- Surface Water Drainage Control
- Post Closure Monitoring
- Phased Installation of slurry cut-off wall with leachate collection and treatment if post-closure monitoring so indicates.

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan, I have determined that the phased capping, monitoring and waste isolation option (System C) for the Neal's Dump site is a cost-effective remedy, and that it effectively mitigates and minimizes damage to, and provides adequate protection of public health, welfare, and the environment.

Gene A. Lucero, Director Office of Waste Programs Enforcement (WH-527) 7/27/83
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: JUL 20 1983


FROM: Valdas V. Adamkus
Regional Administrator

TO: Gene Lucero, Director
Office of Waste Programs Enforcement (WH 527)

Issue: Regional recommendation of final remedy for Neal's Dump to be sought in ongoing civil litigation against Westinghouse Electric Corporation (hereinafter Westinghouse) to be communicated to the Federal District Court and the Defendant Westinghouse by July 22, 1983.

Background: On January 4, 1983, the United States filed a civil action against Westinghouse pursuant to Section 7003 of the Resource Conservation and Recovery Act and Sections 104, 106 and 107 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 alleging an imminent and substantial endangerment due to improper disposal of PCBs at two sites near Bloomington, Indiana. Since the filing of the lawsuit, the U.S. EPA has been engaged in developing a plan for final remedial measures to be sought at Neal's Dump. The final remedy selected by the Region is being sent via this memorandum to U.S. EPA Headquarters for concurrence.

Discussion: The remedial engineer involved in the litigation has developed a Remedial Alternatives Assessment for Neal's Dump which outlines the elements and costs for several final remedial alternatives for that site. The opinions of hydrogeology and geology experts retained for the litigation as to their ability to support the listing of alternatives and selection of a specific system were solicited. Those experts supported the range of alternatives reviewed and agreed that the alternative preliminarily selected by the Region addresses the environmental, public health and welfare concerns present at and near the site. In addition, the criteria listed in Section 300.68 of the National Contingency Plan were examined in developing the listing of alternatives and in initial selection of the remedy to be recommended.

The Waste Management Division and the Office of Regional Counsel have jointly reviewed the alternatives outlined in the Remedial Alternatives Assessment and have reached agreement on the final remedy to be sought in the civil litigation. Both of those offices support the selection of a phased System C approach which entails capping of the site, fencing, and a monitoring program to determine if PCB contamination is
migrating in the groundwater from the site. If the monitoring program indicates that contamination is in fact leaving the site, the phased System C approach will require that a slurry wall be installed and additional monitoring be undertaken to assess hydraulic head conditions. If hydraulic head conditions threaten the integrity of the slurry wall, requirements for a purge and mobile treatment system would be activated. The Waste Management Division and the Office of Regional Counsel hereby recommend that this phased remedial system be selected as the appropriate resolution to be sought in the litigation.

Recommendation: Region V of the U.S. EPA recommends that the phased System C remedial plan be selected as the final remedy the United States will seek in the civil litigation against Westinghouse. Should the U.S. EPA obtain a settlement or order requiring installation of all elements of phased System C contemporaneously that would be acceptable to the Agency. I would appreciate expedited consideration of this recommendation.

VALDAS V. ADAMKUS  
REGIONAL ADMINISTRATOR  
Region V, United States Environmental Protection Agency

Attachment
ATTACHMENT

Three alternative systems were developed which address the potential for migration of PCB contaminants from the Neal's Dump site. In addition, the ground water movement through the waste was evaluated with respect to possible response actions. All alternative systems were developed with the expectation that contaminant levels greater than 1.0 parts per million of PCB in exposed or potentially exposed soils and 0.1 parts per billion in surface and ground waters is to be prevented.

The three alternatives are:

System A. Removal of all wastes from the Dump site; transportation and proper redispal; refilling of excavation with soil and grading; surface water drainage and erosion control and revegetation; removal of security fencing; and roadway work; and monitoring. Present worth of System A - $3,410,000.

System B. Installation of a permanent cover over the Dump (waste remains in place); construction of a slurry wall as a barrier to ground water flowing laterally through the buried refuse; provisions for wells for future leachate collection, if needed; surface water drainage and erosion control and revegetation; and security fencing modifications and roadway work. Present worth of System B - $419,500. If the leachate treatment system is needed add $82,000 to the present worth figure: the total would then be $479,500.

System C. Installation of a permanent cover over the Dump (waste remains in place); surface water drainage and erosion control and revegetation; roadway work; installation of monitoring wells and implementation of a monitoring program. Present worth of System C - $220,000.

If the monitoring program so indicates, a second phase of System C would be required. That phase would include installation of a slurry wall through the existing cover and additional monitoring. Total capital cost for this phase - $265,000.

If phase two monitoring indicates the need for purge and treatment of leachate within the con-
tainment structure, phase three would entail the use of a mobile treatment unit. The cost of that element would be $82,000.

If all contingencies are met the total cost for a phased System C would be $567,000.
REMEDIAL ALTERNATIVES
ASSESSMENT
NEAL'S LANDFILL
BLOOMINGTON, INDIANA
REMEDIAL ALTERNATIVES ASSESSMENT

NEAL'S LANDFILL
BLOOMINGTON, INDIANA

PREPARED FOR:
U. S. ENVIRONMENTAL PROTECTION AGENCY
EEI CONTRACT TDD NO. R5-8302-07A

July 1983
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to be Posted, Patroled & Monitored

Figure 3 Extent of Conard's Branch & Richland Creek
to be Posted, Patroled & Monitored

Drawing System "B" Alternative
SECTION I INTRODUCTION

1.0 Scope

This report is the result of an evaluation of alternative remedial actions for Polychlorinated Biphenyl (PCB) contamination at the Neal's Landfill site, west of Bloomington, Indiana, located in a part of the South Half of Section 33, Township 9 North, Range 2 West, 2nd Principal Meridian, Monroe County. The site is the subject of a litigation effort by the U.S. Department of Justice against the Westinghouse Electric Corporation.

Continuing discharge of PCB from the site establishes the need to proceed toward implementation of remedial measures as soon as feasible. Accordingly, this report has been prepared on a "fast track" procedure. Basic water quality; ground water gradient - elevation, and combined ground water - surface water discharge monitoring is continuing. This study has been performed with reliance upon review of assorted field data and other information in rough form collected to date without re-presentation of summaries and data compilation available in other forms. Data evaluation, conclusions and professional judgments have been accomplished primarily through exchange of hard copy data and verbal interaction between members of the investigation team. Additional field data becomes available beyond the drafting of this report, comparisons will be made with that data available to date to determine if modifications of conclusions and professional judgments are warranted. Reference is made where appropriate to the respective data sources via footnotes.

The evaluation of remedial actions was based on the approach prescribed in Section 300.68 of the National Oil and Hazardous Substances Pollution Contingency Plan (Federal Register, Part V EPA, July 16, 1982).

1.1 Project Investigative Team

A team of experts and consultants consisting of:

- Daily & Associates, Engineers, Inc.
- P.E. LaMoreaux & Associates
- Geosciences Research Associates, Inc.
- R.A. Griffin and Associates
- Ecology and Environment, Inc.
- U.S. Environmental Protection Agency

provided technical evaluation and input into this study.
1.2 Data Sources

Data considered during the evaluation process included:

- results of analyses of water and sediment samples taken from Conard’s Branch, Richland Creek and various springs and seeps at the site;
- results of analyses of samples and water level measurements obtained at various monitor wells at the site;
- results of analyses of soil and vegetation samples at the site;
- results of analyses of aquatic life in Conard’s Branch and Richland Creek;
- observations and measurements of rainfall and flows at springs and seeps at the site;
- geophysical information regarding the location of disturbed areas at the site;
- opinions of experts regarding the geology and hydrogeology of the site;
- affidavits from toxicologists, health experts and U.S. Fish and Wildlife personnel.

1.3 Characteristics

Levels of PCB contamination in the monitoring wells and springs adjacent to the site have been identified in levels up to 9.8 parts per billion (ppb). Soil samples collected on site showed PCB levels of 219,000 parts per million (ppm). Stream sediments in Conard’s Branch and Richland Creek ranged from 2.0 to 68 ppb PCB. PCB levels in water samples from Conard’s Branch have approached 1.0 ppb (excluding springs). Samples of aquatic life from Conard’s Branch and Richland Creek exhibited PCB levels up to 279 ppm. Samples of vegetation from the site have contained PCB levels as high as 1118 ppm.
SECTION II  PRELIMINARY REMEDIAL ACTION MEASURES

2.0 General

Prior to the commencement of the study regarding possible final remedial actions, it was determined that certain initial remedial measures were feasible and necessary to limit exposure or threat of exposure to a significant health or environmental hazard. (1)

This determination was made based upon various field observations and analytical test results, which revealed the following:

- there is an actual or direct potential contact with the PCB contaminant by nearby population and local animal life;
- there is no effective drainage control system to prevent the runoff of PCB contaminants;
- visible PCB laden capacitors and capacitor paper and PCB stained soils are present on the landfill site at or above ground surface which poses a serious threat to the public health and the environment;
- conditions are such that normal rainfall events upon the landfill may cause the PCB contaminants to migrate from the site to pose a threat to the public health and environment.

2.1 Preliminary Remedial Measures

The United States and Westinghouse Electric Corporation have engaged in extensive discussions regarding preliminary remedial measures to be implemented at the site. In general, the remedial measures discussed include:

- removal of exposed capacitors, capacitor paper and certain soils in close proximity to exposed capacitors, and disposal of the removed materials in appropriate facilities;
- clearing of vegetation from areas where cover and grading activities are to be performed;
- application of cover material in designated areas so that a full two feet of clay loam will exist above the waste in such areas;
- grading specified areas of the site to minimize erosion from surface drainage on the fill area;
- seeding of disturbed areas so that a full coverage of perennial vegetative growth is established and maintained;
- implementation of erosion control measures to include surface water diversion ditches and erosion control fences;
- implementation of dust control measures;
- provision of a chain-link security fence around the site to restrict access, and posting of warning signs.

In addition to the above-referenced measures, the parties have discussed supplementary conditions regarding preconstruction meetings, the role of the federal on-scene coordinator, site security, decontamination procedures, safety procedures and maintenance.
For purposes of this report, it has been assumed that the preliminary remedial measures discussed by the parties will shortly be implemented. Should this not occur, it would be necessary to modify certain elements of the final remedies evaluated in this report and to make corresponding adjustments in the costs of the systems evaluated.
Footnotes


(2) United States of America and Environmental Management Board of the State of Indiana versus Westinghouse Electric Corporation and Monsanto Company, proposed Exhibit A to Stipulation and Order in the United States District Court for the Southern District of Indiana, Indianapolis Division, No. IP-83-9-C, draft of June 8, 1983
SECTION III - FINAL REMEDIAL ACTION SELECTION AND SCREENING

3.0 General

3.0.1 Appropriateness of Remedial Action Measures - Remedial action measures generally are contained in three categories: one, the no-action alternative; secondly, a source control or on-site remedial action; and thirdly, an off-site remedial action.

In general, "source control remedial actions may be appropriate if a substantial concentration of hazardous substances remain at or near the area where they were originally located and inadequate barriers exist to retard migration of substances into the environment." Criteria normally used to assess the source control remedial action alternatives are: one, extent to which substances pose a danger to public health, welfare or the environment, considering factors such as population at risk, amount and form of substance, hazardous properties of substance, hydrogeological factors, and climate; two, extent of migration of contaminant; three, previous experiences and approaches; four, environmental effects and welfare concerns. (1)

Off-site measures typically will address contamination that has migrated beyond the area where the hazardous substances were originally located. These "measures may include provision of permanent alternative water supplies, management of a drinking water aquifer plume or treatment of drinking water aquifers. The following criteria are generally used in determining whether and what type of off-site action should be considered": one, air, land and water pollution; two, migration of pollutants; and if an actual or potential danger may be posed - three, extent and adequacy of existing barriers; four, extent to which substances pose a danger to public health, welfare and the environment which can include population at risk, amount and form of the substance present, hazardous properties of the substance, hydrogeological factors, and climate; five, previous experiences; and six, environmental effects and welfare concerns. (2)

3.0.2 Development of Alternatives - The alternatives developed for study in the initial screening process were selected depending upon the remedial action that was deemed appropriate considering the criteria indicated in Section 3.0.1. They include both source control and off-site remedial action.

3.0.3 Factors Considered in Initial Screening of Alternatives - In order to identify the list of potential remedial actions for further detailed analysis, three broad criteria were used in the screening process: 1) the cost of installing and implementing the remedial action, including operation and maintenance costs where appropriate; 2) positive and adverse effects on the environment from the alternative itself, including implementation, or whether the alternative would be likely to achieve adequate control of source material, or for off-site remedial actions, would effectively mitigate or minimize the threat of harm to public health, welfare or the environment. Generally, only those alternatives that effectively contributed to the protection of the public health, welfare or the environment were considered in further detailed analysis; 3) the alternatives should be feasible for the location and conditions of the release, applicable to the problems and represent a reliable means of addressing the problem.
The alternatives selected for initial screening, where appropriate, were subjected to cost evaluations utilizing existing cost curves and cost data from various EPA referenced publications and traditional construction cost data books, such as "Means" and "Dodge." Where necessary, these reference sources had their costs updated to 1983 dollars utilizing the Engineering News Record Construction Cost Index History. Where adequate reference material on general cost data was not available, figures were generated using interviews with knowledgeable persons and personal experience.

3.1 No Action Alternative

The no action alternative was considered, but is not believed to be a viable possibility since the current situation poses a much greater environmental or health danger than any remedial action considered during the initial screening of alternatives phase. PCB contamination has been noted in the abandoned landfill and is leaking from the site such that appreciable levels of PCB have been found up to several miles away. The migration of PCB's has been found in the surface and ground waters and soil sediments of Conard's Branch and portions of Richland Creek. In addition, from affidavits taken in December, 1982, PCB's have been noted in aquatic fish and crayfish and potentially in nearby wildlife. Since the Richland Creek area is a source of recreation fishing by local individuals, a potential bio-accumulation of PCB's in humans through consumption of the contaminated fish life exists.

3.2 On-Site Remedial Actions

The following is a listing of those on-site remedial action alternatives developed and considered in the initial screening process. Note that while the cost and effects of the alternatives as well as acceptable engineering practice are the three broad criteria which should be used in the screening process, it wasn't necessary to consider all three in detail for each alternative. Upon initial investigation it was found that some alternatives would have either adverse environmental effects; little effect in minimizing or mitigating the harm to the environment; were deemed inadequate; or acceptable engineering practices have not been developed to date to allow implementation of the process. For purposes of definition in this screening process, those actions termed "on-site" or "source control" are deemed to be those actions occurring immediately adjoining to or inside the security fencing to-be constructed as a Preliminary Remedial Action Measure.

On-Site Remedial Action Alternatives

A) Remove all refuse and contaminated soil from the landfill
B) Remove only PCB contaminated refuse and soils
C) Install permanent cap on landfill
D) Surface water drainage control, grading and revegetation
E) Install impermeable barrier around and under site, include the treating of leachate
F) Flush the landfill and treat the resultant discharge to remove contaminants
G) Security fence
H) Leachate collection system
I) In-situ treatment of waste and soil
J) Ground water drainage enhancement
3.3 Off-Site Remedial Action Alternatives - The following is a listing of those alternatives developed for consideration in the screening process. As indicated in Section 3.2, it was deemed not necessary to consider in detail all three criteria of costs, effects and engineering practice.

**Off-Site Remedial Action Alternatives**

A) Surface water drainage control, grading and revegetation
B) Interceptor trench to lower water table (nominal base flow in South Spring retained)
C) Impermeable barrier upgradient with ground water diversion drains
D) Impermeable barrier downgradient and treatment of ground water and leachate
E) Remove and properly dispose of contaminated stream sediments
F) Treatment of surface and ground water leaving site
G) Public announcements, posting and monitoring of Conard's Branch and Richland Creek
H) Elimination of aquatic life from Conard's Branch and portions of Richland Creek

3.4 Screening of Alternatives - The initial alternatives developed had estimated costs ranging from $0.2 Million to $113.6 Million with varying degrees of effectiveness in mitigating or minimizing the hazard.

The preliminary remedial action measures had some effect on the screening of the final measures in that drainage control, grading, revegetation and security fencing that are expected to be in place are effective for their purpose and did not require further study at this time. It was sufficient to indicate that their ultimate fate will be either tied to other alternatives as complimentary work items or need retrofit and maintenance to conform to the final recommended plan.

Some alternatives were deemed to be very limited in effectiveness or have doubtful constructability. In some instances, development of cost estimates for screening was not warranted; i.e., in-situ microbial treatment of soil and waste and leachate collection system. For additional information regarding the various alternatives, see Appendix 1.

The screening process revealed that no one alternative action would be able to contain or eliminate the pollutant discharge and its subsequent contaminated areas. It was obvious that a system of actions would be necessary to provide a proper response. Therefore, those alternatives which survived the effectiveness, constructability, and order of magnitude of cost tests were studied for the purpose of developing a system of action to be considered in detail.
Footnotes


(2) Ibid, p. 31216

(3) Ibid, p. 31216


SECTION IV - ANALYSIS OF ALTERNATIVES

4.0 Alternative Systems Subjected to Detailed Evaluation

Three alternative systems were developed which address the leakage of PCB contaminants from the landfill, the off-site contaminated soils, and the off-site contaminated aquatic life in Conard's Branch and Richland Creek. In addition, the ground water movement under the site in and near the base of the waste was evaluated with respect to possible response actions. All alternative systems were developed with the expectation that contaminant levels were to be reduced to 1.0 parts per million of PCB in soils and 0.1 parts per billion in surface and ground waters.

The three alternatives that received detailed evaluation were:

. System A. Removal of all wastes from the landfill site; installation of a permanent cover over the base of the landfill and exposed bedrock; removal of contaminated stream sediments from Conard's Branch and Richland Creek; surface water drainage control and revegetation; temporary modification of and later removal of security fencing; public announcement and posting of Conard's Branch and Richland Creek; and treatment of water transporting residual contaminants left in soil overburden and in the fractured bedrock.

. System B. Installation of a permanent cover over the landfill (waste remains in place); construction of a deep interceptor trench to intercept and control the water table and storm flows affecting the landfill; treatment of ground water discharged from beneath the landfill; removal of contaminated stream sediments in Conard's Branch and Richland Creek; public announcement and posting of Conard's Branch and Richland Creek; surface water drainage control and revegetation; and additional security fencing.

. System C. Installation of a permanent cover over the landfill (waste remains in place); treatment of ground water discharged from beneath the landfill; removal of contaminated stream sediments in Conard's Branch and Richland Creek; public announcement and posting of Conard's Branch and Richland Creek; surface water drainage control and revegetation; and additional security fencing.

Note: reference in this section to TSCA refers to Toxic Substances Control Act; RCRA refers to Resource Conservation and Recovery Act.
4.1 Assumptions

Developing the details of the three final alternatives systems required numerous assumptions. Assumptions common to more than one of the alternatives were made regarding the following topics:

- Factors considered in the evaluation
- Accuracy of cost estimate
- Economic analysis
- Grading of permanent covers
- Ground water movements and volumes
- Infiltration through waste
- Fluid of decomposition and leakage
- Surface water drainage controls
- Soil stabilization
- Land and easements

4.1.1 Factors Considered in the Evaluation (1) included detailed refinements and specifications of the alternative systems; detailed cost estimates including distribution of costs over time; capability for engineering implementation or constructability; to what extent the alternative is expected to effectively mitigate and minimize damage to, and provide protection of public health, welfare, and the environment relative to other alternatives; and adverse environmental impacts.

4.1.2 Accuracy of Cost Estimates - The cost estimates are intended solely for comparison of the alternatives. The final cost of the selected remedial action will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project cost will probably vary from the estimates presented in this report.

4.1.3 Economic Analysis - All costs are at mid-1983 price levels. Interest during construction and price escalation are not included in the analysis. Project costs do not include sales tax, use tax, licensing or permit fees. A contingency amounting to 10% was applied to each alternative studied. The project life for Systems "B" and "C" were set at 30 years, although it is conceivable that operational and maintenance costs could be incurred beyond that period. Due to the complete removal of all waste in System "A", reoccurring annual costs will depend upon how long residual contaminants are present. A period of 7 years was assumed in this case.

Annual operation and maintenance costs developed for each system studied are in terms of 1983 dollars and generally consist of the following categories:

- Costs for operating an activated carbon treatment plant with supplemental treatment units, disposal of sludge and spent carbon.
- Costs to maintain and repair damage to the surface water drainage control features, fencing and revegetation.
- Costs to maintain public awareness, patrolling of affected streams and yearly testing of aquatic life for levels of PCB contamination.
- Costs to monitor the effectiveness of the remedial action for the life of the project on a quarterly basis.
In addition to operation and maintenance expense, Systems "B" and "C" include an allowance for replacing equipment during the life of the project. Generally, the useful life for components of a treatment plant can be expressed as follows: (2)

- Land - permanent.
- Waste water conveyance structures (includes collection systems, outfall pipes, interceptors, force mains, tunnels, etc.) - 50 years.
- Other structures (includes plant building, concrete process tankage, basins, lift stations structures, etc.) - 30-50 years.
- Process equipment - 15-20 years.
- Auxiliary equipment - 10-15 years.

Noting that nearly half of the treatment facilities consist of process and auxiliary equipment, a 15 year life was assumed for half the plant cost with the remainder of the cost having a useful life of 30 years or more.

The annual O&M and capital replacement costs were then evaluated using their present value. A present value analysis compares alternative future cash flows of a project on a common basis (i.e., in 1983 dollars). This common basis is obtained through adjusting future dollars by applying a factor called the discount rate (10%). The discount rate is based on the value of having the use of money now instead of in the future.

4.1.4 Grading of Permanent Covers - Because of the need to prevent ponding of water on fill materials and minimize the possibilities of soil erosion, it was assumed that the cover material called for in Systems B and C would be designed and constructed such that the north and south slope faces of the landfill would be no steeper than 5(H):1(V) and that the top of the cover fill material would have a grade of no less than 5%. Additional grading is anticipated to maintain sheet flow of runoff waters rather than allow it to concentrate.

4.1.5 Ground Water Movements and Volume - The general direction of ground water movement at the site is in a northwesterly direction and consists of a shallow ground water system which comes into contact with the buried refuse (3) and contributes to the average base flow of 0.5 CFS (4) at South Flume. The main aquifer is a deeper ground water system located in the fractured and cavernous bedrock which transmits the larger volumes of water observed during storm events. (Discharges of 62 CFS have been extrapolated at South Flume.) (3) (4) Water levels measured in monitoring wells indicate that the water table rises to within a few feet of the base of the landfill refuse. (3) A combination of these events concerning the two ground water systems allows for generation and transport of PCB laden leachate from the landfill by the ground water with a resultant discharge of liquid and sediment in South Spring and Conard's Branch. (3) Levels of 1.7 to 7.0 parts per billion in the spring discharge have been noted. (5)
The above factors were utilized in determining what remedial actions were to be applied to each system alternative studied; i.e., treatment plant sizing, interceptor trench to control ground water movement and volumes, permanent cover and surface water drainage controls.

4.1.6 Infiltration Through Refuse - Precipitation falling on the surface of waste or its cover which infiltrates through the waste produces a leachate.

4.1.7 Fluid of Decomposition and Leakage - Materials and containers containing fluid release the fluid over time and the decaying of refuse generates a fluid, both of which produce a leachate.

4.1.8 Surface Water Drainage Control - The primary purpose of the drainage control is to prevent surface runoff resulting from precipitation events from coming in contact with the landfill area. This was deemed necessary to prevent erosion of the permanent cover materials and contributions to the moisture levels in the refuse itself. Because of time constraints and limited information on local soil erosion rates, no detail study was conducted regarding stabilization of drainage channel beds, slopes or control of erosional stream velocities. There are various ways available to stabilize these drainage ways. General cost allowances were made in the cost estimates for these yet to be determined measures.

4.1.9 Soil Stabilization All soils disturbed during construction of the system alternatives were assumed in the cost estimates to be stabilized by seeding with native grasses that grow without supplemental watering. Other procedures are possible, but time constraints and limited information on local soil erosion rates were not available. It is recommended that in the final design stages of this project that the local Soil Conservation Service (USDA) be consulted regarding recommended grasses, rates, and protection to maximize the vegetative cover growth and long term protection of upper soil layers.

4.1.10 Land and Easements - In addition to the land occupied by the landfill and enclosed by the preliminary remedial action measures, land will be needed for the activated carbon treatment facility (3.0 acres more or less). Furthermore, easements for installation of pipe lines and stream sediment removal operation will be needed. Since not all of the affected property owners have yet been identified and in the case of stream sediment removal the areas requiring easements depend upon additional sampling surveys to determine scope of construction activity, these easement areas are not identified in this report. Consideration of this aspect will have to be made in later stages of the project. No costs were assigned to the project cost summaries for the system alternatives at this time.

4.2 System "A" Alternative

System A involves the complete removal of all wastes from the landfill site and its disposal at proper facilities. Additional supplementary actions are anticipated to cleanup or mitigate contaminated areas on and off site.
4.2.1 System "A" Assumptions

- There will be no further residential, commercial or agricultural use of the site.
- Suitable borrow material for permanent cover material will be found within 5 to 10 miles of the site.
- Adequate capacity is available at EPA approved landfill sites meeting TSCA or RCRA criteria and EPA approved PCB incinerator facilities to handle the volumes of waste from Neal's Landfill.
- Adequate transportation will be available to handle the waste removed from the site in a timely manner.
- Capacitor body dimension and weights are such that two capacitors with associated small parts and paper may be placed in a 55 gallon storage drum for transportation to the incinerator facility.
- Capacitors in 55 gallon drums may be stockpiled on site until truckload quantities are generated.
- The working face of the refuse excavation will be kept to the smallest area possible to minimize nuisance odors. In addition, the working face will be protected (i.e., sheltered) during excavation and when excavation has halted to minimize erosion or intrusion of rain or surface waters.
- Work done on and off site will be done in level B and C protective clothing and equipment.
- Normal landfilling procedures will be taken to control blowing dust and waste debris.

4.2.2 System "A" Detailed Description - The initial phase of work anticipated under the System "A" alternative will consist of the initiation of the following work items:

- Securing necessary permits.
- Commencement of waste removal by excavation.
- Loading, transportation and disposal of waste in respective EPA approved sites.
- Posting of Conard's Branch and Richland Creek for 6.0 miles downstream.
- Beginning of Public Notice regarding prohibition of fishing or body contact in the affected waters and commencement of patrolling the stream.
- Removal of contaminated stream sediments from Conard's Branch and selected portions of Richland Creek to the Whitehall Bridge area.
- Commence surface water and drainage control items.

The second phase consists of initiating the design and construction of the PCB treatment facility so that it will be ready for operation about the time all the waste has been removed from the landfill. Work includes extension of the security fence and construction of a plant access road.

The final phase of work consists of:

- Placing the permanent cover over the base of the excavated landfill.
- Revegetation.
- Removal of fencing around landfill site.
- Startup of treatment facilities.
- Removal of contaminated stream sediments accumulated during the construction period.
The cost presented for removal and disposal of refuse considered that all waste would go to an EPA approved disposal site meeting TSCA criteria. The capacitor units, paper and parts would be barrelled and then incinerated at a facility approved by EPA for PCB destruction. Investigation of available data obtained by field surveys and available aerial photos during the period of 1939 and 1983 indicates that capacitors, contaminated soil and capacitor paper are in random and unpredictable areas throughout the site. Further correlation of capacitor disposal dates with aerial photos of the site, supplemented by use of a geophysical technique such as "ground truth radar" in a grid pattern, appears to be feasible as a means of identifying, without excavation, fill areas which do not contain buried capacitor casings. If analyses of refuse samples taken from such areas demonstrate that fill materials in such areas have not been contaminated by migration of PCB leachate or fluids, the need to remove waste from such areas would be eliminated and the cost of implementing System A would be reduced accordingly. The approximate cost of the "ground truth radar" survey, including interpretation, is $26,000. Also it is possible that during the excavation phase, with the use of a field laboratory and excavation techniques, the material could be classified according to levels of contamination. Materials having concentrations less than 50 ppm but more than 1.0 ppm PCB may be eligible for disposal in an EPA approved landfill meeting RCRA criteria at lower unit costs.

Erosion control and sediment containment construction procedures are expected during the excavation process to minimize PCB releases to Conard's Branch.

Surface water drainage control measures generally consist of providing for permanent diversion of runoff waters on the eastern and southeastern edge of the site to prevent their contact with the excavation process and the possible erosion of the permanent cap. Additional work consists of cleaning out of a swallow hole near the cattail pond on site and filling in of the pond area to prevent future ponding of waters.

Prior to the removal of contaminated stream sediments, a field survey with soil sample collection and testing of Conard's Branch and Richland Creek areas is needed to determine the extent of soils containing greater than 1.0 ppm of PCB that must be removed. These contaminated soils will be disposed of in EPA approved landfills as discussed in the refuse excavation section. Since sediments in a liquid state are difficult to handle, transport and dispose, those collected along Richland Creek may need to be de watered via a sediment basin or by other means prior to transporting. A second removal process is anticipated to follow the placement of the permanent cover and startup of the treatment facility. This is necessary since additional discharge of PCB from the site is expected during the excavation process due to sediment runoff and contaminated ground water flowing from South Spring.

A permanent cover is to be placed over the excavated landfill. The purpose of this cover is to minimize exposure of the landfill base to infiltration of precipitation. The cover design anticipated is a four foot thick blanket of clay loam material over the top of the landfill base, compacted in 6 inch lifts to 90% of Standard Proctor density (ASTM D-698) within the range of 3% less to 3% more than the optimum water content. It is assumed one foot thickness of the existing cover is salvageable for reuse on site for this final cover.
A treatment facility is also planned to remove the residual PCB contaminants discharged from the remaining overburden and fractured bedrock through South Spring. Current estimates of the plant’s hydraulic capacity is 1.5 CFS which was selected to handle three times average base flow from South Spring. Flows in excess of this value would be bypassed. PCB loading concentrations and the length of time treatment will be necessary are unknown. For the purpose of this report, concentrations are expected to be at the same levels currently evidenced and continue for a period of seven years until the last of the contaminants are flushed out.

The facility is located along the western edge of the existing landfill and generally consists of the following components:

- Pump stations with underground piping.
- Sedimentation tanks.
- Sand filtration system.
- Carbon absorption reactors.
- Control building with monitoring and testing facilities.
- Standby power facilities.
- Sludge dewatering beds.

Included in the cost is a small pumping facility to collect waters from Southwest Seep (located in the southern edge of the landfill) for treatment. The sedimentation tanks and sand filters are provided to remove suspended sand and sediment material collected at the springs prior to carbon absorption. Sediment sludge and spent carbon will be contaminated with PCB and will have to be disposed of, on a periodic basis, in a manner depending upon their PCB loads.

In addition to removing PCB to a level approaching 0.1 ppb, the facility will also remove any organic compounds found in the spring waters. A pilot study regarding carbon treatment in the final design to enable carbon selection and reactor vessel sizing is expected.

The total estimated capital cost for the System A alternative is $46,280,000. This is the most expensive of the three alternatives. Anticipated present worth of the project including post construction cost disbursements is $47,844,000. Length of project construction is estimated at 3.5 years, more or less.

4.3 System "B" Alternative

System B involves leaving the waste in place, treating the contaminated waters discharging from the spring, ground water control, permanent cover, removal of off site contaminated soil samples and additional supplementary remedial actions.

4.3.1 System "B" Assumptions

- There will be no future residential, commercial or agricultural use of the site.
- Suitable borrow material for the permanent cover material will be found within 5 to 10 miles of the site.
- Work done on and off site in contact with PCB contaminants will be in Level C protective clothing and equipment. Non-contact work such as treatment plant or interceptor trench construction will utilize normal construction safety and health precautions.
- Work areas where soil fill is to be applied will be grubbed and/or cleared of vegetative matter.
Standard construction techniques will be utilized to control blowing dust and soil erosion from the working areas until revegetative procedures are completed.

Adequate capacity is available at EPA approved landfills meeting TSCA or RCRA criteria for the stream sediments to be disposed.

Adequate transportation will be available to handle the stream sediments removed in a timely manner.

**4.3.2 System B - Detailed Description** - The initial phase of work anticipated under the System B alternative will consist of simultaneous initiation of the following work items:

- Secure applicable permits.
- Commencement of the permanent cover installation.
- Commencement of the treatment facility construction.
- Commencement of removal of stream sediments that are PCB contaminated.
- Post affected receiving stream, issue public notices regarding prohibition of fishing or body contact with the waters, and commence patrolling the streams.
- Commence surface water and drainage control items.
- Commence construction of the ground water interceptor trench.

The second phase includes installation of additional security fencing when construction progresses sufficiently and revegetation of disturbed areas.

Following the startup of the treatment facilities and completion of the previously stated work items, undertake a second stream sediment removal operation to remove accumulated PCB's during construction.

A permanent cover is to be placed over the landfill, 17.3 acres, whose purpose is to minimize exposure of the refuse to infiltration or precipitation. It is anticipated that up to two-foot thickness of clay loam material will be existing on the landfill from the preliminary remedial action undertaken. This layer shall be cleared of vegetative matter and proof rolled. Approximately one foot of additional clay loam material shall then be applied and compacted to bring the clay loam layer to a thickness in excess of two-foot. Next, a two-foot thick blanket of granular drain material with drainage pipe to convey collected seepage away from the underlying clay loam shall be placed across the 17.3 acres. Then, a two-foot thick layer of clay loam material shall be placed to provide the top of the cover. The north and south landfill faces shall be filled and graded to the minimum slopes stated earlier in this report. For every 100 feet of slope distance on these north and south faces, an interceptor ditch shall be placed across the slopes to collect and convey away surface waters. All clay loam materials shall be placed in 6-inch lifts and compacted to 90% of Standard Proctor density (ASTM D-698) within a range of 3% less to 3% more than the optimum water content.

The ground water interceptor trench construction is to control and divert ground water entering the landfill site from the easterly and southerly boundaries. The precipitation induced ground water flow will be collected upgradient which will reduce the hydraulic load on the treatment facilities and reduce the ground water level fluctuations near the landfill base.
Two criteria are considered. One, interception of the predominant crevices and solution cavities upgradient from the landfill is necessary. Two, preservation of a continuous discharge at South Spring near the present base flow rate is a secondary goal to enable collection of contaminants which continue to migrate from the landfill. For cost estimating purposes, the trench design is based on gravity flow to a surface discharge near North Spring from an assumed upgradient floor elevation 729 and a six-foot bottom width. Mostly rock excavation (with explosives) is anticipated. Owing to the fractured and cavernous nature of the limestone bedrock, it should be obvious when the main ground water solution cavities or crevices are encountered. It is expected that an exploratory program would be conducted in conjunction with construction to confirm what actual depth of trench is required to meet the objectives stated above. A concrete pipe or formed concrete tunnel is then placed in the trench connected to these ground water sources. The pipe or tunnel shall have a hydraulic capacity of 140 CFS, more or less (estimated 100-year ground water discharge frequency). (7)

Access points spaced at 1000 feet, more or less, shall be provided (4' diameter manhole barrel section assumed) for maintenance access. The trench is to be backfilled with the excavated rock to near the ground surface, then capped with 3 to 4 feet of salvage soil material. The discharge point of the trench shall be below North Spring with appropriate energy dissipation structures and erosion control construction on Conard's Branch.

The stream sediment removal, surface water drainage control and posting of Conard's Branch and Richland Creek work is the same as that described in the System A alternative. Additional security fencing will be necessary so that the drainage control and interceptor trench work will be within the security area. Miscellaneous site work includes the demolition and removal of the existing structures on the southeast portion of the site. Following completion of the permanent cover, an all-weather access road is planned from State Route 48 to the treatment plant site. The road cost is included with miscellaneous site work.

A treatment facility identical in capacity and process units to the System A facility is planned except a project design life of 30 years is projected.

The total estimated capital cost for the System B alternative is $19,830,000. This is the second lowest cost of the three alternatives. Anticipated present worth of the project including post construction cost disbursements is $23,152,000. Length of project construction is 2.0 years, more or less.

### 4.4 System "C" Alternative

System C is identical to the System B alternative except that no interceptor trench construction is contemplated to manage the main ground water zone during storm events. Furthermore, the contaminated stream sediments removal operation is to be undertaken once.

### 4.4.1 System "C" Assumptions - The assumptions presented in the System B alternative are applicable for System C.
4.4.2 System C - Detailed Description - The following work items are anticipated to commence simultaneously:

- Secure applicable permits
- Commencement of the permanent cover installation.
- Commencement of the treatment facility construction.
- Commencement of removal of stream sediments that are PCB contaminated.
- Post affected receiving streams, issue public notices regarding prohibition of fishing or body contact with the waters and commence patrolling the streams.
- Commence surface water and drainage control items.

Later phases of work consist of revegetating areas disturbed by construction and startup of the treatment facilities.

The details of the permanent cover; sediment removal; drainage work; fencing; posting, public notice and monitoring of streams; miscellaneous site work are as identified in the System B.

Due to the wide range of flows anticipated at the treatment plant (0.5 to 126 CFS), (8) there will have to be bypass provisions included at the pumping station and at the plant site so that flows in excess of 1.50 CFS that would hydraulically overload the process units can be diverted directly to Conard's Branch.

The total estimated capital cost for the System C alternative is $12,066,000. This is the lowest cost of the three systems studied. Anticipated present worth of the project including post construction cost disbursements is $15,373,000. Length of project construction is 1.75 years, more or less.

4.5 System Costs

The following tables provide a general cost breakdown for each system and the anticipated annual costs following construction. Provided below is a brief description of certain line items common to each system cost.

4.5.1 Mobilization - Startup - Includes allowances for such items as Builders All-Risk, Public Liability and equipment insurance, performance bonds; temporary facilities such as construction trailers, equipment buildings, sanitary facilities, etc.; cost of mobilizing/demobilizing major pieces of equipment to the job site; and costs for temporary utilities.

4.5.2 Safety Protocol and Decontamination - Allows for on site safety requirements such as equipment, clothing, first aid equipment, monitoring equipment, training program and medical examinations and safety officer. In addition, those pieces of equipment that come in contact with contaminated soils and refuse will need cleaning before leaving the site.

4.5.3 Contingency - Since it is not possible to account for all anticipated work components or anticipate actual costs at this stage of the project, an allowance of 10% has been included for those fortuitous events which come with foresight or expectation.
4.5.4 Engineering, Legal and Administrative - Costs have been estimated at 20% for Systems B and C; and at 15% for System A. This item includes costs associated with field surveys, planning, design contract preparation and review, bidding, contract administration, inspection, permit acquisition, construction management, and other associated costs.

4.5.5 Cost Summaries for Systems A, B, and C - These cost estimates presented are not included to represent actual labor and material costs, competitive market conditions, and other variable factors; but are intended solely for comparison of the alternatives.
## FINAL REMEDIAL MEASURES
### SYSTEM A - ALTERNATIVE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization - Startup</td>
<td>$1,030,000</td>
</tr>
<tr>
<td>Excavation, Processing &amp; Loading Waste</td>
<td>2,083,000</td>
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<tr>
<td>Transportation To and Fees At (TSCA) Landfill for Waste and Soils</td>
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<tr>
<td>Transportation To and Fees At (TSCA) Incinerator</td>
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<td>Permanent Cover Over Floor of Excavated Landfill</td>
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<tr>
<td>Posting of Stream, Public Notice, Patrol, Monitor Fish and Aquatic Life (Conard's Branch and Richland Creek)</td>
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<tr>
<td>Removal of Contaminated Stream Sediments (Conard's Branch and Selected Portions of Richland Creek)</td>
<td>6,264,000</td>
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<td>Surface Water Drainage Control</td>
<td>131,000</td>
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<tr>
<td>Erosion Control and Sediment Containment During Construction (Installation and Removal)</td>
<td>50,000</td>
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<tr>
<td>PCB Treatment Facility</td>
<td>2,240,000</td>
</tr>
<tr>
<td>Removal of Fencing</td>
<td>20,000</td>
</tr>
<tr>
<td>Revegetation</td>
<td>70,000</td>
</tr>
<tr>
<td>Miscellaneous Site Work</td>
<td>110,000</td>
</tr>
<tr>
<td>Safety Protocol and Decontamination</td>
<td>65,000</td>
</tr>
<tr>
<td>Contingency (10%)</td>
<td>3,640,000</td>
</tr>
</tbody>
</table>

Subtotal $40,244,000

Engineering, Legal and Administrative (15%)

$6,036,000

**TOTAL ESTIMATED CAPITAL COST** $46,280,000

Present Worth of Yearly Operating and Maintenance Costs

311,700 (pwf-10%-7 Yr)

$1,517,000

Present Worth of Site Monitoring (Annual Basis)

10,000 (pwf-10%-7 Yr)

$49,000

**PRESENT WORTH OF SYSTEM "A" ALTERNATIVE** $47,846,000
### FINAL REMEDIAL MEASURES
#### SYSTEM B - ALTERNATIVE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
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</thead>
<tbody>
<tr>
<td>Mobilization - Startup</td>
<td>$500,000</td>
</tr>
<tr>
<td>Permanent Cover Over Landfill</td>
<td>2,741,000</td>
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<tr>
<td>Interceptor Trench</td>
<td>2,552,000</td>
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<tr>
<td>Removal of Contaminated Stream Sediments (Conard's Branch and Richland Creek)</td>
<td>6,464,000</td>
</tr>
<tr>
<td>PCB Treatment Facility</td>
<td>2,240,000</td>
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<tr>
<td>Surface Water Drainage Control</td>
<td>131,000</td>
</tr>
<tr>
<td>Security Fencing</td>
<td>70,000</td>
</tr>
<tr>
<td>Revegetation</td>
<td>163,000</td>
</tr>
<tr>
<td>Posting of Stream, Public Notice, Patrol, Monitor Fish and Aquatic Life (Conard's Branch and Richland Creek)</td>
<td>21,000</td>
</tr>
<tr>
<td>Miscellaneous Site Work</td>
<td>110,000</td>
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<tr>
<td>Safety Protocol and Decontamination</td>
<td>34,000</td>
</tr>
<tr>
<td>Contingency (10% ‰)</td>
<td>1,500,000</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$16,526,000</strong></td>
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<tr>
<td>Engineering, Legal and Administrative (20% ‰)</td>
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<td><strong>TOTAL ESTIMATED CAPITAL COST</strong></td>
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<tr>
<td>Present Worth of Yearly Operating and Maintenance Costs</td>
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<td>313,300 (pwf-10%-30 Yr)</td>
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<tr>
<td>Present Worth of Site Monitoring (Annual Basis)</td>
<td>94,000</td>
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<tr>
<td>10,000 (pwf-10%-30 Yr)</td>
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<tr>
<td>Present Worth of Treatment Plant Equipment Replacement</td>
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<td>1,120,000 (pwf'-10%-15 Yr)</td>
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<td><strong>PRESENT WORTH OF SYSTEM B ALTERNATIVE</strong></td>
<td><strong>$23,152,000</strong></td>
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## FINAL REMEDIAL MEASURES
### SYSTEM C - ALTERNATIVE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization - Startup</td>
<td>355,000</td>
</tr>
<tr>
<td>Permanent Cover Over Landfill</td>
<td>2,741,000</td>
</tr>
<tr>
<td>Removal of Contaminated Stream Sediments (Conard's Branch and Richland Creek)</td>
<td>3,355,000</td>
</tr>
<tr>
<td>PCB Treatment Facility</td>
<td>2,240,000</td>
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<tr>
<td>Surface Drainage Control</td>
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<tr>
<td>Security Fencing</td>
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</tr>
<tr>
<td>Revegetation</td>
<td>100,000</td>
</tr>
<tr>
<td>Posting of Stream, Public Notice, Patrol, Monitor, Fish and Aquatic Life (Conard's Branch and Richland Creek)</td>
<td>21,000</td>
</tr>
<tr>
<td>Miscellaneous Site Work</td>
<td>110,000</td>
</tr>
<tr>
<td>Safety, Protocol and Decontamination</td>
<td>34,000</td>
</tr>
<tr>
<td>Contingency (10% £)</td>
<td>916,000</td>
</tr>
</tbody>
</table>

Subtotal $10,055,000

**Engineering, Legal and Administrative (20% £)** 2,011,000

**TOTAL ESTIMATED CAPITAL COST** $12,066,000

- Present Worth of Yearly Operating and Maintenance: 2,945,000
- Present Worth of Site Monitoring (Annual Basis): 94,000
- Present Worth of Treatment Plant Equipment Replacement: 268,000

**PRESENT WORTH OF SYSTEM C ALTERNATIVE** $15,373,000
4.6 Technical Evaluation

The technical evaluation of the three alternatives was performed by comparing various criterion suggested by the National Contingency Plan for Oil and Hazardous Substances. All three systems evaluated in the final screening utilize established technology. Analysis of the remaining criteria is presented in chart form as follows:

<table>
<thead>
<tr>
<th>Criterion</th>
<th>System A</th>
<th>System B</th>
<th>System C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Life Cycle Costs (Present Worth)</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2. Reliability</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. Implementation</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4. Constructability</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. Protection of Public Health, Welfare and Environment</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. PCB Contaminant Removal</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>7. Duration of Construction</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8. Duration of Facility Operation and Maintenance</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Each alternative was ranked numerically (first, second, or third) per criterion with "1" being best of the three and "3" being least desirable of the three alternatives. In order to acknowledge that in certain instances, two or more alternatives may compare very close in a category, equal ranking was allowed where it was warranted.

System C resulted in the lowest life cycle costs with System A having the most expenditure of money.

From a reliability standpoint, System A proved best in the long range with its fail safe approach of removing all sources of contamination from the area. System C appears the least reliable due to lack of ground water control which during storm events has the potential of discharging large amounts of low level PCB concentration to the downstream areas.

Implementation relates to the level of management effort required to carry the project into effect. Systems B and C both rank highly in this aspect, with System A requiring considerable planning to arrange for necessary permits, location of ultimate disposal for large volumes of waste, arrangements for incineration of capacitors, and the collection of a fleet of transport vehicles.
Considering constructability, System C has the least amount of work required, and that work which is necessary does not involve the use of explosives for trench excavation (System B), or excavation of buried refuse (System A).

Over a long term basis, complete removal of buried waste offers the best protection of the public health, welfare and environment. However, excavation of general refuse presents certain potential nuisance problems which will require special attention.

The ground water control trench and treatment facility in System B should produce the most significant short term reduction in the level of PCB's leaving the site. System A ranks close, but it cannot prevent ground water fluctuation and the flushing of contaminated sediments from fractured bedrock underlying the former fill during a storm event, and storm event flows in excess of 1.5 CFS will bypass the PCB treatment facility.

System C has the least control over discharge of PCB contaminants to the environment.

Duration of construction has an effect on how long PCB discharges are possible before final remedial measures are achieved. In this category, System C has the shortest term with System A the longest term.

Once construction is completed the length of time that annual expenditures of money are necessary has an effect on the desirability of an alternative. With System A expected to cease treatment and monetary operations after seven years, more or less, it compares more favorably than the 30 years or longer period of Systems B or C.

Based upon the above discussed factors, if the numerical ranking for each alternative is totaled; an overall technical evaluation of the systems is apparent which can aid in the selection of the actual remedial action alternative to be implemented. This ranking does not give weight to individual criterion items. Final selection should be based on consideration of the relative importance of dominant criterion.
Footnotes

(1) Federal Register, 40 CFR Part 300 op. cit., p. 31217


(5) United States Environmental Protection Agency, Region V, "Review of Region V CLP Data, Neal's Landfill, Laboratory Test Results, SMO Case No. 1557, Summary of Test Data; December 1982 through March 1983; SC 000369 to SC 000417, Central Regional Laboratory Review Dates May 5, 16, 1983.

(6) Federal Investigative Team, op. cit., June 1, 2, 1983 Chicago, Ill. and June 14, 15, 1983 Bloomington, Ind.


(8) Ibid, June 1, 2, 1983 Chicago, Ill. and June 14, 15, 1983 Bloomington, Indiana.

(9) Federal Register, 40 CFR Part 300 op. cit., p. 31217

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APPENDIX 1

INITIAL SCREENING OF ALTERNATIVES
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Removal of Refuse and Contaminated Soils

DESCRIPTION

Two options are considered in this alternative; 1) complete removal of all waste and 2) removal of only PCB contaminated wastes and soils. In general, both removal operations cover the following general procedures. Remove existing cover, landfill that portion contaminated and stock-pile the rest. Determine which portion of the waste must go to an EPA approved landfill meeting TSCA* criteria (greater than 50 ppm PCB) and that which can go to an EPA approved secure landfill meeting RCRA** criteria (less than 50 ppm PCB). Provide control over exposure to precipitation and drainage in working areas during excavation and properly deal with leachate. Following removal, a 4 foot soil cover is to be placed over the base of the landfill, graded and seeded according to applicable standards.

COST

Range: $28.0 M to $44.0 M (complete removal)  
$16.0 M to $24.0 M (partial removal)

EFFECTS

- mitigate PCB discharge from site by removing source
- does not take into consideration existing contaminated soil beyond limits of fill and aquatic contaminants downstream
- possible air pollution problems due to excavation of decomposing general refuse
- contact with precipitation during excavation and loading must be minimized (water and leachate encountered may require special handling and/or treatment)
- the site will be restored to a terrain similar to that existing prior to the landfill
- some contaminants may be present in sub soils and fractured rock beneath the site as residue affecting the aquifer following refuse removal
- erosion control measures will be necessary during removal operation
- long term of local and cross country transportation will require special permits

ACCEPTABLE ENGINEERING PRACTICE

Previous experience exists. Planning and construction procedure will require serious consideration of health and safety factors. In the option of partial removal, exploratory trenching may be necessary; also, on-site testing will probably be desirable to determine what portion of waste must be incinerated, and the classification of landfill (RCRA or TSCA criteria) that would be the destination.

CONCLUSION

Recommended for further detailed study.

* Toxic Substances Control Act
** Resource Conservation and Recovery Act
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Installation of Permanent Cap on Landfill (assumes 2 feet of cover is present from preliminary remedial action work)

DESCRIPTION

Considered two types; 1) additional 2 feet of compacted clay loam material (60,000 CY +) and 2) additional 4 feet of cover with 2 foot layer of clay loam (60,000 CY +) over 2 foot layer of granular material (60,000 CY).

Slope to drain water which infiltrates the upper clay loam through the granular material to the perimeter of the cover. The low permeability of the bottom layer can be preserved as a result of isolation from severe freezing, seasonal changes and root penetration. Also, includes seeding and additional fill material along north and south faces of landfill so that final slopes will be no greater than 5:1.

COST

Range: $0.68 to $1.98 M Capital Cost
$0.69 to 1.99 M Life Cycle Cost

EFFECTS

- reduces infiltration of precipitation through surface of landfill into refuse and ground water
- does not mitigate leakage of PCB's from capacitors
- the effects of ground water passing through or near the bottom of the landfill needs consideration
- not expected to impact the shallow ground water system east of and in the landfill which provides for continuation of saturation of refuse
- does not mitigate the hazard of contaminated aquatic life and downstream soil sediments
- ground water beneath landfill will still have PCB concentrations
- increases runoff
- requires erosion control procedures and maintenance

ACCEPTABLE ENGINEERING PRACTICE

Construction is feasible for site, but by itself it is not expected to eliminate the discharge of PCB's from the site.

CONCLUSION

Recommended for detailed study as a part of a series of actions to mitigate or eliminate PCB discharges.
ON-SITE AND OFF-SITE REMEDIAL ACTION

ALTERNATIVE

Surface Water Drainage Control (Run On), Grading and Revegetation of Disturbed Areas

DESCRIPTION

The objective is to prevent runoff due to precipitation on adjacent areas from discharging onto or into the landfill site, to prevent ponding of water, and to prevent or minimize soil erosion. The preliminary remedial action plan included serious consideration of these topics and it is expected that the ultimate final plan will include many of these components as a maintenance or upgrading aspect. In addition, many of the other alternatives will take aspects of this remedial action into consideration as a course of their investigation (i.e., filling of existing sink holes in the south and north spring watersheds). Components include a sidehill swale along the east side directing runoff around the southeast corner and south side, a sidehill swale along the north side directing runoff to an outlet north of North Spring. The specific location must be adapted to the geometry of each correspondent principal remedial measure. The depth of excavation shall be limited to minimize opportunity for creation of new sink holes. Maintenance required.

COST

Not determined during initial screening

EFFECTS

- reduce infiltration of water through the surface cover into the refuse
- this alternative not expected to minimize or prohibit the release of PCB contaminants from the site or improve already contaminated areas
- potential dust and down stream sedimentation as a result of construction requires attention
- the diversion swales may become permanent features
- removes cover over near surface limestone-dolomite bedrock in limited areas

ACCEPTABLE ENGINEERING PRACTICE

- previous experience available
- constructability is not a problem

CONCLUSION

Recommended for detailed study as a part of a series of actions to mitigate or eliminate PCB discharges.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Installation of Impermeable Barrier Around and Under Site

DESCRIPTION

Considers containerizing the landfill, around its perimeter (3850 L.F. and wall face area 135,000 S.F. +) and floor (18.8 Ac +) using grouting methods. Slurry wall construction not considered due to shallow depth to bed rock. May require periodic withdrawal of leachate and treatment.

COST

Range: $58.6 M to $113.6 M Capital Cost
$63.9 M to $124.1 M Life Cycle Cost

EFFECTS

- containerizes waste in landfill to mitigate additional discharge of PCB's from site
- does not address the problem with existing contaminated soil sediments or aquatic life down stream of landfill
- requires secure cover over landfill to reduce water infiltration into waste
- grading to divert surface water from landfill site would be required

ACCEPTABLE ENGINEERING PRACTICE

Grouting of the fractures and solution cavities in the limestone bedrock is expected to be difficult and probably not effective in creating a barrier (particularly the floor area). Previous history of failures. Possible complex underground caverns and channels may be too extensive to seal. Clayey material in fractured rock will probably not allow predictable and controllable grout penetration. Verification of effectiveness of grouting process is questionable.

CONCLUSION

Not recommended for detailed study. Cost is high and alternative is not considered technically feasible for this site.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Flushing of the Landfill and Treatment of the Resultant Discharge to Remove Contaminants

DESCRIPTION

Injection of water and or solvents into the landfill refuse to leach PCB from the waste, then withdraw for treatment. Continue flushing, withdrawal and treatment until acceptable limits of PCB are achieved. The landfill would probably have to be divided up into smaller areas or segments so the refuse could be saturated.

COST

Not determined during initial screening

EFFECTS

- large quantities of water and/or solvents would be required
- the solvents and increased leachate contaminants from general refuse may develop adverse impacts greater than the existing PCB contamination problem
- the risk of polluting the aquifer under the landfill is high
- the flush and treat operation would extend for many years before acceptable PCB limits are achieved.
- existing capacitors would continue to corrode and leak even after flush and treat operation is ceased

ACCEPTABLE ENGINEERING PRACTICE

Not acceptable at the landfill site in question for reasons indicated above.

CONCLUSION

Not recommended for detailed study.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Security Fencing

DESCRIPTION

Provided to protect human and animal life from contact with the contaminated materials on the site. This alternative was developed for implementation in the preliminary remedial action plan. Upgrading, modification or maintenance of the existing fencing is anticipated in the final remedial action analysis. No additional study was undertaken in the initial alternative screening analysis.

COST

Not determined during initial screening

EFFECTS

Not determined during initial screening

ACCEPTABLE ENGINEERING PRACTICE

Previous experience exists.

CONCLUSION

Recommended for detailed study as a part of a series of actions. As long as PCB waste is present on site, unauthorized human or animal intrusions must be prevented.
ON-SITE REMEDIAL ACTION

ALTERNATIVE
Leachate Collection System

DESCRIPTION
Considered for the purpose of extracting refuse leachate from the base of the landfill and treating it to remove PCB contamination. Probably consists of a series of small withdrawal or scavenger wells, within the waste area, evenly spaced over the 17 acre site and directed to a common treatment unit (activated carbon).

COST
Not determined during initial screening

EFFECTS
- not considered to be effective in mitigating release of PCB's from site
- shallow and main ground water systems will continue to affect site, particularly during storm events
- cavernous conduits are expected to continue to receive contaminants due to contact or proximity of waste to jointed/fractured bedrock
- does not consider existing contaminants off site
- rain water infiltration will continue
- due to permeable bottom of landfill, the withdrawal wells cannot adequate capture the liquid within the waste area before it reaches the bedrock system

ACCEPTABLE ENGINEERING PRACTICE
Previous experience exists, but for above stated reasons not believed to be effective.

CONCLUSION
Not recommended for detailed study. Not believed suitable for this site.
ON-SITE REMEDIAL ACTION

ALTERNATIVE
In-Situ Treatment of Waste and Contaminated Soils

DESCRIPTION
Considers the injection of mixed microbial cultures into the refuse waste and contaminated soil to degrade the PCB contaminants within the landfill.

COST
Not determined during initial screening

EFFECTS
- Not considered to be effective. Previous laboratory research indicates some success particularly with the mono- and dichloro-biphenyl isomers; lesser success was shown for trichlorobiphenyls isomers and almost no success with the tetrachlorobiphenyl isomer. Aroclor 1242, a relatively lower chlorinated series of isomers, still contains a significant percent of the higher chlorinated isomers which will probably be difficult to deg.
- Effects of mixed microbial cultures escaping from the landfill is not known at this time.
- Continued corrosion of capacitors in the landfill will require the maintenance of a permanent microbial colony in the site.

ACCEPTABLE ENGINEERING PRACTICE
- No practical experience with process, although an interesting potential full scale research project, its probable success is unknown at this time.
- Would require large amounts of the microbial cultures, maybe over an extended period of time, such amounts may not be available.
- Even dispersion of the cultures in the refuse would be difficult.

CONCLUSION
Not recommended for detailed study.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Ground Water Drainage Enhancement In and Around South Spring

DESCRIPTION

Studies to date suggest that the discharge from South Spring is restricted due to the size and shape of the opening(s) at the mouth of the spring. This would subsequently allow the water table in the aquifer beneath the landfill to rise significantly, particularly during storms of high intensity and short duration. By excavating and/or the use of explosives at or around South Spring the opening(s) at the mouth of the spring could be enlarged or "blockage" removed with a consequent enhanced flow. This excess discharge during events would be rapid and subsequently, the expected rise in the water table may be reduced.

COST

Not determined during initial screening -- (probably relatively small compared to other alternatives)

EFFECTS

- may reduce the risk of contact of the water table with the base of the refuse
- would not mitigate the discharge of PCB's at South Spring
- adverse effects would include the noise and vibration problems due to the use of explosives. Also, this process could result in the increase of movement of leachate from the landfill through the formation or interconnection of fractures which otherwise may act as barriers.
- potential danger of subsidence

ACCEPTABLE ENGINEERING PRACTICE

Previous experience exists. Desired results may not be predictable.

CONCLUSION

Not recommended for detailed study. Does not mitigate or minimize PCB discharge from landfill site.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE
Interceptor Trench to Maintain Water Table at a Lower Elevation

DESCRIPTION
To reduce the volume of water flowing beneath the landfill site such that flows normally discharged through South Spring would be diverted upgradient from the site and carried around the east side of the site to Conard's Branch. A nominal base flow in South Spring is desirable to avoid elimination of the spring. A concrete pipe or lined tunnel would be installed, then the trench backfilled (length 3100 L.F. +, trench rock excavation 42,000 CY +). Special discharge structure necessary to minimize outfall erosion.

COST
Range: $3.0 M to $5.2 M Capital Cost
$3.5 M to $5.9 M Life Cycle Cost

EFFECTS
- diversion of flow from the shallow ground water system away from the refuse
- diversion of main ground water system from landfill such that discharge from South Spring is maintained at or near base flow
- during lowering of the water table, ground water flow under the landfill may reverse and induce flow from the landfill to the trenches thus requiring treatment of waters until reverse flow ceases
- PCB release from refuse into lowered ground water will continue
- does not consider existing contaminated soil and aquatic life downstream
- increases the rate of discharge to Conard's Branch
- may alter ground water system feeding other springs in the valley of Richland Creek downgradient from the site
- water levels in wells adjacent to site may be affected

ACCEPTABLE ENGINEERING PRACTICE
- existing construction practice available
- success will depend upon the interconnection of the trench and fracture/solution channels system in the limestone
- construction cost will depend upon actual trench width using existing technology and safety procedures

CONCLUSION
Recommended for detailed study as a part of a series of actions. Seen as a way of controlling water volumes to be treated for contaminant removal.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE

Impermeable Barrier Up-Gradiant from Landfill

DESCRIPTION

A grout curtain was considered since sheeting and slurry walls would be impractical due to shallow depth to bedrock. The barrier location was considered on the west, east and south of site (3150 L.F. ± in length and 173,000 S.F. wall face area) with a drain pipe at base of curtain (4000 L.F. ±) to minimize breaching of grout curtain during storm events. The purpose is to stabilize the water level fluctuations below the base of the landfill.

COST

Range: $13.7 M to $25.7 M Capital Cost
$20.4 M to $39.1 M Life Cycle Cost

EFFECTS

- prevent the water level from raising beneath the landfill and coming in contact with waste
- expected to cut off the flow from the shallow ground water system east of site from entering landfill
- may not mitigate PCB contamination in the discharge of South Spring
- PCB in refuse can still leach into ground water below waste
- does not consider contaminated aquatic life and down stream soil sediments
- blasting of rock in drain pipe trench will create noise - accepted as a regular event at the quarry 2 miles away
- hanging curtain may not be effective due to possible deeper cavernous conduits under the site

ACCEPTABLE ENGINEERING PRACTICE

Grouting attempts in the fractured and cavernous bedrock are expected to be difficult and probably not effective in creating a barrier. Previous history of failures. Possible complex underground caverns and channels may be too extensive to grout. Clayey material in fractured rock will probably not allow predictable and controllable grout penetration.

CONCLUSION

Not recommended for detailed study. Not considered technically feasible for this site.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE
Impermeable Barrier Down-Gradient with Treatment of Ground Water and Leachate

DESCRIPTION
Considers the use of a grout curtain including drain pipe (1200 L.F. +, wall surface area 48,000 S.F. +) down-gradient of the landfill site. Installation of ground water collection sump pumps and a treatment sump are required. Flow rates for the treatment process were anticipated at 0.5 CFS (220 gpm +) base flow and peaks to 55 CFS (24,000 gpm). The contaminated waters leaving the site are to be caught and treated (granular activated carbon, assumed) for PCB removal. Peak discharges of 55 to 126 CFS estimated for rainfall events of 24 hour duration up to a return frequency of 100 years would be bypassed.

COST
Range: $34.5 M to $36.6 M Capital Cost
$43.6 M to $48.8 M Life Cycle Cost

EFFECTS
- would minimize the discharge of PCB's from the landfill site
- construction noise, dust and vibration during curtain wall and drain pipe trench construction (explosives)
- treatment of ground waters would continue as long as PCB in refuse continues to leach into ground water
- would require secure cover over landfill to minimize infiltration and grading to keep surface waters away from site
- does not consider existing soil and aquatic life contaminants down stream
- may increase potential for ground water contact with waste

ACCEPTABLE ENGINEERING PRACTICE
Grouting attempts in the fractured and cavernous bedrock are expected to be difficult and probably not effective in creating a barrier. Previous history of failures. Possible complex underground caverns and channels may be too extensive to grout. Clayey material in fractured rock will probably not allow predictable and controllable grout penetration. The previous experience with activated carbon treatment processes is good. Engineering limitations or difficulties to be investigated or overcome are:
- wide range in flows, 0.5 to 55 CFS and up, will provide operational problems (inadequate room for on site storage of excess waters)
- need pilot studies of activated carbon and leachate on site to determine its treatability characteristics, type of carbon to be used and expected removal efficiency

CONCLUSION
Not recommended for detailed study. Not considered technically feasible for this site.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE

Removal of Contaminated Stream Sediments from Conard's Branch and Portions of Richland Creek

DESCRIPTION

Removal of PCB contaminated soil from streams (areas greater than 1.0 ppm of PCB) consisting of 4300 lineal feet, more or less. Removed soil will have to be placed in a secure landfill. Procedure should include temporary diversion of base flow to minimize volume and maximize density of sludge which must be handled and disposed of. Removal in spaces between rock ledges will be difficult.

COST

$4.6 M

EFFECTS

- since the stream sediment is a part of the aquatic life food chain, its removal is expected to break the PCB cycle in the food chain
- soil removal operation will increase turbidity in stream waters (disturb Eco-system)
- soil removal will cause removal of protective ground cover and may increase soil loss and/or erosion along stream banks
- will not be effective unless the PCB discharge at the source is controlled
- repetition may be required
- will require an extensive review of application for permit

ACCEPTABLE ENGINEERING PRACTICE

- previous experience exists
- removal in upper portion of Conard's Branch may be difficult due to shallow depth to and exposed bed rock
- will require survey of stream sections in sampling and testing to determine width and depth of excavation.

CONCLUSION

Recommended for detailed study as a part of a series of actions.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE

Treatment of Surface Waters and Ground Waters Leaving Site

DESCRIPTION

Generally, this includes collecting contaminated waters leaving site and treating for PCB removal. Collection of the waters is assumed to be near the South Spring. This alternative has similarities to other alternatives studied with treatment requirement at different flow rates and capacities. Costs of treatment for those other alternatives were not always evaluated, since the dollar figures presented here can give order of magnitude comparison for various situations.

The activated carbon treatment process evaluated consists of the following:

- Pump Station: for transporting the waters.
- Sedimentation: to remove gravel/sand and settleable solids received at the collection point.
- Rapid Sand Filtration: to remove clay and silt particles from the waters which would interfere with the carbon absorption.
- Carbon Absorption Reactors: for removal of PCB's from the waters.

The flow rates of the contaminated waters have an average base flow rate of 0.5 CFS and a maximum monitored discharge of 62 CFS for a recent storm event which includes surface water runoff. Discharge of 90-210 CFS was estimated as peak rates for the 25, 50 and 100 year/24 hour rainfall events.

The plant sizing can be considered two ways; 1) treat base flows only (i.e., no storm flows) or 2) treat all flows received including peak storm events. The 10:1 ratio between wet and dry weather flows will cause excessive oversizing of the treatment plant for the latter case during most of the plant's operation. As a result, a third option was considered assuming a 1.5 CFS plant and a surge lagoon of 130 Ac-Ft + to hold the excess waters from storm events. Since there is no adequate room on or near the landfill site for a treatment process of this size, a location 3600 feet north of the landfill site was assumed.

COST

<table>
<thead>
<tr>
<th>Plant Capacity</th>
<th>Capital Cost</th>
<th>Life Cycle Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 CFS</td>
<td>$1.4 M</td>
<td>$3.0 M</td>
</tr>
<tr>
<td>1.5 CFS w/Lagoon</td>
<td>$15.0 M</td>
<td>$18.9 M</td>
</tr>
<tr>
<td>60 CFS</td>
<td>$31.2 M</td>
<td>$38.5 M</td>
</tr>
</tbody>
</table>
EFFECTS

- mitigate PCB discharge
- requires construction of permanent facilities and their operation as long as PCB's continue to leach out of the refuse
- does not consider existing contaminants in soil and aquatic life downstream
- requires power consumption and generates additional hazardous wastes in the form of waste carbon and sedimentation sludge
- in the case of the off-site treatment facility and lagoon; will take useful land (10-15 Ac.) out of use for treatment process
- the treatment equipment and structures will absorb PCB and become contaminated

ACCEPTABLE ENGINEERING PRACTICE

Previous experience in process. Will need pilot scale studies to fine tune the carbon absorption process. The surge lagoon details will be complicated due to expected shallow depth to bed rock and potential leakage.

CONCLUSION

Recommended for detailed study as a part of a series of actions. If used with the interceptor trench to control ground water flows to a level of 1.5 CFS or less, the surge lagoon and large land requirements would be eliminated and large storm water flows would not be present to adversely affect plant operation.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE

Public Announcements, Posting and Monitoring of Conard's Branch and Richland Creek

DESCRIPTION

This alternative consists of notifying the local public of the contaminated fish and aquatic life in the receiving stream through available news media (TV, newspaper, etc.) and posting signs along the banks of the stream warning of the problem and stating no fishing allowed. Pending the type of remedial action taken to contain or eliminate the PCB source, a monitoring program is also anticipated for a number of years following the posting, as well as, repeated public announcements. Generally, the monitoring will include collection of aquatic life for testing of contaminant levels and patrolling the streams on a periodic basis to check the signs and see that they have not been ignored by fishermen.

COST

Range: $10,000 to $35,000 - Initial Costs
$200,000 to $235,000 - Life Cycle Costs

EFFECTS

- warns the public of the presence of contaminated fish
- after a number of years, allows for a majority of the contaminated aquatic life to die out of natural causes, provided the PCB discharge from the landfill is halted
- aquatic life that is migratory may leave the area that has been posted; this causing additional stream segments to be posted
- does not have the destructive effect that the aquatic life removal alternative has using a toxicant
- does not address the source of contamination

ACCEPTABLE ENGINEERING PRACTICE

Previous experience using passive techniques exists.

CONCLUSION

Recommended for detailed study as a part of a series of actions.
OFF-SITE REMEDIAL ACTION

ALTERNATIVE

Removal of Aquatic Life from Conard's Branch and Selected Portions of Richland Creek

DESCRIPTION

Use of toxicant such as Rotenone with Potassium Permanganate neutralizer to kill non-air breathing aquatic life that are PCB contaminated. This alternative considers removal for 2.7 to 5.9 miles of stream (i.e., from landfill to Whitehall Bridge or Hendricksville).

COST

Range: $313,000 to $627,000

No O & M cost anticipated --

EFFECTS

- expected to remove PCB contaminated aquatic life from selected stream segments, except for air breathers, i.e., frogs or snakes
- will kill non-affected fish life
- contaminated fish already migrated from segments will not be affected
- will mitigate human and animal consumption of contaminated fish
- will not be effective unless contaminated stream sediment is removed and PCB source discharge stopped
- may be contrary to regulatory agency policy; permits will probably be difficult to acquire
- may require restocking of fishlife where practical

ACCEPTABLE ENGINEERING PRACTICE

- Practice traditionally has been limited to ponds, small lakes or small portions of streams -- little experience for larger surface water areas
- may have problem effectively dosing and mixing chemical toxicant and neutralizer for optimum results

CONCLUSION

Not recommended for detailed study. Believe existing PCB levels not yet warrant removal option. For protection of public, recommend public announcement, posting and monitoring of stream as for detailed study as a part of a series of action.
APPENDIX 2

FIGURES AND DRAWINGS
WHITEHALL, IND. 1957
PHOTOREVISED 1980

EXTENT OF CONARD'S BRANCH & RICHLAND CREEK TO BE POSTED, PATROLED & MONITORED

SYSTEM A, B, & C ALTERNATIVES
NEAL'S LANDFILL, BLOOMINGTON, IND.
EXTENT OF CONARD'S
BRANCH & RICHLAND
CREEK TO BE POSTED,
PATROLED & MONITORED
SYSTEM A, B, & C
ALTERNATIVES
NEAL'S LANDFILL
BLOOMINGTON, IND.
REMOVAL OF CONTAMINATED STREAM SEDIMENTS (CONARD'S BRANCH & RICHLAND CREEK)
SYSTEM A, B, & C
ALTERNATIVES
NEAL'S LANDFILL
BLOOMINGTON, IND.
ENFORCEMENT - CONFIDENTIAL

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

NEAL'S LANDFILL

Westinghouse Electric Corporation

Site Location and Description

The Neal's Landfill site refers to the PCB contaminated landfill located in Richland Township, Monroe County, Indiana (fig. 1). The site is located in a sparsely populated rural area approximately 4½ miles west of Bloomington and 500 feet north of Indiana State Highway 48 (fig. 1). The landfill site is mostly within SE¼SW¼ sec. 33, T. 9 N., R. 2 W., Second Principal Meridian, but a portion of it is also within SW¼SE¼ sec. 33, T. 9 N., R. 2 W.

The site lies on top of a ridge in the eastern margin of the Crawford Upland physiographic province of Indiana. The Crawford Upland is a dissected plain with steep hills, rounded ridge tops, and narrow valleys. In the landfill area the topography is also typified by numerous karstic features such as sinkholes, karst valleys, and springs. Surface drainage in the vicinity of the landfill is northwest and south of the landfill via two streams (Conard's and Southwest Branches) which eventually discharge to Richland Creek. The regional direction of ground-water flow is generally west. However, at the landfill, ground water flows to the northwest as controlled by a local geologic structure.

Neal's Landfill is underlain by Paoli and Ste. Genevieve Limestones of the Mississipian period. These rocks dip west or southwest at 25 to
FIGURE 1. LOCATION OF NEALS LANDFILL.
30 feet per mile regionally, but form a structural trough plunging northwest at the site. These limestones are extensively jointed and contain numerous solution cavities.

Ground water, in the vicinity of the site, occurs in two zones in the Ste. Genevieve Limestone. The eroded land surface in the vicinity forms a topographic saddle in which the landfill is located. The upper water zone is dissected by topography and is therefore discontinuous. The lower ground-water zone is located at an elevation below the saddle and is continuous throughout the vicinity.

Solution cavities, joints, and other fractures serve as routes for ground-water movement. The movement of water along the fractures is generally downward then laterally either down the slope of the strata or to a point of discharge. The direction of water movement is in response to differences in the hydraulic head and along the path of least resistance.

Contaminated ground water occurs in the aquifer underlying the site. The contaminant plume appears to be moving toward the northwest as evidenced by the presence of contaminants of water in monitoring wells and from springs northwest of the site (fig. 2). The contaminated ground water and surface water feed Conard's Branch and eventually flows into Richland Creek. Contaminated surface water in the vicinity of the site consists of water in Conard's and Southwest Branches of Richland Creek. Conard's Branch receives both surface and ground water from the site while Southwest Seep Branch receives mostly surface run-off and ground-water discharge as base flow.
FIGURE 2. NEAL'S LANDFILL WELL, SPRING, AND CREEK LOCATIONS.
Ground-water use in the vicinity of Neal's Landfill is limited to a few wells used as a source of residential supply. North and downgradient of the site (3,000 feet) are residential wells which may be hydraulically connected to the ground-water system beneath the landfill. South of the site and south of Highway 48 are three residential wells which are upgradient. No municipal wells are present in the area.

Surface water in the area is limited to Conard's Branch, Southwest Seep Branch, Richland Creek, and tributary streams. These streams are used primarily for fishing purposes and are used by livestock and wildlife which forage along the streams.

Site History

From 1950 to 1977, the Neal's Landfill property was owned by Mr. Ray Neal. From 1977 to 1980, the site was owned by Mr. Richard Neal. Since 1980, the site has been owned jointly by William Taylor, Wanda Taylor, Everett Williams, and Lois Williams.

The Westinghouse Facility in Bloomington, Indiana, manufactured and reprocessed electrical capacitors using PCB as an insulating fluid. The PCBs were produced by Monsanto Company. Reject capacitors were hauled to and dumped in several landfills and dumps near Bloomington. Mr. Ray Neal, previous owner of the landfill site, hauled the PCB contaminated capacitors and materials to Neal's Landfill under a contract with Westinghouse.

Neal's Landfill was operated as a sanitary landfill between the years of 1950 and 1972. Between 1966 and 1967, for a period of one and a half years, PCB filled capacitors and PCB contaminated rags,
sawdust, and filter clay were disposed of at the site. Approximately 18 acres of the site are filled with refuse.

In 1975 EPA identified Westinghouse of Bloomington as one of 37 localities in the United States where PCBs are used and may be entering the environment. On September 30, 1976, public hearings were initiated by the Environmental Management Board of Indiana.

Between 1976 and 1981 investigations of the site were performed to obtain preliminary estimates of the degree of and extent of contamination and to determine appropriate action response. These preliminary investigations included site and vicinity reconnaissance activities, and collection and chemical analysis of soil and water samples from springs, wells, ponds, landfill soil, and streams.

Since 1981, numerous field inspections and investigations of Neal’s Landfill have been performed by the Westinghouse Electric Corporation and EPA to determine the location of PCB contaminated soil, wells, springs, streams, ponds and refuse; and the level of PCBs in those contaminated materials (Table 1). Also determined were the direction of movement of contaminant plumes; the configuration of bedrock, soil, and refuse surfaces, and their areal extent; and the history of waste emplacement at the site. These investigations include geophysical studies, interpretations of aerial photographs, installation of monitoring wells, surface borings, monitoring of water wells, seeps, and springs to determine water levels, spring discharges, and water quality, atmospheric PCB emission study, corrosion study of metallic materials contained in capacitors, and sampling and PCB chemical analysis of deer browse materials and caged fish in Conard’s Branch of Richland Creek.
Table 1. Neal's Landfill, PCB Concentrations.

<table>
<thead>
<tr>
<th>SITE</th>
<th>PCB CONCENTRATION RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eroded Sediment Surface Borings</td>
<td>&lt; 1.0 to 411.5 ppm</td>
</tr>
<tr>
<td>Site Wells</td>
<td>&lt; 0.1 to 9.6 ppb</td>
</tr>
<tr>
<td>North Spring</td>
<td>&lt; 1.0 to 3.96 ppb</td>
</tr>
<tr>
<td>South Spring</td>
<td>&lt; 0.1 to 9.77 ppb</td>
</tr>
<tr>
<td>Overflow Springs</td>
<td>&lt; 0.1 to 2.29 ppb</td>
</tr>
<tr>
<td>Southwest Seep</td>
<td>&lt; 1.0 to 2.8 ppb</td>
</tr>
<tr>
<td>Frog and Northeast Seeps</td>
<td>&lt; 1.0 ppb</td>
</tr>
<tr>
<td>On-Site Pond</td>
<td>&lt; 0.1 to 2.78 ppb</td>
</tr>
<tr>
<td>Stream Sediments</td>
<td>&lt; 1.0 to 1,700 ppm</td>
</tr>
<tr>
<td>Conard's Branch Water</td>
<td>&lt; 0.1 to 2.7 ppb</td>
</tr>
<tr>
<td>South Flume</td>
<td>&lt; 1.0 to 3.4 ppb</td>
</tr>
<tr>
<td>North Flume</td>
<td>&lt; 1.0 to 3.69 ppb</td>
</tr>
<tr>
<td>Residential Wells</td>
<td>&lt; 1.0 ppb</td>
</tr>
</tbody>
</table>
PCB levels detected during investigations are included in Table 1. These investigations have shown that PCBs are present at levels exceeding the Federal Drug Administration tolerance levels in fish and unacceptable levels in surface water, ground water, air, vegetation, and soil on site and in the vicinity of Neal's Landfill. They have also shown that contaminants are continuing to be transported to water via ground-water flow, discharge, and transport of PCB contaminated soil to local streams. Release of PCBs from the landfill is the result of leaching of PCBs into ground water, air releases, erosion, run-off, and transport of PCB contaminated surface soil.

Current Site Status

The interim remedial measures recently performed by Westinghouse Corporation in fulfillment of the Stipulation and Order of the preliminary injunction filed Tuesday, January 4, 1994, include:

1. Removal of exposed capacitors and associated contaminated soil for off-site disposal.
2. Upgrading of cover over refuse areas.
3. Control of surface-water run-on and run-off at the site.
4. Placement of a security fence around the perimeter of the site.
5. Performance of diagnostic studies including:
   a. determination of PCB concentrations in surface sediment near the site.
   b. aerial photographic interpretations of the site.
c. calculation of water balance for the site, including infiltration.


7. Construction of diversion ditches.

Investigations conducted by the EPA and Westinghouse Corporation have defined the physical nature of the contaminated ground water at the site and have determined the discharge points of contaminated water, the extent of contaminated soil in the vicinity of the site and the physical boundaries of the landfill.

Ground-water flow at the site occurs in the Ste. Genevieve Limestone, a thinly bedded limestone. (Beds range in thickness from 4 to 12 inches generally but some beds may be as thick as 7 feet.) Underlying the Ste. Genevieve is the St. Louis Limestone, a more thinly bedded, shaly limestone. The St. Louis is more impervious to water movement than the Ste. Genevieve due to the presence of these shale layers.

The contaminant movement at the site, as presently understood, is described as follows:

1. Downward via water which has come in contact with PCBs through surficial soil and refuse, where present, to the Ste. Genevieve bedrock below.

2. Thence downward through the Ste. Genevieve Limestone through openings along joints or fractures and solution cavities until it reaches the aquifer.

3. Laterally within the aquifer toward points of ground-water discharge such as springs and seeps.
4. To the northwest to North and South Springs, downgradient along the Ste. Genevieve Limestone bedding planes via openings along fractures, joints, and solution features.

5. Downward via water into sinkholes and radially outward from sinkholes during or after rainfall events, which recharge the ground-water reservoir at that location.

6. Downstream along the Southwest and Conard's Branches of Richland Creek via surface-water run-off and ground-water discharge which has reached the branches of Richland Creek.

7. Overland via surface run-off from the site in the form of contaminated run-off water and suspended sediment.

Enforcement

On January 4, 1983, the U.S. Department of Justice filed a suit on EPA's behalf against Westinghouse under Sections 104, 106, and 107 of CERCLA and 7003 of RCRA.

On October 11, 1983, Mayor Tomi Allison announced that the City of Bloomington and Westinghouse had reached a conceptual agreement to destroy PCB soil and other PCB materials, using proven destruction techniques.

The preliminary injunctive relief sought by the government was satisfied by a Stipulation and Order between the parties in which Westinghouse Electric Corporation agreed to perform diagnostic studies at the site including sampling of stream sediment from Conard's and Southwest Seep Branches, photography interpretation, test borings at 20 locations, and water balance calculations. It also was required that
the following interim remedial actions be performed: upgrade the existing cover; grade the surface; control erosion on site by constructing ditches and culverts, grade and revegetate; install security fences; remove exposed capacitors, insulators, and capacitor papers, as well as contaminated soil; and cover excavated areas with soil.

The permanent injunctive relief sought by the United States would require Westinghouse Electric Corporation to undertake such actions as may be necessary to remedy the conditions which may cause, contribute to, or present an imminent and substantial endangerment to health and welfare or the environment at Neal's Landfill, arising out of or in any way relating to the handling, disposal, presence, release or threatened release of solid or hazardous waste or hazardous substances.

Interim Remedial Measures

The Consent Decree requires that the following interim remedial actions be taken at Neal's Landfill to protect the health, welfare, and environment in the period prior to the removal of PCB contaminated materials at the site.

1. Monitor water levels and collect water samples at selected residential wells within a 5,000-feet radius of the site. Determinations will be made for pH, specific conductance, and temperature, and laboratory analyses for PCBs will be completed. Also monitoring of selected wells, springs, seeps, and streams on site and off site for the parameters and frequency listed above.
2. Capture and treat the combined flows from South Spring, North Spring, and Southwest Seep up to 1.0 cubic feet per second. Westinghouse will design and construct a Lamella sediment collection system and test its ability to capture PCBs from the site with the requirement that they meet an effluent standard of 1.00 ppm. If this standard is exceeded, Westinghouse will install a GAC system.

3. Conduct tests to determine the PCB concentrations in the influent and effluent waters to the treatment system and in the fish in Conard's Branch.

4. Excavate shallow surface-eroded soil between the landfill and the headwater springs of Conard's Branch following a step-wise protocol agreed upon by the parties.

5. Install erosion control fencing.

6. Post warning signs reading "Keep Out - Stream Contaminated with PCBs" along those lengths of Conard's Branch and Richland Creek which are bordered by Mr. Conard's pasture land.

7. Remove all sediments through use of a hydrovacuum within the banks of the following stream reaches:
   a. For Conard's Branch, the entire length of the stream from its beginning within Neal's Landfill to its confluence with Richland Creek;
   b. For Richland Creek, from 25 feet upstream of its confluence with Conard's Branch to a point 200 feet downstream from sand confluence.
8. Remove all sediments in Richland Creek which are removable through use of a hydrovacuum which are identified by the State of Indiana as contaminated with PCBs subsequent to entry of the Consent Decree prior to April 1, 1985.

9. Following the sediment removal, sample and analyze the stream sediments in order to provide baseline data.

10. Establish a total vegetative cover over all disturbed areas.

11. Capture contaminated sediment in the treatment system.

The interim remedial measures recently performed by Westinghouse Corporation in fulfillment of the stipulation and order of the preliminary injunction filed Tuesday, January 4, 1984, include:

1. Removal of exposed capacitors and associated contaminated soil for off-site disposal.

2. Upgrading of cover over refuse areas.

3. Control of surface-water run-on and run-off at the site.

4. Placement of a security fence around the perimeter of the site.

5. Performance of diagnostic studies including:
   a. determination of PCB concentrations in surface sediment near the site;
   b. aerial photography interpretations of the site;
   c. calculation of water balance for the site, including infiltration.


7. Construction of diversion ditches.
On Site Remedial Measures

In the development of the actions described herein, several alternative actions were considered. The alternatives developed for study in the initial screening process were selected based upon the remedial action that was deemed appropriate considering the criteria indicated below.

Criteria used to assess the remedial action alternatives are those presented in the NCP in 40 CFR 300.68 (E) - (J), (i.e. ... (1) extent to which substances pose a danger to public health, welfare or the environment, considering factors such as population at hydrogeological factors, and climate; (2) extent of migration of contaminant; (3) previous experiences and approaches; (4) environmental effects and welfare concerns.)

Factors Considered in Initial Screening of Alternatives

In order to identify the list of potential remedial actions for further detailed analysis, three broad criteria were used in the screening process: (1) the cost of installing and implementing the remedial action, including operation and maintenance costs where appropriate; (2) positive and adverse effects on the environment from the alternative itself, including implementation, or whether the alternative would be likely to achieve adequate control of source material, or for off-site remedial actions, would effectively mitigate or minimize the threat of harm to public health, welfare or the environment (Generally, only those alternatives that effectively contributed to the protection of the public health, welfare, or the environment were considered in further
detailed analysis.); (3) the alternatives should be feasible for the location and conditions of the release, applicable to the problems, and represent a reliable means of addressing the problem.

Upon consideration of the above factors, the remedial action measures in the Consent Decree were developed. Those actions are presented below. The Consent Decree requires that Westinghouse excavate and remove quantities of soil, debris, and other materials contaminated with polychlorinated biphenyls ("PCBs") and other associated materials from Neal's Landfill, and to construct an incinerator to incinerate said materials in an incinerator in order to prevent and mitigate alleged threats to the public health, welfare and the environment. To satisfy these requirements Westinghouse shall:

1. Excavate and transport for incineration all materials following a stepwise protocol agreed upon by the parties.
2. Excavate and transport for incineration all refuse materials plus an additional two feet of soil perpendicular to the surface remaining after all refuse has been removed as a "buffer zone".
3. Conduct sampling or analysis of ground water.
4. Excavate and transport for incineration all materials from five sinkholes up to a maximum of 2000 cubic yards. This quantity represents the maximum amount of material believed to be contained in these sinkholes.
5. Implement a surface-water, drainage, and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site.
6. Minimize the disturbance of contaminated materials yet to be removed.
7. Provide impermeable protection systems sufficient to cover the active excavation zone.
8. Provide adequate slopes, crowns, and ditches to ensure satisfactory drainage at all times.
9. Provide pumps to remove any contaminated water or leachate at the surface during excavation and provide constructed, lined ponds to store such water until it can be removed and treated.
10. Decontaminate equipment.
11. Provide maintenance for interim removal and remedial measures, including maintenance of fences, signs, erosion, security fences, diversion ditches, dikes, monitoring wells, and temporary caps.

Off-Site Remedial Measures

In the development of the actions described herein, several alternatives were considered. The alternatives developed for study in the initial screening process were selected depending upon the remedial action that was deemed appropriate considering the criteria indicated below.

Criteria used to assess the remedial action alternatives are those described in NCP in 40 CFR 300.68 (E) - (J), (i.e. ... (1) air, land and water pollution; (2) migration of pollutants, and if an actual or potential danger may be posed; (3) extent and adequacy of existing
barriers; (4) extent to which substances pose a danger to public health, welfare and the environment which can include population at risk, amount and form of the substance present, hazardous properties of the substance, hydrogeological factors, and climate; (5) previous experiences; and (6) environmental effects and welfare concerns.

Factors Considered in Initial Screening of Alternatives

In order to identify the list of potential remedial actions for further detailed analysis, three broad criteria were used in the initial screening process: (1) the cost of installing and implementing the remedial action, including operation and maintenance costs where appropriate; (2) positive and adverse effects on the environment from the alternative itself, including implementation, or whether the alternative would be likely to achieve adequate control of source material, or for off-site remedial actions, would effectively mitigate or minimize the threat of harm to public health, welfare, or the environment (Generally, only those alternatives that effectively contributed to the protection of the public health, welfare or the environment were considered in further detailed analysis.); (3) the alternatives should be feasible for the location and conditions of the release, applicable to the problems, and represent a reliable means of addressing the problem.

Upon consideration of the above factors, the remedial action measures in the Consent Decree were developed. Those actions are presented below.

The complaint sought and the Consent Decree requires that actions be taken to eliminate the imminent danger to public health via contact
with PCB contaminated materials. Therefore, the remedial actions described herein provide for the containment and subsequent removal of moving contaminant plumes and PCB contaminated materials in the vicinity of Neal's Landfill.

The off-site remedies to be performed include:

1. Monitor water levels and collect water samples at selected residential wells within a 5,000-feet radius of the site. Determinations will be made for pH, specific conductance, and temperature, and laboratory analyses for PCBs will be completed. Monitoring activities at all sites will cease sometime between 5 and 30 years after closure of the site, contingent on decisions made by Environment Protection Agency (EPA), Indiana State Board of Health (ISBH), and the City of Bloomington based on monitoring results.

2. Capture sediment eroding off the landfill surface into Conard's Branch of Richland Creek. Transport sediment to the incinerator for incineration.

3. Provide an alternative water supply for the cattle and hogs raised by Mr. Conard at his farm just north of the site, if necessary.

4. Provide maintenance for removal and measures, including maintenance of monitoring wells, sediment collection systems, and any water treatment systems.
Closure and Post Closure

The Consent Decree provides for closure and post closure activities to be performed by Westinghouse Electric Corporation. These activities and plans have been developed in accordance with RCRA regulations, State of Indiana regulations, and the opinions of technical experts on the significance of:

1. Results of analyses of water and sediment samples taken from Conard's Branch, Richland Creek, and various springs and seeps at the site.
2. Results of analyses of samples and water level measurements obtained at various monitoring wells at the site.
3. Results of analyses of soil and vegetation samples at the site.
4. Results of analyses of aquatic life in Conard's Branch and Richland Creek.
5. Observations and measurements of rainfall and flows at springs and seeps at the site.
6. Geophysical information regarding the location of disposal areas at the site.
7. The geology and hydrogeology of the site.

Closure

The Consent Decree requires that the following closure measures be performed:

1. Conduct on-site and off-site monitoring.
2. Close all excavated areas to a grade having a minimum slope of 2 percent and a maximum slope of 25 percent without depressions which would cause ponding of water. To achieve this, Westinghouse shall backfill excavated areas as necessary with suitable fill materials placed in a structurally stable manner to maintain the minimum grades required. Suitable fill materials shall be defined as any materials which are not a hazardous waste, a solid waste, or contaminated with PCBs including rock, stone, earth, and other materials.

3. Implement a surface-water, drainage and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site. Establish a total vegetative cover in all disturbed areas in a timely manner. Vegetative cover shall provide short and long term erosion control. The root growth of the vegetative cover shall be deep enough to prevent erosion but not penetrate the clay cap where it exists.

4. Construct a four-foot thick clay cap having a permeability of equal to or less than $1 \times 10^{-6}$ cm/second, capable of vegetative support over those excavated areas where residual soils (as opposed to bedrock) remain.

5. Construct a clay cap over excavated areas where residual soil is not present.
Post Closure

The Consent Decree requires that the following post closure activities be implemented:

1. Sample Conard's Branch representative sediment locations as determined by the State.

2. Remove from said stream those sediments removable through the use of a hydrovacuum which are identified by the State of Indiana as contaminated with PCBs.

3. Conduct on-site and off-site monitoring.

4. Maintain the soil cover and vegetation to prevent erosion, and correct the effects of settling and subsidence to maintain proper slope. Westinghouse shall reseed as necessary. The root growth of the vegetative cover shall be deep enough to prevent erosion. Westinghouse shall continue to prevent surface-water run-on and run-off from eroding or otherwise damaging the soil cover.

5. Maintain integrity of fence until end of post closure period at which time security fencing (and warning signs) shall be removed.

6. Restrict property use to activity that will not adversely impact upon the integrity of the cover. All agricultural use of property is prohibited.

Community Relations

The City of Bloomington has been involved in various discussions concerning resolutions of the PCB contamination problem. The dialogue
occurred between U.S. EPA, Indiana State Board of Health, and Westinghouse, with the Mayor, the City Council, the Utilities Service Board, and the Environmental Quality and Conservation Commission.

Three local information repositories have been established.

Once the proposed Consent Decree is initialed by the negotiating parties, various community relations activities will occur.

1. The City of Bloomington cannot sign the Decree until it has been discussed publicly in City Council meetings. It is predicted that a minimum of thirty days will be needed to meet this requirement.

2. Indiana Environmental Management Board will also consider the Consent Decree before signing it.

3. The U.S. EPA will advertise in the local press and conduct a public meeting to brief the public on the terms of the agreement and respond to citizens’ questions. The Agency will also distribute fact sheets summarizing the agreement and the future opportunities for public participation.

Copies of pertinent documents will be added to the three information repositories for public review.

U.S. EPA will continue to implement, with the cooperation of the State and City, various community relations activities to assist citizens in developing informed public participation. This will include informational meetings, documents, and conversations during the thirty day public comment period required by the Department of Justice, and throughout the RCRA and TSCA permitting processes. The City and
the State will conduct public participation activities during their siting approval processes.

**Consistency With The National Contingency Plan**

When the U.S. Department of Justice filed the complaint against Westinghouse in January 1983, specific remedies to abate the endangerment presented by the landfill were sought in the complaint. Those elements are a part of the negotiated settlement. The remedies include excavation and removal of soil, debris, and other materials contaminated with CBs and other hazardous substances and incineration of the materials in a federally approved high-temperature incinerator to incinerate PCBs. Unlike the requirement in the complaint that the excavated materials be sent to an off-site incinerator, Westinghouse will design, construct, and operate an incinerator to be located at the Dillman Road Sewage Treatment Plant. The excavation, transportation to the incinerator, incineration, and disposal of the ash and other by-products of incineration will be in accordance with requirements of a TSCA, RCRA permit. The site will be remedied to mitigate further releases of contaminants into the environment from the landfill. These remedies form the basis for negotiation with Westinghouse for remedial action plan for the final Consent Decree.

All remedial actions required by the Consent Decree are not inconsistent with the National Contingency Plan.
Operation and Maintenance

Operation and maintenance requirements associated with the remedial actions herein will be required. The operation and maintenance costs incurred will be paid by Westinghouse Electric Corporation. The operation and maintenance will include provisions for fences, signs, erosion control devices, site security fences, diversion ditches, dikes, monitoring wells, clay caps and all other technical activities required by the Consent Decree.
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REMEDIAL ALTERNATIVES ASSESSMENT

NEAL'S DUMP
SPENCER, INDIANA

PREPARED FOR:
U.S. ENVIRONMENTAL PROTECTION AGENCY
EEI CONTRACT TDD NO. R5-8302-07A

July 1983
SECTION I INTRODUCTION

1.0 Scope

This report is the result of an evaluation of alternative remedial actions for Polychlorinated Biphenyl (PCB) contamination at the Neal's Dump site, south of Spencer, Indiana, located in a part of the Northeast Quarter of the Northeast Quarter of Section 12, Township 9 North, Range 4 West, 2nd Principal Meridian, Owens County. The site is the subject of a litigation effort by the U.S. Department of Justice against the Westinghouse Electric Corporation.

Continuing exposure of a thin soil cover over contaminated buried capacitors, capacitor paper, parts, soaked rags, and sawdust at the approximately 0.5 acre site establishes the need to proceed toward implementation of remedial measures as soon as feasible. Accordingly, this report has been prepared on a "fast track" procedure. Basic water quality and ground water level monitoring in wells is continuing. Additional soil borings and monitoring wells will be installed by Westinghouse in the near future. This study has been performed with reliance upon review of assorted field data and other information in rough form collected to date without re-presentation of summaries and data compilation available in other forms. Data evaluation, conclusions and professional judgments have been accomplished primarily through exchange of hard copy data and verbal interaction between members of the investigation team. As additional field data becomes available beyond the drafting of this report, comparisons will be made with that data available to date to determine if modifications of conclusions and professional judgments are warranted. Reference is made where appropriate to the respective data sources via footnotes.

The evaluation of remedial actions was based on the approach prescribed in Section 300.68 of the National Oil and Hazardous Substances Pollution Contingency Plan (Federal Register, Part V EPA, July 16, 1982).

1.1 Project Investigative Team

A team of experts and consultants consisting of:

- Daily & Associates, Engineers, Inc.
- P.E. LaMoreaux & Associates
- Geosciences Research Associates, Inc.
- R.A. Griffin and Associates
- Ecology and Environment, Inc.
- U.S. Environmental Protection Agency

provided technical evaluation and input into this study.
1.2 Data Sources

Data considered during the evaluation process included:

- boring logs prepared for monitoring wells at the site;
- results of analyses of samples and water level measurements obtained at various monitor wells at the site;
- results of analyses of soil samples at the site;
- general inspection memorandum from USEPA-V;
- opinions of experts regarding the geology and hydrogeology of the site including attenuation characteristics;
- affidavits from health experts and toxicologists.

1.3 Characteristics

Values ranging from 0.41 ppm to 101,000 ppm PCB have been identified in soil samples taken from the surface of the dump area. (1) There is a potential for lateral movement of water through silty sand and sand adjacent to the burial zone. Infiltration of precipitation through the cover material and direct ground water contact with the refuse mobilize PCB's.

SECTION II  PRELIMINARY REMEDIAL ACTION MEASURES

2.0 General

Prior to the commencement of the study regarding possible final remedial actions, it was determined that certain initial remedial measures were feasible and necessary to limit exposure or threat of exposure to a significant health or environmental hazard. This determination was made based upon various field observations and analytical test results, which revealed the following:

1. there is an actual or direct potential contact with the PCB contaminant by nearby population and local animal life;
2. there is no effective drainage control system to prevent the runoff of PCB contaminants;
3. visible PCB laden capacitors and capacitor paper and PCB stained soils were present on the dump site at or above ground surface which poses a serious threat to the public health and the environment;
4. conditions are such that normal rainfall and subsequent infiltration at the dump may cause the PCB contaminants to migrate from the site to pose a threat to the public health and environment.

2.1 Preliminary Remedial Measures

The United States and Westinghouse Electric Corporation have engaged in extensive discussions regarding preliminary remedial measures to be implemented at the site. In general, the remedial measures discussed include:

1. removal of exposed capacitors, capacitor papers and certain soils in close proximity to exposed capacitors, and disposal of the removed materials in appropriate facilities;
2. seeding of disturbed areas so that a full coverage of perennial vegetative growth is established and maintained;
3. implementation of erosion control measures to include erosion control fences;
4. provision of a chain-link security fence around the site to restrict access, and posting of warning signs.

In addition to the above-referenced measures, the parties have discussed supplementary conditions regarding preconstruction meetings, the role of the federal on-scene coordinator, site security, decontamination procedures, safety procedures and maintenance.

For purposes of this report, it has been assumed that the preliminary remedial measures discussed by the parties will shortly be implemented. Should this not occur, it would be necessary to modify certain elements of the final remedies evaluated in this report and to make corresponding adjustments in the costs of the systems evaluated.
Footnotes


(2) United States of America and Environmental Management Board of the State of Indiana versus Westinghouse Electric Corporation and Monsanto Company, proposed Exhibit A to Stipulation and Order in the United States District Court for the Southern District of Indiana, Indianapolis Division, No. IP-83-9-C, draft of June 8, 1983
SECTION III - FINAL REMEDIAL ACTION SELECTION AND SCREENING

3.0 General

3.0.1 Appropriateness of Remedial Action Measures - Remedial action measures generally are contained in three categories: one, the no-action alternative; secondly, a source control or on-site remedial action; and thirdly, an off-site remedial action.

In general, "source control remedial actions may be appropriate if a substantial concentration of hazardous substances remain at or near the area where they were originally located and inadequate barriers exist to retard migration of substances into the environment." Criteria normally used to assess the source control remedial action alternatives are: one, extent to which substances pose a danger to public health, welfare or the environment, considering factors such as population at risk, amount and form of substance, hazardous properties of substance, hydrogeological factors, and climate; two, extent of migration of contaminant; three, previous experiences and approaches; four, environmental effects and welfare concerns. (1)

Off-site measures typically will address contamination that has migrated beyond the area where the hazardous substances were originally located. These "measures may include provision of permanent alternative water supplies, management of a drinking water aquifer plume or treatment of drinking water aquifers. The following criteria are generally used in determining whether and what type of off-site action should be considered": one, air, land and water pollution; two, migration of pollutants; and if an actual or potential danger may be posed - three, extent and adequacy of existing barriers; four, extent to which substances pose a danger to public health, welfare and the environment which can include population at risk, amount and form of the substance present, hazardous properties of the substance, hydrogeological factors, and climate; five, previous experiences; and six, environmental effects and welfare concerns. (2)

3.0.2 Development of Alternatives - The alternatives developed for study in the initial screening process were selected depending upon the remedial action that was deemed appropriate considering the criteria indicated in Section 3.0.1.

3.0.3 Factors Considered in Initial Screening of Alternatives - In order to identify the list of potential remedial actions for further detailed analysis, three broad criteria were used in the screening process: 1) the cost of installing and implementing the remedial action, including operation and maintenance costs where appropriate; 2) positive and adverse effects on the environment from the alternative itself, including implementation, or whether the alternative would be likely to achieve adequate control of source material, or for off-site remedial actions, would effectively mitigate or minimize the threat of harm to public health, welfare or the environment. Generally, only those alternatives that effectively contributed to the protection of the public health, welfare or the environment were considered in further detailed analysis; 3) the alternatives should be feasible for the location and conditions of the release, applicable to the problems and represent a reliable means of addressing the problem. (3)
The alternatives selected for initial screening, where appropriate, were subjected to cost evaluations utilizing existing cost curves and cost data from various EPA referenced publications and traditional construction cost data books, such as "Means" and "Dodge." Where necessary, these reference sources had their costs updated to 1983 dollars utilizing the Engineering News Record Construction Cost Index History. Where adequate reference material on general cost data was not available, figures were generated using interviews with knowledgeable persons and personal experience.

3.1 No Action Alternative

The no action alternative was considered, but is not believed to be a viable possibility since the current situation poses a much greater environmental or health danger than any remedial action considered during the initial screening of alternatives phase. PCB contamination is present in the abandoned dump. The topographic and hydrogeologic features of the site and vicinity and limitations of the existing cover over the dump characterize a setting wherein the risk of migration of the contaminants must be reduced.

3.2 On-Site Remedial Actions

The following is a listing of those on-site remedial action alternatives developed and considered in the initial screening process. Note that while the cost and effects of the alternatives as well as acceptable engineering practice are the three broad criteria which should be used in the screening process, it wasn't necessary to consider all three in detail for each alternative. Upon initial investigation it was found that some alternatives would have either adverse environmental effects; little effect in minimizing or mitigating the harm to the environment; were deemed inadequate; or acceptable engineering practices have not been developed to date to allow implementation of the process. For purposes of definition in this screening process, those actions termed "on-site" or "source control" are deemed to be those actions occurring immediately adjoining to or inside the security fencing to be constructed as a Preliminary Remedial Action Measure.

On-Site Remedial Action Alternatives

A) Remove all refuse and contaminated soil from the dump
B) Remove only PCB contaminated refuse and soils from the dump
C) Install permanent cap on dump
D) Surface water drainage control, grading and revegetation
E) Install impermeable barrier around and under site, include the treating of leachate
F) Security fence
G) In-situ treatment of waste and soil
H) Leachate collection system
3.3 Off-Site Remedial Action Alternatives

Test results available to date indicate there has been limited migration of PCB contaminants from the immediate vicinity of the buried refuse. Accordingly, off-site remedial actions do not appear to warrant specific consideration at this time. Two actions given general consideration were provision of an alternate water supply for nearby residents and/or relocation of nearby residents with posting of the area. It is concluded that the situation, as currently defined, can be adequately addressed with on-site alternatives.

3.4 Screening of Alternatives

The initial alternatives developed had estimated costs ranging from $0.1 Million to $4 Million with varying degrees of effectiveness in mitigating or minimizing the hazard.

The preliminary remedial action measures had some effect on the screening of the final measures. The security fencing is expected to be in place. It was sufficient to indicate that the fencing will be either tied to other alternatives as complimentary work items or need retrofit and maintenance to conform to the final recommended plan.

Some alternatives were deemed to be very limited in effectiveness or have doubtful constructability. In some instances, development of cost estimates for screening was not warranted; i.e., in-situ microbial treatment of soil and waste and leachate collection system.

The screening process revealed that no one alternative action as defined for initial screening would be able to mitigate the threat of contamination of adjacent areas. It was obvious that a system of actions would be necessary to provide a proper response. Therefore, those alternatives which survived the effectiveness, constructability, and order of magnitude of costs tests were studied for the purpose of developing a system of action to be considered in detail.
Footnotes


(2) Ibid, p. 31216

(3) Ibid, p. 31216

(4) Ron Lillich, Environmental Scientist, United States Environmental Protection Agency, "Inspection at Neal's Dump in Owen County Near Spencer, Indiana" reported January 15, 1981, including Laboratory Test Results and Sample Location Descriptions
SECTION IV - ANALYSIS OF ALTERNATIVES

4.0 Alternative Systems Subjected to Detailed Evaluation

Three alternative systems were developed which address the potential for leakage of PCB contaminants from the dump. In addition, the ground water movement through the waste was assessed with respect to possible response actions. All alternative systems were developed with the expectation that contaminant levels greater than 1.0 parts per million of PCB in exposed or potentially exposed soils and 0.1 parts per billion in surface and ground waters is to be prevented.

The three alternatives that received detailed evaluation were:

1. **System A.** Removal of all wastes from the dump site; transportation and proper redisposal; refilling of excavation with soil and grading; surface water drainage and erosion control and revegetation; removal of security fencing; roadway work; and monitoring for a period estimated at 7 years.

2. **System B.** Installation of a permanent cover over the dump (refuse remains in place); construction of a slurry wall as a barrier to ground water flowing laterally through the buried refuse; provision of wells for monitoring and potential future leachate collection, surface water drainage and erosion control and revegetation; security fencing modifications; roadway work; and monitoring for a period of 30 years or more. Future lease and operation of a portable treatment plant may be necessary.

3. **System C.** Same as B without the slurry wall. Monitoring includes the basis on which it may be determined if there is need for a slurry wall at a later date. Future lease and operation of a portable treatment plant may be necessary.

Note: reference in this section to TSCA refers to Toxic Substances Control Act; RCRA refers to Resource Conservation and Recovery Act.
4.1 Assumptions

Developing the details of the three final alternative systems required numerous assumptions. Assumptions common to more than one of the alternatives were made regarding the following topics:

- Factors considered in the evaluation process
- Accuracy of cost estimate
- Economic analysis
- Grading of permanent covers
- Ground water movement
- Infiltration through refuse
- Fluid of decomposition and leakage
- Surface water drainage controls
- Soil stabilization
- Land and easements

4.1.1 Factors Considered in the Evaluation (1) included detailed refinements and specifications of the alternative systems; detailed cost estimates including distribution of costs over time; capability for engineering implementation or constructability; to what extent the alternative is expected to effectively mitigate and minimize damage to, and provide protection of public health, welfare, and the environment relative to other alternatives; and adverse environmental impacts.

4.1.2 Accuracy of Cost Estimates - The cost estimates are intended solely for comparison of the alternatives. The final cost of the selected remedial action will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors. As a result, the final project cost will probably vary from the estimates presented in this report.

4.1.3 Economic Analysis - All costs are at mid-1983 price levels. Interest during construction and price escalation are not included in the analysis. Project costs do not include sales tax, use tax, licensing or permit fees. A contingency amounting to approximately 10% was applied to each alternative studied. The project life for Systems "B" and "C" were set at 30 years, although it is conceivable that operational and maintenance costs could be incurred beyond that period. Due to the complete removal of all waste in System "A", reoccurring annual costs will depend upon how long it takes for residual contaminants to be attenuated within an acceptable distance from the original source.

Annual operation and maintenance costs developed for each system studied are in terms of 1983 dollars and generally consist of the following categories:

- Costs to maintain and repair damage to the surface water drainage control features, fencing and revegetation.
- Costs to monitor the effectiveness of the remedial action for the life of the project on a quarterly basis.
The annual costs were then evaluated using their present value. A present value analysis compares alternative future cash flows of a project on a common basis (i.e., in 1983 dollars). This common basis is obtained through adjusting future dollars by applying a factor called the discount rate (10%). The discount rate is based on the value of having the use of money now instead of in the future.

4.1.4 Grading of Permanent Cover - Because of the need to prevent ponding of water on fill materials and minimize the possibilities of soil erosion, it was assumed that the cover material called for in Systems B and C would be designed and constructed such that the cover would have a grade of no less than 6%. Additional grading is anticipated to maintain sheet flow of runoff waters rather than allow it to concentrate.

4.1.5 Ground Water Movement - The general direction of movement of a shallow ground water system which comes into contact with the buried refuse is westerly.

4.1.6 Infiltration Through Refuse - Precipitation falling on the surface of refuse or its cover which infiltrates through the waste produces a leachate.

4.1.7 Fluid of Decomposition and Leakage - Materials and containers containing fluid release the fluid over time and the decaying of refuse generates a fluid, both of which produce a leachate.

4.1.8 Surface Water Drainage Control - The primary purpose of the drainage control is to prevent surface runoff resulting from precipitation on areas adjacent to the buried refuse from coming in contact with the cover material. This was deemed necessary to prevent erosion of the permanent cover materials and contributions to the moisture levels in the refuse itself.

4.1.9 Soil Stabilization - All soils disturbed during construction of the system alternatives were assumed in the cost estimates to be stabilized by seeding with native grasses that grow without supplemental watering. It is recommended that in the final design stages of this project that the local Soil Conservation Service (USDA) be consulted regarding recommended grasses, rates, and protection to maximize the vegetative cover growth and long term protection of upper soil layers.

4.1.10 Land and Easements - Consideration of this aspect will have to be made in later stages of the project. No costs were assigned to the project cost summaries for the system alternatives at this time.

4.2 System "A" Alternative

System A involves the complete removal of all wastes from the dump site and disposal at proper facilities. Associated work to restore the site and monitoring is included.
4.2.1 System "A" Assumptions

- Suitable borrow material for refilling the excavation will be found within 5 to 10 miles of the site.
- Adequate capacity is available at EPA approved landfill sites meeting TSCA or RCRA criteria and EPA approved PCB incinerator facilities to handle the volumes of refuse from Neal's Dump.
- Adequate transportation will be available to handle the refuse removed from the site in a timely manner.
- Capacitor body dimension and weights are such that two capacitors with associated small parts and paper may be placed in a 55 gallon storage drum for transportation to the incinerator facility.
- Capacitors in 55 gallon drums may be stockpiled on site until truckload quantities are generated.
- The working face of the refuse excavation will be kept to the smallest area possible to minimize nuisance odors. In addition, the working face will be protected (i.e., sheltered) during excavation and when excavation has halted to minimize erosion or intrusion of rain or surface waters.
- Work done on and off site will be done in level B and C protective clothing and equipment.
- Normal landfilling procedures will be taken to control blowing dust and refuse debris.

4.2.2 System "A" Detailed Description - The work anticipated under the System "A" alternative will consist of the initiation of the following work items:

- Securing necessary permits.
- Commencement of refuse removal by excavation.
- Loading, transportation and disposal of refuse in respective EPA approved sites.
- Placing soil in the excavation to bring it to grade and shaping of the surface.
- Removal of fencing around dump site.
- Revegetation.

The cost presented for removal and disposal of refuse considered that all waste would go to an EPA approved disposal site meeting TSCA criteria. The capacitor units, paper and parts would be barrelled and then incinerated at a facility approved by EPA for PCB destruction.

Erosion control and sediment containment construction procedures are expected during the excavation process to protect adjacent water courses.

Surface water drainage control measures generally consist of providing for temporary diversion of runoff waters on the eastern and southeastern edge of the site to prevent flow across the work area.

Soil placed in the excavation should be compacted to minimize settlement after the filling operation is completed. A density of 80% of the maximum dry density defined by the Standard Proctor Test (ASTM D-698) is presumed adequate.

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The access roads to existing trailer locations must be reconstructed due to the encroachment of the excavation and security fence upon the present locations.

Monitoring of existing wells should continue for a period of seven years on a quarterly basis.

The total estimated capital cost for the System A alternative is $3,384,000. This is the most expensive of the three alternatives. Anticipated present worth of the project including post construction cost disbursements is $3,410,000. Length of project construction is estimated at 1 year, more or less.

4.3 System "B" Alternative

System B involves leaving the waste in place and includes a slurry wall, a permanent cover, and supplementary remedial action. See the Drawing in Appendix 2.

4.3.1 System "B" Assumptions

- There will be no future residential, commercial or agricultural use of the site.
- Suitable borrow material for the permanent cover material will be found within 5 to 10 miles of the site.
- Work done on and off site in contact with PCB contaminants will be in Level C protective clothing and equipment. Non-contact work such as treatment plant or slurry wall construction will utilize normal construction safety and health precautions.
- Work areas where soil fill is to be applied will be grubbed and/or cleared of vegetative matter.
- Standard construction techniques will be utilized to control blowing dust and soil erosion from the working areas until revegetation procedures are completed.

4.3.2 System "B" - Detailed Description - The initial phase of work anticipated under the System B alternative will consist of simultaneous initiation of the following work items:

- Secure applicable permits
- Access roads
- Security fence addition and relocation
- Slurry wall
- Surface water and drainage control

The second phase includes construction of the permanent cover, installation of four new monitoring wells and revegetation of disturbed areas.
For purposes of a cost estimate, the slurry wall is assumed to average 21-foot depth from the ground surface and 4-foot thickness. The objective is that it socket into the existing silty clay stratum (glacial till--average thickness 20 feet) thereby obstructing the lateral movement of ground water through the overlying sand and silty sand to prevent contact with the buried refuse. It should penetrate the stratum approximately one foot. It is expected that borings along the proposed alignment of the slurry wall will be needed to confirm an adequate tie-in elevation for the well bottom. A bentonite slurry formulated and installed according to good engineering and construction practice is the material and methodology recommended.

A permanent cover is to be placed over the buried refuse, 0.5 acres, whose purpose is to minimize exposure of the refuse to precipitation and infiltration. The existing surface shall be cleared of vegetative matter and proof rolled. Clay or clay loam soil shall then be applied to produce a crown near the center of the area which will result in at least 6% slopes to the perimeter of the refuse area. Next, clay or clay loam soil shall be placed in 6-inch lifts and compacted to 90% of the maximum Standard Proctor density (ASTM D-698) within a range of 3% less to 3% more than the optimum water content. The surface of this layer will be picked clear of cobbles or large pebbles, especially objects with sharp edges. The surface shall then be flat rolled, then a 20-mil thick membrane (PVC assumed) applied on this surface with all seams sealed. A two-foot thick blanket of clayey soil shall then be placed on top of the membrane in 12-inch lifts. Nominal compaction shall be applied to this material in order to prevent puncture of the membrane. Several passes with wide wheel or broad tired construction equipment is expected to be adequate to achieve a density which will minimize future erosion of the soil. The existing nearby soil surface appears to have provided reasonable erosion resistance and appears to afford a good growth medium. The top 12 inches of the cover should be constructed of soil similar to the existing surface soil present on the areas adjacent to the site.

Four monitoring wells would be located within the perimeter of the slurry wall nearly evenly spaced to penetrate the buried refuse (maximum one foot below deepest waste at each well). They shall be constructed 4-inch diameter with a corrosion resistant screen and gravel packed to serve as future extraction wells if pumping for water table management and treatment becomes necessary. The structural integrity and imperviousness of the slurry wall is related to the tolerable differential water elevation across the wall. Water table fluctuations outside the wall and leachate accumulation within the wall produce the differential. Levels which indicate a need for pumping are a slurry wall design requirement. Monitoring is expected to continue for 30 years or more.

An estimate is presented for the cost of leasing and operating a portable carbon adsorption treatment plant. This measure may or may not be required. Implementation of this remedial measure component is contingent upon the need to withdraw leachate (PCB contaminated) to regulate differential pressures across the slurry wall or in the event that critical levels of PCB contaminants migrate past or through the slurry wall.
The total estimated capital cost for the System B alternative is $385,000. This is the second lowest cost of the three alternatives. Anticipated present worth of the project without the cost for a portable treatment plant is $444,500. Length of project construction is 0.75 year, more or less.

4.4 System "C" Alternative

System C is identical to the System B alternative except that no slurry wall construction is contemplated until such time, if any, a need is demonstrated based on a monitoring program.

4.4.1 System "C" Assumptions - The assumptions presented in the System B alternative are applicable for System C.

This alternative depends upon the natural attenuation capacity of the soils surrounding the buried refuse and PCB's.

4.4.2 System C - Detailed Description - The following work items are anticipated to commence simultaneously

- Secure applicable permits
- Access roads
- Security fence addition and relocation
- Surface water and drainage control

The second phase includes construction of the permanent cover, installation of four new monitoring wells and revegetation of disturbed areas.

The details of the permanent cover; access roads; drainage work; fencing; are as identified in the System B.

The action considerations for determination of the need for a slurry wall would include:

- Two new monitoring wells, each approximately 10 ft. downgradient of the edge of buried refuse.
- Monitoring for the concentration of PCB quarterly.
- When and if the concentration of PCB reaches 10 ppb, install a third and possibly fourth monitoring well 10 ft. further downgradient in line with the well at which this level is reached.
- Monitor third well for concentration of PCB quarterly.
- Evaluate observations of monitoring wells and make decision about apparent attenuation rates.
- If conclusion is that natural attenuation along the path to a discharge point is not adequate, implement construction of slurry wall described in alternative System B.

The total estimated capital cost for the System C alternative is $162,500. This is potentially the lowest cost of the three systems studied. Anticipated present worth of the project including post construction cost disbursements is $220,000. Length of project construction is 0.5 year, more or less. However, if a slurry wall must be constructed at a later date, the capital cost (1983 cost rates) would be $265,000. None of these costs include a portable treatment plant lease and operation if needed in the future.
4.5 System Costs

The following tables provide a general cost breakdown for each system and the anticipated annual costs following construction. Provided below is a brief description of certain line items common to each system cost.

4.5.1 Mobilization - Startup - Includes allowance for such items as Builders All-Risk, Public Liability and equipment insurance, performance bonds, temporary facilities such as construction trailers, equipment buildings, sanitary facilities, etc.; cost of mobilizing/demobilizing major pieces of equipment to the job site; and costs for temporary utilities.

4.5.2 Safety Protocol and Decontamination - Allows for on site safety requirements such as equipment, clothing, first aid equipment, monitoring equipment, training program and medical examinations and safety officer. In addition, those pieces of equipment that come in contact with contaminated soils and refuse will need cleaning before leaving the site.

4.5.3 Contingency - Since it is not possible to account for all anticipated work components or anticipate actual costs at this stage of the project, an allowance of approximately 10% has been included for those fortuitous events which come with foresight or expectation.

4.5.4 Engineering, Legal and Administrative - Costs have been estimated at 25% for Systems B and C; and at 15% for System A. This item includes costs associated with field surveys, planning, design contract preparation and review, bidding, contract administration, inspection, permit acquisition, construction management, and other associated costs.

4.5.5 Cost Summaries for System A, B, and C - These cost estimates presented are not included to represent actual labor and material costs, competitive market conditions, and other variable factors; but are intended solely for comparison of the alternatives.
## FINAL REMEDIAL MEASURES
### SYSTEM A - ALTERNATIVE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization - Startup</td>
<td>$122,000</td>
</tr>
<tr>
<td>Excavation, Processing &amp; Loading Waste</td>
<td>110,000</td>
</tr>
<tr>
<td>Transportation To and Fees At (TSCA) Landfill for Waste and Soils</td>
<td>916,000</td>
</tr>
<tr>
<td>Transportation To and Fees At (TSCA) Incinerator (Capacitors)</td>
<td>1,350,000</td>
</tr>
<tr>
<td>Surface Water Control &amp; Soil Erosion Measures</td>
<td>15,000</td>
</tr>
<tr>
<td>Fill Excavation</td>
<td>137,000</td>
</tr>
<tr>
<td>Revegetation</td>
<td>6,000</td>
</tr>
<tr>
<td>Fence Removal</td>
<td>2,500</td>
</tr>
<tr>
<td>Roadway Work</td>
<td>3,500</td>
</tr>
<tr>
<td>Safety Protocol and Decontamination</td>
<td>21,000</td>
</tr>
<tr>
<td>Contingency (≈10%)</td>
<td>260,000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$2,943,000</td>
</tr>
<tr>
<td>Engineering, Legal and Administrative (≈15%)</td>
<td>441,000</td>
</tr>
<tr>
<td><strong>TOTAL ESTIMATED CAPITAL COST</strong></td>
<td>$3,384,000</td>
</tr>
<tr>
<td>Present Worth of Annual Site Monitoring</td>
<td>26,000</td>
</tr>
<tr>
<td>5,300 (pwf-10%-7 Yr)</td>
<td></td>
</tr>
<tr>
<td><strong>PRESENT WORTH OF SYSTEM &quot;A&quot; ALTERNATIVE</strong></td>
<td>$3,410,000</td>
</tr>
</tbody>
</table>
## FINAL REMEDIAL MEASURES
### SYSTEM B - ALTERNATIVE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization - Startup</td>
<td>$ 18,000</td>
</tr>
<tr>
<td>Slurry Wall Construction</td>
<td>152,000</td>
</tr>
<tr>
<td>Permanent Cover Over Site</td>
<td>89,000</td>
</tr>
<tr>
<td>Fencing (Removal &amp; Replacement; Retrofit)</td>
<td>3,500</td>
</tr>
<tr>
<td>Surface Water Drainage Control</td>
<td>2,500</td>
</tr>
<tr>
<td>Revegetation</td>
<td>6,000</td>
</tr>
<tr>
<td>Soil Erosion Control</td>
<td>2,500</td>
</tr>
<tr>
<td>Roadway Work</td>
<td>3,500</td>
</tr>
<tr>
<td>Monitoring Extraction Wells</td>
<td>4,000</td>
</tr>
<tr>
<td>Contingency (≈ 10%)</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>$ 308,000</td>
</tr>
<tr>
<td>Engineering, Legal and Administrative (≈ 25%)</td>
<td>77,000</td>
</tr>
<tr>
<td><strong>TOTAL ESTIMATED CAPITAL COST</strong></td>
<td>$ 385,000</td>
</tr>
<tr>
<td>Present Worth of Yearly Operating &amp; Maintenance Costs $1000 (pwf-10%-30 Yr)</td>
<td>9,500</td>
</tr>
<tr>
<td>Present Worth of Annual Site Monitoring $5300 (pwf-10%-30 Yr)</td>
<td>50,000</td>
</tr>
<tr>
<td><strong>PRESENT WORTH OF SYSTEM &quot;B&quot; ALTERNATIVE</strong></td>
<td>$ 444,500</td>
</tr>
</tbody>
</table>

Note: Withdrawal of leachate and treatment with a portable plant is a potential cost dependent upon monitoring:

**ESTIMATED LEASE AND OPERATING COST** - $82,000 (each time needed)
<table>
<thead>
<tr>
<th>ITEM</th>
<th>COSTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilization - Startup</td>
<td>$11,000</td>
</tr>
<tr>
<td>Permanent Cover Over Site</td>
<td>$89,000</td>
</tr>
<tr>
<td>Surface Water Drainage Control</td>
<td>$2,500</td>
</tr>
<tr>
<td>Revegetation</td>
<td>$6,000</td>
</tr>
<tr>
<td>Soil Erosion Control</td>
<td>$2,500</td>
</tr>
<tr>
<td>Roadway Work</td>
<td>$3,500</td>
</tr>
<tr>
<td>Monitoring-Extraction Wells</td>
<td>$4,000</td>
</tr>
<tr>
<td>Contingency (= 10%)</td>
<td>$11,500</td>
</tr>
</tbody>
</table>

**Subtotal** $130,000

| Engineering, Legal and Administrative (= 25%) | $32,500 |

**TOTAL ESTIMATED CAPITAL COST** $162,500

<table>
<thead>
<tr>
<th>Present Worth of Yearly Operating &amp; Maintenance Cost</th>
<th>$7,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Worth of Site Monitoring</td>
<td>$5300</td>
</tr>
</tbody>
</table>

**PRESENT WORTH OF SYSTEM C ALTERNATIVE** $220,000

Potential Later Construction of Slurry Wall:
(dependent on site monitoring)

| Mobilization - Startup          | $12,000 |
| Slurry Wall Construction        | $152,000 |
| Permanent Cover Adjustment      | $29,000  |
| Contingency (= 10%)             | $19,000  |

**Subtotal** $212,000

| Engineering, Legal and Administrative (= 25%) | $53,000 |

**TOTAL ESTIMATED CAPITAL COST** $265,000

Note: Withdrawal of leachate and treatment with a portable plant is a potential cost dependent upon monitoring:

**ESTIMATED LEASE AND OPERATING COST** - $82,000

(each time needed)
4.6 Technical Evaluation

The technical evaluation of the three alternatives was performed by comparing various criterion suggested by the National Contingency Plan for Oil and Hazardous Substances. All three systems evaluated in the final screening utilize established technology. Analysis of the remaining criteria is presented in chart form as follows:

<table>
<thead>
<tr>
<th>Criterion</th>
<th>System A</th>
<th>System B</th>
<th>System C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Life Cycle Costs (Present Worth)</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2. Reliability</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. Implementation</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4. Constructability</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5. Protection of Public Health, Welfare and Environment</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. Duration of Construction</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7. Duration of Facility Operation and Maintenance</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Each alternative was ranked numerically (first, second, or third) per criterion with "1" being best of the three and "3" being least desirable of the three alternatives. In order to acknowledge that in certain instances, two or more alternatives may compare very close in a category, equal ranking was allowed where it was warranted.

System C resulted in the lowest life cycle costs with System A having the most expenditure of money.

From a reliability standpoint, System A proved best in the long range with its fail safe approach of removing all sources of contamination from the area. System C appears the least reliable due to dependence upon natural attenuation without restriction of ground water contact with PCB contaminants.

Implementation relates to the level of management effort required to carry the project into effect. Systems B and C both rank highly in this aspect, with System A requiring considerable planning to arrange for necessary permits, location of ultimate disposal for large volumes of waste, arrangements for incineration of capacitors, and the collection of a fleet of transport vehicles.
Considering constructability, System C has the least amount of work required. System B includes a slurry trench, but is still substantially less construction than System A.

Over a long term basis, complete removal of buried waste offers the best protection of the public health, welfare and environment. However, excavation of general refuse presents certain potential nuisance problems which will require special attention.

Duration of construction has an effect on how long PCB discharges are possible before final remedial measures are achieved. In this category, System C has the shortest term with System A the longest term.

Once initial construction is completed the variable cost becomes the maintenance and monitoring or deferred construction. System A costs are expected to cease after 7 years. Systems B and C will require maintenance and monitoring for 30 years or longer.

Based upon the above discussed factors, if the numerical ranking for each alternative is totaled; an overall technical evaluation of the systems is apparent which can aid in the selection of the actual remedial action alternative to be implemented. This ranking does not give weight to individual criterion items. Final selection should be based on consideration of the relative importance of dominant criterion.
Footnotes


(4) Ibid, June 1, 2, 1983 Chicago, Ill. and June 14, 15, 1983 Bloomington, Ind.

(5) Ibid, June 1, 2, 1983 Chicago, Ill. and June 14, 15, 1983 Bloomington, Indiana

(6) Federal Register, 40 CFR Part 300 op. cit., p. 31217
APPENDIX 1

INITIAL SCREENING OF ALTERNATIVES
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Removal of Refuse and Contaminated Soils

DESCRIPTION

Two options were considered in this alternative: 1) complete removal of all refuse, and 2) removal of only PCB contaminated refuse and soils. In general, both removal operations involve the following procedures. Remove the existing cover and refuse in a manner which will allow separation of capacitor bodies, capacitor parts and capacitor paper to be placed in approved 55 gallon drums. The drums are then transported to and incinerated in an EPA approved facility meeting TSCA* criteria. Unless testing can demonstrate that appreciable areas of the refuse are not PCB contaminated or that concentrations are less than 50 ppm PCB the refuse must be transported to and properly disposed in an EPA approved landfill meeting TSCA criteria. (Refuse at less than 50 ppm can go to an EPA approved secure landfill meeting RCRA** criteria). Provide control over exposure to precipitation and drainage in working areas during excavation and properly deal with leachate. Following removal, the excavation would be filled with soil, compacted to minimize settlement, graded for surface drainage and seeded according to applicable standards.

* TSCA: Toxic Substances Control Act
** RCRA: Resource Conservation and Recovery Act

COST

Range: $3 to $4 Million (complete removal)
Not sufficient data available to estimate partial removal cost.

EFFECTS

- mitigates potential for PCB discharge from site by removing source
- possible air pollution problems due to excavation of decomposing general refuse
- contact with precipitation during excavation and loading must be minimized (water and leachate encountered may require special handling and/or treatment)
- the site will be restored to a condition similar to that which existed prior to the waste burial
- some contaminants may be present in subsoils under and adjacent to the portion excavated to remove buried refuse
- transportation impact on local and cross country routes
- will require special permits

ACCEPTABLE ENGINEERING PRACTICE

Previous experience exists. Planning and construction procedure will require serious consideration of health and safety factors.

CONCLUSION

Recommended for further detailed study. Consider related measures for an effective system.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Installation of Permanent Cap on Landfill

DESCRIPTION

Considered soil, rubberized asphalt or portland cement concrete the most applicable of potential design options. Concluded that a polyvinylchloride membrane would be functional with each. Construction to achieve comparable infiltration reductions using the latter two materials would be more expensive than soil. Land use doesn't warrant the added cost. Soil cap quantity based on four-foot minimum total thickness plus grading to provide 6% minimum top slope. Clay or clay loam material obtained off site would be compacted to produce the principal barrier component directly above the refuse with a minimum two-foot thickness graded to the 6% minimum slope; a 20-mil PVC membrane carefully placed on a flat rolled surface of the compacted soil; then a two-foot thick layer of clayey soil placed on top of the membrane with care to protect the layer. The latter soil layer should be compacted to the maximum feasible while protecting the PVC membrane. The vegetative bed (top of the layer) should include soil similar to the existing material adjacent to the site since its erosion resistance appears reasonable. Also includes seeding in accordance with applicable standards.

COST

Range: $0.10 to $0.15 Million (soil & PVC design only)

EFFECTS

- reduces infiltration of precipitation through surface of landfill into refuse and ground water
- does not mitigate leakage of PCB's from capacitors
- the effects of ground water contacting the buried refuse needs consideration
- not expected to impact the ground water system easterly of and in the buried refuse which provides for continuation of saturation of refuse
- ground water in refuse will still have PCB concentrations
- requires erosion control and maintenance

ACCEPTABLE ENGINEERING PRACTICE

Previous experience exists.

CONCLUSION

Recommended for further detailed study. Consider related measures for an effective system.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Surface Water Drainage Control (Run On), Grading and Revegetation of Disturbed Areas

DESCRIPTION

The objective is to prevent runoff due to precipitation on adjacent areas from discharging onto or into the buried waste, to prevent ponding of water and to prevent or minimize soil erosion. This measure would involve regrading to raise the grade of the existing cover and/or excavate a swale near the easterly, northeasterly and southeasterly side of the buried refuse site to cause surface runoff to bypass the area over the buried refuse.

COST

Not determined during initial screening.

EFFECTS

- reduces infiltration of water through the surface cover into the refuse
- this alternative not expected to minimize or prohibit the release of PCB contaminants from the buried waste
- potential dust and down gradient sedimentation as a result of construction requires attention
- the diversion swales would become permanent features
- most effective as a measure to complement other measures involving grading

ACCEPTABLE ENGINEERING PRACTICE

Previous experience available.

CONCLUSION

Recommended for further detailed study. Consider other principal measures for an effective system.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Installation of Impermeable Barrier Around and Under Site

DESCRIPTION

Considers containerizing the landfill, its perimeter (650 lineal feet) and floor (0.5 acre +) using grouting methods. Bentonite slurry anticipated. Sheet piling not included as alternate design in view of lack of fine soil particles needed to seal seams.

COST

Not determined during initial screening

EFFECTS

- provides significant restriction of migration of PCB contaminants
- requires secure cover and surface grading over landfill to reduce water infiltration into refuse
- potential differential water levels on each side of the wall due to water table fluctuations may require water table management to prevent piping failure of the wall
- may require treatment of leachate accumulation within cell to prevent hydraulic failure of barrier
- success highly dependent on distribution of grout for floor which cannot be readily monitored

ACCEPTABLE ENGINEERING PRACTICE

Limited experience available relating to creation of slurry floor without removal of waste. Previous experience exists for slurry walls.

CONCLUSION

Not recommended in total form described. Would not expect grouted floor to be a significant improvement over existing silty clay strata under refuse. Consider slurry wall as a part of a system with existing silty clay formation below refuse accepted as floor.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

Security Fencing

DESCRIPTION

Provided to protect human and animal life from contact with the contaminated materials on the site. This alternative was developed for implementation in the preliminary remedial action plan. Upgrading, modification or maintenance of the existing fencing is anticipated in the final remedial action analysis. No additional study was undertaken in the initial alternative screening analysis.

COST

Not determined during initial screening

EFFECTS

Not determined during initial screening

ACCEPTABLE ENGINEERING PRACTICE

Previous experience exists.

CONCLUSION

Recommended for detailed study as a part of a series of actions. As long as PCB waste is present on site, unauthorized human or animal intrusions must be prevented.
ON-SITE REMEDIAL ACTION

ALTERNATIVE

In-Situ Treatment of Waste and Contaminated Soils

DESCRIPTION

Considers the injection of mixed microbial cultures into the refuse waste and contaminated soil to degrade the PCB contaminants within the landfill.

COST

Not determined during initial screening

EFFECTS

- Not considered to be effective. Previous laboratory research indicates some success particularly with the mono- and dichloro-biphenyl isomers; lesser success was shown for trichlorobiphenyls isomers and almost no success with the tetrachlorobiphenyl isomer. Aroclor 1242, a relatively lower chlorinated series of isomers, still contains a significant percentage of the higher chlorinated isomers which will probably be difficult to degrade.
- Effects of mixed microbial cultures escaping from the landfill is not known at this time.
- Continued corrosion of capacitors in the landfill will require the maintenance of a permanent microbial colony in the site.

ACCEPTABLE ENGINEERING PRACTICE

- No practical experience with process, although an interesting potential full scale research project, its probable success is unknown at this time.
- Would require large amounts of the microbial cultures, maybe over an extended period of time, such amounts may not be available.
- Even dispersion of the cultures in the refuse would be difficult.

CONCLUSION

Not recommended for detailed study.
ON-SITE REMEDIAL ACTION

ALTERNATIVE
Leachate Collection System

DESCRIPTION
Considered for the purpose of extracting refuse leachate from the buried refuse and treating it to remove PCB contamination. Expected to consist of 3 to 5 small diameter scavenger wells for withdrawal of leachate, strategically placed within the burial zone. Portable activated carbon treatment plant would be feasible for reduction of concentration of PCB in discharge from wells to detectible limits.

COST
Not developed during initial screening.

EFFECTS
- does not prevent generation of leachate
- infiltration of precipitation will continue
- barriers within buried waste could prevent migration of leachate to scavenger wells, but allow migration from site

ACCEPTABLE ENGINEERING PRACTICE
Previous experience exists.

CONCLUSION
Recommended only in conjunction with an alternative which provides for isolation of the buried refuse from the adjacent areas.
APPENDIX 2

DRAWINGS
Site Location and Description

Neal's Dump refers to the PCB contaminated landfill site located in a rural area in Owen County, Indiana, approximately four miles south-west of the Town of Spencer.

The dump is located in part of the NW\(^{1/4}\)NW\(^{3/4}\) sec. 7, T. 9 N., R. 3 W., and part of the NE\(^{3/4}\)NE\(^{3/4}\) sec. 12, T. 9 N., R. 4 W., of the Second Principal Meridian. The location is shown on the Freedom, Indiana, 1:24,000 scale U.S. Geological Survey (USGS) topographic map. The dump is situated on the crest of a hill with a general western slope toward the White River (fig. 1) and encompasses approximately one-half acre. Road access to the site is provided by Old Morrow Road which is adjacent to the site and joins Pottersville Road approximately 3,000 feet southeast of Neal's Dump.

The glaciated portion of the Crawford Upland physiographic unit encompasses the site. Relief in the vicinity of the site is as much as 75 feet from the White River's floodplain to ridge top. The site property, a small terrace remnant on the steep eastern valley wall of the White River, is approximately 50 feet above the floodplain and 75 feet above the normal river level (fig. 1). Surface-water drainage from the site and adjacent area flows into ravines on the north and south sides and down a gradual slope on the western side. Springs or seeps were not evident in the ravines near the site.
Unconsolidated deposits of Pleistocene to Recent age immediately underlie the site. Based on borings these deposits range from approximately 50 to 80 feet in thickness within a few hundred feet of the site itself.

Four distinct layers of unconsolidated materials have been identified. The uppermost of these layers, a sand or sandy silt, was determined to be as much as 26 feet thick. Water is present in this silt layer (between 5 and 12 feet below land surface). However, this saturated zone appears localized and does not yield an adequate supply of water for use. The refuse, in part, is below the water table.

Beneath the sandy silt is an unsaturated glacial till layer that is 17 to 25 feet thick. The refuse is sitting on top of the till in the surficial sand/sandy silt.

A saturated sand layer from < 4 to 20 feet thick underlies the glacial till layer. Due to its seasonal amplitude of water level fluctuation and presumed low yield potential this sand layer is not considered as a source for residential water supply.

An unsaturated lacustrine clay layer occurs beneath the lower sand. This clay varies from 2 to 21 feet in thickness and rests on the limestone bedrock. Vertical infiltration of precipitation through the site appears to be redirected into horizontal flow at each of the two unsaturated layers (the till and the clay) in the surficial sandy silt and the saturated sand beneath the till. Due to the relative impermeability of the till layer, contaminated ground water will not reach the aquifer within the lower sandy zone. Also, contamination of bedrock aquifers should not occur.
The Ste. Genevieve Limestone of middle Mississippian age underlies the unconsolidated deposits. This limestone was tentatively identified at the bottom of the borings. Additional identifications were made in several small exposures occurring along the base of hills to the northwest of the site. Regional dip of this bedrock unit is approximately 3.0 feet per mile to the southwest.

The sampling and geologic data support the conclusion that PCB contamination is restricted to the upper ground-water system (sandy silt) by the physical nature of the four distinct layers of unconsolidated materials and presents no imminent danger to the health and welfare of nearby residents.

Ground-water samples from the uppermost, sandy silt, saturated zone were obtained from monitoring wells. The results of chemical analyses revealed that the PCB contaminant plume was moving down the hydraulic gradient in a general northwesterly direction. The highest PCB concentration determined was 31 parts per billion at a monitoring well west of the site. However, there was no re-occurrence of elevated concentrations of PCBs in other samples collected from the monitoring well. Also, the impervious nature of the till layer beneath the refuse precludes downward movement of contaminated water and the hydrogeologic setting is such that lateral movement of ground water is very slow.

Wells developed in the second saturated zone (the sand layer) were sampled. These data revealed no PCBs in water from all wells and elevated pH, conductivity, and total dissolved solids (TDS) levels only in the northwesternmost well.
Site History

Westinghouse manufactured and reprocessed electrical capacitors using PCB as an insulating fluid. The PCBs were produced by Monsanto Company. Reject or non-usable capacitors were hauled to and dumped in several landfills and dumps near Bloomington. It has been estimated that two (2) truckloads a week with each truck containing 10 to 40 capacitors, as well as PCB contaminated rags and sawdust had been hauled to Neal's Dump for several months during 1970-1971.

Neal's Dump covers approximately one-half acre all of which is currently owned by Edward Morrow and Mary Winkles. During its period as a landfill, the site was owned and operated by Raymond Neal. It is reported that the landfill was an unlined trench approximately 20 feet in depth. During discovery exchanges, Westinghouse estimated that more than 10,000 capacitors were dumped at this site.

In 1975, the Environmental Protection Agency (EPA) identified Westinghouse of Bloomington as one of 37 localities in the United States where PCBs are used and may be entering the environment.

On September 30, 1976, public hearings were initiated by the Environmental Management Board of Indiana. At that time Richard Neal, son of Raymond Neal, revealed the nature and contents of Neal's Dump.

In 1976 and again in 1981 soil sampling was performed on-site and off-site to determine the location and extent of PCB contamination. On-site soils were determined to contain up to 220,000 parts per million PCBs while PCB concentrations off-site were not detected.
Since 1981 numerous field inspections and investigations of Neal's Dump have been performed by the Westinghouse Electric Corporation and EPA to determine the locations of PCB contaminated soil, placement and monitoring of ground-water wells, and the level of PCBs in those materials. Studies have also been performed to determine the direction of movement of contaminant plumes, the extent, and the history of waste emplacement at the site. These investigations include geophysical studies, interpretations of aerial photographs, installation of monitoring wells (fig. 2) surface borings, and monitoring of wells to determine water quality. PCB levels detected during investigations are included in Table 1.

**Current Site Status**

The interim remedial measures recently performed by Westinghouse Corporation in fulfillment of the Stipulation and Order of the preliminary injunction filed Tuesday, January 4, 1984, include:

1. Removal of exposed capacitors and associated contaminated soils for off-site disposal.
2. Placement of a security fence around the perimeter of the site.
3. Performance of diagnostic studies including:
   a. determination of PCB concentrations in surface soils near the site.
   b. aerial photograph interpretations of the site.
EXPLANATION

NEAL'S DUMP

• B4 MONITORING WELL LOCATION AND NUMBER

70  0  70  140

SCALE IN FEET

FIGURE 2. NEAL'S DUMP MONITORING WELL LOCATIONS.
Table 1. Neal's Dump, PCB Concentrations.

<table>
<thead>
<tr>
<th>SITES</th>
<th>PCB CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Wells</td>
<td>&lt; 0.01 to 31.0 ppb</td>
</tr>
<tr>
<td>Soil Samples On-Site</td>
<td>0.03 to 220,000 ppm</td>
</tr>
<tr>
<td>Site Air Releases Upwind</td>
<td>&lt; 0.04 to 0.20 microgram/standard cubic meter</td>
</tr>
<tr>
<td>Site Air Releases Downwind</td>
<td>0.08 to 0.20 microgram/standard cubic meter</td>
</tr>
</tbody>
</table>
Investigations conducted by EPA and Westinghouse have estimated the physical size of and general number of the capacitors within the landfill. The overall volume of material to be removed has been estimated for use in the Consent Decree as 14,000 cubic yards. The extent of ground-water contaminant plume migration and direction have tentatively been identified. There has been no evidence to indicate that the Ste. Genevieve Limestone aquifer, the source of domestic water supply in the area, is contaminated. Contamination of the aquifer has been prevented due to the presence of a till layer beneath the contaminated zone and above the Ste. Genevieve. The landfill boundary has also been determined.

There are no known large extractions of ground water to affect its natural movement. Contamination has apparently been confined to the shallow, sandy silt ground-water system. Movement of the contaminant plume should not affect any domestic water supplies since no domestic wells are developed in this shallow ground-water system.

The movement of contaminant at the site, as presently understood, is described as follows:

1. Downward with water which has come in contact with PCBs in the surficial soils and refuse to the water table above the till layer.

2. Northwest of the site, downgradient along the top of the relatively impermeable till layer.
Enforcement

On January 4, 1983, the United States filed a suit against Westinghouse under sections 104, 106, and 107 of CERCLA and 7003 of RCRA.

On October 11, 1983, Mayor Tomi Allison announced that the City of Bloomington and Westinghouse had reached a conceptual agreement to destroy PCB soils and other PCB materials, using proven destruction techniques.

The preliminary injunctive relief sought by the government was satisfied by a Stipulation and Order between the parties in which Westinghouse Electric Corporation agreed to perform diagnostic studies at the site including test borings. It also required that the following interim remedial actions be performed: erosion control on site by constructing ditches and culverts; installation of security fences; removal of exposed capacitors, insulators and capacitor papers, as well as contaminated soil; and covering excavated areas with soil.

The United States permanent injunctive relief sought to require Westinghouse Electric Corporation to undertake such actions as may be necessary to remedy the conditions which may cause, contribute to, or present an imminent and substantial endangerment to health and welfare or the environment at Neal's Dump arising out of or in any way relating to the handling, disposal, presence, release, or threatened release of solid or hazardous waste or hazardous substances. These issues are addressed in the remedies set forth in the Consent Decree.
Remedial Measures

There are no further interim remedial measures required by the Consent Decree.

The interim remedial measures recently performed by Westinghouse Corporation in fulfillment of the Stipulation and Order of the preliminary injunction filed Tuesday, January 4, 1984, include:

1. Removal of exposed capacitors and associated contaminated soils for off-site disposal.

2. Placement of a security fence and warning signs around the perimeter of the site.

3. Areas where exposed capacitors were removed were backfilled and graded with suitable materials to prevent ponding. In addition, Westinghouse installed erosion control fences.

On-Site Remedial Measures

In the development of the actions described herein, several alternative actions were considered. The alternatives developed for study in the initial screening process were selected depending upon the remedial action that was deemed appropriate considering the criteria indicated below.

Criteria normally used to assess the remedial action alternatives are those described in the NCP 40 CFR 300.68 (e)-(j), i.e. determination of: (1), extent to which substances pose a danger to public health, welfare, or the environment, considering factors such as population at hydrogeological factors, and climate; (2), extent of migration
of contaminant; (3), previous experiences and approaches; and (4),
environmental effects and welfare concerns.

In order to identify the list of potential remedial actions for fur-
ther detailed analysis, three broad criteria were used in the screening
process: (1) positive and adverse effects on the environment from the
alternative itself, including implementation, or whether the alternative
would be likely to achieve adequate control of source material, or for
off-site remedial action, would effectively mitigate or minimize the threat
of harm to public health, welfare or the environment (Generally, only
those alternatives that effectively contributed to the protection of the
public health, welfare or the environment were considered in further
detailed analysis.); (2) the alternatives should be feasible for the loca-
tion and conditions of the release, applicable to the problems, and
represent a reliable means of addressing the problem; (3) the cost of
installing and implementing the remedial action, including operation and
maintenance costs, where appropriate.

Upon consideration of the above factors, the remedial action mea-
sures in the Consent Decree were negotiated in the settlement discus-
sion with Westinghouse. Those measures are presented below. The
Consent Decree requires that Westinghouse excavate and remove quanti-
ties of soils, debris, and other materials contaminated with polychlori-
nated biphenyls ("PCBs") and other associated materials from Neal's
Dump, to construct an incinerator to incinerate said materials in order
to prevent and mitigate alleged threats to the public health, welfare,
and the environment. To satisfy these requirements Westinghouse shall:
1. Following a stepwise protocol agreed upon by all the parties, excavate and transport for incineration all refuse materials plus an additional two feet of soil perpendicular to the surface remaining after all refuse has been removed as a "buffer zone".

2. Cover excavation, regrade cover, and revegetate.

3. During interim, removal, closure, and post closure periods, monitor water levels and collect water samples at selected wells. Determinations will be made for pH, specific conductance, temperature, and laboratory analyses for PCBs.

Based on experience and knowledge about Neal's Dump and considering the limited extent of the contaminant plume, a ground-water purge and treatment system was not recommended by engineering and hydrogeologic experts.

Closure and Post Closure

The Consent Decree provides for closure and post closure activities to be performed by Westinghouse Electric Corporation. These activities and plans have been developed in accordance with RCRA regulations, State of Indiana regulations, and the opinions of technical experts considering the following:

1. Results of analyses of samples and water level measurements obtained at various monitoring wells at the site.

2. Results of analyses of soil at the site.

3. Geophysical information regarding the location of refuse areas at the site.
4. The geology and hydrogeology of the site.

Closure

The Consent Decree requires that the following closure measures be performed:

1. Conduct on-site monitoring.

2. Close all excavated areas to a grade having a minimum slope of 2 percent and a maximum slope of 25 percent without depressions which would cause ponding of water. To achieve this, Westinghouse shall: (1) backfill excavated areas as necessary with suitable fill materials placed in a structurally stable manner to maintain the minimum grades requires; (2) place over the excavated areas a soil cover to effect a two-foot minimum thickness compacted to a modified proctor density of 85 percent capable of vegetative support. Suitable fill materials shall be defined as any materials which are not a hazardous waste, a solid waste, or contaminated with PCBs including: rock, stone, earth, and other materials.

3. Implement a surface-water, drainage and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site. Establish a total vegetative cover in all disturbed areas in a timely manner. Vegetative cover shall provide short and long term erosion control. The root growth of the vegetative cover shall be deep enough to prevent erosion.
Post Closure

The Consent Decree requires that the following post closure activities be implemented:

1. Conduct on-site monitoring.
2. Maintain the soil cover and vegetation to prevent erosion, and correct the effects of settling and subsidence to maintain proper slope. Westinghouse shall reseed as necessary. The root growth of the vegetative cover shall be deep enough to prevent erosion. Westinghouse shall continue to prevent surface-water run-on and run-off from eroding or otherwise damaging the soil cover.
3. Maintain integrity of fence until end of post closure period at which time security fencing (and warning signs) shall be removed.
4. Record a statement notifying potential future owners of past use of the property and Consent Decree requirements.

Community Relations

The City of Bloomington has been involved in various discussions concerning resolutions of the problem. The dialogue occurred between US. EPA, Indiana State Board of Health, and Westinghouse, with the Mayor, the City Council, the Utilities Service Board, and the Environmental Quality and Conservation Commission.

Three local information repositories have been established.

Once the proposed Consent Decree is initialed by the negotiating parties, various community relations activities will occur.
1. The City of Bloomington cannot sign the Decree until it has been discussed publicly in City Council meetings. It is predicted that a minimum of sixty days will be needed to meet this requirement.

2. Indiana Environmental Management Board will also consider the Consent Decree before signing it.

3. The U.S. EPA will advertise in the local press, and conduct a public meeting to brief the public on the terms of the agreement and respond to citizens' questions. The Agency will also distribute fact sheets summarizing the agreement and the future opportunities for public participation.

Copies of pertinent documents will be added to the three information repositories for public review.

U.S. EPA will continue to implement, with the cooperation of the State and City, various community relations activities to assist citizens in developing informed public participation. This will include informational meetings, documents, and conversations during the thirty-day public comment period required by the Department of Justice, and throughout the RCRA and TSCA permitting processes. The City and the State will conduct public participation activities during their siting approval processes.

Consistency with the National Contingency Plan

When the United States filed the complaint against Westinghouse in January 1983, specific remedies to abate the endangerment presented by the dump were sought in the complaint. Those measures entailed
on-site containment of PCBs. The remedial measures included in the proposed settlement go far beyond those sought in the complaint. The negotiated remedies include excavation and removal of soil, debris, and other materials contaminated with PCBs and other hazardous substances, and incineration of the materials in a State and Federally approved high-temperature incinerator. Unlike the prayer in the complaint that PCBs be contained on-site, under the Consent Decree, Westinghouse will design, construct, and operate an incinerator to be located at the Dillman Road Sewage Treatment Plant. The excavation, transportation to the incinerator, incineration, and disposal of the ash and other by-products of incineration will be in accordance with requirements of law. Source removal will be completed to mitigate further releases of contaminants into the environment from the site.

All remedial actions required by the Consent Decree are not inconsistent with the objectives of the National Contingency Plan.

Operation and Maintenance

Operation and maintenance requirements associated with the remedial actions herein will be required. The operation and maintenance costs incurred will be paid by Westinghouse Electric Corporation. The operation and maintenance will include provisions for signs, erosion control devices, site security fences, diversion ditches, dikes, monitoring wells, clay caps, and all other technical activities required by the Consent Decree.
Site Location and Description

The Lemon Lane Landfill site refers to the PCB contaminated landfill located in a residential area on the northwest side of Bloomington, Monroe County, Indiana (fig. 1). The site is located immediately west of Lemon Lane, approximately 1,000 feet south of Vernal Pike and 1,000 feet southeast of Indiana Highway 37 (fig. 2). The landfill site is mostly within SW1/4SE1/4NE1/4 sec. 31, T. 9 N., R.1.W., sec. 31, Second Principal Meridian, but a portion of it is also within SW1/4NW1/4SE1/4 NE1/4 sec 31, T. 9 N., R. 1 W.

The site lies on the eastern margin of the Mitchell Plain physiographic province of Indiana. In the landfill area the topography is typified by numerous karstic features such as sinkholes, karst valleys, and springs. The site is near the watershed divide between Clear Creek to the south and Stout Creek to the north in an area of sinkholes. Surface drainage from the site flows into depressions and sinkholes 60 to 90 feet above valley bottoms where several springs are located. The regional direction of ground-water flow is generally west. However based on available water level data, at the landfill ground water flows to the east and northeast but also flows in other directions depending on climatological conditions.
FIGURE 1. LOCATION OF LEMON LANE LANDFILL
FIGURE 2. LEMON LANE LANDFILL MONITOR WELL LOCATIONS.
The landfill is underlain by 70 to 80 feet of St. Louis Limestone of Mississippian age. The soil cover over the St. Louis Limestone ranges in thickness from 5 to 20 feet at the landfill site. The Salem Limestone (also 70 to 80 feet thick) underlies the St. Louis Limestone. The Harrodsburg Limestone underlies the Salem Limestone. The strata of the area generally has a regional dip of approximately 20 to 30 feet per mile to the west-southwest in the Bloomington area, however, local exceptions do occur. The landfill area is one such exception. Data to date indicate that the St. Louis Limestone probably slopes to the southwest and south at the landfill. Stratigraphically lower units may or may not conform to the slope of the St. Louis Limestone.

The St. Louis Limestone in the vicinity of the landfill is thinly bedded, and contains limestone, dolomite, and shale. The relatively thin units are fractured at close intervals into relatively small joint bound blocks of limestone. Joints transect more than one bed, and cross joints are common.

Solution cavities, joints, other fractures serve as routes for ground-water movement regardless of their orientation. The movement of water along the fractures is generally downward then laterally either down the slope of the strata or to a point of discharge. Water flows in response to differences in the hydraulic head and along the path of least resistance. The downward movement of water may in some places be retarded by impermeable strata such as the shale units that are present in the subsurface at the site. In a karst topography the hydraulic gradient may change due to recharge of water moving
downward from sinkholes during rainfall events and after the events change to a different direction.

The Salem Limestone is more massive than the St. Louis Limestone and is usually less weathered, less fractured, and contains fewer solution channels. Water level data collected to date suggest that the Salem Limestone aquifer may be recharged by the overlying St. Louis aquifer.

The western part of the landfill is situated in a large elongated compound sinkhole. The bedrock surface (from seismic and drilling data) slopes inward toward the sinkhole as does the predisposal land surface. The network of sinkholes forms a deep south-southwest/north-northeast trending trough or karst valley in the bedrock of the western half of the landfill (fig. 4). The karst valley is transected and blocked by a railroad embankment which causes the ponding of surface run-off. Many depressions exist in the immediate and general area of the landfill which readily accept surface water that recharges the ground-water aquifer. Water movement is down dip but could be to adjacent sinkholes in other directions due to hydraulic gradient changes in response to the location of points of recharge and discharge.

It appears that the plume of contaminated ground water is within both the St. Louis and Salem Limestone aquifers. However, the lack of consistent monitoring well completion prohibits a more positive determination. The lateral extent of PCB contamination from Lemon Lane Landfill has not been determined. PCBs have been found in water from three springs to the south and southeast of the landfill (fig. 3):
FIGURE 3. SPRINGS IN THE VICINITY OF LEMON LANE LANDFILL.
Figure 4. Lemon Lane Landfill, Top of Bedrock (After Blasland and Bouck, 1984).
Stoney East Spring, 1.1 miles south-southwest; Quarry Spring, 0.8 mile southeast; and Illinois Central Spring, 0.7 mile southeast. To date no PCBs have been found in nearby domestic wells. PCBs were detected (below GC/MS detection limits) in EPA monitoring well B-4 north-northeast of the landfill.

Surface-water sampling in 1981 by EPA and the City of Bloomington of Hensenberg Creek and Stout Creek and the pond northwest of the landfill (Sargent's Pond) found PCB concentration (0.9 ppb) only in Sargent's Pond.

The sediment was sampled in the three springs south of the landfill, Stout Creek, and Sargent’s Pond in 1981. PCBs were found in two of these sediment samples of Quarry Spring (0.5 ppm) and Sargent's Pond (0.52 ppm).

Ground-water use in the vicinity of the Lemon Lane Landfill is limited to wells being used as residential water supplies. There are no known large withdrawals of water for other uses.

Site History

The Lemon Lane Landfill covers approximately ten acres, seven of which are owned by the City of Bloomington, Indiana, with Edward Pelfree owning the remaining three acres.

The Westinghouse Facility in Bloomington, Indiana, manufactured and reprocessed electrical capacitors using PCBs as an insulating fluid. The PCBs were produced by Monsanto Company. Reject capacitors were hauled to and dumped in several landfills and dumps near Bloomington.

Lemon Lane Landfill was operated as a sanitary landfill from the late 1930's to the late 1970's. Between 1958 and the fall of 1966 for a
period of nine years, PCB filled capacitors and PCB contaminated rags, sawdust, and filter clay were disposed of at the site.

In 1975 EPA identified Westinghouse of Bloomington as one of 37 localities in the United States where PCBs are used and may be entering the environment. On September 30, 1976, public hearings were initiated by the Environmental Management Board of Indiana.

Between 1976 and 1981 investigations of the site were performed to obtain preliminary estimates of the degree and extent of contamination, and to determine appropriate action response. These preliminary investigations included site and vicinity reconnaissance activities, as well as the collection and chemical analysis of soil and water samples from springs, wells, ponds, landfill soil, and streams.

Since 1981, numerous field inspections and investigations of Lemon Lane Landfill have been performed by the Westinghouse Electric Corporation and the EPA to determine the location of PCB contaminated soil, water, and refuse, and the level of PCBs in these contaminated materials. Also studied were the direction of movement of contaminant plumes, the configuration of bedrock, soil refuse surfaces, and their areal extent. Additionally, the history of waste emplacement at the site, and the location of PCB contaminated wells and springs were investigated. These investigations include geophysical studies, interpretations of aerial photographs, installation of monitoring wells, surface borings, monitoring of water wells, seeps, and springs to determine water levels, spring discharges, and water quality. PCB levels detected during investigations are included in Tables 1 and 2.
Table 1. Lemon Lane Landfill, PCB Concentrations.

<table>
<thead>
<tr>
<th>TYPE OF INVESTIGATION</th>
<th>PCB CONCENTRATION RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stream Water</td>
<td>Not detected</td>
</tr>
<tr>
<td>Sargent's Pond</td>
<td>0.9 ppb</td>
</tr>
<tr>
<td>Residential Wells</td>
<td>Not detected</td>
</tr>
<tr>
<td>Site Wells (EPA)</td>
<td>Not detected to detected below detectable limits</td>
</tr>
<tr>
<td>Site Wells (Westinghouse)</td>
<td>&lt; 0.01 to 2.4 ppb</td>
</tr>
<tr>
<td>On Site Soils</td>
<td>0.1 - 57,000 ppm</td>
</tr>
<tr>
<td>Sargent's Pond Soil</td>
<td>0.52 ppm</td>
</tr>
</tbody>
</table>
Table 2. Lemon Lane Landfill Regional Springs, PCB Concentrations.

<table>
<thead>
<tr>
<th>TYPE OF INVESTIGATION</th>
<th>PCB CONCENTRATION RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>REGIONAL SPRING WATER SITES:</td>
<td></td>
</tr>
<tr>
<td>Quarry Spring</td>
<td>2.7 to 6.8 ppb</td>
</tr>
<tr>
<td>Illinois Central Spring</td>
<td>10.1* to 12.2 ppb</td>
</tr>
<tr>
<td>Stoney Spring East</td>
<td>Not detected to 1.85 ppb</td>
</tr>
<tr>
<td>Stoney Spring West</td>
<td>Not detected</td>
</tr>
<tr>
<td>Hinkle Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>Snoddy Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>Detmer Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>Robertson Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>PH Road Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>Slaughter House Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>Packing House Spring</td>
<td>Not detected</td>
</tr>
<tr>
<td>REGIONAL SPRING SEDIMENT SITES:</td>
<td></td>
</tr>
<tr>
<td>Quarry</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>Stoney Spring East</td>
<td>Not detected</td>
</tr>
<tr>
<td>Stoney Spring West</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

* detected below GC/MS detection limit.
The results of investigations show that contaminants are transported to water via ground-water flow, discharge, and the transport of PCB contaminated soils. Release of PCBs from the landfill is the result of leaching of PCBs into ground water, erosion, run-off, and transport of PCB contaminated surface soils.

Current Site Status

Investigations conducted by the EPA and Westinghouse Corporation have defined the physical nature of the zones of ground water at the site, the extent of contaminated soils in the vicinity of the site, and the physical boundaries of the landfill. The nature of the contaminated aquifer at depth and the location of its discharge points have not been fully determined.

Ground-water flow at the site occurs in the St. Louis Limestone, a thinly bedded limestone. Underlying the St. Louis is the Salem Limestone, a more massive and less fractured limestone.

The St. Louis aquifer has been found to contain PCB contaminated water near the landfill itself, but no PCBs have been detected in nearby domestic wells. Three springs to the south and southeast approximately one mile from the landfill have been found to have water and sediment containing PCBs.

The karst topography with many recharge and discharge points creates varied hydraulic gradients and directions of water movement. The contaminant movement of the site, as presently understood, is best described as follows:
1. Downward via water which has come in contact with PCBs through surficial soils and refuse, where present, to the St. Louis bedrock below.

2. Downward via water through the St. Louis Limestone through openings along joints or fractures and solution cavities until it reaches the aquifer.

3. Laterally within the aquifer toward points of ground-water discharge, such as springs and seeps.

4. Predominantly east and northeast of the site via openings along fractures, joints, and solution features.

5. Downward via water into sinkholes and radially outward from sinkholes during or after rainfall events which recharge the ground-water reservoir at that location.

6. Overland via contaminated surface run-off and suspended sediment in down-slope directions from the site.

Enforcement

On October 11, 1983, Mayor Tomi Allison announced that the City of Bloomington and Westinghouse had reached a conceptual agreement to destroy PCB soils and other PCB materials, using proven destruction techniques.

Negotiations were initiated with representatives of Westinghouse, the City of Bloomington, EPA, and Indiana State Board of Health in January 1984 seeking mitigation of endangerment and relief for the affected areas. The Consent Decree requirements provide for the remedy to be undertaken by Westinghouse.
The Consent Decree will require Westinghouse Electric Corporation to undertake such actions as may be necessary to remedy the conditions which may cause, contribute to, or present an imminent and substantial endangerment to health and welfare or the environment at Lemon Lane Landfill, arising out of or in any way relating to the handling, disposal, presence, release or threatened release of solid or hazardous waste or hazardous substances.

**Interim Remedial Measures**

The Consent Decree requires that the following interim remedial actions be taken at Lemon Lane Landfill to protect the health, welfare, and environment in the period prior to the removal of PCB contaminated materials at the site.

1. Monitoring of water levels and collection of water samples at selected wells within a 5,000 feet radius of the site. Determinations will be made for pH, specific conductance, and temperature, and laboratory analyses for PCBs will be completed. Also monitoring of selected wells, springs, seeps, and streams on site and off site for the parameters and frequency listed above.

2. Install erosion control fencing.

3. Removal of exposed capacitors and associated contaminated soils for off site disposal.

4. Establish a total vegetative cover over all disturbed areas.

5. Stabilize the southern slope of the site by grading and covering.
6. Cover those portions of the landfill with existing cover depth less than two feet to yield a minimum two-foot cover depth.

7. Grade the landfill to prevent the ponding of water and the severe erosion of soils.

On-Site Remedial Measures

The actions described herein are based upon the factors considered in selecting a remedy at Neal's Landfill (a site of similar karst hydrogeologic setting).

Upon consideration of the those environmental factors, the remedial action measures in the Consent Decree were developed. Those actions are presented below. The Consent Decree requires that Westinghouse excavate and remove quantities of soils, debris, and other materials contaminated with polychlorinated biphenyls ("PCBs") and other associated materials from Lemon Lane Landfill, to construct an incinerator to incinerate said materials in order to prevent and mitigate alleged threats to the public health, welfare, and environment. To satisfy these requirements Westinghouse shall:

1. Excavate and transport for incineration all materials following a stepwise protocol agreed upon by the parties.

2. Following the completion of excavation described above, conduct a sampling program approved by all plaintiffs as part of the excavation plan to identify PCB contaminated materials, if any, in concentrations equal to or greater than 50 parts per million in the remaining refuse and soil. Westinghouse shall
then excavate and transport for incineration all such materials identified pursuant to the sampling program.

3. Upon completion of the sampling program and any resulting excavation described above, Westinghouse shall excavate an additional three feet of the refuse and/or soil (down to bedrock) perpendicular to the surface remaining after excavation as a "buffer zone".

4. Implement a surface-water, drainage, and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site.

5. Minimize the disturbance of contaminated materials yet to be removed.

6. Provide impermeable protection systems sufficient to cover the active excavation zone.

7. Provide adequate slopes, crowns, and ditches to ensure satisfactory drainage at all times.

8. Provide pumps to remove any contaminated water or leachate at the surface during excavation and provide constructed, lined ponds to store such water until it can be removed and treated.

9. Decontaminate equipment.

10. Monitoring of water levels and collection of water samples at selected sites. Determinations will be made for pH, specific conductance, temperature, and laboratory analyses for PCBs.
Off-Site Remedial Measures

The actions described herein are based on the factors considered in selecting a remedy at Neal’s Landfill.

The Consent Decree requires that actions be taken to eliminate the imminent danger to public health via contact with PCB contaminated materials.

The off site remedies to be performed include:

1. Monitoring of water levels and collection of water samples at selected sites within a 5,000 feet radius of the site. Determinations will be made for pH, specific conductance, and temperature, and laboratory analyses for PCBs will be completed. Monitoring activities at all sites will cease sometime between 5 and 30 years after closure of the site, contingent on decisions made by Environment Protection Agency (EPA), Indiana State Board of Health (ISBH), and the City of Bloomington based on monitoring results.

2. Provide alternative domestic water supplies, if necessary.

3. Provide maintenance for removal and measures, including maintenance of monitoring wells, sediment collection systems, and any water treatment systems.

Closure and Post Closure

The Consent Decree provides for closure and post closure activities to be performed by Westinghouse Electric Corporation. These activities and plans have been developed in accordance with RCRA
Regulations, State of Indiana regulations, and the opinions of technical experts on the significance of:

1. Results of analyses of samples and water level measurements obtained at various monitoring wells at the site.
2. Results of analyses of soil and vegetation samples at the site.
3. Geophysical information regarding the location of disposal areas at the site.
4. The geology and hydrogeology of the site.

Closure

The Consent Decree requires that the following closure measures be performed:

1. Conduct on-site and off-site monitoring.
2. Close all excavated areas to a grade having a minimum slope of 2 percent and a maximum slope of 25 percent without depressions which would cause ponding of water. To achieve this, Westinghouse shall: first, backfill excavated areas as necessary with suitable fill materials placed in a structurally stable manner to maintain the minimum grades required; secondly, place over the excavated areas a soil cover to effect a two-foot minimum thickness compacted to a modified proctor density of 85 percent capable of vegetative support. Suitable fill materials shall be defined as any materials which are not a hazardous waste, a solid waste, or contaminated with PCBs including: rock, stone, earth, and other materials.
3. Implement a surface-water, drainage and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site. Establish a total vegetative cover in all disturbed areas in a timely manner. Vegetative cover shall provide short and long term erosion control. The root growth of the vegetative cover shall be deep enough to prevent erosion.

4. Install a compacted clay cover of two feet minimum thickness and recompacted to less than $1 \times 10^{-6}$ cm/second permeability and a minimum six-inch soil cover sufficient to support shallow-rooted vegetation.

Post Closure

The Consent Decree requires that the following post closure activities be implemented:

1. Conduct on site and off site monitoring.

2. Maintain the soil cover and vegetation to prevent erosion, and correct the effects of settling and subsidence to maintain proper slope. Westinghouse shall reseed as necessary. The root growth of the vegetative cover shall be deep enough to prevent erosion. Westinghouse shall continue to prevent surface-water run-on and run-off from eroding or otherwise damaging the soil cover.

3. Maintain integrity of fence until end of post closure period at which time security fencing (and warning signs) shall be removed.
4. Restrict property use to activity that will not adversely impact upon the integrity of the cover. All agricultural use of property is prohibited.

Community Relations

The City of Bloomington has been involved in various discussions concerning resolutions of the PCB contamination problem. The dialogue occurred between U.S. EPA, Indiana State Board of Health, and Westinghouse, with the Mayor, the City Council, the Utilities Service Board, and the Environmental Quality and Conservation Commission. Three local information repositories have been established.

Once the proposed Consent Decree is initialed by the negotiating parties, various community relations activities will occur.

1. The City of Bloomington cannot sign the Decree until it has been discussed publicly in City Council meetings. It is predicted that a minimum of thirty days will be needed to meet this requirement.

2. Indiana Environmental Management Board will also consider the Consent Decree before signing it.

3. The U.S. EPA will advertise in the local press and conduct a public meeting to brief the public on the terms of the agreement and respond to citizens' questions. The Agency will also distribute fact sheets summarizing the agreement and the future opportunities for public participation.

Copies of pertinent documents will be added to the three information repositories for public review.
U.S. EPA will continue to implement, with the cooperation of the State and City, various community relations activities to assist citizens in developing informed public participation. This will include informational meetings, documents, and conversations during the thirty-day public comment period required by the Department of Justice, and throughout the RCRA and TSCA permitting processes. The City and the State will conduct public participation activities during their siting approval processes.

Consistency With The National Contingency Plan

The remedies include excavation and removal of soil, debris, and other materials contaminated with PCBs and other associated materials and incineration of the materials in a federally approved high-temperature incinerator to incinerate PCBs. Westinghouse will design, construct, and operate an incinerator to be located at the Dillman Road Sewage Treatment Plant. The excavation, transportation to the incinerator, incineration, and disposal of the ash and other by-products of incineration will be in accordance with requirements of a TSCA, RCRA permit. The site will be remedied to mitigate further releases of contaminants into the environment from the landfill. These remedies form the basis for negotiation with Westinghouse for remedial action plan for the final Consent Decree.

All remedial actions required by the Consent Decree are not inconsistent with actions to be achieved at Neal's Landfill (a site in a similar karst setting) and are not inconsistent with the objectives of the National Contingency Plan.
Operation and Maintenance

Operation and maintenance requirements associated with the remedial actions herein will be required. The operation and maintenance costs incurred will be paid by Westinghouse Electric Corporation. The operation and maintenance will include provisions for fences, signs, erosion control devices, site security fences, diversion ditches, dikes, monitoring wells, clay caps and all other technical activities required by the Consent Decree.
Site Location and Description

The Winston-Thomas Sewage Treatment Plant site refers to the sewage treatment plant contaminated with PCBs from discharges from the Westinghouse Electric Corporation (Westinghouse) facility in Bloomington, Monroe County, Indiana. The treatment plant is located on the southside of Bloomington about 2 3/4 miles south of Monroe County courthouse and a mile southeast of Broadview in a residential area within the limits of Bloomington (fig. 1).

The site is between Walnut Street and the Illinois Central Railroad, about 1/2 mile south of County Club Drive and just north of Gordon Pike. The site is located in the W^SW^ sec. 16, T. 8 N., R. 1 W.

The site (fig. 2) refers to the following:

- 17 acre tertiary lagoon (6 inch clay liner reported)
- 2 abandoned lagoons
- 2 sludge drying beds
- 4 sludge storage tanks
- 1 trickling filter (1.5 acre concrete structure 8 feet deep)
- 4 digesters (2-40 feet diameter, 2-50 feet diameter)
- Pumps, pipes, valves, etc.
- General land area of the plant and lagoon.
Enforcement

On October 11, 1983, Mayor Tomi Allison announced that the City of Bloomington and Westinghouse had reached a conceptual agreement to destroy PCB soils and other PCB materials, using proven destruction techniques.

Negotiations were initiated with representatives of Westinghouse, the City of Bloomington, the EPA, and the Indiana State Board of Health in January, 1984 seeking mitigation of endangerment and relief for the affected areas. The Consent Decree requirements provide for the remedy to be undertaken by Westinghouse.

The Consent Decree will require Westinghouse Electric Corporation to undertake such actions as may be necessary to remedy the conditions which may cause, contribute to or present an imminent and substantial endangerment to health and welfare or the environment at Winston-Thomas Treatment Plant, arising out of or in any way relating to the handling, disposal, presence, release or threatened release of solid or hazardous waste or hazardous substances.

Interim Remedial Measures

The Consent Decree requires that the following interim remedial actions be taken at Winston-Thomas to protect the health, welfare and the environment in the period prior to the removal of PCB contaminated materials at the site.

1. Monitoring of water levels and collection of water samples at selected wells within a 5,000 feet radius of the site. Determinations will be made for pH, specific conductance, and
temperature, and laboratory analyses for PCBs will be completed.

2. Remove sediments with a hydrovacuum in Clear Creek, from a point 25 feet upstream of the northern boundary of the Winston-Thomas site to a point 500 feet downstream of the southern boundary of said site.

3. Remove those sediments removable through the use of a hydrovacuum in Clear Creek which are identified by the State of Indiana as contaminated with PCBs subsequent to the entry of the Consent Decree and prior to April 1, 1985.

4. Following the sediment removal, sample and analyze the stream sediments in order to provide baseline data.

5. Establish a total vegetative cover over all disturbed areas.

6. Control of surface water run-on and run-off at the site.

7. Install any additional diking around the lagoon necessary to maintain a freeboard of 24 inches to prevent overflow in the event of a storm, with the City continuing to pump the lagoon daily to the Dillman Road Sewage Treatment Plant at an average rate of 50 gallons per minute. Any discharge to the Dillman Road Sewage Treatment Plant shall meet applicable state and local pretreatment requirements. Westinghouse shall pay for any additional pumping in excess of an average rate of 50 gallons per minute that may be necessary.

8. Conduct investigative studies, as necessary, to determine the geology and hydrology of the site.
On-Site Remedial Measures

In the development of the actions described herein, remedies were sought which are based upon the factors considered in selecting a remedy at Neal’s Landfill.

Upon consideration of those factors, the remedial action measures in the Consent Decree were developed. Those actions are presented below. The Consent Decree requires that Westinghouse excavate and remove quantities of soils, debris and other materials contaminated with polychlorinated biphenyls ("PCBs") and other associated materials from Winston-Thomas, to construct an incinerator to incinerate said materials in an incinerator in order to prevent and mitigate alleged threats to the public health, welfare and the environment. To satisfy these requirements Westinghouse shall:

1. Remove the contents of the tertiary lagoon. Any water not removed and incinerated shall be treated prior to discharge to a concentration established by the State pursuant to its authority under state and federal law.

2. Excavate and remove all stored sludge and the entire sludge, drying beds following a stepwise protocol agreed upon by the parties and transport these materials for incineration. Westinghouse also shall excavate and transport for incineration an additional two feet of soil perpendicular to the surface remaining after all materials have been removed as a "buffer zone".
3. Remove the loose organic material from the filter media by means of a mechanical sieve. After removal of the organic material, the filter media shall be redeposited and covered.

4. Westinghouse shall excavate and transport for incineration the contents of the abandoned lagoons down to the clay layer beneath the lagoon following a stepwise protocol agreed upon by the parties. Westinghouse also shall excavate and transport for incineration an additional two feet of soil perpendicular to the surface remaining after the contents of the lagoons have been removed as a "buffer zone".

5. Remove the sludge stored in the digester tanks and flush with water using high pressure sewer cleaning equipment any sediments remaining in the facility piping system. All flushing shall be transported to the terminal lagoon or other appropriate facility for processing and removal pursuant to state permits. After the sediments are flushed, Westinghouse shall plug the pipes except to the extent that such plugging causes drainage problems.

6. Conduct sampling and analysis upon completion of the activities described above.

7. Implement a surface water, drainage, and sediment control program to prevent or minimize surface water and sediment run on and run off from the site.

8. Minimize the disturbance of contaminated materials yet to be removed.
9. Provide impermeable protection systems sufficient to cover the active excavation zone.

10. Provide adequate slopes, crowns and ditches to ensure satisfactory drainage at all times.

11. Provide pumps to remove any contaminated water or leachate at the surface during excavation and provide constructed lined, ponds to store such water until it can be removed and treated.

12. Decontaminate equipment.

13. Monitoring of water levels and collection of water samples at selected sites. Determinations will be made for pH, specific conductance, temperature, and laboratory analyses for PCB.

14. Provide maintenance for interim removal and remedial measures, including maintenance of fences, signs, erosion, security fences, diversion ditches, dikes, monitoring wells, and temporary caps.

15. Transport contaminated materials to the incinerator for incineration.

The remedial actions described herein will be performed until such time that the post closure period has been completed.

Off-Site Remedial Measures

In the development of the actions described herein, remedies were sought which are based on the factors considered in selection of a remedy at Neal's Landfill. Upon consideration of the those factors,
the remedial action measures in the Consent Decree were developed. Those actions are presented below.

The Consent Decree requires that actions be taken to eliminate the imminent danger to public health via contact with PCB contaminated materials.

The off-site remedies to be performed include:

1. Monitoring of water levels and collection of water samples at selected wells within a 5,000 feet radius of the site. Determinations will be made for pH, specific conductance, and temperature, and laboratory analyses for PCB will be completed. Monitoring activities at all sites will cease sometime between 5 and 30 years after closure of the site, contingent on decisions made by Environment Protection Agency (EPA), Indiana State Board of Health (ISBH), and the City of Bloomington based on monitoring results.

2. Provide an alternative water supply for local residents, if necessary.

Closure and Post Closure

The Consent Decree provides for closure and post closure activities to be performed by Westinghouse Electric Corporation. These activities and plans have been developed in accordance with RCRA regulations, State of Indiana regulations and the opinions of technical experts:

1. Results of analyses of water and sediment samples taken from the site.
2. The information available on the geology and hydrogeology of the region.

Closure

The Consent Decree requires that the following closure measures be performed:

1. Conduct on-site and off-site monitoring.
2. Redeposit and cover the filter media.
3. Close all excavated areas to a grade having a minimum slope of 2 percent and a maximum slope of 25 percent without depressions which would cause ponding of water. To achieve this, Westinghouse shall: first, backfill excavated areas as necessary with suitable fill materials placed in a structurally stable manner to maintain the minimum grades required; secondly, place over the excavated areas a soil cover to effect a two-foot minimum thickness compacted to a modified proctor density of 85 percent capable of vegetative support. Suitable fill materials shall be defined as any materials which are not a hazardous waste, a solid waste or contaminated with PCBs including: rock, stone, earth, and other materials.
4. Implement a surface water, drainage and sediment control program to prevent or minimize surface water and sediment run-on and run-off from the site.
5. Establish a total vegetative cover in all disturbed areas in a timely manner. Vegetative cover shall provide short and long
term erosion control. The root growth of the vegetative cover shall be deep enough to prevent erosion.

Post Closure

The Consent Decree requires that the following post closure activities be implemented:

1. Remove from said stream those sediments removable through the use of a hydrovacuum which are identified by the State of Indiana as contaminated with PCBs.

2. Conduct on-site and off-site monitoring.

3. Maintain the soil cover and vegetation to prevent erosion, and correct the effects of settling and subsidence to maintain proper slope. Westinghouse shall reseed as necessary. The root growth of the vegetative cover shall be deep enough to prevent erosion. Westinghouse shall continue to prevent surface water run-on and run-off from eroding or otherwise damaging the soil cover.

4. Maintain integrity of fence until end of post-closure period at which time security fencing (and warning signs) shall be removed.

5. Restrict property use to activity that will not adversely impact upon the integrity of the cover. All agricultural use of property is prohibited.
Community Relations

The City of Bloomington has been involved in various discussions concerning resolutions of the problem. The dialogue occurred between U.S. EPA, Indiana State Board of Health, and Westinghouse, with the Mayor, the City Council, the Utilities Service Board, and the Environmental Quality and Conservation Commission.

Three local information repositories have been established.

Once the proposed Consent Decree is initialed by the negotiating parties, various community relations activities will occur.

1. The City of Bloomington cannot sign the Decree until it has been discussed publicly in City Council meetings. It is predicted that a minimum of thirty days will be needed to meet this requirement.

2. Indiana Environmental Management Board will also consider the Consent Decree before signing it.

3. The U.S. EPA will advertise in the local press, and conduct a public meeting to brief the public on the terms of the agreement and respond to citizens' questions. The Agency will also distribute fact sheets summarizing the agreement and the many future opportunities for public participation.

Copies of pertinent documents will be added to the three information repositories for public review.

U.S. EPA will continue to implement, with the cooperation of the State and City, various community relations activities to assist citizens in developing informed public participation. This will include informational meetings, documents, and conversations during the thirty day
public comment period required by the Department of Justice, and throughout the RCRA and TSCA permitting processes. The City and the State will conduct public participation activities during their siting approval processes.

**Consistency With The National Contingency Plan**

All on-site and off-site remedial actions required by the Consent Decree are not inconsistent with the objectives of the National Contingency Plan.

Remedies include excavation and removal of soil, debris, and other materials contaminated with PCBs and incineration of these materials in a federally approved high-temperature incinerator to incinerate the PCB, and decontamination of hardware and plugging of pipes associated with the Winston-Thomas Sewage Treatment Plant. Westinghouse will design, construct, and operate an incinerator to be located at the Dillman Road Sewage Treatment Plant. The excavation, transportation to the incinerator, incineration, and disposal of the ash and other by-products of incineration will be in accordance with requirements of law. The site will be remedied to mitigate further releases of contaminants into the environment from the plant site. These remedies form the basis for negotiation with Westinghouse for remedial action plan for the final consent decree. The remedies described herein are consistent with those sought for Winston-Thomas.
Operation and Maintenance

Operation and maintenance requirements associated with the remedial actions herein will be required. The operation and maintenance costs incurred will be paid by Westinghouse Electric Corporation. The operation and maintenance will include provisions for fences, signs, erosion control devices, site security fences, diversion ditches, dikes, monitoring wells, clay caps and all other technical activities required in the achievement of the provisions of the Consent Decree.
Site Location and Description

The Bennett's Dump site refers to the PCB contaminated area of disposal located near Bloomington, Monroe County, Indiana (fig. 1). The site is located in a sparsely populated rural area approximately one mile northwest of Bloomington, west of Indiana State Highway 37 Bypass and south of Highway 46 (fig. 2). The landfill site is within NE\frac{1}{4} sec. 30, T. 9 N., R. 1 W., Second Principal Meridian.

The site lies in the Mitchell Plain physiographic province of Indiana. This province is characterized as a high plain with numerous karstic features such as sinkholes and springs. However, no sinkholes are present in the immediate vicinity of the site.

Solution cavities, joints, and other fractures serve as routes for ground-water movement. The movement of water in openings along the fractures is generally downward then laterally either down the slope of the strata or to a point of discharge. The movement of water is in response to differences in the hydraulic head and along the path of least resistance.

Surface drainage at Bennett's Dump is toward Stout's Creek which is immediately adjacent to the site. Stout's Creek is a tributary of Beanblossom Creek which is approximately four miles north of the site.
FIGURE 1. LOCATION OF BENNETT'S DUMP
FIGURE 2. BENNETT'S DUMP SITE MAP.
Several small ponds and water-filled quarries are in close proximity of the site. Some surface drainage at the site is also toward local ponds.

Bennett's Dump is underlain by the Salem Limestone of Mississippian age. Regionally, the Salem Limestone dips gently westward or southwestward at 25 to 30 feet per mile. The dip of this unit at the site has not been determined. The Salem Limestone is a massively bedded, fossiliferous limestone of high quality which is frequently quarried for use as dimension stone. Although the limestone is 60 to 80 feet thick regionally, the thickness of the unit at the site has not been determined.

Underlying the Salem Limestone at the site is the Harrodsburg Limestone also of Mississippian age. The elevation of the contact between the Harrodsburg and Salem Limestones has not been determined.

The characteristics of the aquifers and water in these aquifers underlying the site have not been determined due to a lack of hydrogeologic information. The hydraulic relation between surface and ground water at the site, therefore, is not known.

The occurrence of and degree of PCB contamination of ground water at the site is unknown at this time due to lack of hydrogeologic information.

Ground water in the vicinity of Bennett's Dump is used by residents living north of the site along Stout's Creek. Water-filled quarries within the confines of Bennett's Quarry are frequently used by local residents for swimming and scuba diving. The water of Stout's Creek immediately adjacent to Bennett's Dump and downstream from the
site provides the water supply for livestock raised on farms along the creek.

Site History

The Bennett's Quarry property is owned by Edwin Bennett. Bennett's Quarry is composed of a series of water-filled pits which were formed when the limestone was quarried for building stone. Sometime after quarrying activities ceased, part of the area of Bennett's Quarry (referred to as Bennett's Dump) was used for waste disposal. No records of waste emplacement were kept, but contacts have indicated that landfilling activities began at least 20 years ago. The quantity of PCB contaminated materials disposed of is as yet undetermined. A visual inspection of the site indicates that high power electrical capacitors (Westinghouse Type FP Outdoor), each weighing 30 to 60 pounds, have been discarded in at least one part of the dump.

The Westinghouse Facility in Bloomington, Indiana, manufactured and reprocessed electrical capacitors using PCBs as an insulating fluid. The PCBs were produced by Monsanto Company. Reject capacitors were hauled to and dumped in several landfills and dumps near Bloomington.

The Bennett's Dump site first came to the attention of public officials on March 22, 1983, when a contact reported to the Monroe County Health Department that the site had been used for the dumping of electrical parts.

In response to the information obtained from the contact, the Monroe County Health Department contacted the Environmental Protection Agency (EPA) on March 31, 1983. Early in April 1983,
representatives of the two agencies conducted a site visit during which capacitor labels from Westinghouse Electric Corporation were identified.

After the April 1983 site visit, the Monroe County Health Department contacted the Indiana State Board of Health (ISBH) and requested a site assessment by the EPA. On May 9, 1983, the EPA requested that the Technical Assistance Team assist the ISBH in conducting a site assessment.

The site visit by ISBH and the Technical Assistance Team was conducted on May 12, 1983. During the visit, capacitor papers and capacitor parts were seen. It was estimated that at least 100 capacitors were lying on the surface in various states of deterioration. Light soils were visibly stained by oil. Submerged capacitors were observed in ponds on site. The depth of fill could not be determined by visual inspection. Nine samples of soil and water were collected for analysis. The conclusions reached with the site investigation were: 1) Bennett's Dump represents a serious imminent threat to human health and the environment, 2) pathways for release of PCB contaminated oils and sediments to off-site areas were present.

Current Site Status

Investigations to date conducted by the subcontractors of the EPA and Westinghouse Electric Corporation have not defined the physical nature of Bennett’s Dump site. They have only defined the lateral extent of buried metallics at the site. Nothing is known of the structural geology or hydrogeology at the site.
Soil and water samples have been collected and analyzed. Summary of results of PCB analyses are given in Table 1. Recently aerial photographic interpretation studies of historical air photographs have been performed to aid in the determination of refuse burial areas at the site. Additional geophysical magnetic studies have been performed to aid in this evaluation. Additional trenching has led to expansion of the site.

On May 11, 1984, test trenches were dug at the site to confirm the presence of buried iron as indicated in previous geophysical investigations and to determine the vertical extent of capacitors and contaminated soils. The trenches were terminated at a depth of 3 to 4 feet in some places due to the large number of capacitors encountered and the presence of ground water just below the surface. All other trenches were terminated at a depth of six feet. The study indicated widespread PCB contamination and the presence of capacitors to a depth of at least six feet below land surface. For purposes of the Consent Decree, a total of 23,000 cubic yards of contaminated soils was estimated to be present at the site.

In the summer of 1983, EPA removed 252 exposed capacitors, installed a temporary drainage cap, and fenced the site.
Table 1. Bennett's Dump, PCB Concentrations.

<table>
<thead>
<tr>
<th>SITES</th>
<th>PCB CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Soil Samples</td>
<td>31 - 380,000 ppm</td>
</tr>
<tr>
<td>Soil Borings</td>
<td>Up to 24,648 ppm (at 0.5 feet)</td>
</tr>
<tr>
<td></td>
<td>Up to 52,332 ppm (at 2.5 feet)</td>
</tr>
<tr>
<td></td>
<td>Up to 15,947 ppm (at 5.5 feet)</td>
</tr>
<tr>
<td>Pond Sediment</td>
<td>102 ppm</td>
</tr>
<tr>
<td>Stout's Creek Sediment</td>
<td>&lt; 5.0 ppm</td>
</tr>
<tr>
<td>Stout's Creek Water</td>
<td>&lt; 1.0 ppb</td>
</tr>
<tr>
<td>Residential Well</td>
<td>&lt; 1.0 ppb</td>
</tr>
<tr>
<td>On-Site Pond Water</td>
<td>7.0 ppb</td>
</tr>
</tbody>
</table>
Enforcement

On October 11, 1983, Mayor Tomi Allison announced that the City of Bloomington and Westinghouse had reached a conceptual agreement to destroy PCB soils and other PCB materials, using proven destruction techniques.

In early 1984, Bennett's Dump was added to the list of hazardous waste sites to be included in the settlement negotiations with Westinghouse Electric Corporation. Since that time, negotiations have continued with representatives of Westinghouse Electric Corporation, the City of Bloomington, EPA, and Indiana State Board of Health seeking relief of the alleged endangerment presented by the presence of the PCBs at the site.

The Consent Decree will require Westinghouse Electric Corporation to undertake such actions as may be necessary to remedy the conditions which may cause, contribute to, or present an imminent and substantial endangerment to health and welfare or the environment at Bennett's Dump, arising out of or in any way relating to the handling, disposal, presence, release, or threatened release of solid or hazardous waste or hazardous substances.

Interim Remedial Measures

The Consent Decree requires that the following interim remedial actions be taken at Bennett's Dump to protect the health, welfare, and environment in the period prior to the removal of PCB contaminated materials at the site.
1. Investigative studies, as necessary, to characterize the geology and hydrology of the site.

2. Monitoring of water levels and collection of water samples at selected wells and springs. Determinations will be made for pH, specific conductance, temperature, and laboratory analyses for PCBs.

3. Post warning signs around the site and along that length of Stout's Creek bordering Bennett's Farm and cattle pasture land.

4. Implement a surface-water drainage and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site.

5. Remove all surface exposed capacitors, insulators, papers, refuse, and contaminated soil from the landfill site and transport to Bloomington for incineration.

6. Close all excavated areas to a grade having a minimum slope of 2 percent and without depressions which would cause ponding of water. Establish a total vegetative cover in all disturbed areas during pre-removal and closure.

Remedial Measures

Upon consideration of factors similar to those listed in formulating remedial positions for Neal's Landfill and Neal's Dump (i.e., 40 CFR 300.68e-j), and considering that the hydrogeologic setting of Bennett's Dump is similar to that of Neal's Landfill (Both areas lie in karstic
terrain typified by sinkholes, solution channels, fractures, and cavernous limestone.), the remedial action measures in the Consent Decree were negotiated with Westinghouse during settlement discussions. Those actions are presented below. The Consent Decree requires that Westinghouse excavate and remove quantities of soil, debris, and other materials contaminated with polychlorinated biphenyls ("PCBs") and other associated materials from Bennett's Dump, to construct a State and Federally approved incinerator to incinerate said materials. To satisfy these requirements Westinghouse shall:

On-Site Remedial Measures

1. Following a stepwise protocol agreed upon by the parties, excavate and transport for incineration all refuse materials plus an additional two feet of soil perpendicular to the surface remaining after all refuse has been removed as a "buffer zone".

2. Monitor water levels and collect water samples at selected wells and springs. Determinations will be made for pH, specific conductance, temperature, and laboratory analyses for PCBs during interim, removal, closure, and post closure periods.

3. Provide maintenance for remedial measures, including maintenance of signs, erosion, security fences, diversion ditches, dikes, monitoring wells, and cap.

4. Transport contaminated materials to the incinerator for incineration.
Off-Site Remedial Measures

1. Monitor water levels and collect water samples at selected sites within a 5,000-foot radius of the site. Determinations will be made for pH, specific conductance, and temperature, and laboratory analyses for PCBs will be completed. Monitoring activities at all sites will cease sometime between 5 and 30 years after closure of the site, contingent on decisions made by Environment Protection Agency (EPA), Indiana State Board of Health (ISBH), and the City of Bloomington based on monitoring results.

2. Remove contaminated sediment from Stout's Creek and transport to incinerator.

3. Incinerate PCB contaminated materials in a Federally approved high temperature incinerator to be built by Westinghouse Electric Corporation.

4. Provide an alternative water supply for the livestock presently utilizing water of Stout's Creek.

5. Provide maintenance for interim removal and remedial measures, including maintenance of monitoring wells.

6. Post warning signs around the site.

Closure

The closure activities and plans have been developed in accordance with RCRA regulations, State of Indiana regulations, and the opinions of technical experts.
The Consent Decree requires that the following closure measures be performed:

1. Conduct on-site and off-site monitoring.

2. Close all excavated areas to a grade having a minimum slope of 2 percent and a maximum slope of 25 percent without depressions which would cause ponding of water. To achieve this, Westinghouse shall: first, backfill excavated areas as necessary with suitable fill materials placed in a structurally stable manner to maintain the minimum grades required; secondly, place over the excavated areas a soil cover to effect a two-foot minimum thickness compacted to a modified proctor density of 85 percent capable of vegetative support. Suitable fill materials shall be defined as any materials which are not a hazardous waste, a solid waste, or contaminated with PCBs including: rock, stone, earth, and other materials.

3. Implement a surface-water, drainage and sediment control program to prevent or minimize surface-water and sediment run-on and run-off from the site. Establish a total vegetative cover in all disturbed areas in a timely manner. Vegetative cover shall provide short and long term erosion control. The root growth of the vegetative cover shall be deep enough to prevent erosion.
Post Closure

The post closure activities and plans have been developed in accordance with RCRA regulations, State of Indiana regulations, and the opinions of technical experts.

The Consent Decree requires that the following post closure activities be implemented:

1. Conduct on-site and off-site monitoring.
2. Maintain the soil cover and vegetation to prevent erosion, and correct the effects of settling and subsidence to maintain proper slope. Westinghouse shall reseed as necessary. The root growth of the vegetative cover shall be deep enough to prevent erosion. Westinghouse shall continue to prevent surface-water run-on and run-off from eroding or otherwise damaging the soil cover.
3. Maintain integrity of fence until end of post closure period at which time security fencing (and warning signs) shall be removed.
4. Recording of a statement notifying potential future owners of past use of property and Consent Decree requirements.

Community Relations

The City of Bloomington has been involved in various discussions concerning resolutions of the PCB contamination problem. The dialogue occurred between U.S. EPA, Indiana State Board of Health, and Westinghouse, with the Mayor, the City Council, the Utilities Service Board, and the Environmental Quality and Conservation Commission.
Three local information repositories have been established.

Once the proposed Consent Decree is initialed by the negotiating parties, various community relations activities will occur.

1. The City of Bloomington cannot sign the Decree until it has been discussed publicly in City Council meetings. It is predicted that a minimum of sixty days will be needed to meet this requirement.

2. Indiana Environmental Management Board will also consider the Consent Decree before signing it.

3. The U.S. EPA will advertise in the local press and conduct a public meeting to brief the public on the terms of the agreement and respond to citizens' questions. The Agency will also distribute fact sheets summarizing the agreement and the many future opportunities for public participation.

Copies of pertinent documents will be added to the three information repositories for public review.

U.S. EPA will continue to implement, with the cooperation of the State and City, various community relations activities to assist citizens in developing informed public participation. This will include informational meetings, documents, and conversations during the thirty-day public comment period required by the Department of Justice, and throughout the RCRA and TSCA permitting processes. The City and the State will conduct public participation activities during their sitting approval processes.
Consistency With The National Contingency Plan

All remedial measures achieved by the Consent Decree are consistent with action to be taken at Neal's Landfill.

The remedies include excavation and removal of soil, debris, and other materials contaminated with PCBs and other associated materials and incineration of the materials in a Federally approved high temperature incinerator. Westinghouse will design, construct, and operate an incinerator to be located at the Dillman Road Sewage Treatment Plant. The excavation, transportation to the incinerator, incineration, and disposal of the ash and other by-products of incineration will be in accordance with requirements of a TSCA, RCRA permit. The site will be remedied to mitigate further releases of contaminants into the environment from the landfill. These remedies form the basis for negotiation with Westinghouse for remedial action plan for the final Consent Decree.

The remedial actions required by the Consent Decree are not inconsistent with the objectives of the National Contingency Plan.

Operation and Maintenance

Operation and maintenance requirements associated with the remedial actions herein will be required. The operation and maintenance costs incurred will be paid by Westinghouse Electric Corporation. The operation and maintenance will include provisions for signs, erosion control devices, site security fences, diversion ditches, dikes, monitoring wells, clay caps, and all other technical activities required by the Consent Decree.
MEMORANDUM

TO: For The Record
FROM: Philip E. LaMoreaux, Sr.
SUBJECT: EPA/Bloomington Sites - Remedial Alternative
(PELA File No. 451000)
DATE: August 1, 1984

On the basis of data obtained to date on the geology and hydrology of Neal's Landfill, Lemon Lane Landfill, Bennett's Dump and the Winston-Thomas Treatment Plant, it is concluded that pumping and purging of groundwater and leachate is not an economically feasible remedial action at those sites. Neal's Landfill and Lemon Lane Landfill are in a karst region typified by sinkholes, solution channels, fractures and cavernous limestone. Although these karstic features are not readily apparent on the surface near Bennett's Dump and the Winston-Thomas Treatment Plant, it is probable that solution channels, fractures and cavernous limestone underlie the sites (literature references indicate that the geologic formation underlying the sites are karstified in other areas in the vicinity.)

Pumping and purging of groundwater and leachate is a complex problem in a karst area due to the groundwater flow-system. Groundwater flow is via numerous discrete, solution channels oriented along joint/fracture and bedding planes. Also, the location of the discharge points of groundwater in karst regions may vary with changes of storage of groundwater in the system. For example, as water levels rise or decline, the direction and rate of groundwater movement may change as the zone of saturation within the solution channels may be increased or decreased in the groundwater flow system network. Placement of wells and pumps at appropriate locations in a karst system is therefore very difficult due to:
1. Problems in identifying exact locations of subsurface water bearing solution channels.
2. Variability of flow regime with changes in hydrologic conditions.

Dr. Philip E. LaMoreaux, Sr.
President

Certified Professional Geologist:
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State of Indiana #366

PEL, Sr./ra15/01
A Report On Some Problems Associated With Removal Of Groundwater From Karst Terrains At Bloomington, Indiana

by

Richard L. Powell, Ph.D.
Senior Geologist
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The feasibility of cleaning up groundwater beneath a capped hazardous waste is diminished by several variable factors common to karst terrains developed on limestone bedrock. The Neal's Landfill and Lemon Lane sites are on karst terrain on soil mantled limestone bedrock, the dump at Bennett Quarry is on limestone and into a quarry, and the Winston-Thomas site is on alluvial materials on limestone. A groundwater purge system, in my opinion, would not be a feasible or reliable method to control the migration of contaminants into the groundwater or controlling groundwater migration from these sites, owing to their geologic settings.

The limestone bedrock units of the sites in the Bloomington area do not have a uniform permeability or transmissivity. They do not constitute a homogeneous medium. Some strata are more porous, more broken by joints and fractures, or more soluble than others. Similarly, an individual lithologic unit may have lateral variations in transmissivity, especially where some open joints have been enlarged by solution along particular subterranean routes.

Cavernous voids, solution conduits, and open joints that transmit large volumes of groundwater constitute a small volume within the limestone bedrock. The solution enlarged zones are commonly along sinuous routes and usually not detectable from the surface. Consequently, they are difficult to locate by boring.

Groundwater levels in limestone bedrock, particularly along cavernous routes, commonly fluctuate highly following heavy precipitation in the area. Some sinkholes temporarily flood until the conduits can drain the waters after the storm abates. Temporary high water levels in caverns may rise into sinkholes and soils contaminated with refuse, thus the water would become contaminated. A cap over a filled sinkhole would not prevent a temporary high storm water or groundwater level from flooding a sinkhole or saturating the adjacent soils. Similarly, any unconsolidated sediments within the solution conduits would be temporarily saturated.

Purge wells completed in bedrock with a low transmissivity probably would not effectively drain adjacent cavernous voids. Wells completed in cavernous openings at one elevation may not effectively drain similar openings and smaller voids more remote from the boring, and would not affect such openings at lower elevations. Some wells in cavernous voids might be replenished with such a large volume of transient groundwater that an effective drawdown would not be accomplished without installation of a grout curtain around the site.

The installation of a grout curtain in fractures and solution voids around and under a site in cavernous bedrock is not feasible for several reasons. For example, it is difficult to establish the certainty of boring into all open voids, adequate sealing of large open passages or solution conduits is not assured, and replacement of sediments with grout in those voids that contain sediment is uncertain.

Richard L. Powell
30 July 1984