United States Environmental Protection Agency

Office of Emergency and Remedial Response

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June 1988

EPA

# Superfund Record of Decision:

## IMC Terre Haute, IN

50272-101

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Second Remedial Action - Final

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16. Abstract (Limit: 200 words)

The IMC/Terre Haute site is located in southeastern Terre Haute, Vigo County, Indiana. The 37-acre site is bordered on the west by the Milwaukee, St. Paul, and Pacific Railroad and on the east by the Louisville Railroad. The site is part of a semi-industrialized area of Terre Haute and is 1.8 miles east of the Wabash River and 1 mile north of the Thompson ditch. A waste disposal area, encompassing approximately six acres, is located in the northeastern portion of the plant site. From 1946 to 1954 a small facility on a six-acre segment of the property manufactured, packaged, and warehoused technical-grade benzene hexachloride (BHC-tech). This material was sold to insecticide manufacturers as a raw material for the production of insecticides, including lindane. The site has been owned by International Minerals and Chemical Corporation since 1975. IMC conducted surficial and subsurficial soil sampling in 1979, finding that contamination was within seven feet of the surface and well above the ground water table. Seven ground water monitoring wells were installed at the site, and samples indicated measurable BHC concentrations in two of the wells. In 1980, approximately 28,500 yd$^3$ of soil, rubble, piping and other debris were excavated and placed in a secure clay-capped mound to prevent offsite migration of BHC-tech. The cap system included a surface drainage collection system and soil gas venting. The
(See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision
IMC/Terre Haute, IN
Second Remedial Action - Final
Contaminated Media: gw, soil
Key Contaminants: pesticides

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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16. ABSTRACT (continued)

concentration in ground water of lindane, the gamma isomer of BHC, declined relatively quickly after construction of the mound and has continued to decline at a slower rate since 1983. The soil cleanup and mound construction has proven to be effective in containing the source of BHC-tech and in reducing ground water contamination to MCL and MCLG concentrations. The primary contaminants of concern are lindane and total BHC.

The selected remedial action for this site is no further action with a maintenance program, which includes: inspection of the existing cap quarterly, and maintenance of the vegetative cover; initiation of a ground water monitoring program (sampling of upgradient and downgradient wells semi-annually for the next five years and then annually until 2010); access restrications; and establishment of a contingency plan. The estimated present worth cost for this remedial action is $159,000 for O&M of the existing system.

**RECORD OF DECISION**

**REMEDIAL ALTERNATIVE SELECTION**

SITE: IMC EAST PLANT
Terre Haute, IN Site (IMC)

DOCUMENTS REVIEWED

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

1. P.E. LaMoreaux and Associates (PELA), "The Impact of Waste Disposal Practices on the Hydrogeologic System at IMC East Plant, Terre Haute, Indiana". March 1980

2. Camp Dresser & McKee, Inc. (CDM), "Waste Disposal Alternatives for the East Plant Site". May 1980

3. Camp Dresser & McKee, Inc. (CDM), "Plans and Specifications for International Minerals and Chemical Corporation, Terre Haute, Indiana". July 1980

4. Ecology and Environment Inc. (E&E), "Groundwater Contamination Study, International Minerals & Chemical Corporation, Terre Haute, Indiana". Field Investigations of Uncontrolled Hazardous Waste Sites, Task Report to the Environmental Protection Agency, Contract No. 68-01-06056

5. P.E. LaMoreaux and Associates (PELA), "Ground Water Monitoring Programs for IMC East Plant Waste Proposal Mound, Terre Haute, Indiana". June 16, 1981

6. P.E. LaMoreaux and Associates (PELA), "Monitoring Well Installation for the IMC East Plant Waste Disposal Mound, Terre Haute, Indiana". June 16, 1981

7. Weston-Sper, "Site Assessment for IMC, Terre Haute, Indiana". February 1985

8. Camp Dresser & McKee, Inc. (CPM), "Draft Remedial Investigation, IMC East Plant Site, Terre Haute, Indiana". August 1987

9. Jacobs Engineering Group Inc., "Evaluation of Remedial Investigation Draft Report, EPA, Region V Contract No. 68-01-7351 Work Assignment No. 491", TES IV Prepared by Metcalf & Eddy, Inc. October 1987

10. Camp Dresser & McKee, Inc. (CDM), Remedial Investigation, IMC Est Plant Site, Terre Haute, Indiana. January 1988.

Prior IMC Remedial Action

- Collected onsite contaminated soils to 50 ppm BHC.
- Disposed of soils in a capped earth mound located on a fenced site above elevation of highest groundwater level.
- Constructed surface water drainage away from earth mound via french drain.

Future IMC Operation and Maintenance

- Continue to monitor the groundwater semi-annually.
- Maintain cap and site security.
- Deed restrictions on the site land use.
- Performance review every 5 years with U.S. EPA.

DECLARATIONS

Consistent with the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments Reauthorization Act of 1986 (SARA), and the National Contingency Plan (40 CFR Part 300), I have determined that the remedy outlined above at the IMC East Plant Site is the most cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of Indiana has been consulted and agrees with the approved remedy. In addition, the action will require operation and maintenance activities to ensure the continued effectiveness of the remedy.

I have also determined that the action being taken is appropriate when balanced against the availability of secure off-site disposition, is more cost-effective than other remedial actions, and is necessary to protect public health, welfare or the environment.

6/22/88

Date

Frank M. Covington, Acting

Regional Administrator

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DESCRIPTION OF SELECTED REMEDY

- Collect onsite contaminated soils to 50 ppm BHC.
- Dispose of soils in a capped earth mound located on a fenced site above elevation of highest groundwater level.
- Construct surface water drainage away from earth mound via french drain.
- Continue to monitor the groundwater semi-annually.
- Deed restrictions on the site land use.

DECLARATIONS

Consistent with the Comprehensive Environmental Response Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments Reauthorization Act of 1986 (SARA), and the National Contingency Plan (40 CFR Part 300), I have determined that the remedy outlined above at the IMC East Plant Site is the most cost-effective remedy and provides adequate protection of public health, welfare, and the environment. The State of Indiana has been consulted and agrees with the approved remedy. In addition, the action will require operation and maintenance activities to ensure the continued effectiveness of the remedy.

I have also determined that the action being taken is appropriate when balanced against the availability of secure off-site disposition, is more cost-effective than other remedial actions, and is necessary to protect public health, welfare or the environment.

22 JUN 1988 — Original signed by: /s/ Frank M. Covington

Date — Regional Administrator

## 1.0 Location Description

The IMC East Plant in southeastern Terre Haute, Indiana, is in the Wabash Lowland physiographic province of southwestern Indiana. The plant site is located in Vigo County, approximately 1.8 miles east of the Wabash River and one mile north of the Thompson Ditch at latitude 39°26'N., longitude 87°23'W (see Figures 2 through 5). The plant site, which has an area of approximately 37 acres, is bordered on the west by the Milwaukee, St. Paul, and Pacific Railroad and on the east by the Louisville Railroad. The disposal area encompasses approximately 6 acres in the northeastern portion of the plant site.

## 1.1 Physiography

The Wabash River is the most prominent physiographic feature in the region. The topography of the area is characterized by wide alluvial plains and aggraded valleys that have low relief and a slightly undulating land surface. Hills occur in areas where the more resistant bedrock has not been eroded. The altitude ranges from about 430 feet above msl (mean sea level) along the Wabash River to about 520 feet on the valley floor. In the southeastern part of the study area, there is a prominent hill with a maximum altitude of about 580 feet above msl.

Some of the precipitation in the Terre Haute area results in overland runoff into the Wabash River. In the urban area much of the drainage by the city drainage network is to the Wabash River or Thompson Ditch.

### 1.1.1 SITE AREA FEATURES

### 1.1.2 POPULATION

The East Plant Site is located in southeastern Terre Haute, approximately 1.8 miles from the Wabash River at its closest point in a semi-industrialized area of the city. Railroad tracks are located along the west and east boundaries of the facility. Industrial facilities in close proximity to the property include:

- Ulrich Chemical, 1400 Lockport Avenue;
- Indiana Gas and Chemical, 1341 Hulman Street;
- Farmers Bureau Co-Op, 2600 South 13th Street;
- Modern Album, 1299 Vorhees Street;
- C-Board Railroad, 2301 19th Street.

The population of 61,125 residents in Terre Haute obtains water from a mixture of well water and water from Wabash River. The city water system wells are located approximately 3 miles north-northwest of the East Plant. Two parts of groundwater from the wells are blended with one part surface water from the Wabash River and delivered via service lines to areas as far south as Margaret Avenue. Although city water is available, some residents in the vicinity of the East Plant site obtain their water from private wells. No residential property or residential wells border the East Plant site. Figure 3 shows the location of residential wells in the area, including approximately 30 considered downgradient of the East Plant site. The average private well depth is 65 ft.

### 1.1.3 Land Use/Zoning

The East Plant site is located in a Heavy Industrial (M2) zoning classification according to local zoning ordinance authorities. A portion of the IMC property, outside (and upgradient) of the original disposal areas, is used as an employee picnic area.

## 1.2 Plant History

Land parcels making up the so-called East Plant property (36.8 acres) were purchased by Commercial Solvent Corporation (CSC) in 1946 from three individuals, from the CE&I R/R, and from the Wabash & Erie Canal Co. Prior use of this property was for agricultural activities.

In 1946, a small facility was constructed on a six-acre segment of this property for manufacturing, packaging, and warehousing of technical-grade benzene hexachloride (BHC-tech.). This material was sold to insecticide manufacturers as a raw material for the production of an insecticide for control of the cotton boll weevil. Production of BHC-tech. at this facility ceased in 1954. Process equipment and buildings were partially dismantled and demolished - only the warehouse, the process control building, and some storage tankage remained.

In 1966, the BHC-tech. warehouse was converted into an animal housing facility in which evaluation of the effectiveness of animal growth promotants was conducted. This testing was conducted on a small numbers of swine, cattle, and sheep.

CSC was purchased by International Minerals & Chemical Corporation in mid-1975.

## 1.3 NATURE AND EXTENT OF CONTAMINATION

BHC-tech. is a mixture of several isomers, primarily alpha, beta, gamma, and delta. The gamma isomer of BHC, was the once widely used pesticide "lindane".
Only BHC-tech. was produced at this site, it was not purified to produce lindane. BHC-tech. produced at this site was sold to others as a raw material for insecticide production.

In mid-1979 soil samples, surficial and subsurficial, were taken by IMC and P.E. LaMoreaux and Associates. Results of the sampling program showed that over 90 percent of the contamination was within seven feet of the surface and well above the groundwater table. The shallow depth of contaminant penetration, 25 years after plant operation were discontinued, illustrates the low mobility of BHC-tech. Seven monitoring wells were installed at the site. Groundwater samples indicated the presence of measurable BHC concentrations in two of the seven wells.

In 1980, Camp Dresser & McKee, Inc. environmental engineers, advised on methods for preventing off-site migration of BHC-tech. Approximately 18,500 yards of soil, rubble, piping and other debris were excavated and placed in a secure clay-capped mound. Soil samples were collected and analyzed to control the removal of soils in the site containing in excess of 50 parts per million of BHC. The residual concentration of BHC remaining in the on-site soil is substantially less than 50 ppm. The clay mound was designed in accordance with guidelines for closure of hazardous waste landfills as published by U.S. EPA (43 FR 59011, December 18, 1978). The mound cap consists of a minimum of 6 inches of clay covered by 12 inches of common fill and 6 inches of loam.

The cap system included a surface drainage collection system and soil gas venting. The cap is currently in sound condition and supports a thick, green vegetative growth of crown vetch. Monitoring wells upstream and downstream of the mound have been monitored quarterly since 1981 and results sent to the Indiana State Board of Health.

In 1984, chloroform was found in one well (7 ppb) at the East Plant Site by Weston-Spur, the EPA Technical Assistance Team (TAT) contractor. Chloroform was not used in any IMC East Plant process or operations. The chloroform was found in well B-5 which is upgradient of the capped mound and close to the eastern boundary of the IMC facility. TAT concluded that the chloroform was likely emanating from an off-site source east of the facility.

TAT's Site Assessment, completed in 1985, concluded that the waste mound "is not presently adversely impacting the groundwater in the surrounding area". This conclusion was based on sampling and analysis work for both chloroform and lindane. The analytical work performed by Weston-Sper showed no presence of lindane in any of the samples.

## 1.3.1 Fate and Transport of Site Chemicals

### BHC

Research has suggested that photolysis of BHC in the environment will not be an important process due to the low light adsorption coefficients above 290 nm. Despite the limited light adsorption, several papers have reported lindane (gamma-BHC) as well as alpha, beta, and delta photolysis. The data is suspect and the reported photolysis is likely due to processes such as photoreaction caused by impurities in the BHC used.

Oxidation of BHC isomers in the environment is not a significant process. Actual attempts to oxidize in aquatic systems using ozone (lindane in hexane or water-acetone solvent), chlorine, potassium permanganate, and potassium persulfate have not been successful.

Limited data on the hydrolysis rates for the isomers of BHC indicate that this process is not significant in the environment. BHC (all isomers) is believed to have a hydrolysis half life of more than two years (Callhan et al, 1979).

The research data available on volatization of BHC and lindane (gamma isomer) have indicated that the volatization of lindane from solution is slow and therefore not an important transfer process.

In subsurface soil environments, the adsorption of lindane is critical and ultimately affects the movement, uptake, and microbial and chemical decomposition. Lindane adsorption is proportional to the organic content of the soil, and to a lesser extent, the mineral fraction (cation exchange capacity and surface area). It has been reported that an increase in soil moisture content may decrease adsorption, but it may enhance bioactivity. Freundlich adsorption isotherms and organic carbon normalized adsorption constants for lindane can be found in the literature for a number of soil types. Information on the adsorption of BHC indicate that subsequent deposition and transformation in anaerobic environments may be the most important fate for BHC.

Information available on the bioaccumulation of the four isomers indicates that they are not extensively bioaccumulated in organisms. Concentration factors vary from about 10 to 500 depending on the isomer and organism. One study concluded that the beta isomer showed the greatest tendency to accumulate. Isomerization to the beta form was suggested as a possible explanation.

Very little information is available on biotransformation processes of alpha, beta, or delta BHC. However, it has been suggested that all three of these isomers are potential biotransformation products of lindane. Interconversion of BHC isomers in aquatic environments can complicate fate and transport conclusions for individual isomers. Numerous research projects have identified microorganisms capable of transforming lindane. Transformation products for a variety of microorganisms include: pentachlorocylclohexane, tetraclorocyclohexane, chlorinated phenols, chlorinated benzenes, and benzene. It is generally accepted that microbial dechlorination and degradation of lindane is more favorable under anaerobic conditions.

## 1.4 Hydrogeology

### 1.4.1. Hydraulic Conductivity

A series of rising and falling head tests were conducted on the borehole to obtain information on aquifer permeability. This information supplemented existing information developed by PELA in their extensive site hydrogeologic investigation performed in 1980. The aquifer is known to be highly permeable.

### 1.4.2 Soil Attenuation Capacity

A determination of the local soil attenuation capacity for lindane was carried out by measuring the organic carbon content of undisturbed native soils of the type that are contained in the clay mound. Determination of the organic carbon content allowed calculation of the soil sorption constant. A retardation factor was then calculated. This factor is a relative measure of the velocity of a contaminant relative to the mean velocity of the groundwater.

The Retardation Factor, R, is a function of the sorption constant, soil bulk density and effective porosity:

$$R = 1 + Pb \left(\frac{1-ne}{ne}\right) \times K$$

Specific values for parameters applied to the IMC site are as follows:

Pb = Soil bulk dry density = 1.90 Kg/l
(Value for sand and silt obtained from "An Introduction to Geotechnical Engineering, Holtz & Kovacs, Prentice-Hall, 1981)

ne = Effective porosity (unitless) = 0.32
(Value for sand and silt obtained from "Groundwater & Wells", Driscoll, F.G., 2nd Edition, Johnson Division, 1986)

K = Sorption Constant (L/Kg) = 9.5 to 15

On the basis of these parameters, the Retardation Factor, R, varies from 39 to 62.

The Retardation Factor, R, is defined as the mean velocity of water through soil divided by the apparent mean velocity of the solute (Lindane) through the soil. A value of R approaching 1 would indicate a "no soil" condition, or little retardation. The retardation factors calculated for the IMC site, indicate substantial attenuation of any Lindane which might be dissolved by percolating rainwater.

### 1.4.3 Site Geology

The IMC East Plant is underlain by approximately 85 feet of glacial outwash overlying bedrock. This outwash is covered in some areas by up to seven feet of black silty clay. Bedrock beneath the outwash is gray shale with coal seams of Pennsylvanian Age that slopes northward approximately 17 feet per mile.

The upper 15 to 25 feet of outwash consists of brown fine- to coarse-grained sand containing some boulders. The lower part consists of gray fine- to coarse-grained sand and gravel which increases in size downward to boulders.

### 1.4.4 Ground Water

Ground water occurs in the area in the consolidated bedrock and in the overlying unconsolidated deposits. These unconsolidated deposits are the principal source of ground water in the area.

The sand and gravel outwash deposits of the Wabash River valley constitute the thickest and most extensive aquifer of the area. Ground water in these deposits occurs under artesian and water table conditions. Artesian conditions occur in areas where the glacial outwash is overlain by glacial till, whereas water table conditions occur in the study area. The saturated thickness of the water table aquifer ranges from 50 feet near the edge of the river valley to more than 100 feet near the river. In the study area, the saturated thickness of the aquifer is about 60 feet.

The regional ground water movement is west toward the Wabash River. However, changes in the general direction of groundwater movement can occur locally by groundwater withdrawals, topography, and the configuration of the bedrock surface. At the plant site the groundwater movement is to the north-northwest.

Water-well drillers in the area have reported yields as high as 2,700 gpm (gallons per minute) from wells in the unconsolidated deposits. The average yield per well based on a study conducted by the U.S. Geological Survey in 1973 is approximately 660 gpm.

### 1.4.5 Groundwater Usage

Until the 1960's, the source of raw water for the Terre Haute municipal supply was the Wabash River. Withdrawal was subsequently undertaken to allow blending. Blending continues today on a year-round basis and consists of about 2/3 groundwater blended with about 1/3 surface water. A near-term goal of the local utility is to attain a 50-50 blend.

The municipal water utility, which provides water throughout the city, has five supply wells immediately adjacent to the Wabash River upstream (north) of downstream Terre Haute. Reports prepared in 1979 for the water utility by a consulting groundwater hydrology firm (Keck Consulting Services, East Lansing, MI) state that these wells, which are about 130 feet deep, are hydraulically connected to the Wabash River. The reports conclude that groundwater available to these wells is replenished almost solely by infiltration from the Wabash River and that well production is controlled almost exclusively by river stage levels.

### 1.4.6 Groundwater Sampling

Groundwater at six on-site and six off-site locations was sampled and analyzed for the four isomers of BHC and chloroform. The on-site wells included three upgradient (B-1, B-2 and B-5) and three downgradient (B-9, B-10 and B-11) of the mound. The off-site wells included 2 residential wells downgradient of the (on Stewart Avenue and on 11th Street) and four wells located on the Ulrich Chemical Company property (Monitoring Wells MW-1, MW-3, Mw-7 and MW-9). The locations of all of these monitoring points are shown on Figure 4. Data and results are presented in the Appendix.

### 1.4.7 Surface Water

In the immediate area of the plant site, a drainage divide extends northeast from the southwestern part of the property. Precipitation that falls on the southeastern half of the plant site drains southward into Thompson Ditch. Surface water in a small part of the northeastern side of the plant site drains toward a topographic low to the northeast. A cinder dike around the disposal area on the northwestern part of the site once served to impound the surface drainage in the area, resulting in downward percolation of surface water into the glacial outwash aquifer. This dike was excavated and placed into the disposal mound along with the contaminated soil associated with the impoundment. Natural drainage outside of the mound now flows toward the northwest. Runoff from the disposal mound is collected in a concrete intercepting ditch surrounding the mound. It is then channeled to a gravel percolation pit located directly south of the mound.

## 1.5 PUBLIC HEALTH ISSUES

An obvious potential health concern associated with the IMC East Plant site is the water quality of the Wabash River Valley aquifer. Contamination of the aquifer could impact residences using the aquifer as a water supply.

Quarterly onsite groundwater monitoring wells analyses for a period of six years has shown that only two wells contain measurable concentrations of BHC. These wells are located immediately downstream of the capped mound and contain BHC isomers at or below maximum concentration level goal (MCLG). The only reported occurrence of BHC in offsite groundwater samples is that of the delta isomer found in the Ulrich Chemical wells number 7 and 9 during the RI field work. The data for this one occurrence are highly suspect. No BHC has ever been found in residential wells.

The IMC East Plant site is not endangering public health in the general area.

### 1.5.1 Chloroform

As documented, there is no history of chloroform use on the IMC site. Chloroform is known to be ubiquitous in the environment and is often found in treated drinking water supplies as a result of chlorination of naturally occurring organic materials in the water. The body of data accumulated on this site, including the 1984 TAT investigation and the most recent sampling done as part of the RI, show chloroform being detected up and downgradient of the site and disposal mound. Chloroform concentrations on site fall far below the Safe Drinking Water Act Maximum Contaminant Level (MCL) of 100 ppb. As stated in the Work Plan, EPA considers the MCLs to be only relevant/applicable ambient standard for groundwater contamination.

The highest concentrations detected in the last sampling round (except for matrix spikes which represent laboratory induced contamination for quality control purposes) are 1.9 ppb in tank truck water (field blank for groundwater) and 1.6 ppb in baked quartz sand (field blank for soil).

Chloroform was detected at 0.3 and 0.4 ppb in the two samples taken at well B-10A immediately downgradient of the mound. Chloroform was also detected at

3.3 ppb at Monitoring Well #3 on the Ulrich Chemical property and at 10.9 and 9.9 ppb in groundwater at the Stewart Avenue and 11th Street residences, respectively.

In summary:

- Chloroform concentrations in groundwater in the entire region as detected in the sampling programs associated with this project fall well below the MCL concentration of 100 ppb.
- Chloroform, which has generally not been detected in samples taken directly under the IMC site, is at least one order of magnitude lower in concentration than chloroform detected downgradient of the site.
- There is clearly no cause-and-effect relationship between the negligible chloroform found onsite and the low concentrations detected offsite. Isolated instances of offsite residential well chloroform contamination cannot be attributed to the site.

For these reasons, the presence of chloroform should not be an issue for further study in regard to this site.

### 1.5.2 BHC-tech

The occurrence of Benzene Hexachloride-tech. (BHC-tech.) and its production and disposal history on the IMC site are well documented. The issues to be addressed in this program are the effectiveness of the site closure at preventing the further migration of BHC, the impacts of the BHC remaining in the groundwater and the investigation into the cost/benefit properties of other remedial actions.

The data pertaining to BHC analyses conducted during the RI and the results of IMC's continuing quarterly monitoring program are appended for reference.

Of the four isomers of BHC, only the "Gamma" isomer, also known as lindane, is a priority pollutant. It is also the only isomer for which an MCL has been established. The MCL for lindane in drinking water is 4 ppb. A MCLG of 0.2 ppb has been proposed by EPA for lindane.

Lindane was detected in the groundwater onsite during the RI program only at B-9A and B-10A at concentrations of 0.029 ppb and 0.043 to 0.05 ppb respectively. Both of these locations are immediately downgradient of the disposal mound and both show contamination levels lower than the MCL and MCLG as confirmed by the body of data accumulated during the quarterly monitoring program. The data also show that these low levels of lindane are declining and are now well below the MCLG of 0.2 ppb. Figure 1 shows plots of lindane concentrations in B-9A and B-10A groundwater with respect to time.

All other groundwater sampling locations, on and offsite, showed no detectable lindane.

Lindane was detected (0.051 ppb) in soil at the SB-1 boring at the groundwater interface and was detected (0.029 ppb) in the 1 foot deep soil sample taken at the picnic area. Both of these values are well below the 50 ppm target cleanup values established and implemented in 1980.

As stated in the Work Plan, EPA considers the MCLs to be the relevant/ applicable ambient standard for groundwater contamination at this site.

The conclusion that can be drawn is that the currently implemented RCRA closure is effective at controlling lindane in the groundwater to below current MCL and the more stringent proposed MCLG levels.

## 1.6 Enforcement

On May 6, 1986, the U.S EPA Regional Administrator for Region V signed a CERCLA 106 Administrative Consent Order (Order) with IMC that stipulates the undertaking of a remedial investigation (RI) and feasibility study (FS) by IMC. As part of the RI, the Order requires that an endangerment assessment be completed by IMC to determine the actual or potential harm presented by the site to public health, welfare or the environment.

The stated objectives of the Order were: (1) to determine fully the nature and extent of the threat, if any, to the public health or welfare or the environment caused by the release or threatened release, if any, of hazardous substances into the environment from the East Plant; and (2) to evaluate alternatives, if any, for the appropriate extent of remedial action to prevent or mitigate the migration or the release or threatened release of hazardous substances from the site which includes evaluation of past remediation at the site and to evaluate the need for and appropriate extent of additional remedial action, if any.

## 1.7 Community Relations

The signed Order for undertaking the RI/FS went out for public comment in September 1986. Minimum comments were received on the Order during the thirty day comment period, and the Order became effective thereafter.

The IMC site has generated little public interest or media attention since being identified as a potential Superfund site.

The draft Feasibility Study (FS) went out for a thirty day public comment period beginning March 1988. An opportunity for a public meeting was provided on April 7, 1988, for interested parties. Following the completion of the comment period on April 29, 1988, comments were summarized and included in the Administrative Record. A Responsiveness Summary is attached hereto.

## 2.0 Alternatives Evaluation

The FS for the IMC site developed and evaluated an array of remedial alternatives. A series of screening criteria were employed to narrow the field of possible alternatives. The resulting final array of alternatives was analyzed in detail to select remedies that attain an acceptable level of effectiveness and implementability, and were cost effective.

### 2.1 ALTERNATIVE REMEDIAL ACTION TECHNOLOGIES EVALUATION

The following remedial technologies are recommended for consideration in this Feasibility Study:

- No Action
- Incineration
- Off-Site Disposal
- Chemical Treatment
- Biological Treatment

Briefly, the remedial technologies can be described as follows:

#### No Action (Monitoring and Maintenance of Existing System)

The no action maintenance alternative includes periodic monitoring of groundwater, fence maintenance, and long term maintenance of the cover system. All materials, including the soil disposed in the clay-capped mound, would be left in place.

#### Incineration

This technology involves the high temperature destruction of contaminants present on-site. Materials may be burned in either a permanent or temporary (mobile) on-site or off-site incinerator.

Off-Site Disposal

Land disposal of contaminated materials involves the movement of these materials from their original locations to a secure landfill. The material disposed of may be the original materials present on the site, or may be the remnant product of a treatment process. Hazardous materials must be disposed of in a RCRA (Resource Conservation and Recovery Act) approved landfill.

Chemical Treatment

Dechlorination of several technical grade insecticides at laboratory scale has been reported by several researchers. One process takes place in an alcohol medium by the catalytic action of nickel boride in an excess of sodium borohydride. The laboratory studies were done on insecticides dissolved in acetone and suspended in water. Extraction of pesticides from soil and treatment of the extract by this process has not been reported. Scaling up this to the degree necessary to handle the materials on site has also not been done.

Because the technology has not been proved at laboratory or commercial scale, this particular process will not be further considered as a viable technological alternative for this site. A different dechlorination process, using Alkaline Polyethylene Glycol (APEG) process is more promising from laboratory and field scale perspective and is further evaluated as remedial alternative at this site.

Biotreatment

Biological treatment as applied to this site would involve the use of native microbes, selectively adapted bacteria, or genetically altered anaerobic microorganisms to degrade, in situ, the contaminants present on-site. Conflicting opinions in the literature concerning the effectiveness of biodegradation in lindane treatment, the potential for the development of more mobile toxic halogenated organics and byproducts, the requirement for long-term pilot studies and the need for a water phase in the mound all cast doubt that the pursuit of this alternative would result in a workable solution. Accordingly, biotreatment will not be further evaluated as a remedial alternative at IMC.

## 2.2 EVALUATION CRITERIA

The evaluation of remedial alternatives will be performed using the following considerations:

1. Overall Protection of Human Health and the Environment
2. Compliance with ARARs
    a. applicable or relevant and appropriate requirements (MCL in groundwater)
    b. ability of alternative to attain or exceed standards, or reduce likelihood of present or future threats from the hazardous substances
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility or Volume
5. Short-Term Effectiveness
6. Implementability
7. Cost Evaluation
    a. capital costs
    b. operational and maintenance costs
    c. present worth analysis
8. Support Agency Acceptance
9. Community Acceptance of RI/FS and Proposed Plan

Each of these criteria is more fully described in the following subsections.

### 2.2.1 Overall Protection of Human Health and the Environment

This criterion considers the effectiveness of the alternative in meeting the site remedial objectives based on potential human health and the environment.

### 2.2.2 Compliance with ARARs

This criterion addresses regulatory constraints associated with the remedial alternatives. The degree to which site remediation alternatives comply with applicable or relevant and appropriate regulatory requirements is considered. This includes, for example, CERCLA, RCRA, the Clean Water Act, and the Clean Air Act.

### 2.2.3 Long-Term Effectiveness and Permanence

(a) This criterion includes the effectiveness and useful life of remedial alternatives. The remedial alternative is evaluated in terms of its ability to perform as desired. The applicability of the alternative to site conditions is evaluated as it relates to its technical performance. Useful life considers the service life of the alternative until replacement is required.

(b) This criterion includes operation and maintenance requirements and previously demonstrated reliability of the alternative. Past documented performance of the technology for similar site conditions is considered. The technical and operational complexities of the alternative are considered as related to functional reliability.

### 2.2.4 Reduction of Toxicity, Mobility or Volume

Beneficial and adverse impacts to the environment are considered for each remedial alternative. This evaluation considers both short-term (i.e., construction related) impacts and long-term impacts.

The environmental impact evaluation addresses the following specific issues for each alternative:

1. Potential release of contaminants to the air and groundwater during construction.

2. Elimination of contaminant migration and elimination of future potential impacts.

These potential impacts and other applicable impacts, along with mitigation measures, are addressed for each alternative.

### 2.2.5 Short-Term Effectiveness

This criterion addresses the safety of workers and nearby neighborhoods or other potential receptors during construction of the remedial alternatives. Air quality impacts due to emissions during site remediation are considered relative to workers and area residents. Direct contact exposure to workers is also considered.

### 2.2.6 Implementability

This criterion considers the constructability of a remedial alternative based on site-specific constraints such as depth to bedrock, site access, existing land use, waste characteristics, and water table elevations. Construction problems that may ultimately impact site remediation objectives are identified. The time to construct/implement the remedial alternative is also estimated. The time required from start up of the remedial alternative until desired remedial response objectives are achieved is considered.

### 2.2.7 Cost Evaluation

The cost analysis has been conducted in the following steps:

1. Estimation of capital and annual operation and maintenance costs;

2. Present worth calculations to allow comparison of alternatives; and

3. Sensitivity analysis of major cost items to determine potential impacts on overall costs and alternative comparison.

All cost estimates include a 30 percent engineering and contingency factor. Present worth calculations for future annual costs are based on a 10 percent discount rate. Future costs would be incurred primarily in the operation and maintenance of the on-site disposal mound, and in groundwater monitoring over a 30-year period following completion of on-site remedial construction.

### 2.2.8 Support Agency Acceptance

IDEM has commented on the preferred alternatives based upon its review of the RI/FS and proposed plan.

### 2.2.9 Community Acceptance

Public comments based upon the RI/FS and proposed plan have been received and assessed.

# 3.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

## 3.1 NO ACTION (MONITORING AND MAINTENANCE OF EXISTING SYSTEM)

### 3.1.0 Description

The work associated with the no action alternative includes fence maintenance, long term maintenance of ground-cover and fencing, and continuation of the groundwater monitoring program. These actions will provide continued protection for the public in the vicinity of the IMC site.

In 1980, after completion of the soil sampling plan, 28,500 cubic yards of contaminated materials were excavated, mounded and secured by a 6-inch clay cap at the site. Excavation was carried out in all areas until soil samples contained less than 50 ppm BHC. The areas from which contaminated soil was taken were then graded, seeded and fertilized. The clay covered mound was covered with one foot of common fill and six inches of seeded loam. The vegetative cover is now fully established. The mound was encircled with a concrete drainage ditch which diverts direct runoff away from the edge of the mound toward a gravel infiltration area to the south.

After completion of the mound, a periodic groundwater monitoring program was instituted. Figure 5 is a plot of total BHC-tech and lindane concentrations versus time at wells B-9A and B-10A, both located immediately downgradient of the mound. As the plots indicate, concentration of lindane in the groundwater declined relatively quickly after construction of the mound and has continued to decline, at a slower rate, since early 1983. Other isomers of BHC show similar behavior. Concentration of lindane in the groundwater remains well below the MCL concentration of 4 ppb and is also below the MCLG concentration of 0.2 ppb.

The soil cleanup and mound construction has been effective in containing the source of BHC-tech. and in reducing groundwater contamination to well below MCL and MCLG concentration.

The disposal mound is surrounded by a security fence. The fencing should be checked semi-annually for the 30-year life of the remediation activity by IMC and maintained as necessary.

Groundwater Monitoring

Groundwater has been tested on a quarterly basis for BHC. Background water quality is assessed by monitoring upgradient wells PW-1 (production well), B-1, and B-2. Downgradient wells that have been used to monitor the groundwater quality are observation wells B-9, B-10, B-11. This monitoring program will be continued for the 30-year monitoring period which began with closure in August 1980. The program will include semi-annual monitoring for the next 5 years and annual monitoring thereafter.

Should downgradient monitoring show increasing contamination additional groundwater samples will be taken to determine if the data are valid (e.g., consistent increase over more than two monitoring periods when compared to general trends defined by previous sampling or presence of contamination above MCL level with no increase in concentrations upgradient). If these confirmatory samples indicate an upward trend in downgradient contamination, remedial action may be necessary. Because of the variability inherent in sampling and in laboratory techniques, it is not possible to propose objective criteria for initiating cap repairing; data must be evaluated in the context of previous data and judgement must be applied prior to initiating action. The contingency plan under these circumstances will be to repair damaged portions of the cap. If no damage is apparent, then the cap will be replaced by stripping the loam and vegetative cover, installing a high density polyethylene membrane over the entire mound, and reestablishing vegetative cover by placing one foot of common fill and six inches of reseeded loam over the membrane. In view of low solubility of BHC-tech in water (less than 15 ppm), and its relative immobility (as demonstrated by high soil attenuation properties calculated), the contingency plan will keep groundwater contamination below MCLGs, protecting human health and environment.

### 3.1.1 Public Health and Environmental Impacts

The no action alternative will protect the public from direct contact with contaminated materials and reduce the migration of contaminants offsite through rainwater percolation and groundwater recharge. Concentrations of lindane currently are below MCL and MCLG standards in groundwater and, therefore, site remediation objectives have been attained.

### 3.1.2 Compliance with ARARs

The no action alternative entails maintaining the fence surrounding the disposal mound to prevent damage to the capping system, and direct contact with the disposal materials, and monitoring. The institutional requirements of greatest concern are RCRA 40 CFR Part 264, Subpart G (Closure and Post-Closure). The site closure was conducted in accordance with RCRA regulations proposed at the time. Up- and down-gradient monitoring and maintenance of site security are in accordance with these regulations.

The no action/monitoring alternative is equivalent to maintaining the natural attenuation process which relies on the groundwater's natural ability to lower contaminant concentration through physical, chemical and biological processes until cleanup levels are met. As the body of data shows, groundwater cleanup has occurred to MCL and MCLG levels and contaminant concentrations continue to decline.

This alternative has a high institutional ranking.

### 3.1.3 Long-Term Effectiveness and Permanence

The intended function of the fence and cap system is to protect human health by preventing direct contact of humans with the contaminated, on-site soils and reduce particulates and surface runoff from migrating off-site. In addition, the installed clay cap is effective in preventing rainfall from percolating through the contaminated soils, thereby protecting the groundwater from new contamination. Additional safety is derived from the low solubility and low mobility of BHC-tech. These systems are expected to accomplish these safety objectives over the 30-year life of remediation. In addition, the monitoring program consisting of up- and downgradient groundwater sampling will give early warning of cap failure. High levels of performance are assigned to this alternative because of ease in maintenance and performance to date.

It is entirely feasible to ensure the integrity of the cap, fencing and ground cover over its 30-year life. Operation and maintenance activities will entail fence repair and replacement as necessary. The monitoring program, with upgradient and downgradient groundwater sampling points, forms a reliable means of data gathering for additional protection. This alternative is given a high reliability ranking. The capping system, fence, ground cover and monitoring program should be reliable systems for prevention of direct contaminant contact, for prevention of contaminant migration, and for early warning should some failure of the capping system occur.

### 3.1.4 Reduction of Toxicity, Mobility or Volume

Beneficial environmental impacts associated with the no action alternative are derived from the fact that contaminant transport and the potential for direct contact with contaminated materials have been minimized. This is true both in the short- and long-term future. Faithful monitoring and maintenance of the capping system will also prevent future impacts on the groundwater beneath the site. Sufficient warning will be given by the monitoring program to allow timely implementation of further remedial action in the unlikely event that they become necessary. The unlikely catastrophic failure of a substantial portion of the cap over a considerable time period has the possibility of allowing sufficient transport of BHC to affect the groundwater. Because the monitoring points are close to the mound and because current groundwater contaminant levels are well below drinking water standards early detection is possible and no impact on downgradient groundwater users is anticipated.

The Public Health is further protected by the 5-year review of the selected remedy required by Sec. 121(b)(2)(c) of SARA. Under the no action scenerio, contaminants would remain on-site, requiring review of the remedy at least every 5 years to assure protection of human health and the environment. If action under Sec. 104 or 106 is appropriate such action will be taken at that time.

The rating of this alternative from a public health standpoint is high.

### 3.1.5 Short-Term Effectiveness

This alternative receives a high ranking because personnel will not be required to directly handle hazardous materials.

### 3.1.6 Implementability

The implementability of this alternative receives a high ranking due to the fact that the capping system, fencing and ground cover are already in place and have proven effective over seven years of record. The monitoring program has been implemented and coordinated with laboratory service and sampling crews. Deed restrictions will state that no private use of this site will be permitted for the 30 year period.

### 3.1.7 Cost Analysis

#### Capital Cost

There are no initial capital costs for the no action alternative. All necessary capital improvements were completed in 1980.

#### Operation and Maintenance

Operation and maintenance (O&M) costs for the no action alternative include sampling and analytical costs and costs for the maintenance of the fence and ground cover. These costs are summarized in Table 1.

3.1.8 Support Agency Acceptance

IDEM approved the orginal cap installation in 1980 and as both MCLs and MCLGs are for lindane being met by the current remedy they continue to support this remedy.

3.1.9 Community Acceptance

Monitoring provides early warning in event of cap failure. As there is no need to re-open site, a contingency plan is available and future reviews are planned the community supports this alternative.

TABLE 1
NO ACTION ALTERNATIVE
(MONITORING AND MAINTENANCE OF EXISTING SYSTEM)

CAPITAL COST
NO INITIAL CAPITAL COSTS ASSOCIATED
WITH THIS ALTERNATIVE

OPERATION AND MAINTENANCE COST

| | |
|---|---|
| Cap Inspection, Mowing, Repairs | $10,000 |
| Sampling & Analysis | SEE BELOW |
| Record Keeping and Review | 5,000 |
| SUBTOTAL ANNUAL O&M | $15,000 |
| Allowance for Replacement of Fence in 15 Years | $20,000 |
| Sampling and Analysis (Semi-annual for first 5 years, annual thereafter through year 2010) Present worth (10%) = ($2000 x 3.791) + (($1000 x 8.20)/1.610)= | $13,000 |

30-Year Present Worth (10%):

TOTAL O&M COST ($15,000 x 9.427) + ($20,000 x 0.2394)

$141,000 + $5,000 + $13,000 = $159,000

TOTAL NO ACTION PROGRAM COST: $159,000

## 3.2 OFF-SITE DISPOSAL

### 3.2.0 Description

The off-site disposal alternative entails the excavation of contaminated soil and subsequent hauling and disposal at a RCRA approved off-site landfill. The procedures necessary to implement this alternative include excavation, transportation, disposal, and site restoration. Soil would be excavated from the mound as needed to fill the transport vehicles.

Before the soil can be transported for disposal at a landfill, it must pass the paint filter test, discussed in RCRA 40 CFR Section 264.314. It is expected that soil moisture will be low enough to allow it to pass this test without moisture adjustment. Saturated soils will need the paint filter test.

Soil characteristics must be determined to ensure that appropriate methods of handling, transportation, and disposal are employed. All methods utilized must be in full compliance with local, state, and federal requirements (40 CFR 262 and 263). Approximately 31,000 cubic yards of contaminated soil are to be hauled offsite under this alternative. This includes 18,500 cubic yards of soil in the mound plus all soil to a depth of 7 feet (maximum BHC penetration defined in soil sampling program) under the mound. Excavated soils will be transported by 20 cubic yard truckloads.

As per 40 CFR 264.13(2)(4), landfill requirements entail taking samples from selected truckloads before disposal. Samples are analyzed to ascertain their chemical and physical composition. This includes specific gravity, moisture content, pH, hydrocarbon composition, and PCB content. Testing for priority pollutants is conducted based upon each receiving facility's waste analysis plan.

Potential commercial landfill facilities considered are as follows:

- Chemical Waste Management (Model City, New York; Fort Wayne, Indiana; Emelle, Alabama)
- Cecos (Williamsburg, Ohio), or
- GSX (Pinewood, South Carolina).

Landfill selection would be based on available capacity at the time of disposal and the landfill's, or state government's, policies regarding maximum disposal volumes acceptable for any one site. As landfill capacity becomes more limited in the future, restrictions and allocation of remaining capacity can be expected.

### 3.2.1 Public Health and Environmental Impacts

The excavation and off-site disposal of the contaminated soils eliminates the potential exposure to local and distant populations from this media. Furthermore, the downward migration of contaminants and surface water contamination will also be mitigated.

### 3.2.2 Compliance with ARARs

This source control remedial alternative was evaluated for compliance with federal, state, and local regulations.

This alternative is in compliance with RCRA Subparts G (closure and post-closure) and N (landfills). The transport of contaminated soils to an off-site landfill facility complies with RCRA Parts 261, 263, 265 and DOT regulations 49 CFR Parts 171-179 and 387.

Secure landfill capacities are becoming an issue in New York State and are expected to result in disposal restrictions there and elsewhere in the future. This fact, coupled with the pending landfill ban defined by 40 CFR Part 268, encourage the implementation of on-site solutions to contamination where possible.

This alternative is given a low rating for institutional issues.

### 3.2.3 Long-Term Effectiveness and Permanence

The performance of this alternative is dependent upon weather conditions. To achieve the best results, this alternative should not be implemented during the spring when regional rainfall is at its maximum. Excavation will remove all contaminated soil from the site.

However, disposal to an off-site landfill will not alleviate the overall problem of contamination. Once the contaminated soils are placed in the off-site landfill, performance will be equivalent to the no action alternative.

During excavation, the opportunity for releases to the groundwater during rainfall will occur. For these reasons, performance is rated at a medium level.

Excavation of contaminated soils requires little or no operation and maintenance. This operation requires an 8-hour shift for 5 days a week for the duration of the cleanup. All of the necessary equipment is standard excavation equipment.

Once the contaminated materials are finally disposed of, the potential for on- and off-site release is low. Reliability is therefore rated high for this alternative.

### 3.2.4 Reduction of Toxicity, Mobility or Volume

The adverse effects occurring from the excavation of the soils can be controlled through engineering and personal protective equipment. The primary adverse effects that could potentially occur are as follows:

1. Potential release and worker exposure during excavation.
2. Potential exposure to all populations from accidental spills or wind carried releases during off-site transport to the landfill.
3. The potential failure of the off-site RCRA landfill, causing contamination of surface water and groundwater.

This alternative is given a medium ranking regarding public health protection.

### 3.2.5 Short-Term Effectiveness

The IMC site is fenced. Access to the work area must be restricted to operation personnel only. Excavated soils that are to be hauled offsite will be stored in a way that prohibits further contamination. This includes covers consisting of polyethylene sheets to reduce fugitive emissions and rainfall percolation. The working face of the mound must also be protected with this sheeting when work is not in progress or when it is raining. On-site safety issues include truck traffic, accidents, and fugitive emissions in the working area. Trucks transporting excavated materials off-site must be carefully loaded, secured, and decontaminated to ensure that residual contamination is not transferred from the site to public area.

From a safety perspective, this alternative is given a medium rating.

### 3.2.6 Implementability

Excavation needs to be implemented during a dry period to minimize transport of exposed contaminants to the groundwater. This may not be possible due to unpredictable weather and operational or permitting problems associated with an off-site disposal facility. Implementation is uncomplicated in all other respects and is therefore rated medium for this alternative.

### 3.2.7 Cost Analysis

#### Capital Cost

Initial capital costs for the off-site alternative involve costs for the following:

1. Excavation and handling of the contaminated soils at the site with transport to a RCRA landfill. The handling and transportation costs are based on unit costs provided by waste management companies. The unit costs vary widely depending on the landfilling method and the location of the disposal site. A conservative cost estimate was adopted for this analysis.

2. Backfill and regrade the site after excavation, including loam and seed.

3. Sample and analysis. The work includes both regular analysis for the landfill and additional tests for the EPA priority pollutants.

#### Operation and Maintenance

Operation and maintenance costs for the off-site landfill alternative represent the costs for annual post closure monitoring (2 rounds per year for the first 5 years, 1 round per year for the remaining 25 years.)

All estimated costs for this alternative are presented in Table 2.

### 3.2.8 Support Agency Acceptance

As land restrictions have made off-site removal permits more difficult the state has only limited support for this alternative.

### 3.2.9 Community Acceptance

Alternative involves re-exposing contaminated materials and dust generation from truck traffic. While community would prefer to have material removed it resists any unneeded exposure to BHC.

## 3.3 INCINERATION

### 3.3.0 Description

At the IMC site it is estimated that approximately 31,000 cubic yards of contaminated soil would require detoxification in an on-site incineration system. Of this quantity, 18,500 cubic yards is material which was placed in the disposal mound. The remainder is material existing to a depth of 7 feet below the mound representing an estimate of soil contaminated to at least 50 ppm based on analyses conducted prior to and during mound construction.

We have investigated the economies of off-site versus on-site incineration. Because cost strongly favors on-site incineration, it is the only option investigated under this alternative.

For detoxification of these contaminated soils, the applicable thermal treatment technology commonly available as a mobile system for on-site hazardous waste treatment is rotary kiln incineration. Although the rotary kiln incineration process has been evaluated for this comparison, there are other possible means of incineration such as fluidized bed incinerators and infrared processing systems that may, after a trial burn and/or indepth studies, be viewed as acceptable methods of incineration. The rotary kiln incineration system handles the broadest range of organic compounds and materials.

#### Rotary Kiln Incinerators

The most versatile thermal treatment system is the rotary kiln incinerator. Pumpable and atomizable liquid wastes can be injected through conventional burners into the kiln, sludges and viscous liquids can be pumped through open pipes into the rotary chamber, and soils and other solid materials as well as suitably-sized containers can be fed through entrance chutes. Kiln rotation continuously exposes fresh surfaces to oxidation and provides constant removal of the treated soil and ash at the discharge end. A secondary combustion chamber (afterburner) is provided for the further destruction of unburned gaseous and suspended particulate organics. This combustion system provides turbulent mixing of the waste gases with excess oxygen at high temperatures. If properly designed, the combination of adequate volume, turbulence and temperature will normally provide sufficient residence times to destroy the organics within the allowable limits. If necessary, the off-gases may be quenched and scrubbed of acids and particulates before discharge to the environment.

TABLE 2

OFF-SITE DISPOSAL ALTERNATIVE

CAPITAL COST

| | |
|---|---|
| Excavation | $ 220,000 |
| Backfill | 125,000 |
| Sampling and Analysis | 594,000 |
| Transport, Processing and Disposal | 12,400,000 |
| SUBTOTAL | $13,339,000 |
| Engineering (15%) | 2,001,000 |
| Contingency (15%) | 2,001,000 |
| | $17,341,000 |

OPERATION AND MAINTENANCE COST

| | |
|---|---|
| Post-Closure Monitoring (5 years semi-annual, 25 years annual) 30-Year Present Worth (10%) (\$2,000 x 3.791) + ((\$1,000 x 9.077)/1.610) = | $13,000 |

TOTAL OFF-SITE DISPOSAL PROGRAM COST

$17,341,000 + $13,000 = $17,354,000

Rotary kiln incinerators have been used extensively at fixed facilities for treatment of both hazardous and non-hazardous waste materials. The majority of installations are used for in-plant industrial waste destruction. Rotary kilns have also been developed as mobile or transportable systems, due to their ability to effectively destroy diversified waste feeds. This allows for waste treatment onsite, thereby eliminating the need to transport waste offsite. Once remediation is complete, the system can be moved to another site.

The system consists of six basic process modules:

- Rotary kiln or primary combustion chamber,
- Secondary combustion chamber,
- Heat recovery boiler,
- Air pollution control train,
- Control room and laboratory, and
- Effluent neutralization and concentration equipment.

The rotary kiln or primary combustion chamber operates within a temperature range of 1,200°F-1,800°F. Auxiliary fossil fuel or waste liquids are used in the primary chamber to maintain temperatures. Residence times in the rotary kiln range from seconds for gases to 30 to 40 minutes for solids. The secondary combustion chamber operates at a temperature between 1,400°F-2,400°F. Gas residence times range from 1.7-2.2 seconds at 2,200°F.

Process operation of rotary kiln systems begins with solid waste material being fed into the feed chute of the unit. Once discharged into the feed chute, the feed is introduced into the upper end of the kiln by various methods including hydraulic rams, screw augers and inclined chutes. As waste material is discharged to the kiln, it is exposed to high temperature gases that flow either concurrent or countercurrent to the waste movement. Waste movement through the kiln is promoted by the rotation and inclination of the cylindrical kiln.

As wastes pass through the kiln, they are first dried and then the organic content of the waste is substantially oxidized to gases and ash. Ash and non-combustible detoxified solids, such as soils, are removed at the lower end to the kiln and discharged into a residue receiving container. Meanwhile, exhaust gases from the kiln enter a secondary combustion chamber or afterburner to complete oxidation of the combustible waste. Liquid combustible wastes can be burned in the secondary combustor as well as the primary chamber. As the exhaust gases exit the secondary chamber, they are directed through a pollution control train which may consist of a water quench, a packed tower scrubber or an ejector scrubber system. The water quench section provides for gas washing and additional cooling. Acid gas removal in excess of 99 percent is attained with the packed tower while additional particulate removal is provided by the high-energy ejector scrubber system. Wastewater blowdown for the scrubbing system is analyzed, neutralized and concentrated prior to disposal.

While rotary kilns offer an effective means of thermal treatment for the type of wastes found at many CERCLA sites, the equipment tends to be relatively large in size for a given throughout due to the high percentage of excess air normally required for this system. The required high air volume is reflected in the size, and therefore the cost, of the combustion chambers and the air pollution control equipment. There is also a potential for increased maintenance of the kiln's refractory lining due to abrasive conditions resulting from the motion of the soil and solids in the rotating chamber. These considerations suggest that the application of mobile rotary kiln incinerators are cost effective only on relatively large sites with waste quantities of 5,000 cubic yards or more and those requiring treatment of a variety of contaminated materials (soils, liquids and sludges). Though costly, investigation indicates that on-site incineration is less expensive than hauling contaminated materials to a properly licensed off-site incinerator for processing and disposal.

### 3.3.1 Public Health and Environmental Impacts

Operation of the incinerator will generate some unavoidable environmental impacts, which can be mitigated or controlled to minimize impact. Public health impacts should be minimal, as considerable effort will be expanded to control emissions during the cleanup.

The construction and operation of the incinerator will generate some noise and traffic impacts for local residents. Truck traffic to and from the site will increase, but the increase is not anticipated to be unreasonable.

Noise levels from fabrication and operation of the incinerator may be high.

Overall, there will be moderate impact on the environment due to the stack or fugitive emissions from the incinerator and from the noise and traffic generated by the construction and operation of the unit. The ranking for public health and the environment is medium.

### 3.3.2 Compliance with ARARs

An on-site program of incineration may be regulated by several different guidelines, depending on: (1) the type and degree of contamination, (2) whether it is a Superfund site or private cleanup site and (3) whether the management of the cleanup is an EPA-lead or PRP-lead.

At the IMC site, BHC would be the only contaminant of concern. It is possible that, due to relatively low concentrations, the regulatory process would be simplified. If it is ruled that RCRA requirements must be applied, then the regulatory issues will become more complex. RCRA includes detailed requirements for trial burn plans, which often require considerable time and high level of effort. Additional requirements include: (1) emergency contingency plan, (2) QA/QC, (3) site health and safety, and (4) site security and site restoration.

Other possible permit requirements that may apply to this site are the Clean Air Act (CAA), National Environmental Policy Act (NEPA), National Pollutant Discharge Elimination System (NPDES) for discharge of scrubber wastes, and the Noise Control Act. Also, typical state requirements are Air Pollution Control, State Pollutant Discharge Elimination System, Hazardous Waste Facility Registration Requirement, and Solids Waste Management Requirements. Along with these permits, possible municipal requirements are discharge permits and building permits.

The regulatory approach used at each site is highly dependent on the type of wastes on site and the status of the site. Regulatory compliance is expected to be streamlined in the future as more sites use incineration for cleanup programs.

The issue of ash residue is currently handled on a site-by-site basis. The ash from hazardous waste incinerators is considered hazardous unless it can be proven non-hazardous using the Toxic Characteristic Leach Procedure (TCLP) test. The levels of heavy metals in the soil are key factors, since these contaminants are unlikely to be affected by thermal treatment. If leaching tests on ash residue reveal that heavy metal levels are too high for delisting, stabilization/fixation may be used to reduce the mobility of the metals, allowing the delisting of the treated soil. The soil may be replaced on-site or transported off-site for disposal.

At the IMC site metals are expected to occur at natural soil background concentrations. It is not anticipated that there will be problems with delisting of the treated soil.

There appear to be no institutional obstacles to permitting an incineration facility at the site. The institutional ranking for this alternative is medium.

### 3.3.3 Long-Term Effectiveness and Permanence

High temperature incineration is a proven technology which, when operated in accordance with parameters established during pilot trial burns, is effective at destroying organic contamination.

The major performance risk associated with on-site incineration is that all the contaminated soil and waste material must be effectively excavated and incinerated and that the incinerator must be properly operated to ensure destruction of the contaminants with minimum acceptable air emissions.

Performance for this alternative is rated high.

The reliability of this alternative is high based on the data obtained from both full-scale and pilot work done at other sites.

3.3.4 Reduction of Toxicity, Mobility or Volume

(1) Incinerator stack emissions - Closely regulated for emissions of particulate, HCl and organic contaminants. The stack emissions quality must comply with RCRA and TSCA standards. Impact of stack emissions is likely to be small and of limited duration (1-2 years).

(2) Fugitive dust and emissions - Fugitive emissions may be generated during the excavation and handling of soils. This may result in undesirable odors and/or unacceptably high levels of airborne organics on-site or on neighboring properties. These emissions can be controlled by a number of methods, including enclosing of the work area, or water spray methods for dust control. Impact of fugitive emissions should be small to moderate.

(3) Generation of scrubber effluent - The treatment of stack gases will generate an aqueous stream which can be used for ash quenching. This waste stream must be treated prior to disposal. The scrubber effluent will either be treated to water quality standards and discharged, or shipped off-site for disposal at a treatment facility. Environmental impact from generation of scrubber water is likely to be small.

(4) Bottom ash and detoxified soil - This material is not anticipated to pose any environmental risks following treatment. Heavy metal levels in the soil can be delisted and replaced in the original excavation area. If it cannot be delisted, it may have to be further treated. Dust suppression measures will be used to control fugitive dust emissions. Environmental impact from the treated soil will be small.

(5) Captured flash or particulate - This material may contain unacceptable levels of organic contaminants or heavy metals. This material may be disposed of in a RCRA facility. The environmental and public health impact from this material will not be significant.

### 3.3.5 Short-Term Effectiveness

Safety to workers is a primary concern during the operation of high temperature incineration systems. Leakage of hot gases from kiln seals could be dangerous to operators. Residue is typically discharged hot, approximately 500°F, from these systems and must be handled carefully or given ample time to cool.

Thus, these systems can expose operators to some risk if they are not well informed about the operation of the technology. Therefore, it is imperative that only well trained and knowledgeable personnel operate these systems.

There is a small potential that occasional improper operation of the system could result in unacceptable emission effecting offsite workers and residents.

The safety ranking for this alternative is medium.

### 3.3.6 Implementability

Mobile incineration systems are commercially marketed. There are no anticipated difficulties in obtaining the appropriate process equipment. Companies that offer this service report a 4-week mobilization period. Local building codes, electrical and water supply hookups and air emissions requirements are to be considered. Obtaining an operating permit for the incineration system may lengthen the time for erection and startup.

The time periods for key activities are estimated as follows:

| | |
|---|---|
| Test Burn and Predesign Studies | 6 months |
| Preliminary Design | 2 months |
| Final Design/Permits | 6 months |
| Bid/Award, etc. | 2 months |
| Site Mobilization | 4 months |
| Demobilization | 4 months |

The length of operation periods are dependent on the cleanup criteria which, in turn, decides the volume of the contaminated soil to be processed. If all of the 31,000 cubic yards of soil must be treated, incineration could be accomplished in about a year using two mobile on-site incinerators, each with a 5 ton/hour capacity. A total program time of at least 3 years can therefore be expected.

The overall ranking for implementability of this alternative is medium.

### 3.3.7 Cost Analysis

The cost analysis is based on a rough cost estimate solicited from ENSCO Environmental Services of Little Rock, Arkansas and on general cost data accumulated for similar sites.

This company has prepared cost estimates based on brief site description provided to them. The estimate made was for incineration services only. The cost for excavation, materials handling and site restoration are estimated separately. Recent quotes by ENSCO and companies with rotary kiln incinerator technology have been averaged to approximate the cost for incineration of 31,000 cubic yards of contaminated soil as shown in Table 3.

Operating costs reported in Table 3 represent post-closure monitoring costs.

### 3.3.8 Support Agency Acceptance

IDEM will accept this alternative with the SARA exclusion from permits if pilot plant work is done to confirm feasibility. The requirement for close supervisory attention to the laboratory and incinerator operation is noted.

### 3.3.9 Community Acceptance

The community accepts this alternative but concerns about incinerator vapors, wastes and disturbance of the soil require special effluent control.

## 3.4 ON-SITE TREATMENT (DECHLORINATION BY APEG PROCESS)

### 3.4.0 Description

Alkaline Polyethylene Glycol (APEG) reagents have been used to dechlorinate certain halogenated organic compound, i.e., PCBs, ethylene dibromide and chlorinated dioxins. Typically, potassium hydroxide is reacted with polyethylene glycol to form an alkoxide. The alkoxide, in the presence of dimethylsulfoxide (DMSO), reacts with one of chlorine atoms of the organic molecule to produce an ether and potassium chloride. The chemical reaction may produce other byproducts which can be evaluated for toxicity by bioassay or identified by analytical methods.

#### Process Description

In the full-scale process, contaminated soil is mixed in a process tank with a heated alkaline reagent consisting of potassium hydroxide in a solution of polyethylene glycol and dimethyl sulfoxide. The reagent mixture dechlorinates the chlorinated organics to form a polyethylene glycol ether, which may degrade further to form a totally dechlorinated species.

The soil and reagent are mixed to form a slurry, which is heated to 150°C. Heating to 150°C significantly increases the reaction rates for dechlorination and boils off the water and many volatile organics held within the soil. The water vapor and volatile organics used are captured in a condenser and carbon vapor trap. At the end of the reaction, the slurry is drained and the excess reagent recovered for recycle. The soil is then washed several times using a countercurrent extractor, which cycles clean waste into the secondary wash and moves the secondary wash water into the primary wash. This conserves rinse water and minimizes the volume of rinse water requiring additional treatment.

#### Residual/Effluents

The primary wash becomes contaminated with reagent and reaction byproducts following multiple rinses of processes soil batches. The primary wash is then mixed with recycled dewatered reagent from the dechlorination step. This reagent is then used for further dechlorination of soils. Contaminated water in the reagent mixture is boiled off during the soil heating phase.

The reagent usage rate is approximately 5 gallons/ton. This reagent must be disposed of after it is exhausted. Incineration of the reagent is included in the cost estimate ($0.50/lb for high BTU liquids). Some solid residuals may be generated during cleanup, including some fine clays and silts removed by

TABLE 3

INCINERATION

CAPITAL COST

31,000 cubic yards contaminated soil

| | |
|---|---|
| Excavation | $ 96,000 |
| Operations Area | 232,000 |
| Treatment Process | 10,311,000 |
| Fuel and Electricity | 1,380,000 |
| Replacement of Soils | 14,500 |
| Residuals Disposal | 341,000 |
| Loam 1' | 31,000 |
| Seed | 2,000 |
| Monitoring | 408,000 |
| SUBTOTAL | $12,946,000 |
| Pilot (5%) | 647,000 |
| SUBTOTAL | $13,593,000 |
| Engineering (15%) | 2,039,000 |
| Contingency (15%) | 2,039,000 |
| TOTAL | $17,671,000 |

OPERATION AND MAINTENANCE COST

Post-Closure Monitoring (5 year semi-annual and 25 years annual)

30-Year Present Worth (10%)

($2,000 x 3.791) + (($1,000 x 9.077)/1.610) $13,000

TOTAL INCINERATION PROGRAM COST

$17,671,000 + $13,000 = $17,684,000

filtration during the washing process. The volume of these materials and their disposal requirements are difficult to determine without testing. It is estimated that the volume will be small, as the site soils are predominantly sands.

Optimal Soil Characteristics

The process operates most efficiently when soil moisture content is below 20%. The process will dechlorinate in soils of higher water content, but more time and fuel are required to evaporate the additional water. If soils contain significantly more than 20% moisture, a pre-dewatering step may be necessary.

Sandy soils are processed most effectively in the APEG dechlorination system. Fine particles (clays, silts) cause problems by becoming suspended in the excess reagent removed at the end of the initial dechlorination step and in the multiple step water rinse, where they can be difficult to remove.

### 3.4.1 Public Health and Environmental Impacts

The impacts associated with this alternative are less than that for on-site incineration. Since it is a closed system, air emissions from the process itself are not a problem. Fugitive dust and organic emissions from material excavation are the primary concern for on-site workers.

Health and environmental impacts from these residuals are low. Public health rating of this alternative is therefore high.

There may be some minor unavoidable impacts associated with implementation of this alternative. The construction of a dechlorination system will require preparation of a one to two acre staging and operations area adjacent to the process area. Noise and traffic problems should be minimal during operation of the dechlorination facility and will be of limited duration.

The overall impact of these activities on public health and the environment will be low. Environmental impact rating of this alternative is therefore high.

### 3.4.2 Compliance with ARARs

The regulatory requirements for implementation of a full-scale dechlorination system are considerably less complex than for comparably sized incineration systems. The dechlorination system operates as a closed system and does not generate significant air emissions as product of the process. Some residuals may be generated from the dechlorination process, but the quantity of these effluents is estimated to be low due to the high degree of recycling of wash waters and reagent. Exhausted reagent can be shipped to an incineration facility for disposal.

As with other soil excavation alternatives, regulatory requirements will apply to construction of staging areas for soil excavation, dewatering, if necessary, and storage of soils before and after processing.

The institutional ranking for this technology is high.

### 3.4.3 Long-Term Effectiveness and Permanence

Bench and pilot scale testing of soils from the mound is necessary to evaluate the process and determine its efficiency. Soil samples, before and after treatment and condenser liquids would be analyzed for lindane and other organic byproducts. Information from successful bench-scale testing would be used to determine costs and time estimates for the lindane dechlorination.

Because of undefined process variables, ranking of this alternative for performance is low.

The reliability of this technology at full-scale under IMC site conditions remains unproven. Data currently are only available for bench-scale tests and limited pilot study tests. While the feasibility of the process has been established, problems can be expected during scale-up to full-scale operation.

The reliability ranking for this alternative is low.

### 3.4.4 Reduction of Toxicity, Mobility or Volume

Effluents and residuals generated by the KPEG process might include spent reagent, as well as some effluents from the soil rinsing process, (e.g., filtered fine particulates, some washwater residuals). These effluents can be stored in closed containers until they can be shipped to an off-site facility for disposal. The ranking of this alternative is low.

### 3.4.5 Short-Term Effectiveness

APEG dechlorination systems are considered relatively safe. Reactions occur within a closed system, and risks from the process itself are minimal.

Polyethylene glycol (PEG) is not considered harmful, and is cleared by the FDA for use in commercial food preparations. Residual reaction byproducts, primary ethers, are readily biodegradable and are of low toxicity.

The safety ranking for this alternative is medium.

-

### 3.4.6 Implementability

No data exist on the potential problems associated with implementation. Researchers estimate that full-scale systems can be built using existing heavy industrial equipment. Reagent-soil mixing tanks for 20-ton batches of soil can be provided by using commercial mixing tanks used in the the chemical industry. Countercurrent extraction systems are used in a number of industries, including metal plating and finishing. Extraction systems can be designed and built by several firms.

Implementability ranking for this alternative is medium.

### 3.4.7 Cost Analysis

An accurate cost analysis for APEG treatment of lindane contaminated soils at IMC will largely depend on the results of a pilot study. Unknown factors include the following:

1. The formation and identity of breakdown products
2. Soil characteristics
3. Moisture content of soil
4. Dewatering, if necessary
5. Actual concentrations of lindane in mound
6. Pilot study costs

Table 4 presents capital, operation and maintenance, and total program cost estimates for this alternative based on soil mass of 31,000 cubic yards (18,000 cubic yards in the mound and 13,000 cubic yards of soil, 7 foot depth, under the mound) and a maximum soil moisture content of 20%. These costs have not been substantiated by real experience and should be used for comparative purposes only.

### 3.4.8 Support Agency Acceptance

This alternative is favored if pilot plant testing indicates that scale-up is feasible. By-product water and fines disposal issues cause less concern than the removal alternative.

TABLE 4

CHEMICAL TREATMENT (DECHLORINATION) ALTERNATIVE
31,000 cubic yards of Soil

CAPITAL COST

| | |
|---|---|
| Site Preparation | $ 208,000 |
| Soil Excavation and Handling | 217,000 |
| Process | 3,592,000 |
| Soil Replacement, Loam & Seed | 513,000 |
| Waste Disposal | 374,000 |
| Monitoring | 70,000 |
| SUBTOTAL | $4,974,000 |
| Pilot Study (5%) | 249,000 |
| SUBTOTAL | $5,223,000 |
| Engineering (15%) | 783,000 |
| Contingencies (15%) | 783,000 |
| TOTAL | $6,789,000 |

OPERATION AND MAINTENANCE COSTS

| | |
|---|---|
| Post-Closure Monitoring (5 years semi-annual & 25 years annual) | |
| 30 -Year Present Worth (10%) | |
| ($2,000 x 3.791) + (($1,000 x 9.077)/1.610) | $13,000 |

TOTAL CHEMICAL TREATMENT PROGRAM COST

$6,789,000 + $13,000 = $6,802,000

### 3.4.9 Community Acceptance

The community would accept this alternative if assurances are available that groundwater contamination is avoided. As lower temperatures are involved than in the incinerator alternative this is the preferred on-site disposal method.

## 4.0 SUMMARY AND COMPARISON OF REMEDIAL ALTERNATIVES

A brief summary of each alternative follows:

### 4.1 NO ACTION (MONITORING AND MAINTENANCE OF EXISTING SYSTEM)

The scope of activities associated with this alternative includes continuation of the quarterly monitoring program, immediate repair of the site security fence, posting of warning signs and the long-term maintenance of site security and the vegetative cover over the mound.

Groundwater upgradient of the disposal mound now shows no detectable BHC-tech. This indicates that the site cleanup program undertaken in 1980 was effective in removing contaminated materials for the ground and placing them under the on-site clay cap.

Groundwater downgradient of the mound contains BHC-tech. at low concentrations. Concentration of the gamma isomer (lindane) is well below established MCL and proposed MCLG levels; that is, well below present and proposed future drinking water standards. There are no established standards for the other BHC isomers, however the total concentration of all BHC isomers has not exceeded one quarter of the MCL for lindane. These data provide proof that the site closure conducted in 1980 has been effective in reducing groundwater contamination to safe levels.

Implementation of this alternative meets site remediation objectives.

Total present worth cost of this alternative is $159,000.

### 4.2 OFF-SITE DISPOSAL

The scope of activities under this alternative includes excavation of all contaminated soil disposed in the capped mound (including an estimated seven feet of undisturbed contaminated soil under the mound) and hauling and disposing of this material at a RCRA approved secure landfill. After the soil is removed, the disturbed portions of the site would be graded, covered with loam and seeded.

During excavation, measures will be taken to protect the exposed contaminated soil from rainfall percolation. Some contaminant release to the environment will be unavoidable. Truck and heavy equipment activity will cause noise and traffic impacts locally.

There is some concern that limited secure landfill capacity will make this alternative more difficult and/or expensive in the future.

This alternative will meet site remedial objectives.

Total present worth cost of this alternative is estimated at $17,354,000.

## 4.3 INCINERATION

The scope of activities under this alternative includes excavation of all contaminated soil disposed in the capped mound (including an estimated seven feet of undisturbed contaminated soil under the mound) and processing this soil at one or more rotary kiln incinerators to be brought onto the site. After the soil is treated, tested and delisted, some can be used to fill the disturbed portions of the site; the rest can be placed elsewhere onsite. All areas where the treated soil is placed would be graded, covered with loam and seeded.

During excavation, measures will be taken to protect the exposed contaminated soil from rainfall percolation. Some contaminant release to the environment will be unavoidable. Site activities will cause noise and traffic impacts locally. There may also be short term impacts on air quality.

Feasibility of the incineration process must be confirmed by a pilot program. During operation, the incineration process must be carefully controlled and monitored to assure maximum thermal destruction with minimum emissions.

Total present worth cost of this alternative is estimated at $17,684,000.

## 4.4 ON-SITE TREATMENT

The scope of activities under this alternative includes excavation of all contaminated soil disposed in the capped mound (including an estimated seven feet of undisturbed contaminated soil under the mound) and treating this soil with a heated alkaline reagent consisting of potassium hydroxide in a solution of polyethylene glycol and dimethyl sulfoxide. The end products are dechlorinated organics which are rinsed from the soil. The relatively small volumes of reagent and rinse waste are then disposed of at an industrial waste treatment facility. After the soil is treated, tested and delisted, some can be used to fill the disturbed portions of the site; the rest can be placed elsewhere onsite. All areas where the treated soil is placed would be graded, covered with loam and seeded.

Feasibility of this process is questionable and must be confirmed by pilot testing.

If the process is feasible, it will meet site remedial objectives.

Total present worth cost of this alternative is estimated at $6,802,000.

## 4.5 SELECTION OF RECOMMENDED PROGRAM

Table 5 is a comparative summary of the four remedial alternatives.

4.6 All of the alternatives are capable of meeting site remedial objectives.

The potential for human contact and for migration of contaminants into the groundwater or to off-site locations, though low, is present if contaminated materials must be exposed or handled. The maintenance alternative is the only one which does not involve reexposing and handling the contaminated soil.

The process parameters, and therefore the feasibility, of the On-Site Treatment (Dechlorination) alternative are not well defined when compared to the other alternatives. For this reason, the overall ranking of this alternative is the lowest of the four.

Incineration is reliable when properly designed and operated. The technology is proven and is becoming readily available. A positive consideration is that contamination would be destroyed yielding clean soil and little ash. The process is expensive and not without some short term environmental risk.

Off-Site Disposal carries the advantage that the contaminated materials are removed from the site and, after the removal process, would not pose any environmental threat to the local area. The contaminated materials would carry a low risk of threatening the environment at the ultimate disposal site. This option is currently very expensive and is not encouraged by EPA. As secure landfill space becomes increasingly rare, restrictions will be placed on this type of disposal and the cost will continue to increase. A November 1988 ban on landfilling of certain listed materials, including soil contaminated with lindane, may eliminate this as a practical alternative.

The maintenance alternative meets site remedial objectives at the least cost and low environmental risk. The capping system was constructed in 1980 in accordance with regulations proposed at the time. Although the contaminated materials remain onsite, the clay capping system prevents physical contact with contaminants and prevents transfer of contamination to the groundwater table. The ongoing monitoring program has proven the effectiveness of this system and has consistently demonstrated that groundwater contamination is well below drinking water standards. Continuation of the monitoring program will give early indication if the capping system has failed to the extent that the groundwater is threatened. A contingency plan to repair or replace the cap can be enacted before off-site receptors are threatened.

## SUMMARY OF REMEDIAL ACTION ALTERNATIVES

| | Monitoring | Off-Site Disposal | Incineration | On-Site Treatment |
|---|---|---|---|---|
| | Maintain Existing Closure System. Continue Monitoring | Excavate Mound and Contaminated Soils Beneath. Haul and Dispose of these Materials at Secure Landfill | Incinerate Mound and Contaminated Soils Beneath in On-Site Rotary Kiln | Dechlorination of Mound and Underlying Soil Using Alkaline Polyethylene Glycol Process |
| CRITERIA: Ranking | | | | |
| PUBLIC HEALTH/ENVIRONMENTAL | High | Medium | Medium | High |
| COMPLIANCE WITH ARARS | High | Low | Medium | High |
| TECHNICAL FEASIBILITY | | | | |
| Long-Term Effectiveness and Permanence | High | High | High | Low |
| Reduction of Toxicity, Mobility or Volume | High | Medium | High | Low |
| Short-Term Effectiveness | High | Medium | Medium | Medium |
| Implementability | High | Medium | Medium | Medium |
| COST | $159,000 | $17,354,000 | $17,684,000 | $6,802,000 |
| IDEM ACCEPTANCE | High. MCL/MCLG levels are presently attained in groundwater. | Low. Landfill space becoming restricted. | Medium. Pilot work required to confirm feasibility. Close operator attention is required. | Medium. Feasibility is questionable and must be determined by pilot studies. |
| COMMUNITY ACCEPTANCE | High. Monitoring provides early warning in event of cap failure. | Medium. Alternative involves reexposing contaminated materials. | Low. Alternative involves reexposing contaminated materials. | Medium. Alternative involves reexposing contaminated materials. |

As the aquifer has not been or is not being impacted by contaminated migration the risk involved in the treatment of the BHC was not found to be as protective of the environment as leaving the capped mound undisturbed. The Monitoring and Maintenance alternative is selected among protective, ARAR-attaining cost-effective alternatives by a determination of which option best balances the inevitable tradeoffs among the alternatives in terms of long-term effectiveness and permanence, the reduction in toxicity, mobility or volume afforded through treatment, short-term effectiveness, implementability, and cost, also weighing the statutory preference for treatment as a principal element, and considering support agency and community acceptance.

The maintenance alternative is the recommended program for all of these reasons.

4.7 In summary, the recommended alternative is the Monitoring and Maintenance of the Existing System Alternative based on the following criteria:

4.7.1 - Overall Protection of Human Health and the Environment - The maintenance alternative will provide adequate protection of human health and the environment due to the low solubility and mobility of BHC-tech. in water and soil. It does not involve handling of the contaminated soil and avoids human exposure and migration to off-site locations.

4.7.2 - Compliance with ARARs - the recommended alternative will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental laws. The system has demonstrated effectiveness at meeting MCLs and the proposed MCLGs. See Table 6.

4.7.3 - Long-Term Effectiveness and Permanance - the preferred alternative is believed to afford a permanent adequacy and reliability. If problems arise an upgraded cap can be installed in the future based upon information supplied by the monitoring system. This contingency plan will provide further security if the early warning system indicates it is required.

4.7.4 - Reduction of Toxicity, Mobility or Volume - the alternative adequately prevents mobility of BHC-tech. due to the low water infiltration through the cap, the high adsorbancy of BHC on the organic portion of the soil and the low solubility of the contaminant in water. No opportunity is allowed for migration or exposure due to movement of the soil. Slow decomposition of BHC due to microbial activity will reduce the concentration over time.

4.7.5 - Short-Term Effectiveness - the preferred option prevents any adverse impacts upon the human health of the community or workers

## TABLE 6
## SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS FOR REMEDIAL ACTION ALTERNATIVES

| Alternative | Regulations |
|---|---|
| Monitoring & Maintenance | The construction of the waste mound was voluntarily performed by IMC prior to the RCRA effective date of October 1980. Therefore, this is not a Transportation, Storage or Disposal (TDS) facility by RCRA statutes and does not require two or more liners and a leachate collection system above and between the liners (320 IAC 4.1-53-2(1). |
| Off-Site Disposal<br>On-Site Incineration<br>On-Site Treatment | <u>Groundwater Standards</u><br><br>Water quality standards which apply to the waters of Indiana appear in 330 IAC 1-1(2). They are narrative in nature and require interpretation by the Office of Water Management (OWM).<br><br>The Water Pollution Control Board has recently promulgated new water quality standards 327 IAC 2-1(3). These standards are awaiting final approval. In this document 327 2-1-7 applies to underground waters. When finalized, 327 IAC 2-1-6(a) and 327 2-1-7 would be applicable.<br><br><u>On-Site Construction Activities</u><br><br>Any on-site construction activities which may create a significant amount of fugitive dust are regulated under 325 IAC 6-4-6(4). This rule requires that every available precaution be taken during construction to minimize fugitive dust emissions. |

Indiana statutes filed in Administrative Record as further exposure is avoided. Other alternatives would require excavation, transportion or redisposal.

4.7.6 - Implementability - the recommended remedy requires no further immediate action to complete. Analytical sample points and procedures are established, security systems are in place, the performance is proven, no further permits or off-site actions are required from other agencies.

4.7.7 - Cost - the capital for the preferred "no-action" alternative consists of a contingency fund for future repairs, monitoring and replacement. The present worth of a 30 year program at a 10% discount rate is $159,000. This is less costly than the other options by from $6.6 million to $17.5 million on a present worth basis.

4.7.8 - Indiana Department of Environmental Management Acceptance - after reviewing and commenting on the RI/FS and close interaction in the RI stages IDEM concurs with the selected remedy.

4.7.9 - Community Acceptance - Comments received during the setting of the RI/FS work plan indicated local support for the proposed remedy. No negative comments were received on this alternative. Comments were in favor of not reexposing the local population to the contaminated soil.

## 5.0 RECOMMENDED PROGRAM

### 5.1 GENERAL

The No Action/Maintenance program recommended for the site involves systematic monitoring backed up by a contingency plan of action. The program objectives are to:

- Confirm that the closure system continues to prevent transfer of contamination to the groundwater.
- Provide early warning should capping system failure occur.
- Establish a contingency plan for cap repair or replacement.

### 5.2 MONITORING PROGRAM

The on-going quarterly monitoring should continue until December 2010 (30 years after closure was completed in 1980) and so noted in the deed for the property.

Major elements of this program include:

- Quarterly cap inspection; maintenance of vegetative cover as necessary.
- Sampling of upgradient wells PW-1, B-1 and B-2 with analysis conducted for BHC isomers. (Semi-annual sampling for next 5 years, annual thereafter until year 2010).
- Sampling of downgradient wells B-9A, B-10A and B-11A with analysis conducted for BHC isomers. (Semi-annual sampling for next 5 years, annual thereafter until year 2010).
- Annual reporting of monitoring results to the State of Indiana.
- A review of the results of the remedial action will be conducted with IDEM and the U.S. EPA at the end of each five period.

An estimate of the cost of this program, expressed in December 1987 dollars, appears in Table 7. This cost estimate includes an allowance for replacement of the fence surrounding the disposal mound halfway through the monitoring period.

## 5.3 CONTINGENCY PLAN

The monitoring program will give early warning should the clay cap over the mound fail. Prevailing contaminant levels immediately downgradient of the mound are well below the MCL/MCLG acceptable drinking waters levels. Should contamination reach the MCLG level, or show a consistent, significant (order of magnitude) rise above prevailing levels over more than two monitoring periods, additional samples will be taken to determine if remedial action may be necessary. Because of the variability inherent in sampling and in laboratory analytical techniques, it is not possible to propose objective criteria for initiating cap repair; data must be evaluated in the context of previous data and judgement must be applied prior to initiating action.

Remedial action would definitely be necessary any time the quarterly inspection shows slumping or erosion at any location on the cap.

If localized failure is obvious, the recommended action is to expose and repair the clay in the area of the failure. After repairs are made, the vegetative cover would also be restored.

If no failures are obvious and the data demonstrate that transport of the contaminants to the groundwater is occurring, then replacement of the cap would be necessary. The most effective means of doing this under these circumstances is to strip the vegetative cover, leaving the common fill over

TABLE 7
NO ACTION ALTERNATIVE
(MONITORING AND MAINTENANCE OF EXISTING SYSTEM)

CAPITAL COST
NO INITIAL CAPITAL COSTS ASSOCIATED
WITH THIS ALTERNATIVE

OPERATION AND MAINTENANCE COST

| | |
|---|---|
| Cap Inspection, Mowing, Repairs | $10,000 |
| Sampling & Analysis | SEE BELOW |
| Record Keeping and Review | 5,000 |
| SUBTOTAL ANNUAL O&M | $15,000 |
| Allowance for Replacement of Fence in 15 Years | $20,000 |
| Sampling and Analysis (Semi-annual for first 5 years, annual thereafter through year 2010) Present worth (10%) = ($2000 x 3.791) + ((1000 x 8.20)/1.610) = | |

30-Year Present Worth (10%):

TOTAL O&M COST ($15,000 x 9.427) + ($20,000 x 0.2394)

$141,000 + $5,000 + 13,000 = $159,000

TOTAL NO ACTION PROGRAM COST: $159,000

the clay, to install a high density polyethylene membrane over the entire mound, then install a new vegetative cover over the membrane.

The membrane cover system would consist of six inches of sand on the sides of the membrane, with six inches of common fill and six inches of seeded loam over the top layer of sand. Six inches of clay beneath the membrane is necessary to provide an impervious bedding and to protect the membrane from sharp stones or other potentially damaging materials in common fill. The remaining fill and loam are necessary to sustain the vegetative cover.

A review of the results of the remedial action will be conducted with IDEM and the U.S. EPA at the end of each five year period commensing with the signing of this ROD. The need for such a review, the results of each review and any actions required as a result of such review will be reported to Congress as required in the Superfund Amendments Reauthorization Act Section 121(c).

APPENDIX

TERRE HAUTE - EAST PLANT - - - BHC CONCENTRATIONS IN GROUNDWATER SAMPLES

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SAMPLING - - - - - - - - - - IMC/TERRE HAUTE

ANALYSIS - - - - - - - - - - HAZLETON LABORTORIES AMERICA, INC.
AKA HAZLETON RALTECH, INC.
3301 KINSMAN BLVD
P.O. BOX 7545
MADISON, WISCONSIN 53707
(608) 241-4471

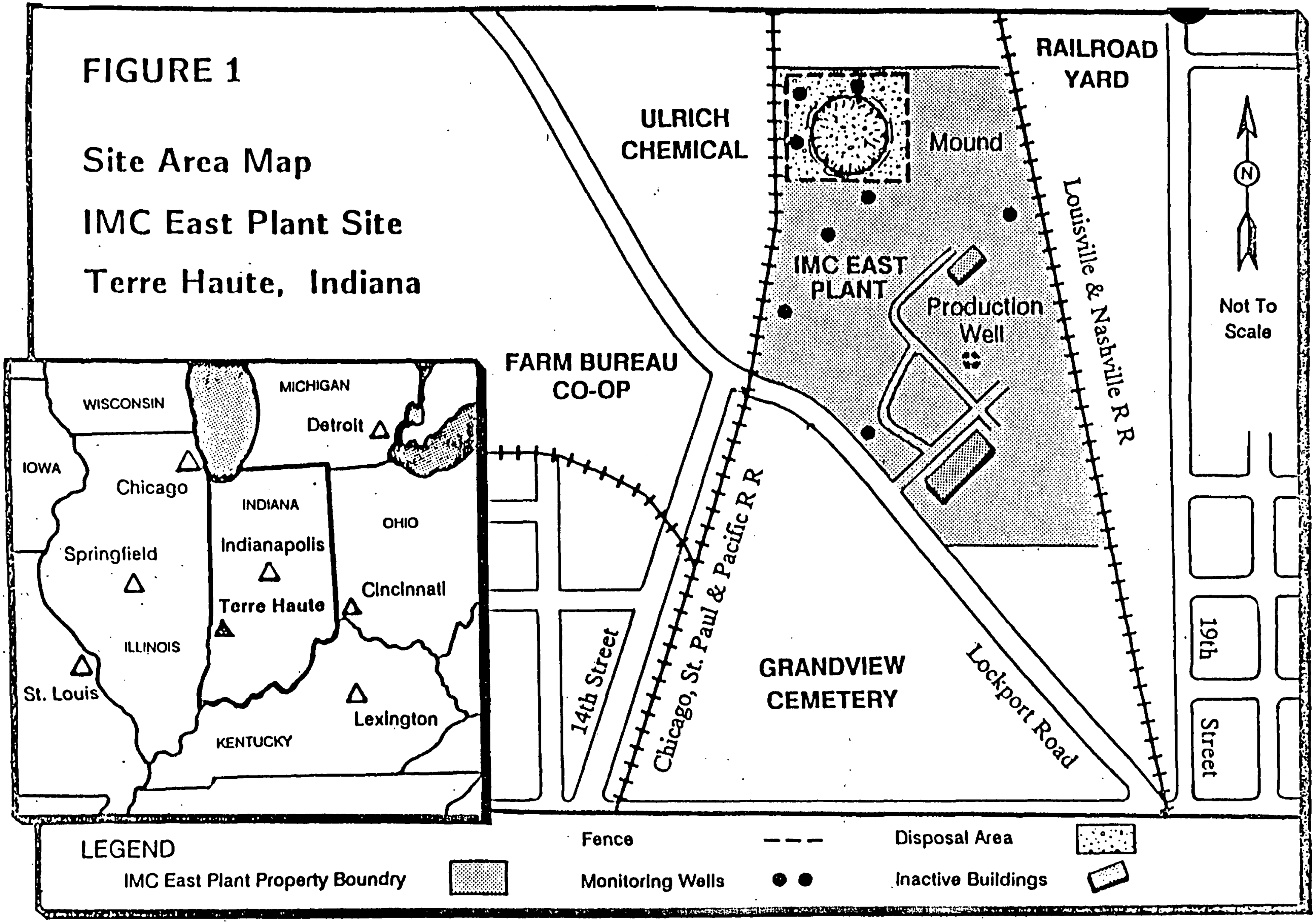


FIGURE 1
Site Area Map
IMC East Plant Site
Terre Haute, Indiana
ULRICH CHEMICAL
RAILROAD YARD
Mound
IMC EAST PLANT
Production Well
Louisville & Nashville R R
Not To Scale
FARM BUREAU CO-OP
WISCONSIN
MICHIGAN
Detroit
IOWA
Chicago
INDIANA
OHIO
Indianapolis
Springfield
Terre Haute
Cincinnati
ILLINOIS
St. Louis
Lexington
KENTUCKY
14th Street
Chicago, St. Paul & Pacific R R
GRANDVIEW CEMETERY
Lockport Road
19th Street
LEGEND
IMC East Plant Property Boundry
Fence
Monitoring Wells
Disposal Area
Inactive Buildings

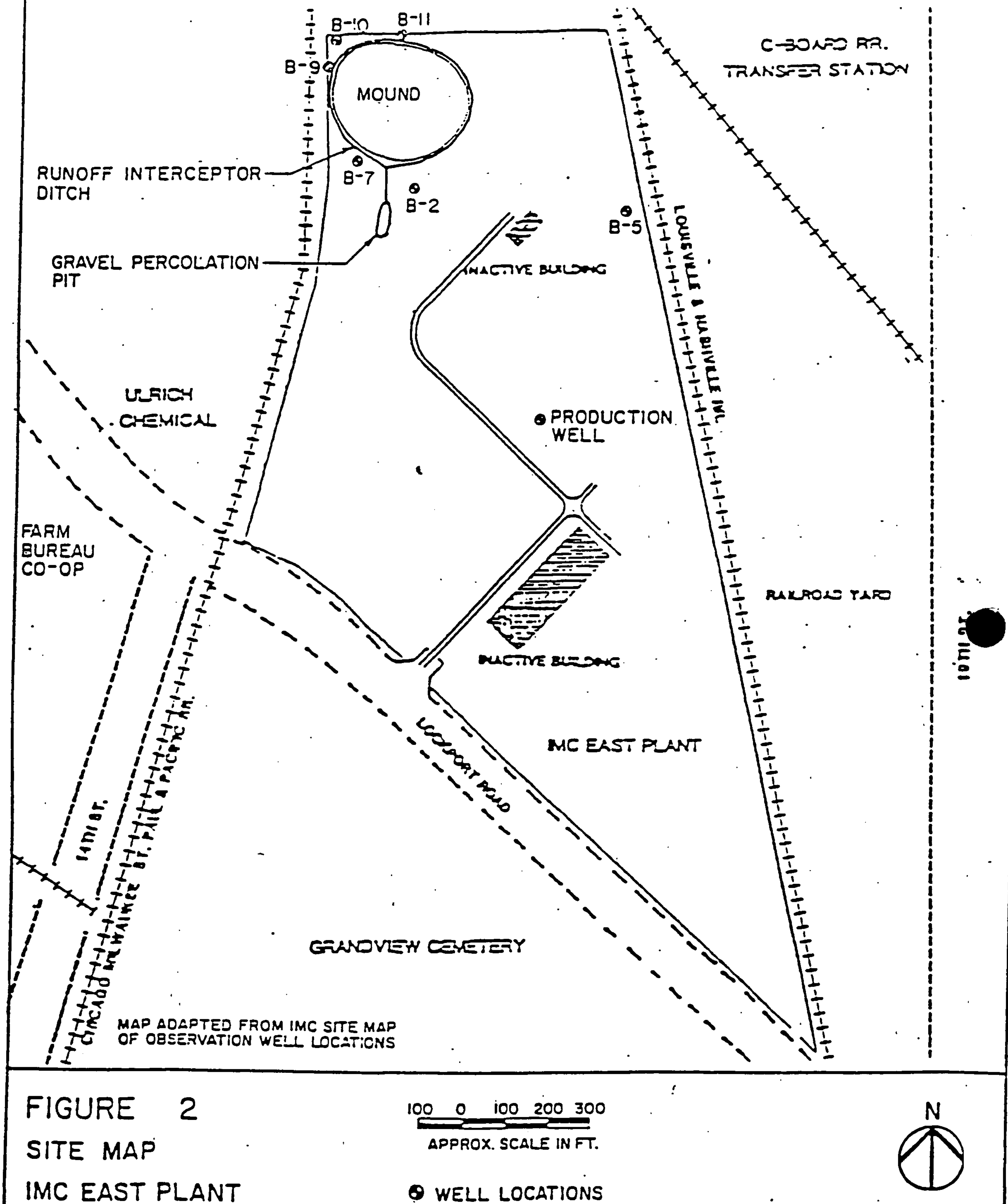



FIGURE 2

SITE MAP

IMC EAST PLANT
TERRE HAUTE, IN

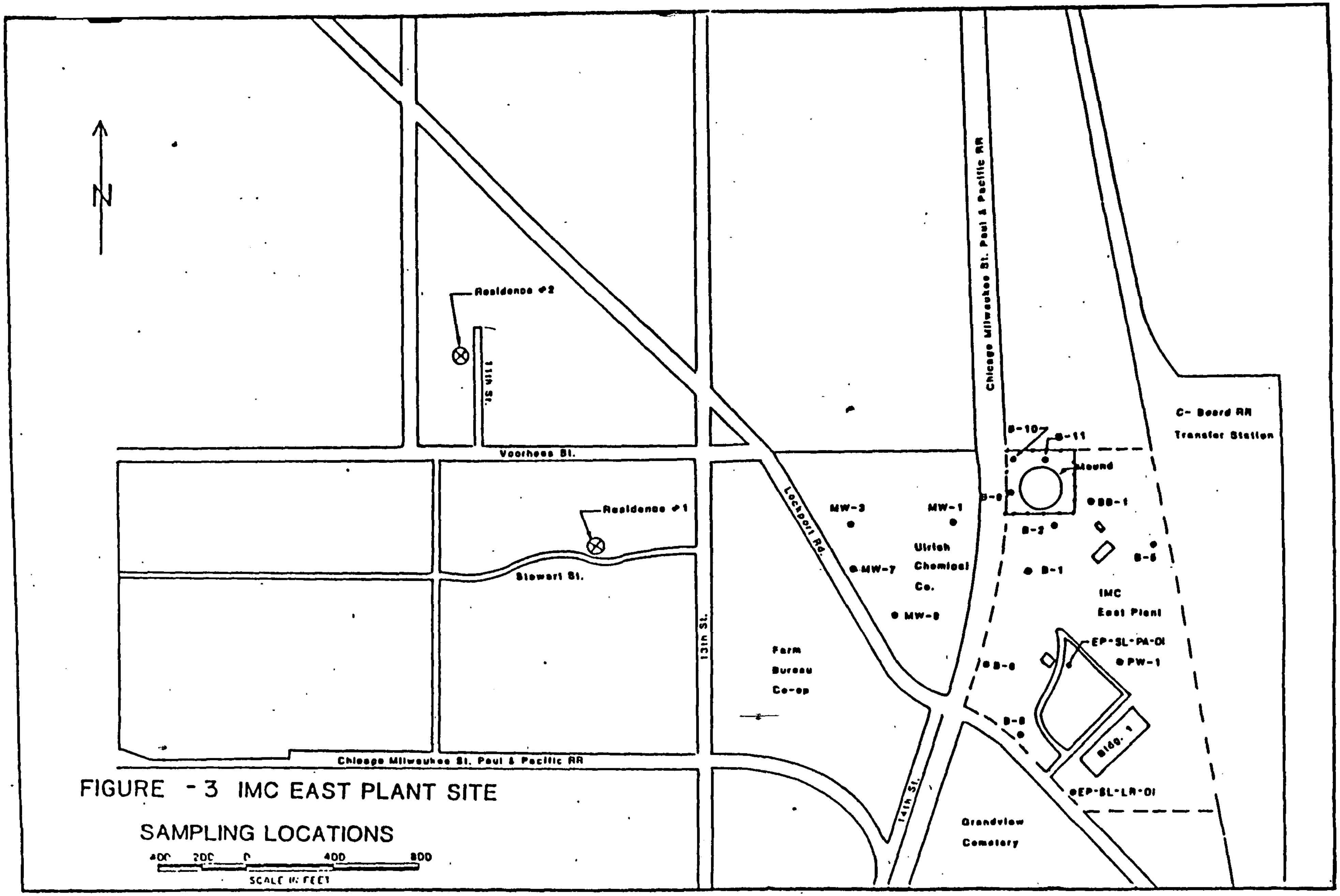
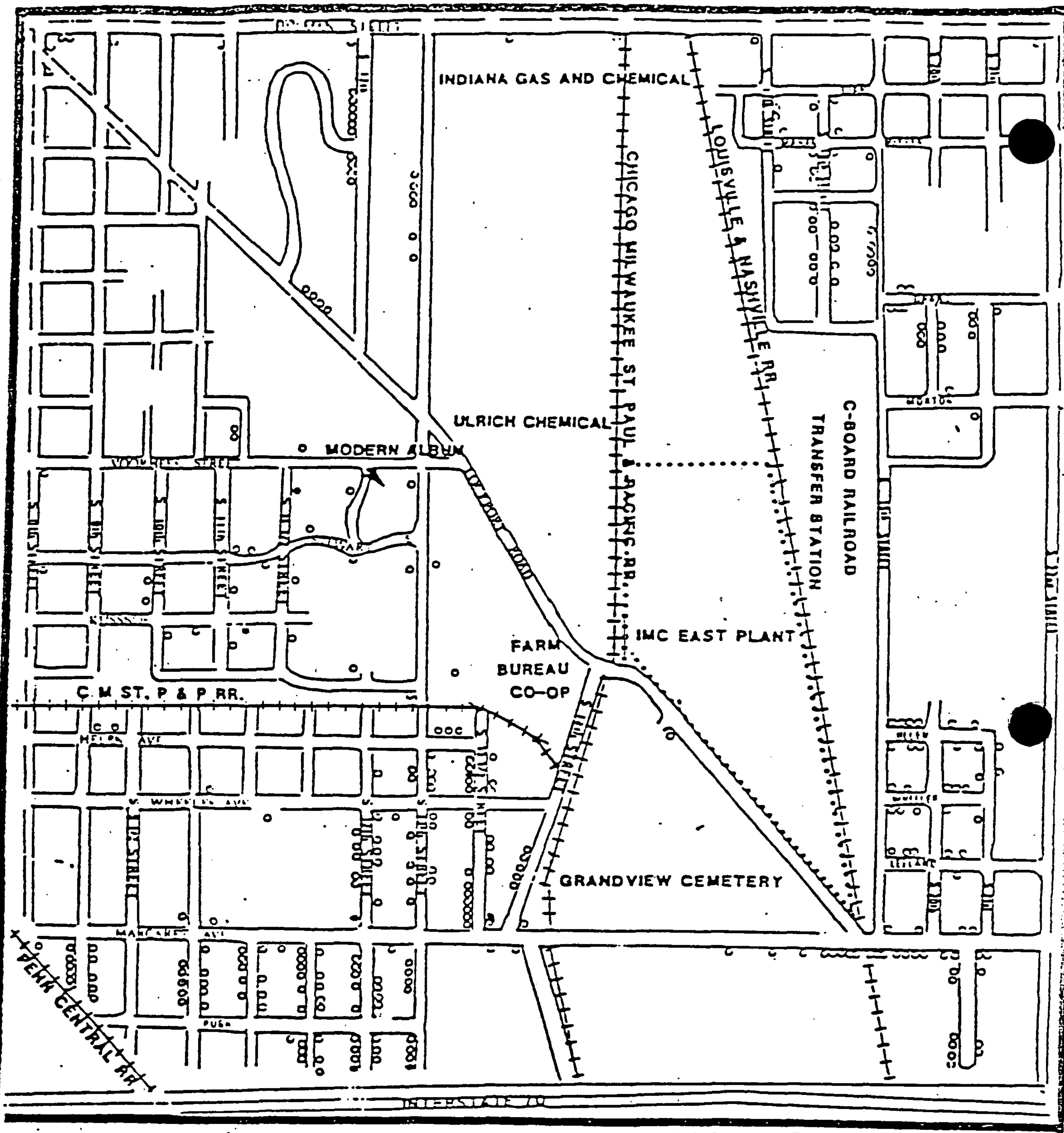



FIGURE - 3 IMC EAST PLANT SITE

SAMPLING LOCATIONS




# FIGURE -4

RESIDENTIAL WELL LOCATIONS
SURROUNDING THE IMC EAST PLANT
TERRE HAUTE, IN

o · PRIVATE RESIDENTIAL WELLS

* WELLS SAMPLED BY WESTON-SPER

WESTON

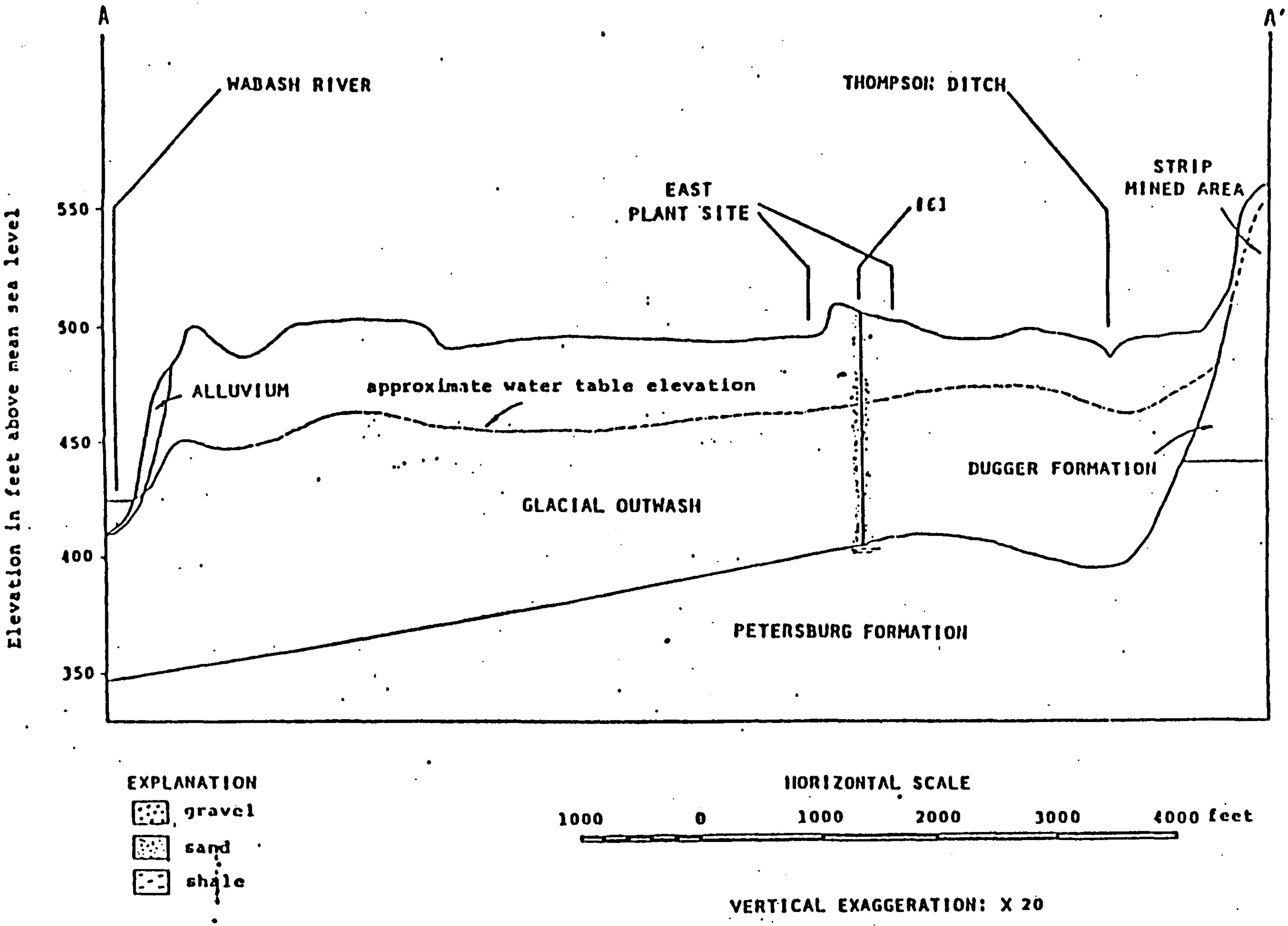
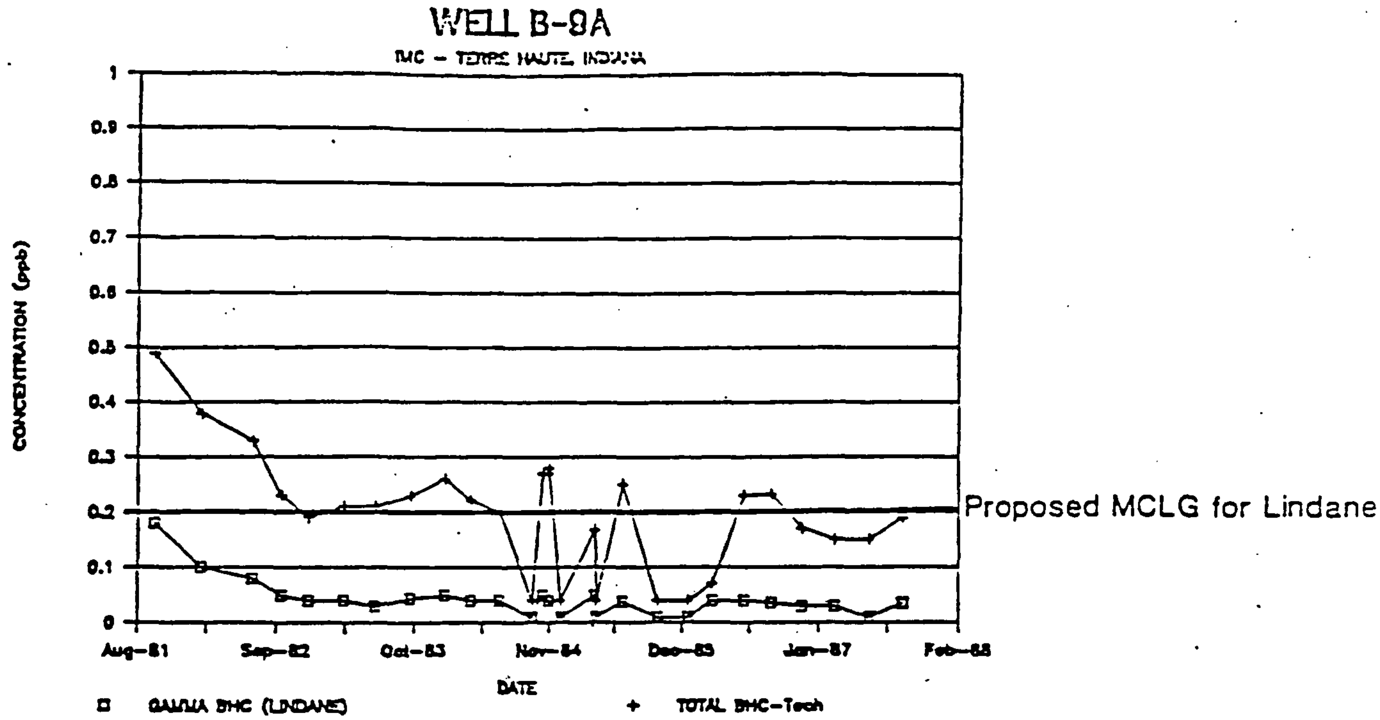



FIGURE 5 . GENERALIZED GEOLOGIC CROSS-SECTION A-A'

Prepared by:
P.E. LaMoreaux & Associates, Inc.




Note: MCL for Lindane is 4 ppb

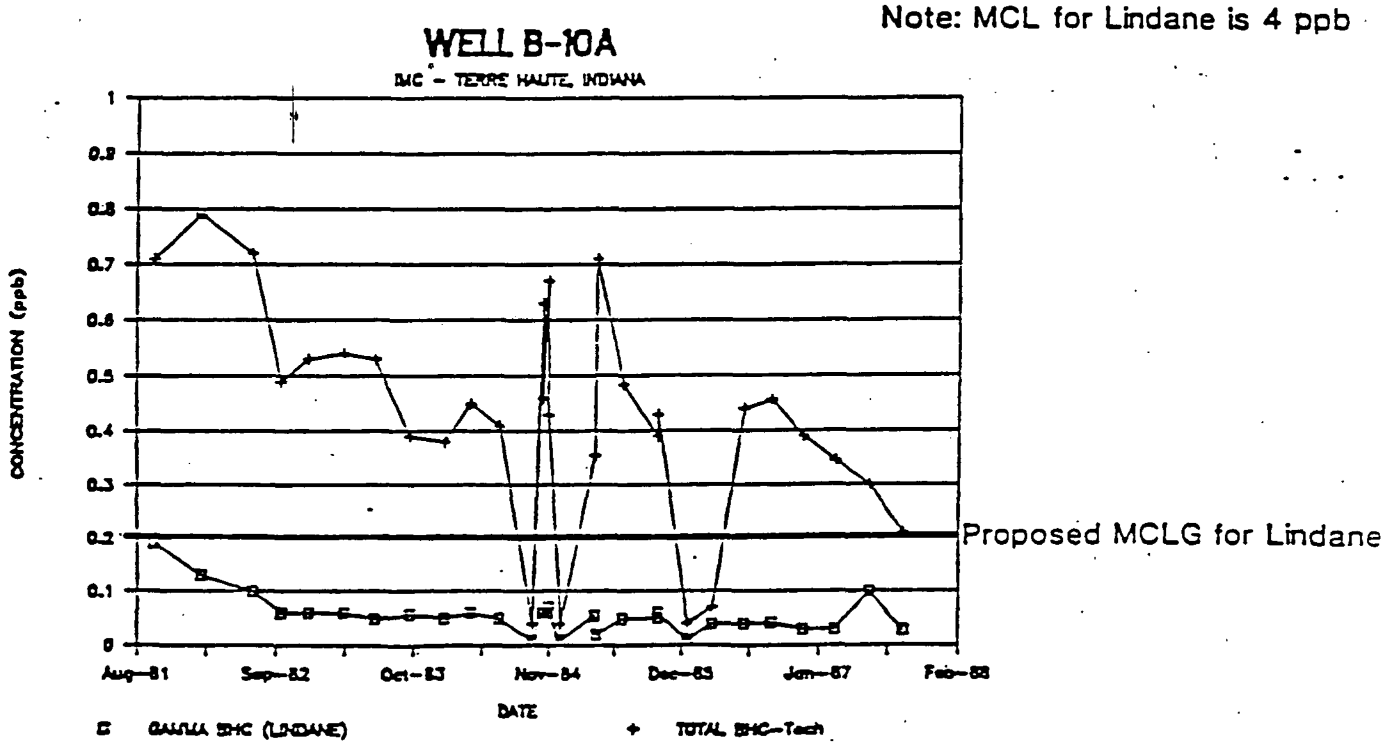



Figure-6

CONCENTRATION FOR LINDANE AND

TOTAL BHC AT B-9A AND B-10A

MONITORING WELLS

| DATE ANALYZED | WELL NO. | ALPHA BHC | BETA BHC | GAMMA BHC | DELTA BHC | TOTAL | COMMENTS |
|---|---|---|---|---|---|---|---|
| 9/21/81 | B-10A | 0.130 | 0.330 | 0.190 | 0.060 | 0.710 | |
| 2/4/82 | B-10A | 0.140 | 0.300 | 0.130 | 0.220 | 0.790 | |
| 7/1/82 | B-10A | 0.100 | 0.320 | 0.100 | 0.200 | 0.720 | |
| 9/21/82 | B-10A | 0.070 | 0.220 | 0.060 | 0.140 | 0.490 | |
| 12/9/82 | B-10A | 0.070 | 0.240 | 0.060 | 0.160 | 0.530 | |
| 3/22/83 | B-10A | 0.070 | 0.280 | 0.060 | 0.13 | 0.540 | |
| 6/20/83 | B-10A | 0.060 | 0.220 | 0.050 | 0.200 | 0.530 | |
| 9/30/83 | B-10A | 0.067 | 0.035 | 0.058 | 0.230 | 0.390 | |
| 1/10/84 | B-10A | 0.050 | 0.240 | 0.050 | 0.040 | 0.380 | |
| 3/26/84 | B-10A | 0.070 | 0.310 | 0.060 | <0.010 | <0.450 | |
| 6/18/84 | B-10A | 0.070 | 0.280 | 0.050 | <0.010 | <0.410 | |
| 9/26/84 | B-10A | <0.010 | <0.010 | <0.010 | <0.010 | <0.040 | |
| 10/27/84 | B-10A | 0.070 | 0.310 | 0.060 | 0.190 | 0.630 | |
| 10/27/84 | B-10A(DUP) | 0.070 | 0.150 | 0.060 | 0.180 | 0.460 | CHCL3 <1: C2H2CL4 <1: C6H6 <2 |
| 11/13/84 | B-10A | 0.080 | 0.350 | 0.070 | 0.170 | 0.670 | |
| 11/13/84 | B-10A | 0.070 | 0.290 | 0.060 | <0.010 | 0.430 | |
| 12/20/84 | B-10A | <0.010 | <0.010 | <0.010 | <0.010 | <0.040 | CHCL3 <10 |
| 4/4/85 | B-10A | 0.070 | 0.097 | 0.055 | 0.124 | 0.355 | |
| 4/10/85 | B-10A | 0.080 | 0.347 | 0.020 | 0.270 | 0.710 | E&EI SURVEY SPLIT |
| 6/27/85 | B-10A | 0.061 | 0.243 | 0.049 | 0.132 | 0.485 | |
| 10/8/85 | B-10A | 0.050 | 0.160 | 0.050 | 0.130 | 0.390 | |
| 10/8/85 | B-10A | 0.050 | 0.180 | 0.060 | 0.140 | 0.430 | DUPLICATE SAMPLE |
| 1/6/86 | B-10A | <0.010 | <0.010 | <0.010 | <0.010 | <0.040 | |
| 3/21/86 | B-10A | <0.010 | <0.010 | 0.040 | <0.010 | <0.070 | |
| 6/23/86 | B-10A | 0.050 | 0.270 | 0.040 | 0.080 | 0.440 | |
| 9/11/86 | B-10A | 0.051 | 0.240 | 0.042 | 0.124 | 0.457 | |

| ANALYZED | NO. | BHC | BHC | BHC | BHC | | |
|---|---|---|---|---|---|---|---|
| 6/18/87 | B-9A | 0.020 | 0.030 | 0.010 | 0.090 | 0.150 | |
| 9/23/87 | B-9A | 0.028 | 0.115 | 0.035 | <0.010 | 0.188 | |
| 12/8/86 | B-10A | 0.040 | 0.200 | 0.030 | 0.120 | 0.390 | |
| 3/10/87 | B-10A | 0.035 | 0.180 | 0.030 | 0.100 | 0.345 | |
| 6/18/87 | B-10A | 0.030 | 0.030 | 0.100 | 0.140 | 0.300 | |
| 9/23/87 | B-10A | 0.035 | 0.138 | 0.028 | 0.010 | 0.211 | |

| DATE ANALYZED | WELL NO. | ALPHA BHC | BETA BHC | GAMMA BHC | DELTA BHC | TOTAL | COMMENTS |
|---|---|---|---|---|---|---|---|
| 9/21/81 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 7/1/82 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/21/82 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/9/82 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/22/83 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/20/83 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/30/83 | PW-1 | <0.005 | <0.005 | <0.005 | <0.06* | <0.075 | |
| 1/10/84 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/26/84 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/18/84 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/26/84 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| | HIGH TOTAL COLIFORM FOUND IN SAMPLE - - - HEAVY DOSE OF HIH PUT DOWN WELL | | | | | | |
| 10/27/84 | PW-1 | <0.01 | <0.01 | <0.01 | <0.02 | <0.05 | CHCL3 113: C2H2CL4 <1: C6H6 <2 |
| 12/21/84 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | CHCL3 <10 |
| 4/4/85 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/27/85 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/8/85 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 1/6/86 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/21/86 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/23/86 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/11/86 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/20/86 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/8/86 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/10/87 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/23/87 | PW-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |

(CONCENTRATIONS IN MICROGRAMS/LITER)

| DATE ANALYZED | WELL NO. | ALPHA BHC | BETA BHC | GAMMA BHC | DELTA BHC | TOTAL | COMMENTS |
|---|---|---|---|---|---|---|---|
| 9/21/81 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 2/4/82 | B-1 | 0.03 | <0.01 | <0.01 | <0.01 | <0.06 | |
| 7/1/82 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/21/82 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/9/82 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/22/83 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/20/83 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/30/83 | B-1 | <0.005 | <0.005 | <0.005 | <0.01* | <0.025 | |
| 1/10/84 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/26/84 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/18/84 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/26/84 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/27/84 | B-1 | <0.01 | <0.01 | <0.01 | <0.02* | <0.05 | CHCL3 <1 : C2H2CL4 <1: C6H6 <2 |
| 11/13/84 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 4/4/85 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/27/85 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/8/85 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 1/6/86 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/21/86 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/23/86 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/11/86 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/8/86 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/10/87 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/18/87 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/23/87 | B-1 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |

| DATE ANALYZED | WELL NO. | ALPHA BHC | BETA BHC | GAMMA BHC | DELTA BHC | TOTAL | COMMENTS |
|---|---|---|---|---|---|---|---|
| 2/4/82 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 7/1/82 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/21/82 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/9/82 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/22/83 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/20/83 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/30/83 | B-2 | <0.005 | <0.005 | <0.005 | <0.04* | <0.055 | |
| 1/10/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/26/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/18/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/26/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/27/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.02* | <0.05 | CHCL3 <1 : C2H2CL4 <1: C6H6 <2 |
| 11/13/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/20/84 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | CHCL3 <10 |
| 4/4/85 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 4/10/85 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | E&EI SURVEY SPLIT |
| 6/27/85 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/8/85 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 1/6/86 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/21/86 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/23/86 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/11/86 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/8/86 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/10/87 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/18/87 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/23/87 | B-2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |

| DATE ANALYZED | WELL NO | ALPHA BHC | BETA BHC | GAMMA BHC | DELTA BHC | TOTAL | COMMENTS |
|---|---|---|---|---|---|---|---|
| 2/4/82 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 7/1/82 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/21/82 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/9/82 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/22/83 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/20/83 | B-11A | <0.01 | <0.01 | <0.01 | 0.01 | <0.04 | |
| 9/30/83 | B-11A | <0.005 | <0.005 | <0.005 | <0.05* | <0.065 | |
| 1/10/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/26/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/18/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/26/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/27/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.04* | <0.05 | CHCL3 <1 : C2H2CL4 <1: C6H6 <2 |
| 11/13/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 12/20/84 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | CHCL3 <10 |
| 4/4/85 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/27/85 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 10/8/85 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 1/6/86 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/21/86 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 6/23/86 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/11/86 | B-11A | <0.01 | 0.012 | <0.01 | <0.01 | <0.04 | |
| 12/8/86 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 3/10/87 | B-11A | <0.01 | <0.01 | 0.02 | <0.01 | <0.05 | |
| 6/18/87 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |
| 9/23/87 | B-11A | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |

(CONCENTRATIONS IN MICROGRAMS/LITER)

| DATE ANALYZED | WELL NO. | ALPHA BHC | BETA BHC | GAMMA BHC | DELTA BHC | TOTAL | COMMENTS |
|---|---|---|---|---|---|---|---|
| 12/20/84 | B-5 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | CHCL3 <10 |
| 6/18/87 | B-5 | <0.01 | <0.01 | <0.01 | <0.01 | <0.04 | |

IMC ADMINISTRATIVE RECORD
GUIDANCE DOCUMENTS - NOT COPIED
MAY BE REVIEWED AT EPA
IN CHICAGO, IL

| TITLE | AUTHOR | DATE |
|---|---|---|
| Community Relations Activities at Superfund Enforcement Sites | | 85/03/22 |
| Guidance on Remedial Investigations and Feasibility Studies | | 85/05/00 |
| NEIC Policy and Procedures Manaual | | 85/05/00 |
| Remedial Action at Waste Disposal Sites, Handbook | | 85/06/00 |
| Superfund State Lead Remedial Project Management Handbook Draft | | 86/06/00 |
| Timely Initiation of Responsible Party Searches, Issuance of Notice Letters, and ---- of Information | | 86/10/09 |

IMC DOCUMENTS INCLUDED IN ADMINISTRATIVE RECORD

| TITLE | AUTHOR | DATE | PAGES |
|---|---|---|---|
| Final Report; National Dioxin Study Tier 6 Dioxin Screening | MMiller - Ecology & Envrnmnt | 00/00/00 | 7 |
| Report of the Lindane Advisory Committee | | 70/07/02 | 22 |
| Lindane; Monograph of an Insecticide | | 72/00/00 | 30 |
| Chronic Toxicity of Lindane to Selected Aquatic Invertebrates and Fishes | U.S. EPA | 76/05/00 | 25 |
| Preliminary Assessment | Ecology & Environment Inc. | 83/04/11 | 5 |
| Potential Hazardous Waste Site Site Inspection Report | EPA | 84/01/26 | 18 |

| TITLE | AUTHOR | DATE | PAGES |
|---|---|---|---|
| Documents regarding meetings between U.S. EPA and IMC et al | | 85/00/00 | 5 |
| Site Assessment for IMC | Weston Sper | 85/02/00 | 40 |
| Federal Register: Lindane; Amendment of Notice of Intent to cancel pesticide products containing lindane | | 85/02/08 | 3 |
| Memo to Regional Environmental Officer, USDI, Chicago Re: Preliminary Natural Resources Survey, IMC | Regional Director, FWS | 85/11/00 | 5 |
| Manual of Acute Toxicity: Interpretation and Data Base for 410 Chemicals and 66 Species of Freshwater Animals | U.S. Dept of the Interior | 86/00/00 | 3 |
| Exhibit A Work Plan RI/FS | Camp Dresser & McKee Inc. | 86/05/23 | 15 |
| Administrative Order on Consent | U.S. EPA | 86/08/06 | 29 |
| EPA Environmental News Release | U.S. EPA | 86/09/08 | 2 |
| Health & Safety Plan for IMC Est Plant Site (1st Draft) | Camp Dresser & McKee Inc. | 86/09/29 | 27 |
| Community Relations Responsiveness Summary for the Public Comment Period on the IMC Administrative Order on Consent | U.S. EPA | 86/11/24 | 10 |
| QAPP (Revised) | Camp Dresser & McKee, Inc | 86/12/05 | 77 |
| Responsiveness Summary for the Public Comment Period on the IMC Administrative Order on Consent | U.S. EPA | 87/01/12 | 10 |
| QAPP for IMC (2nd Revision) | | 87/03/00 | 78 |
| Draft QAPP - Surfact Soil Sampling and Analyses at IMC | RSocki - U.S. EPA | 87/04/14 | 8 |

| TITLE | AUTHOR | DATE | PAGES |
| --- | --- | --- | --- |
| Project Operations Plan for IMC East; Plan Site RI/FS Includes QAPP, Health & Safety Plan, Site Work Plan | Camp Dresser & McKee Inc. | 87/05/00 | 120 |
| Final Community Relations Plan IMC | Jacobs Engr. Group Inc. | 87/05/08 | 36 |
| EPA Environmental News Release | U.S. EPA | 87/05/19 | 1 |
| RI | Camp Dresser & McKee, Inc. | 87/08/00 | 100 |
| FS | Camp Dresser & McKee, Inc. | 88/01/00 | 78 |
| Indiana ARARs | IDEM | 88/04/15 | 68 |
| Responsiveness Summary | U.S. EPA | 88/06/00 | 37 |