000027

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V

IN THE MATTER OF: Metamora Landfill, Metamora, Michigan Proceeding Under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. SS 9601-9657 (1987)	)	Docket No. _____

EXHIBITS TO THE MEMORANDUM IN SUPPORT OF THE PETITION

EXHIBITS

1 The Record of Decision On The Metamora Landfill; Summary of Alternatives; and Responsiveness Summary

2 MDNR Progress Report #9

3 Letter to MDNR Freedom of Information Officer (April 7, 1987); Letter to S. Phillips re: FOIA Request on the Metamora Landfill Site (May 5, 1987) and Letter from S. Phillips re: FOIA Request (May 20, 1987)

4 Report of Dr. Lawrence Halfen

5 Memorandum of Dr. L. Halfen re: April 30, 1987 meeting with Seth Phillips (undated)

6 Michigan Environmental Law Journal Article re: Comparison of the Requirements of the NCP and Superfund Amendments and Reauthorization Act of 1986

7 Kelley v. Chemcentral of Grand Rapids, No. 80-30139 (Mich. App. Ct., May 3, 1984)

8 R. Kimbrough, M.D. and M. Simonds, Compensation of Victims Exposed to Environmental Pollutants, Brief Communication, 41 Archives of Env't Health 185, 187 (May/June 1986)

9 Memorandum from S. Phillips, MDNR, to A. Hogarth, MDNR, re: Metamora Landfill Operable Unit Remedial Design (March 9, 1987) and Memorandum from S. Phillips, MDNR, to Metamora Landfill Design F.6, re: Issues on Operable Unit Design and Record of Decision (February 27, 1987)

10 Letter from R. Hathaway, E.C. Jordan, to S. Phillips, MDNR, re: Metamora Landfill Drum Removal Operable Unit (February 3, 1987)

11 Letter from R. Hathaway, E.C. Jordan, to S. Phillips, re: Available Capacity at Commercial Incineration Facilities (March 1, 1987).

12 Memorandum from B. Herceg, MDNR, to S. Phillips, MDNR, re: Incineration Capacity at Selected Facilities (March 9, 1987).

13 Letter from S. Phillips, MDNR, to J. Atwell, E.C. Jordan (September 16, 1985)

Record of Decision
Remedial Alternative Selection

SITE: Metamora Landfill, Metamora, Lapeer County, Michigan

DOCUMENTS REVIEWED

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

- Metamora Landfill Phased Feasibility Study - August 1986
- Metamora Landfill Site Characterization Report - February 1986
- Summary of Remedial Alternative Selection
- Responsiveness Summary
- August 18, 1986 letter, Seth Phillips, MDNR to John Tanaka, U.S. EPA

DESCRIPTION OF SELECTED REMEDY

The recommended remedy for the Metamora site is to excavate disposal areas one and four, and dispose of all waste at an off-site RCRA compliant incinerator. The estimated present worth cost of the alternative is $41.5 million. The actual excavation of the material is expected to take approximately six to eight months to complete. Disposal of the material will depend on the availability of RCRA compliant facilities. No operation and maintenance will be required to effect the remedy.

DECLARATIONS

Consistent with the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the chosen remedy at the Metamora Landfill is a cost-effective remedy and provides adequate protection of public health and the environment. The State of Michigan has been consulted and agrees with the approved remedy.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund money for use at other sites. In addition, the off-site transport and destruction of excavated waste is more cost-effective than other remedial action, is necessary to protect public health, welfare or the environment, and is consistent with the anticipated final remedy.

EXHIBIT 1

permit since the Stablex denial, which is now before the Michigan Supreme Court.

The point of all this is clear. It is extremely difficult to obtain a construction permit for a hazardous waste TSD facility. The timetable, if no administrative mistakes or technical problems are identified includes:

- a 120 day DNR review period
- a 140 day Site review Board Process
- procurement of a construction contractor (can not be done earlier as bids will expire during permit process)
- construction of the facility
- certification of construction and submittal of the operating license application
- a 140 day DNR review period for the operating license application
- a trial burn
- excavation and preparation of buried wastes
- commencement of operation

I would expect a time line to follow something like this:

1. conduct test pitting program - 6-8 months
2. conduct design work 6-8 months
3. prepare construction permit application 3-6 months
4. DNR application review - 3 months
5. Site Review Board review - 3.5 months
6. Procurement of contractor - 6-9 months
7. construction of facility - 6-8 months
8. construction inspection and certification - 1 month
9. review of operating license application - 3.5 months
10. trial burn and review of same - 1-2 months
11. excavation and preparation of wastes for treatment - 6-12 months
12. Commencement of incineration overlapping item 11.

Total time from above: 45-58 months to commence.

I trust this information is useful to you in reviewing this matter with Headquarters staff. Clearly, this process is involved, cumbersome and likely to produce no success in resolving this problem. Even if it worked perfectly, it is likely that it would take almost 4 years to implement this interim action which needs to be implemented long before that. Indeed, selection of a final remedy would have already occurred and would be into the implementation phase by the time this interim remedy could begin. If you have any questions or need additional information please let me know.

Sincerely,

Seth Phillips, Project Manager
Remedial Action Section
Groundwater Quality Division
517-335-3390

cc: Mr. Hogarth/Mr. Willson/Ms. Kerbawy

The Michigan Department of Natural Resources, through a Cooperative Agreement with the U.S. EPA, is undertaking additional Remedial Investigation/Feasibility Study activities to evaluate the necessity for soil, ground water, and other remedial action. If additional remedial actions are necessary, a separate Record of Decision will be prepared for approval.

September 30th, 1986

Date

Valdas V. Adamkus
Regional Administrator

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION
METAMORA LANDFILL

SITE LOCATION AND DESCRIPTION

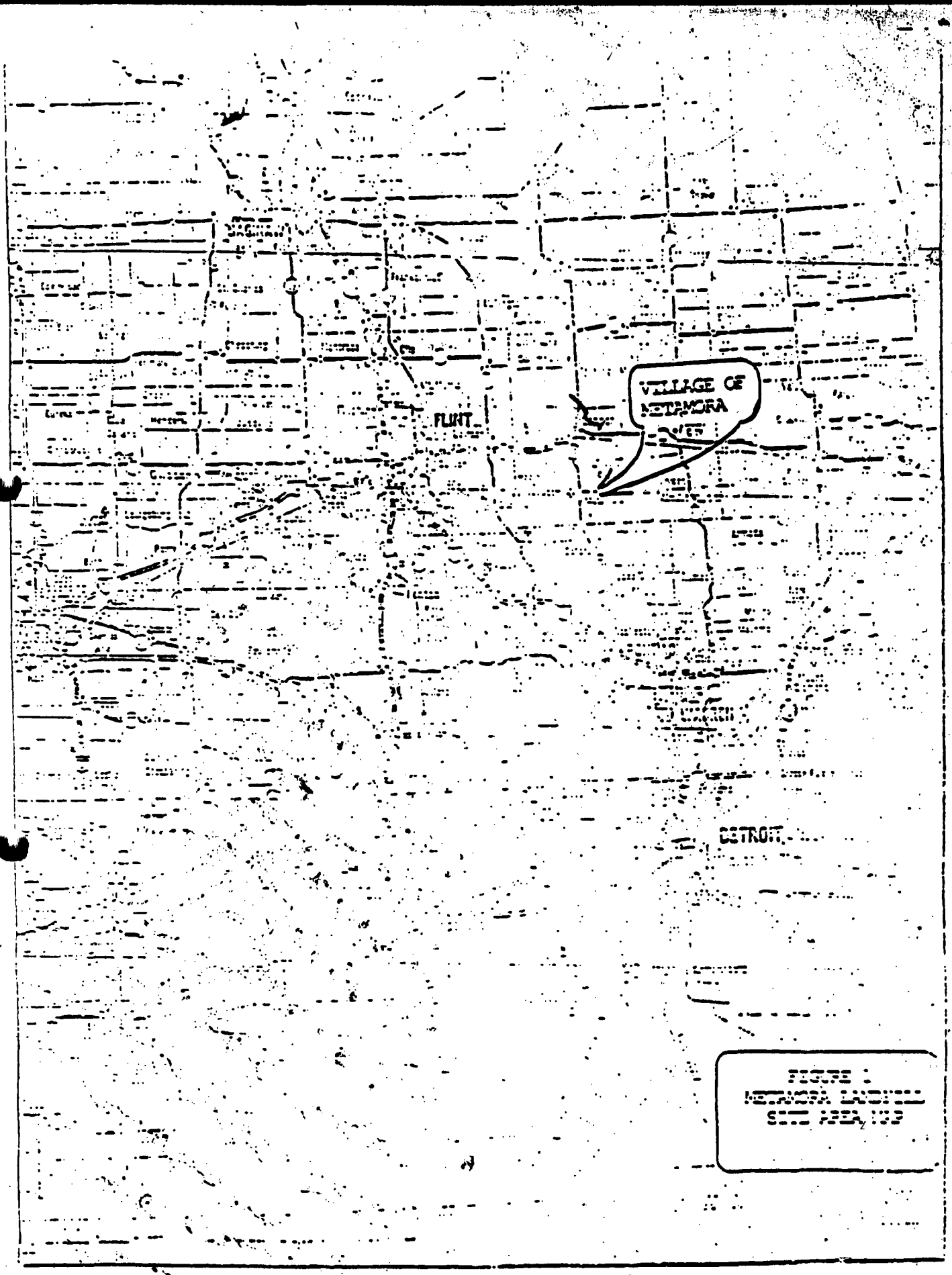
The Metamora Landfill is located in Metamora Township, Lapeer County, Michigan, approximately one-half mile northeast of the Village of Metamora, and 20 miles east-southeast of Flint, MI (Figures 1 and 2). The site is an 80-acre closed landfill that accepted industrial and municipal waste between 1966 and 1980. As many as 35,000 drums may be buried in the landfill. The area was previously used for gravel mining, which accounts for the many steep excavation faces and borrow pits on the site. A gravel mining operation continues immediately south of the site, and a licensed solid waste transfer station currently operates in the western area of the site. The surrounding land use is both residential and agricultural. About 60 people use ground water downgradient of the site. The Village of Metamora's 1982 estimated population was 596 people.

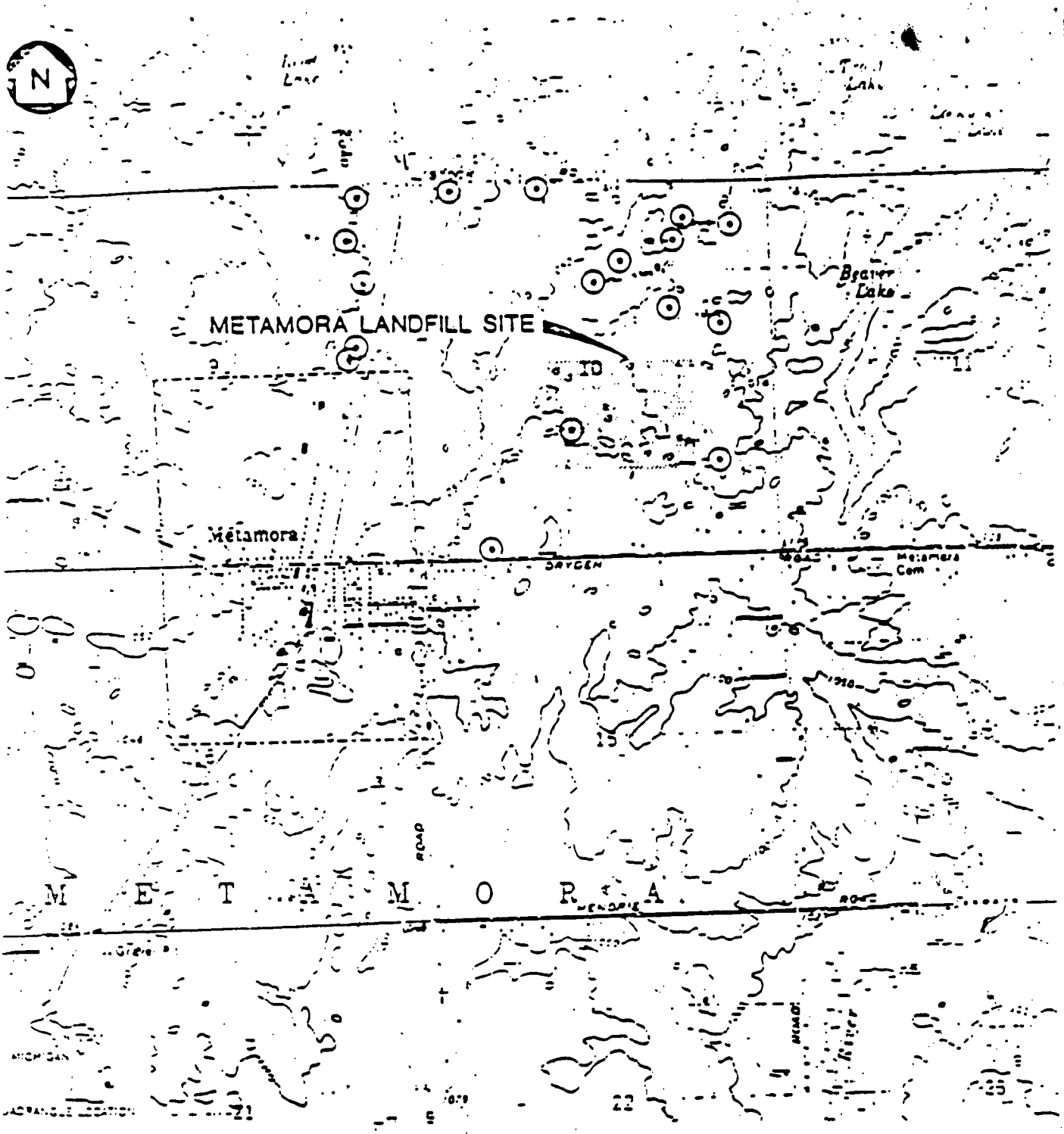
SITE HISTORY

The landfill began operations in 1966 as a privately owned, unregulated open dump. In 1969, the landfill was upgraded to meet existing standards, and licensed to receive general refuse. Two fires at the landfill were documented in 1972 and 1979. The 1972 fire reportedly burned out of control for three days, perhaps fueled by waste materials in the landfill. The site accepted both municipal and industrial waste until its closure in 1980. No records have been discovered that indicate the disposal practices of the former operator. However, it is likely that waste and drums were disposed of in unlined excavations (former mining pits or borrow areas).

PREVIOUS SITE INVESTIGATIONS

In 1981, approximately eight drums were unearthed in area four (Fig. 3) during borrow excavations for the nearby solid waste transfer station. The Michigan Department of Natural Resources (MDNR) sampled seven of these drums and identified (but did not quantify) the presence of methylene chloride, methyl chloroform, dichloroethylene, and styrene, and found up to 40 mg/kg lead. In 1982, the MDNR conducted a magnetometer survey which concluded that as many as 35,000 drums, some containing liquid waste, might be present in five disposal areas around the site (Fig. 3). The survey concluded that area one (16,000 drums) and area four (10,000 drums) contained about 74% of the total estimated number of buried drums in the landfill. Hazardous chemicals in buried drums from areas one and four were confirmed from limited test pit excavations done by the MDNR in June and September 1982 (Table 1).


VILLAGE OF
FLINT
DETROIT



METAMORA, MICH.

1968

PHOTOREVISED 1980

DMA 4369 IV NE-SERIES V882

APPROXIMATE LOCATIONS OF NEAREST DOMESTIC WATER SUPPLY WELLS

2000 4000 FEET

FIGURE 2

SITE LOCATION MAP

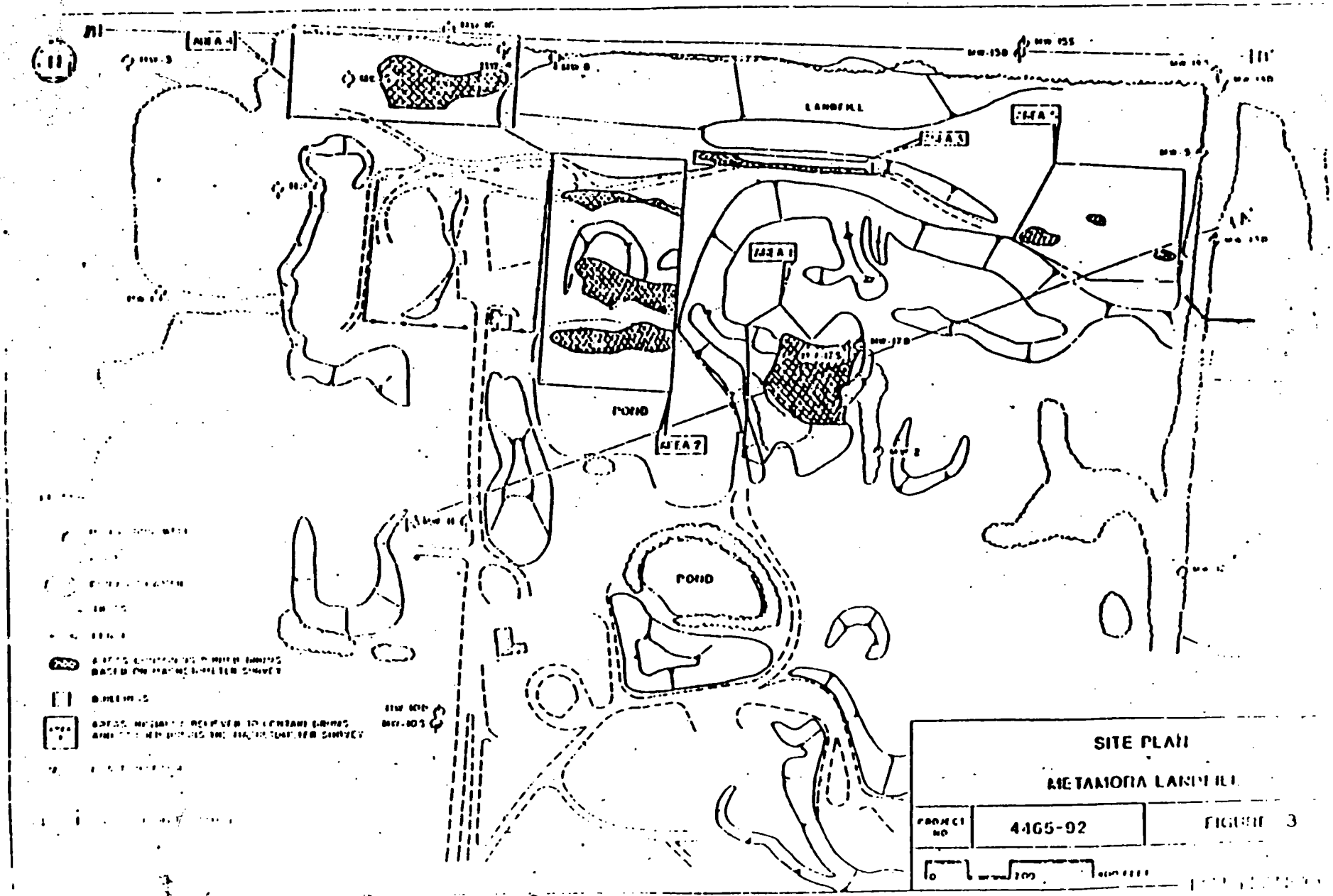

AREA 4
LANDFILL
AREA 3
AREA 1
POND
AREA 2
POND
SITE PLAN
METAMORA LANDFILL
PROJECT NO
4465-02
FIGURE 3

Table 1
Summary of Liquid and Solid Drum Samples

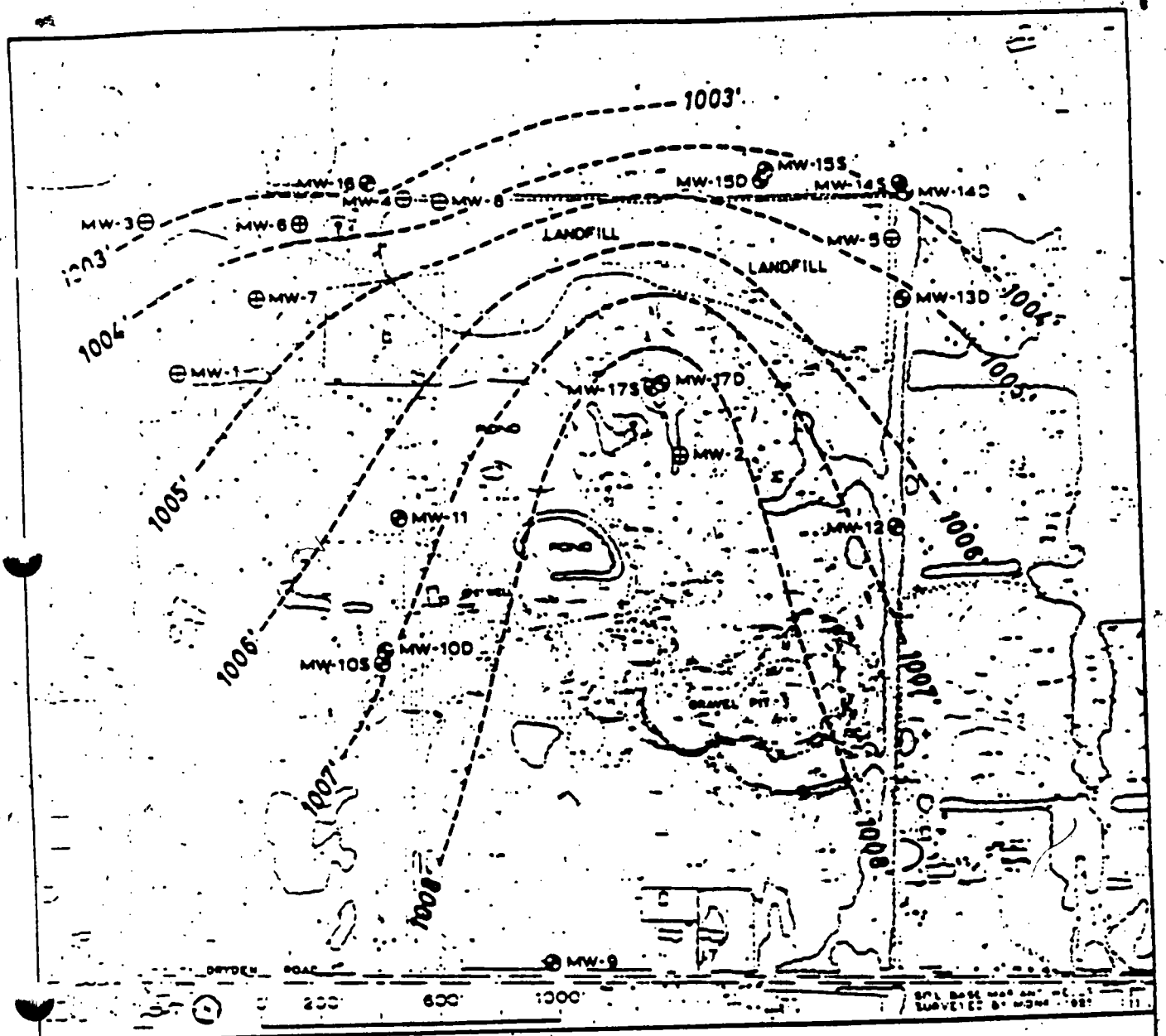
Compound Detected	Concentration Range	Area	Matrix
Ethyl benzene *	ND-27	1	Solid
	750-25,000	1,4	Liquid
Toluene *	ND-100	1	Solid
	1,200-13,000	1,4	Liquid
Trichloroethylene *	ND-2.7	1	Solid
	ND-20	1,4	Liquid
1,1,1-Trichloroethane *	ND-1.6	1	Solid
	ND-20	1,4	Liquid
Tetrachloroethylene	ND-3.5	1	Solid
	ND-65	1,4	Liquid
Xylenes	ND-100	1	Solid
	2,000-80,000	1,4	Liquid
PCBs	ND-1.7	4	Solid
Hexachlorobbenzene	ND-3.2	4	Solid
1,2,4-Trichlorobenzene	ND-3.3	4	Solid
Octachlorocyclopentadiene	ND-0.28	4	Solid
1,3- and 1,4-Dichlorobenzene	20-22	4	Water
Chloroform	ND-150	4	Liquid
1,1-Dichloroethane *	ND-240	4	Liquid
1,2-Dichloroethylene	ND-25	4	Liquid
1,2-Dichloroethane *	ND-300	4	Liquid

Notes:

1. All values in parts per million (ppm)
2. ND = Not detected
3. * = Also detected in ground water
4. For complete data, see E.C. Jordan Site Investigation Report, February 1986.

Table 1 shows that a variety of organic chemicals were detected in high concentrations in liquid and solid samples from the drums, including the carcinogens 1,2-dichloroethane, and 1,1,1-trichloroethane, tetrachloroethylene, trichloroethylene, and hexachlorobenzene.

In the summer of 1985, the MDNR initiated pre-remedial investigation activities at the site, during which soil borings were taken and thirteen ground water monitoring wells emplaced. That work determined that the site geology is variable, but generally consists of unconsolidated sand and gravel that is 250-300 feet thick in some locations, underlain by a clay/till unit. Ground water occurs at an average depth of about 100 feet below ground surface, with the deep aquifer at about 300 feet. Ground water flows from the south-central part of the site to the northwest and northeast (Fig. 4). Sampling results from the investigation confirmed



? MAGNETIC ANOMALIES

⊖ PREVIOUSLY-EXISTING SITE WELLS

● "SHALLOW" WELLS. THIS INVESTIGATION

● "DEEP" (SOIL) WELLS. THIS INVESTIGATION

-1003'- INFERRED ELEVATION OF THE WATER TABLE 09-16-85 - MSL DATUM

FIGURE 4 - SITE AREA

INTERPRETIVE WATER TABLE ELEVATION

SURFICIAL AQUIFER

EC JORDAN CO

the the existence of organic and inorganic ground water contamination. Monitoring wells MW-4 and MW-8, located in the immediate vicinity of area 4, and monitoring wells MW17s and 17d, located adjacent to area 1, all showed contamination by volatile organic compounds (Table 2).

Table 2
Summary of Monitoring Well Sampling

Comoound Detected	Concentration Range (All Wells)	Wells Detected
Benzene	ND-23	4, 17s
Ethyl benzene *	ND-1500	17s, 17d
Methylene chloride	ND-79	4, 11, 14s, 15s, 15d, 17s
Toluene *	ND-660	17s, 17d
Trichloroethylene *	ND-13	8
Trichlorofluoromethane	ND-200	8, 14s, 14d, 15s, 15d, 17d
Trans-1,2-Dichloroethane	ND-360	4, 8
1,1,1-Trichloroethane *	ND-12	8, 14s, 15s
1,1-Dichloroethane *	ND-95	8, 14s, 15s, 17s
1,2-Dichloroethane *	ND-46	8, 17s
Diethylphthalate	ND-9.6	8, 14s
Dioctylphthalate	ND-410	17s
Bis(2-ethylhexyl)phthalate	ND-240	15s, 17s
Di-n-butlyphthalate	ND-38	11, 15d

Notes:

1. All results in micrograms per liter (ppb)
2. ND = Not detected
3. * = Also detected in drum samples
4. Table shows significant organic data only - for complete data see E.C. Jordan Site Investigation Report, Feb. 1986

Some of the same hazardous substances were detected in drum samples (Table 1) and in ground water samples near drum disposal areas one and four (Table 2). Therefore, it is very likely that hazardous substances in suspected drum disposal areas one and four have migrated into the ground water. The pre-RI work is summarized in the report entitled, "Site Investigation Final Report" (E.C. Jordan, February 1986).

RISK TO RECEPTORS VIA PATHWAYS

The primary public health threat posed by the Metamora site is consumption of contaminated ground water by downgradient residential users. Approximately 60 residents are potentially affected by migrating pollutants in ground water. Benzene, 1,2-dichloroethane, and trichloroethylene, which are known or suspected human carcinogens, have been detected in on-site

monitoring well samples in concentrations that exceed the 1x10-6 acceptable risk level established by U.S. EPA. The carcinogens chloroform, hexachlorobenzene, and tetrachloroethylene have also been found in excavated waste samples, and might migrate into the ground water. No contaminants have as yet been detected in downgradient residential water samples, but future contamination is very possible since the buried drums are probably in poor condition (rusted and/or leaking). The ongoing Remedial Investigation/Feasibility Study will better define the hydrogeology and the existence of any contaminant plume(s) in ground water. Direct contact with contaminated soils is currently not a threat since the waste is buried beneath at least 10 feet of fill dirt. No air emissions have been detected in the vicinity of the disposal areas. However, if the site were used in the future, and the fill covering the drums became exposed, the drums and their contents could present an inhalation and direct contact hazard.

ENFORCEMENT

On June 20, 1985, Notice Letters that described the upcoming Remedial Investigation and Feasibility Study were sent to nine Potentially Responsible Parties (PRPs). On April 29, 1986, Notice Letters were sent to ten PRPs offering them the opportunity to undertake the Agency's remedy for this operable unit. To date, PRPs have shown little or no interest in participating in the remedial process. On July 28, 1986, Region V EPA, through a joint memorandum from the Hazardous Waste Enforcement Branch and the Office of Regional Counsel, terminated the PRP negotiations for the operable unit. Therefore, Region V EPA has recommended the use of the Hazardous Substance Response Trust Fund, as described in CERCLA, Section 111, to fund the project. Two PRPs did, however, provide written comments on the public comment draft PFS, but still did not demonstrate a willingness to participate in the project. Theirs and other public comments are summarized in the attached Responsiveness Summary.

PHASED FEASIBILITY STUDY METHODOLOGY AND APPROACH

In response to the potential health threat posed by the site, a Phased Feasibility Study (PFS) was initiated, the objective of which was to formulate remedial alternatives that were protective of public health and the environment. To this end, source control remedial alternatives (as defined in the National Contingency Plan, 40 CFR Part 300.68(d)) that dealt with the five identified drum disposal areas were examined in detail. Management of migration remedial alternatives were not deemed necessary at this time since, based on the most recent monitoring well samples, contaminants had not migrated a significant distance from their original locations.

The PFS then analyzed which source control remedial alternatives were most appropriate. The study initially considered each of the five disposal areas thought to be a source of contamination. Three of the disposal areas (2, 3, and 5) were inaccessible due to the depth (from 27 up to 80 feet) at which materials were disposed (Fig. 3), so the presence of buried drums in these areas was not confirmed. Areas 2, 3, and 5 also

were suspected of containing metallic municipal waste, which may have biased the magnetometer survey performed in these areas. Given the limited information available for areas 2, 3, and 5, and the anticipated depth of burial, it was not possible to accurately predict the cost of remedial action alternatives in these areas. On the other hand, no municipal waste was believed to have been disposed of in areas one and four, and the existence of drums in these areas was confirmed by limited excavations. Therefore, the PFS developed source control remedial action alternatives for disposal areas one and four only, in which it was estimated by the MDNR magnetometer survey that the majority of the drums (26,000 out of 35,000, or 74%) existed. Therefore, although areas 2, 3, and 5 may also contain hazardous waste, the PFS examined the known disposal areas (one and four) believed to be major sources of contamination at the site. The RI/FS will investigate areas 2, 3, and 5 in detail and propose appropriate remedial alternatives if necessary.

Soil and ground water contamination were not addressed by the PFS. This was because insufficient information was available to determine the extent of contamination. Therefore, reasonable cleanup targets could not be accurately established. The RI/FS, scheduled for completion in FY '88, will establish cleanup targets for ground water and soil.

Some material between the drums may be highly saturated with hazardous chemicals from leaking drums. For the purpose of the PFS, this interstitial material was considered to be waste, rather than soil. This waste material would be disposed of along with drummed material. Based on an estimate of 26,000 drums and associated "interstitial" waste material, the total estimated waste volume requiring disposal during this operable unit is 18,150 cubic yards (see Table 3 for calculations).

ALTERNATIVES EVALUATION

Using the response objective of source control of areas one and four as a guideline, potential remedial alternatives were assembled and screened. The following alternatives were eliminated during the screening process using the NCP criteria of cost, acceptable engineering practice, and effectiveness at addressing the site problem.

1. On-site incineration alternatives would involve the construction of a facility on-site. A key factor in the decision not to evaluate on-site incineration alternatives in detail was the additional time necessary to implement such a remedy. Due to the time needed to construct a facility, and the statutory requirements of Michigan Act 64 (Hazardous Waste Management Act), actual incineration of excavated waste under the on-site option would take an estimated 21 to 27 months longer than an off-site incineration alternative. Act 64 establishes a procedure whereby State technical standards are applied on a site-specific basis. This process is extremely lengthy and State technical standards are applied strictly. The process has seldom resulted in the construction of an incinerator on-site; incinerator construction has been authorized only once since 1979. Table 4 outlines the necessary activities and timeframes for both the on-site and off-site incineration scenarios.

Table 3
Estimate of Waste Volume to be Excavated and Disposed

Assumptions:

1. Number of drums in area one = 16,000
2. Number of drums in area four = 10,000
3. All drums uncrushed
4. Volume of one drum = 7.35 cubic feet
5. Interstitial waste material volume equal to volume of drums

Calculations:

DRUMS:

Solids:

$$21{,}000 \text{ drums} \times \frac{7.35 \text{ cubic feet}}{\text{drum}} \times \frac{\text{cubic yard}}{27 \text{ cubic feet}} = 5{,}717 \text{ cu. yd.}$$

Liquids:

$$5{,}000 \text{ drums} \times \frac{7.35 \text{ cubic feet}}{\text{drum}} \times \frac{\text{cubic yard}}{27 \text{ cubic feet}} = 1{,}361 \text{ cu. yd.}$$

INTERSTITIAL WASTE:

Interstitial Waste Volume = Volume of Drums	7,078 cu. yd.
Total Excavated Waste	14,156 cu. yd.
Waste From Storage/Staging Area	4,000 cu. yd.
Total Waste for Disposal	18,156 cu. yd.

Table 4
Implementation Time for On-site vs. Off-site Incineration

Activity:	Implementation Time (months) On-site	Off-site
1. Test Pits	3-4	3-4
2. Remedial Design	6-8	6-8
3. Prepare Act 64 Application	3-6	N/A
4. MDNR Technical Review	3	N/A
5. Site Review Board Review	3.5	N/A
6. Procure Contractor	3-6	3-6
7. Construct Facility	6-8	N/A
8. Construction Inspection and Certification	1	N/A
9. Review Operating License Applic.	3.5	N/A
10. Trial Burn and Review	1-2	N/A
11. Excavate and Test Waste	3-4	3-4
12. Begin Incineration		
Total Time to Begin Incineration	36-49	15-22

Table 4 demonstrates that the off-site incineration alternative can be implemented at least 21 to 27 months sooner than the on-site option. The on-site alternative requires many more review steps than off-site incineration, which means that there are more ways that the project could be further delayed. Therefore, the estimate of 21 to 27 months is the minimum delay expected.

Besides having serious schedule implications, the on-site alternative has real environmental impacts associated with it as well. The drums in areas one and four are known to contain hazardous materials in relatively high concentrations. The Site Investigation report (E.C. Jordan, February 1986) has demonstrated that these drums are probably leaking their contents into the upper ground water aquifer which is currently used as a drinking water source. Ground water in the vicinity of the site generally moves to the northeast and northwest. (Off-site ground water flow must be further defined). Assuming that ground water flow continues in these directions beyond the site boundary, approximately 60 people within one mile of the site are in the path of a potential contaminant plume. (The current data neither confirm nor deny the existence of a contaminant plume). If off-site ground water flow turns out to have a western component, the supply wells for the Village of Metamora, (located approximately one-half mile to the west of the site), which serve about 600 additional residents, may also be impacted. If no plume currently exists, and contamination is confined to the area immediately adjacent to the source material, timely implementation of source control may prevent a contaminant plume from forming.

At a minimum, the implementation of source control will prevent further degradation of the drinking water aquifer. Much greater expense will be incurred in order to extract and treat contaminated ground water if contaminants continue to enter the soil and ground water. The current monitoring well network may not detect an off-site plume. Therefore, the minimum 21 to 27 month time delay associated with on-site incineration could prove to have significant adverse environmental effects.

In light of the above issues, and the fact that the project was designed as a source control remedial alternative requiring more immediate attention, it was decided that on-site incineration was not an implementable alternative at this time. Therefore, it was not carried through to the detailed alternatives analysis.

2. Solidification and/or chemical fixation technologies were screened out due to the high volatile organic content of the waste. The intent of this technology would be to create a non-leachable material to reduce the toxicity and/or mobility of the waste. Lime and inert organic polymers have been used in the past. However, fixation technologies have been generally used for wastes containing PCBs, metals, and some semi-volatile compounds. The high volatile content of the waste makes this particular technology inapplicable for this operable unit.

3. Landfarming would involve the mixing or dispersion of wastes into a soil-plant system, the objective of which would be microbial stabilization, adsorption, and immobilization of the waste. Landfarming was not considered in detail because of the heterogeneous nature of the waste, which would make the determination of the effectiveness and applicability of this technology very difficult. Furthermore, landfarming is a relatively untested technology for hazardous waste disposal.

4. Recycling was ruled out due to the heterogeneous waste stream, which limits the technology's applicability and effectiveness. Recycling has been normally applied to well-defined homogeneous industrial waste streams, and cannot be depended on to address a significant volume of waste during this operable unit.

DETAILED ALTERNATIVES ANALYSIS

After the alternatives screening process was completed the following alternatives were examined in detail.

1. On-site RCRA landfill
2. Off-site RCRA landfilling
3. Off-site incineration
4. Combination off-site incineration and off-site landfill
5. No action

All of the alternatives except for no action involve the excavation and testing of waste in areas one and four, and the construction of two

temporary staging and testing areas on-site. The cost of these activities (total - $ 3.63 million) is the same for each alternative except no action (see Tables 5 and 6 for detailed costs).

1. On-site RCRA Landfill - This alternative would involve the construction of a double lined RCRA Subtitle C facility on the site, approximately one acre in size. The alternative would include provisions for leachate collection and disposal, general operation and maintenance, such as sampling and testing, and cap repair or replacement. Liquids would be solidified prior to disposal, but no waste treatment would take place. Long-term monitoring would also be an integral part of the remedy. Such a landfill would be easily constructed, and reasonably protective of public health and the environment. Detailed costs are shown in Table 7.

2. Off-site RCRA Landfill - Under this alternative, all waste would be transported and disposed of at an off-site compliant RCRA landfill. Liquids would be solidified (but not treated) prior to disposal. The landfill chosen could be expected to provide adequate protection of public health and the environment. Operation and maintenance would be the responsibility of the disposal facility. Detailed costs are shown in Table 8.

3. Off-site Incineration - All waste would be transported to and disposed of at an off-site incinerator. Depending on the waste characteristics, several different commercial incinerators might be used (e.g. liquids and solids might go to separate facilities). This remedy would offer a significant volume reduction of liquids, reduced waste mobility and toxicity, and long-term reliability, protection, and effectiveness. Detailed costs are shown in Table 9.

4. Combination Off-site Incineration and Off-site Landfill - Liquid waste would be disposed of at an off-site incinerator, and solid waste would be taken to a compliant off-site RCRA landfill. (See the above discussions for the elements of this remedy). Detailed costs are shown in Table 10.

5. No action - Under this alternative, no remedial activity would take place. No money would be spent for this alternative. It was included primarily to compare remedial alternatives to baseline conditions.

Table 11 shows the present worth and relative costs (as compared to the on-site landfill) of the alternatives.

TABLE 5

STAGING/STORAGE AREA COSTS

Access road and fencing around storage area		$ 4,400
Berms - 4' high, separating storage areas		4,800
Liner		38,300
Gravel working surface		14,500
Surface water control - drainage ditch, pond, piping, treatment		7,500
	Subtotal	$69,500
	Mobilization	3,500
	Contingency	17,000
	Total	$90,000

TABLE 6

EXCAVATION AND CHARACTERIZATION
TESTING COSTS

Excavation

Excavation Equipment - grappler, loaders, dozer		$439,000
On-Site transport equipment - tank truck, fork lifts		811,000
Labor - 10 people		698,000
Supervision		150,000
Cover soil over excavated areas		17,000
	SUBTOTAL	$2,115,000
	Mobilization	106,000
	Decontamination Facilities	127,000
	Contingency	$530,000
	TOTAL	$2,878,000

Characterization Testing

1 chemist and 3 technicians		$274,000
On-site laboratory		61,000
		$335,000
	Mobilization	$10,000
	Protective Equipment and Contingency	117.000
	TOTAL	$462,000

Total Cost

Excavation	$2,878,000
Characterization Testing	462,000
Overpacks (assumes 1000 overpacks @ $80 each)	200.000
TOTAL	$3,540.000

1.86.103T
0012 0.0

TABLE 7
COSTS FOR ON-SITE DISPOSAL

Capital Costs

Site Preparation		$35,400
Liner		250,000
Leachate Control		74,100
Cap		17,800
Access road and fence		14,000
Leachate storage and treatment		19,800
Monitoring wells		47,900
Solidification of liquids (assume 5000 drums)		375,000
Placement of waste		259,000
	SUBTOTAL	$1,093,000
	Mobilization	55,000
	Engineering & Contingency	382,000
	Permitting	100,000
	TOTAL	$1,630,000

Annual Costs

Sampling and Testing		$26,000
Maintenance		2.000
	TOTAL	$28,000

Cap Replacement Costs

Cap

	Mobilization	$17,800
	Engineering	1,900
	Contingency	8.000
	TOTAL	$27,700

1.86.103T
0013.0.0

TABLE 7 (cont.)

Total Cost

In present worth, amortized at 10 percent for 30 years

Staging Area Costs (Table 5)	$90,000
Excavation and Testing Costs (Table 6)	3,540,000
On-Site Disposal Costs	
Capital Cost	1,630,000
Annual Cost	264,000
Replacement Cost	80,000
TOTAL	$5,604,000

1.66.103T
0013.1.0

TABLE 8

COSTS FOR OFF-SITE DISPOSAL

	PCB < 50 ppm		50 ppm < PCB < 500 ppm	
	Solids (per cy)	Liquids (per drum)	Solids (per cy)	Liquids (per drum)
Testing	$12[1]	$15[1]	60[2]	106[2]
Testing at landfill	2[1]	2[1]	10[2]	17[2]
Trucking	21	8	64	20
Solidification	--	75	--	75
Landfilling[3]	200	60	330	107
Subtotal	$235	$160	$464	$325
Contractor fee	60	40	136	95
Total	$295	$200	$600	$420

[1]Assumes compositing 80 drums of liquids or 100 cubic yards of solids.
[2]Assumes compositing 10 drums of liquids or 20 cubic yards of solids.
[3]These are average costs. Prices will vary depending on the type of waste.

Total Cost

In present worth, amortized at 10 percent for 30 years.

Staging Area Costs (Table 5)	$ 90,000
Excavation and Testing Costs (Table 6)	3,540,000
Off-Site Disposal Costs	
80% of total volume PCB < 50 ppm	
Solids - 12,240 cy	3,610,000
Liquids - 4,000 drums	800,000
20% of total volume - 50 ppm < PCB < 500 ppm	
Solids - 3,060 cy	1,840,000
Liquids - 1,000 drums	420,000
Staging area materials - 4,000 cy	1,180,000
Total	$11,480,000

0015.0.0

TABLE 9
COSTS FOR INCINERATION

	PCB < 50 ppm		50 ppm < PCB < 500 ppm	
	Solids (per cy)	Liquids (per drum)	Solids (per cy)	Liquids (per drum)
Testing	$9[1]	$91	$ 22[2]	$ 19[2]
Trucking	51	16	51	16
Incineration	1120[3]	210[4]	2800	400
SUBTOTAL	$1180	$235	$2873	$435
Contractor fee	340	65	857	130
TOTAL	$1520	$300	$3730	$565

[1]Assumes compositing 20 drums of liquids or 20 cubic yards of solids.
[2]Assumes compositing 10 drums of liquids or 20 cubic yards of solids.
[3]This is a base price. The price will increase depending on the types of wastes.
[4]This is an average price. The actual price may range from $105 to $840/drum.

Total Cost

In present worth, amortized at 10 percent for 30 years.

Staging Area Costs (Table 5)	$ 90,000
Excavation and Testing Costs (Table 8)	3,540,000
Incineration Costs	
80% of total volume - PCB < 50 ppm	
Solids - 12,240 cy	18,600,000
Liquids - 4,000 drums	1,200,000
20% of total volume - 50 ppm < PCB < 500 ppm	
Solids - 3,060 cy	11,410,000
Liquids - 1,000 drums	570,000
Staging area materials - 4000 cy	6.080.000
TOTAL	$41.490,000

1.86.103T
0016.0.C

TABLE 10
COSTS FOR DISPOSAL/INCINERATION

	Incinerate Liquids - Per Drum		Landfill Solids - Per CY	
	PCB < 50 ppm	50 ppm < PCB < 500 ppm	PCB < 50 ppm	50 ppm < PCB < 500 ppm
Testing	$9[1]	$20[2]	12[3]	60[2]
Testing at Landfill	--	--	2[3]	10[2]
Trucking	16	16	21	64
Landfilling[4]	--	--	200	330
Incineration	210[5]	400[5]	--	--
SUBTOTAL	$235	$435	$235	$464
Contractor Fee	65	130	60	136
TOTAL	$300	$565	$295	$600

[1]Assumes compositing 20 drums of liquids.
[2]Assumes compositing 10 drums of liquieds or 20 cubic yards of solids.
[3]Assumes compositing 100 cubic yards of solids.
[4]These are average costs. Prices will vary depending on the type of waste.
[5]This is an average price. The actual price may range from $105 to $840/drum.

Total Cost

In present worth, amortized at 10 percent for 30 years.

Staging Area Costs (Table 5)	$90,000
Excavation and Testing Costs (Table 6)	$3,540,000
Incineration of Liquids	
80% of total volume - PCB < 50 ppm	
4000 drums	1,200,000
20% of total volume - 50 ppm < PCB <500ppm	
1000 drums	570,000
Landfilling of Solids	
80% of total volume - PCB < 50 ppm	
12,240 cy	3,610,000
20% of total volume - 50 ppm < PCB <500ppm	
3.060 cy	1,840,000
Staging Area Materials	
4,000 cy	1,180,000
TOTAL	$12,030,000

1.86.103T
0017 C 0

Table 11
Present Worth and Relative Costs of Alternatives

Alternative	Present Worth *	Relative Cost
1. On-site RCRA landfill	$ 5.6 million	1.0
2. Off-site RCRA landfilling	$ 11.1 "	2.0
3. Off-site Incineration	$ 41.5 "	7.4
4. Combination off-site incineration and off-site landfill	$ 12.0 "	2.1
5. No action	$ 0	---

* Present worths calculated using a 10% interest rate and 30 year project period.

ENVIRONMENTAL IMPACTS

Many of the positive and adverse impacts of the alternatives were similar. For example, all of the alternatives, except for no action, would require excavation of areas one and four, causing some temporary noise and dust impact due to heavy equipment at the site. The no action alternative might allow hazardous chemicals to further migrate in the environment, potentially contaminating residential wells. No adverse long-term environmental or public health impacts are expected from the implementation of the alternatives retained for detailed screening. The specific positive and adverse environmental impacts of each alternative are discussed in the sections entitled, "Alternative Screening Process" and "Recommended Alternative".

CONSISTENCY WITH OTHER ENVIRONMENTAL LAWS

All of the alternatives examined in detail were designed to be fully compliant with applicable environmental laws. The Resource Conservation and Recovery Act (RCRA) entered prominently into the analysis. The on-site landfill alternative would meet all requirements of the RCRA regulations at 40 CFR Part 264, Subpart N, as well as the requirements of the Toxic Substances Control Act (TSCA), 15 U.S.C., Section 2605(e), if concentrations of polychlorinated biphenyls (PCBs) were high enough to require a TSCA-regulated facility. However, it is expected that the majority of waste at Metamora will not require a TSCA-regulated facility. All off-site alternatives would involve only those facilities in compliance with RCRA and/or TSCA. The recommended alternative would fully comply with all applicable State (notably Act 64) and Federal statutes.

ALTERNATIVE SCREENING PROCESS

The detailed screening process used to select the remedy was consistent with the NCP, 40 CFR Part 300.68(h), U.S. EPA's most recent guidance concerning the selection of off-site remedial alternatives, and other Agency guidance as appropriate. In addition, consideration was given to the expected CERCLA reauthorization statutory language which stresses the selection of permanent remedies, such as thermal destruction. The NCP criteria used in the detailed alternatives analysis were:

1. Consideration of established technology and innovative and alternative technology where appropriate.

2. Detailed cost estimation, including operation and maintenance (O&M) costs.

3. Evaluation of engineering implementation, reliability, and constructability.

4. An assessment of the degree of protection afforded by a given alternative, including the attainment of relevant Federal standards.

5. An analysis of any adverse environmental impacts.

6. Consistency of remedial action with final remedy.

7. Cost-effectiveness of the alternative.

A summary of the alternatives with respect to the above criteria is presented in Table 12.

The National Contingency Plan, 40 CFR Part 300.68(j) states that, "the appropriate extent of remedy shall be determined by the lead agency's selection of a cost-effective alternative that effectively mitigates and minimizes threats to and provides for protection of public health and the environment," and that the lead agency shall consider, "cost, technology, reliability, administrative and other concerns, and their relevant effects on public health and the environment". The following alternatives were screened out based on the aforementioned criteria.

1. The on-site RCRA landfill was not selected for several reasons. Due to the relatively permeable nature of the native soils, the site would not be an ideal location for a hazardous waste landfill. Any breach in the containment liner would allow contaminants to easily migrate into the underlying ground water aquifer, which could then contaminate residential water supplies. A corrective action program for ground water would be very expensive since the upper and lower aquifers are about 100 and 300 feet below ground surface, respectively. Installing extraction wells, pumping, and treating ground water at these depths would be very time and capital intensive. Although the alternative offers greater protection of public health and the environment than no action, it does not utilize any treatment of the waste that reduces its volume, toxicity, or mobility. The on-site landfill alternative, though technically feasible, also suffers

TABLE 12

SUMMARY OF DETAILED SCREENING OF ALTERNATIVES

Screening Parameters	No Action	Excavation & Disposal On-site	Excavation & Disposal Off-site	Excavation & Incineration Off-site	Excavation Combination Incineration/Disposal Both Off Site
Constructability	Not Applicable	Readily Constructed	Readily Constructed	Readily Constructed	Readily Constructed
Reliability	Not Applicable	Moderately Reliable	Reliable	Reliable	Reliable
Implementation	Not Applicable	Difficult to implement due to soils on site and Michigan Act 64 Requirements	Readily implementable	May be difficult to implement for all excavated wastes	Implementable
Level of Protection	Provides no additional protection	Meets RCRA guidance	Meets RCRA guidance	Meets RCRA guidance	Meets RCRA guidance
Volume Reduction	None	None	None	Will reduce volume of waste	Will reduce volume of waste
Adverse Environmental Impacts	Potential impacts to groundwater and drinking water	Possible impacts in the event of a liner failure	Possible impacts in the event of a liner failure	None	Possible impacts in the event of a liner failure
Institutional/ Regulatory Factors	Does not reduce chemical migration therefore does not protect public health and welfare or the environment as required by the NCP (300.68.1.1)	On-site facilities must meet all requirements for Subtitle C facilities under RCRA and Michigan Act 64 and must obtain all required state permits	Materials must go to permitted facilities	Materials must go to permitted facilities	Materials must go to permitted facilities
Total Cost	$0	$5.6 million	$11.5 million	$41.5 million	$12.0 million

from problems regarding implementability (see discussion re: on-site incineration, p.5).

2. The off-site landfill alternative was also screened out. The alternative requires a significant RCRA landfill volume (over 18,000 cubic yards), and capacity in compliant facilities is currently severely limited. A delay in the actual disposal of staged waste may occur while waiting for a facility to come into compliance. Additional negative aspects of the alternative were its reliance on proper operation and maintenance to preserve the integrity of the remedial action, and use of non-destructive disposal technology. (The volume, toxicity, and mobility of the waste would not be reduced).

3. The combination off-site incineration and off-site landfill alternative provides significant additional benefits over exclusively landfilling. This alternative provides for the disposal of liquids at a RCRA compliant incinerator and solid waste at a RCRA compliant landfill. The alternative is clearly more desirable than the off-site landfill since it incorporates incineration rather than land disposal of 5,000 drums of liquid waste at an incremental cost of $535,000. However, this option suffers from the same negative aspects as the off-site landfill alternative due to its use of non-destructive disposal technology, and its reliance on compliant RCRA landfill facilities. The alternative is about three and one half times cheaper than total incineration. However, the benefits gained from thermal destruction of the solid material, which constitutes the majority of the waste in areas one and four, outweigh the increased cost (see Recommended Alternative section).

4. No action was not selected since the site clearly poses a potential threat to public health and the environment.

RECOMMENDED ALTERNATIVE

Based on the factors discussed in the previous section, the recommended alternative for this operable unit is the excavation of areas one and four, and thermal destruction of all waste at a compliant RCRA off-site incinerator. Although it is the most expensive remedy ($41.5 million), it is also the most protective of public health and the environment. The main sources of hazardous substances will be removed, and thermal destruction significantly reduces the volume, toxicity, and mobility of the liquid wastes. The volume, toxicity, and mobility of any inorganic solid wastes will be reduced to a lesser degree. Thermal destruction of these wastes will still leave a significant amount of ash for disposal, and most heavy metals, if present in the waste, will remain in the ash. However, high concentrations of heavy metals in the waste are not expected.

The recommended alternative is both cost-effective and consistent with a permanent remedy since the waste is being permanently removed from the site. It is also consistent with the Agency's May 6, 1985 off-site policy (Memorandum from Jack W. McGraw, Acting Assistant Administrator). In addition, the recommended alternative will be easily engineered and constructed, and readily accepted by the public. In light of the above

factors, and U.S. EPA's trend toward the selection of permanent remedies, the additional cost of incinerating all of the waste for an additional $29.5 million, rather than incinerating only liquids, is justified.

It is estimated that 18,150 cubic yards of liquid and solid waste will be incinerated, including 4,000 cubic yards from the staging areas. The estimated total cost of this alternative is $41,500,000, assuming a 10% interest rate and 30 year project period (Table 10). For cost purposes, the PFS assumed that the nearest disposal facility (Chemical Waste Management facility in Chicago, Illinois) would be available. The unit disposal costs in Table 8 reflect this assumption.

COMMUNITY RELATIONS

The local community has been interested in the Metamora site since at least the late 1970's. At that time, their concerns centered around blowing trash, odor, and the height of the landfill. Local interest heightened in the early 1980's when buried drums were found at Metamora, and the site was included on the National Priorities List. In March of 1984, six local residents met with the MDNR and Michigan Department of Public Health to express their concerns regarding Metamora as a hazardous waste site. The MDNR then established a Citizen's Information Committee (CIC) to keep the affected public informed of project details. The CIC has met regularly during the course of the project. The meetings have included discussions regarding the RI/FS and the PFS.

The PFS was published for public comment on August 4, 1986. On August 18, 1986 a public meeting was held to discuss the findings of the Phased Feasibility Study and the recommended alternative. In general, public concern centered around the acquisition of site access to perform the operable unit (which has since been obtained), and the availability of CERCLA funds to to implement the remedy (due to the lack of CERCLA reauthorization. The public comment period ended on August 25, 1986. The attached Responsiveness Summary details the comments received during the public comment period.

OPERATION AND MAINTENANCE

The recommended alternative involves no operation and maintenance at the site in order to implement the remedy and maintain the protection of public health and the environment. The selected off-site disposal facilities would be responsible for operation and maintenance of their own facilities, and would be RCRA-regulated.

SCHEDULE

The following are the key milestones for implementation of the remedial action.

-Approve Remedial Action (sign ROD)	09/15/86
-Amend Cooperative Agreement for Design and Construction	10/15/86
-Start Design	10/31/86
-Complete Design	03/31/86
-Start Construction	11/01/87
-Complete Construction (begin incineration)	05/31/88

FUTURE ACTIONS

This Record of Decision (ROD) recommends the selection of the excavation of areas one and four with off-site thermal destruction. However, the possibility exists that at the time of implementation of the selected alternative, the cost of waste disposal will change the recommended (cost-effective) alternative. If such a situation arises, this ROD may be amended.

In order to complete the site response, an RI/FS has been initiated to study the potential impacts of contaminated soil, ground water, and other media. Test pits in areas one and four have been proposed in order to better define the number, condition, and contents of buried drums. The field work for the test pits is expected to begin in November or December of 1986. The data from the test pits will be used during the remedial design for this operable unit so that better cost estimates for the project may be made. This will allow potential remedial action contractors to submit more accurate bids for the construction of the operable unit. The RI/FS, which will evaluate alternatives for final site remediation, is scheduled for completion during the second quarter of FY '88. Another Record of Decision package shall be prepared for any additional remedial action recommended as a result of the RI/FS, or if test pit information warrants re-evaluation of this Record of Decision.

METAMORA LANDFILL PHASED FEASIBILITY STUDY
Responsiveness Summary

Introduction

A public comment period was in effect from August 4, 1986 until August 25, 1986 to provide for public review of a Phased Feasibility Study (PFS) for the Metamora Landfill Superfund site. The PFS has been prepared to evaluate existing information on the known and suspected disposal of drums of chemical wastes at the site and to determine if the drums pose a more immediate threat to public health or the environment which should be addressed prior to the completion of a full RI/FS. Copies of the Phased Feasibility Study were available for public review of the Metamora branch of the Lapeer County Library. In addition, a Citizen's Information Committee meeting and a public meeting were held during the public comment period. These meetings were conducted to give staff from the Michigan Department of Natural Resources and the U.S. Environmental Protection Agency the opportunity to explain to local residents and other interested parties the PFS and its recommendations, and to answer questions and receive comments.

Background

The Metamora Landfill is a closed municipal landfill, approximately 80 acres in size, of which about 50 acres have been used for disposal of both municipal and industrial chemical wastes. The site is located on Dryden Road approximately a quarter-mile east of the Village of Metamora in Lapeer County. This site currently appears on both the national Priority List (NPL) for the federal Superfund program and the state list of sites of environmental contamination promulgated under the Michigan Environmental Response Act (Act 307 of 1982). Inclusion on these lists makes this site eligible for federal and state funding to investigate the nature and extent of contamination at the site, to determine an effective and appropriate method of resolving the contamination, and to implement the appropriate remedy.

A full-scale Remedial Investigation and Feasibility Study under provisions of the Federal Superfund program, is just beginning at the site. The Michigan Department of Natural Resources, however, has conducted certain investigatory activities at the site since 1981. Two large areas of shallow drum disposal have been confirmed through magnetometer studies and limited excavation of drums. Sampling of these drums revealed various materials including solvents, C-58, toluene, ethyl benzene and perchloroethylene. The excavated drums were in poor condition.

The MDNR, in the fall of 1985, commissioned its site contractor to conduct a Phased Feasibility Study focusing on the two known barrel disposal areas. It was felt by staff that these areas posed the greatest potential threat of on-going release of contaminants to the environment, particularly the groundwater. The purpose of the study was to determine if cleanup or control measures should be implemented prior to the completion of the full site investigation in order to minimize further environmental contamination and threat to public health.

In August, 1986, the DNR and U.S. EPA released the draft Phased Feasibility Study. The draft Phased Feasibility Study evaluated five different clean-up options using criteria such as engineering constructability, reliability, implementability, clean-up level achievable, and other environmental impacts. The report includes the recommendation that the drums buried in the two known disposal areas be excavated, removed from the site, and that wastes be disposed of, as appropriate, through a combination of properly constructed and licensed hazardous waste landfills and incinerators. The cost estimate for this work was $12 million.

A U.S. EPA policy decision which followed the release of the draft PFS has caused a change in the cleanup alternative now being recommended. In an effort to move away from landfilling of wastes whenever possible, the directive from U.S. EPA headquarters was to favor another alternative evaluated in the PFS which involves incineration of all waste materials rather than a combination of landfilling and incineration. The estimated cost for this option is $41 million. This policy decision was received prior to meetings MDNR and EPA staff held with the Citizen's Information Committee and the public meeting held during the public comment period. All commenters were aware of this modification in the report recommendations.

Comments and Responses

Written comments on the Phased Feasibility Study for the Metamora Landfill were received from two parties: Sea Ray Boats, Inc. and Chrysler Corporation.

The commenters provided a large quantity of information to support two primary contentions. These are:

1. No imminent threat to public health or the environment exists.

2. Insufficient information exists to properly evaluate the specific remedial alternatives discussed in the PFS nor to support selection of the alternative recommended.

Their conclusion offered in comment is that the decision to pursue the partial cleanup recommended in the PFS is premature and should not be undertaken.

Comment: No imminent threat to public health or the environment exists.

Response: While complete investigation of the Metamora site needs to be done, a number of investigation efforts since 1980 have provided significant information and understanding of the site. The magnetometer survey conducted at the site identified five areas of significant magnetic anopoly, indicating the presence of large quantities of buried metals. Limited excavation and sampling has been done in areas 1 and 4. These areas do not appear to be in the area of refuse disposal so potential interferences from other sources is thought to be a remote possibility.

The limited excavation and sampling work performed in these areas found no other items disposed except drums of chemical waste. Samples collected from these drums indicated a number of organic chemicals capable of

migrating through soils to the groundwater. Drums encountered were in varying states of integrity with some of them clearly having lost materials to the surrounding environment.

Groundwater monitoring wells installed in 1985 have shown the presence of some of these chemicals in the groundwater in concentrations which exceed established federal criteria for carcinogenicity. Concentrations exceeding these criteria have also been found in drum samples collected from these areas.

Available evidence indicates that groundwater on the site is being contaminated as a result of losses from the drum areas. Although complete detailed definition of the nature and extent of contamination and the environmental characteristics of the site is needed, and is proceeding under the auspices of the remedial investigation, there is sufficient evidence to believe that these drum areas have caused environmental contamination and, if left alone, would continue to contaminate the environment.

Residences near the site rely on groundwater for their water supply. Wells near the site utilize the surficial, contaminated aquifer as well as the bedrock aquifer in which contaminants have not yet been identified. The continued loss of contaminants to the surficial aquifer presents a future threat to some area water supplies.

Based on this information it is appropriate to eliminate the continuing loss and prevent the development of a groundwater problem that will be more significant, costly, and harder to control and clean up in the future.

Comment: Insufficient information exists to properly evaluate the specific remedial alternatives discussed in the PFS nor to support selection of the alternative recommended.

Response: The waste characterization information used to evaluate the remedial alternatives discussed in the PFS was based on a combination of specific information already collected at the Metamora site and the broader history of cleanup experiences of DNR and EPA at large disposal sites. While the real cleanup cost to clean up the two drum areas may show significant variation from the estimates presented in the PFS, cost recovery actions are based on actual expenditures rather than estimates developed during the planning process.

Commenters are correct in stating that additional information is needed prior to the actual removal activity commencing. As discussed during the public meeting on this report, a limited excavation and sampling activity to provide such information is planned in these two areas for late fall of 1986. In addition, further magnetometer work will be performed during 1986 to better define area #4. These efforts will provide information necessary to determine the details of how to proceed with the excavation/ removal work in a safe and efficient manner. This work will also enhance the quality of currently existing information. However, until a full

excavation is completed, any waste characterization effort will be subject to question and will generate estimated costs which will likely be erroneous.

U.S. EPA has recently established cleanup policies which further directed the selection of remedial alternatives. These policies encourage destruction, detoxification and volume reduction of cleanup wastes. Elimination of land disposal approaches to waste management is directed. Given this policy, the only viable alternatives involve total incineration of the excavated wastes. As discussed in the PFS report, consideration of an on-site incinerator was not thought to be viable, leaving off-site incineration as the only viable remedial response.

The remaining comments and questions were voiced at the two meetings that were held in the community during the public comment period. Some of the comments and questions do not directly relate to the PFS or the cleanup recommendations.

Comment: Because of abnormalities in laboratory results of tests on nearby drinking water wells, not enough follow-up sampling of homes and areas in question is being done.

Response: The Lapeer County Health Department and the Michigan Department of Public Health are jointly conducting a series of tests of private domestic wells around the landfill site. In two subsequent rounds of sampling, trace levels of certain organics appeared in some of the samples. Follow-up sampling of the wells in question and others in the area revealed that these trace levels were not found in any locational pattern, and subsequent sampling never duplicated a finding of the same organic in the same well. Trace levels were also detected in field blanks. Because of these factors, it was determined by the county and state health departments that the trace levels found were due to contamination of the original laboratory bottles rather than any real contamination of local wells. It is felt that the follow-up sampling that has been done is sufficient to show these wells to be free of contaminants. The Lapeer County Health Department and Michigan Department of Public Health will continue a cooperative well sampling program which involves sampling of selected area wells on a semi-annual basis and other wells on an annual basis.

Comment: The barrel staging areas shown on the site map should be relocated to spots where air emissions to surrounding areas would be minimized.

Response: The location of barrel staging areas shown on the map are only general approximateions. The commenter is correct that staging areas should be designed and located so as to minimize air emissions or other potential release of contaminants to the environment. An important consideration is minimizing the distance between excavation area and staging area, since loss of materials is most likely during excavation and transport. Staging areas will be located with these factors in mind.

Comment: Since obtaining site access seems to be such a long process, why don't you start now to seek a site access agreement for the drum excavation?

Response: Obtaining site access can be a time-consuming process and one that is essential before any particular actions can be taken at a site. Site access agreements generally cannot be negotiated until the proposed actions are well defined. In other words, a "generic" access agreement to cover any and all site work is not usually possible. The MDNR will begin negotiating an access agreement with the site owner as soon as possible, as the scope of work for the actual excavation takes shape.

Comment: There is concern that Mr. Parrish, the site owner, is still "messing around" in the landfill site, possibly hauling more materials (particularly rubble) to the site.

Response: While the owner still operates a licensed transfer station at the site, any further disposal of wastes at or in the landfill would be illegal. Neither MDNR or EPA staff have seen evidence that further disposal has taken place at the site over the past couple years. Local residents who suspect any illegal activity are asked to bring any evidence of such activity to the attention of MDNR as quickly as possible.

Question: Why hasn't more really been accomplished at the landfill site since 1981?

Response: Funding is a primary constraint in taking action at sites such as Metamora Landfill. Until the early 1980's, there was no state or federal program in existence to deal with such circumstances. In late 1984, state funds under the Michigan Environmental Response Act (Act 307, P.A. 1982) were allocated for some preliminary hydrogeological investigations and this work has taken place. Funding under the Federal Superfund program for comprehensive site investigations became available in summer 1985. After resolving contracting issues and site access issues, this full-scale Remedial Investigation/Feasibility Study is about to proceed.

The preliminary hydrogeological investigation has helped to justify the drum removal action proposed by the Phased Feasibility Study. Funding to implement this excavation is again the issue as the U.S. Congress debates reauthorization of the Superfund program. The drum removal is not likely to proceed until funding is available through a reauthorized Superfund program.

Question: What safety precautions will be taken during drum excavation? Is there any possibility of evacuating nearby residents as was done at Berlin and Farro?

Response: Safety precautions, both for workers and nearby residents, are important considerations prior to implementing waste excavations such as proposed at this site. There is the potential for the release of air emissions, and, depending on the types of materials present, the potential for fire and explosion. There are many precautionary measures that can be employed to reduce these risks. First, both test pitting operations

and actual excavation is proposed for autumn months. Cooler weather will reduce emissions and potential for fire or explosion. Air monitoring will be conducted throughout test pitting and excavation work to determine whether or not volatiles are being released to the air. Work practices at the site can be modified if it is found that emissions are posing a problem. The test pitting and drum sampling scheduled for this fall will provide much more information on what materials are present in the drums and thus help MDNR and EPA to prepare accordingly.

MDNR staff feel that it is very unlikely that an emergency evacuation would become necessary. Despite this, MDNR staff have contacted the Lapeer County Emergency Preparedness Office to develop some initial plans for contacting and involving various local and state agencies in the event of an emergency. This plan will be developed and incorporated into the site safety plan prior to work proceeding.

At Berlin and Farro, a planned evacuation was carried out due to suspicions about the types of wastes present, the possibility of chemical reaction between waste types if accidentally mixed, and the close proximity of homes to the area of excavation. At this time it is not felt that any conditions at the Metamora site warrant such a planned evacuation.

Question: Does Michigan have incinerators that will take the wastes?

Response: No, Michigan does not have any commercial incinerators licensed to accept hazardous wastes. The wastes will need to be shipped out of state. Arrangements with specific incinerator facilities will be made based on the types of wastes encountered and on the basis of availability of incinerator capacity.

Comment: Additional on-site remedial actions should have been considered.

Response: The on-site incineration alternative was screened out early in the Phased Feasibility Study (PFS) process for the reasons stated in the Summary of Remedial Alternative Selection discussion. However, after the PFS had been published for public comment, additional information regarding the cost of on-site incineration became available. Specifically, the Spiegelberg, Michigan PFS estimated that the on-site incineration alternative would cost more than off-site incineration for that project. Using the methodology for the Spiegelberg site, a cost estimate of both on- and off-site incineration for the Metamora Landfill project was made. This analysis showed that on-site incineration at Metamora may be more expensive to implement than off-site incineration. The estimates are not necessarily within the +50/-30 % range developed for the alternatives retained for detailed screening in the PFS, but the estimate provides additional justification for not examining on-site incineration in detail. Furthermore, the concerns regarding the time to implement the on-site alternative are still valid. Nevertheless, the Region has decided to examine the on-site incineration alternative to the same level of detail (+50/-30 % cost accuracy) as the PFS alternatives retained for detailed screening in order to ensure the accuracy of the above-mentioned cost estimate. The revised cost estimate will be done during the remedial design phase of the project.

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

STEVENS T. MASON BUILDING
BOX 30028
LANSING MI 48909

Gordon E. Guyer, Director

August 18, 1986

Mr. John Tanaka
U.S. EPA - Region V
230 South Dearborn
Chicago, Illinois 60604

Dear John:

Per our telephone discussion of August 13, 1986, this letter is to provide a detailed explanation of the complexities and legal problems associated with the construction permit/operating license requirements of the State's Hazardous Waste Management Act, 1979, P.A. 64, as amended and the administrative rules promulgated thereunder (henceforth Act 64).

Act 64 establishes a two tiered permit program for the establishment of new treatment, storage and disposal facilities (TSDF's). The technical requirements are similar to those under RCRA but the permit system is very different and more involved. Act 64 requires a construction permit for the construction of new TSD's and subsequently an operating license prior to commencement of facility operations.

Construction permits under Act 64 are issued by the Director of the DNR as directed solely by the decision of a Site Review Board as constituted under Act 64. Act 64 Sections 17-20 describe the Site Review Board structure, responsibilities and time lines. The Site Review Board is a nine member panel consisting of the directors of three state agencies (DNR, State Police and Public Health), two independent academicians (one geologist and one chemical engineer) and four temporary members appointed to serve on individual boards as follows: two from the municipality where the facility is proposed to be located and two from the county (one of which lives in the municipality) where the facility is proposed to be located. This structure means that four votes are local and normally opposed to siting the facility. Since five votes are needed to approve a construction permit, denial is almost assured by structure alone.

The Board is permitted to review a construction permit application for any and all matters of concern to the community and is permitted to add stipulations to construction permits to address these concerns. Historically, these additions have been lengthy, involved and expensive even on permits eventually denied by the board. In addition, many of the stipulations established by these Boards have involved both technical and

non-technical factors such as limiting hours and days of operation, landscaping, training and alarms for local communities, etc.

The Board is also charged with evaluating the consistency of new proposals with the State Hazardous Waste Management Plan as adopted by the Hazardous Waste Management Planning Committee and the Natural Resources Commission. Hence, any facility which they feel does not adequately resolve concerns relating to technical, social, aesthetic, environmental or Management Plan considerations may be denied. The DNR has no discretion in carrying out decisions of this board.

The process proceeds as follows:

1. Construction permit application is prepared which must include: (per Act 64 rule R 299.9504)

   A. Application fee

   B. General information as required by 40 CFR 270.13 and 270.14(b-d)(this is a significant amount of information)

   C. A complete hydrogeological report (the requirements of this report may be far more extensive than that required for an RI).

   D. An environmental assessment including a failure mode assessment

   E. A complete environmental monitoring program

   F. Complete detailed engineering plans of process equipment and containment structures sealed by an RPE which include:
      - Various plan views, elevations etc. which layout the facility
      - Specifications on all construction materials and installation methods
      - Basis of design for all process equipment and containment
      - Flow diagrams of the entire process
      - Design capacity of each process

   G. A closure cost estimate

   H. A trial burn plan including all the information required in 40 CFR 270.62(b)(2)

   I. A demonstration of how the process will, for each hazardous waste proposed to be incinerated (These must be enumerated in the application):
      - change the physical, chemical, or biological nature of the waste
      - neutralize the waste
      - recover energy or material resources from the waste
      - render the waste nonhazardous

- the proper feed rates, treatment techniques, operating conditions
- whether the chemicals, etc. will have any detrimental effects on the materials used to construct the facility and if so, the method for controlling the effect.
- whether the hazardous waste contains any constituents or contaminants which might interfere with the intended treatment process (incineration) or decreases its effectiveness and if so how these effects will be controlled.

J. A complete application form signed by the facility operator and the owner of title in fee simple of the property where the facility is proposed.

2. The DNR-Hazardous Waste Division reviews the application to determine if it is administratively complete. If not, no further review occurs. If so, internal technical review begins.

3. Within 120 days of receiving a complete application, the Director of DNR must either deny the application or recommend its approval. If denied, no further action occurs until a resubmittal is made. If recommended for approval the application is referred to the Site Review Board for review. They have 120 days to recommend approval or denial of the application. They have at times, however, exceeded this timetable at their discretion. As pointed out earlier, the board may add requirements onto the facility as part of its deliberations. The Board then recommends approval or denial to the DNR Director who is bound by their decision.

4. Following issuance of a construction permit, the facility may be constructed. No operation may begin until a subsequent operating license is obtained from the DNR Director. A separate application is required which contains:

A. All the information required in the construction permit application

B. Revisions to the closure/post-closure cost estimate and plans

C. A certification of the facility's capability to operate as planned (sealed by an RPE)

D. Proof of financial capability (closure/post closure financial assurance and liability insurance)

E. Proof of issuance of all other necessary environmental permits

F. A license fee

G. A signed application form similar to the construction permit application

5. The Department determines if the application is complete and if not, returns it without technical review. If it is complete, the DNR has 140 days to review the application and either deny it or issue the operating license.

It is important to note that specific waste information is required to support these applications. Because of the 90 day storage limitations of RCRA and Act 64, excavation of the waste to develop highly detailed information is not possible until the operation is ready to begin. Hence, if after construction based on test pitting, we begin excavation and find additional waste types or characteristics, we have to go through the process again for the additional wastes and develop additional technical information. It is also possible as a result of such an event that we may find some of the wastes not amenable to incineration in the incinerator as constructed requiring either an additional incinerator or off-site management of those wastes.

There are several issues to take particular note of in this process.

The requirements that the title owner of the property be a party to the permit and license applications requires that some form of legal relationship be established between the operator agency (DNR) and the title holder of the property (Mr. Russel Parrish.) Since Mr. Parrish is also a PRP for this site this means establishing a relationship with a PRP which our attorneys are unlikely to permit. This will likely mean that no application could ever be submitted.

Also of interest, the financial requirements of the act for closure and liability insurance must be complied with. It is unclear in the current liability market that liability insurance is obtainable and many legal as well as cost problems are associated with the allowed closure financial mechanisms.

Some historical perspective on the site review board may also be useful to you. This board has been convened to review five construction permit applications since 1979. Two have been approved. However, those were captive facilities proposed at the outset of the program. Only one of them has ever been placed in operation, that being the Dow Chemical Company Salzburg Road landfill. Being in Midland with several local members on the board, this case may not be representative. The other facility approved was a small captive one waste stream incinerator which was never constructed. Local awareness of this proposal was low and little controversy resulted.

Cases which have been before the board process and denied include: The Stablex Corporation waste treatment facility, the ERES Corporation incinerator complex and the Environmental Management Systems Landfill site. These cases involved lengthy deliberation and board imposed modifications on the permits prior to ultimately denying each for a variety of reasons, many of which were non-technical in nature. Each of these denials has been challenged in the courts although none of them have been resolved. However, it became clear that obtaining a construction permit through this mechanism was nearly impossible and no one has actually submitted a complete application to attempt to secure such a

permit since the Stablex denial, which is now before the Michigan Supreme Court.

The point of all this is clear. It is extremely difficult to obtain a construction permit for a hazardous waste TSD facility. The timetable, if no administrative mistakes or technical problems are identified includes:

- a 120 day DNR review period
- a 140 day Site review Board Process
- procurement of a construction contractor (can not be done earlier as bids will expire during permit process)
- construction of the facility
- certification of construction and submittal of the operating license application
- a 140 day DNR review period for the operating license application
- a trial burn
- excavation and preparation of buried wastes
- commencement of operation

I would expect a time line to follow something like this:

1. conduct test pitting program - 6-8 months
2. conduct design work 6-8 months
3. prepare construction permit application 3-6 months
4. DNR application review - 3 months
5. Site Review Board review - 3.5 months
6. Procurement of contractor - 6-9 months
7. construction of facility - 6-8 months
8. construction inspection and certification - 1 month
9. review of operating license application - 3.5 months
10. trial burn and review of same - 1-2 months
11. excavation and preparation of wastes for treatment - 6-12 months
12. Commencement of incineration overlapping item 11.

Total time from above: 45-58 months to commence.

I trust this information is useful to you in reviewing this matter with Headquarters staff. Clearly, this process is involved, cumbersome and likely to produce no success in resolving this problem. Even if it worked perfectly, it is likely that it would take almost 4 years to implement this interim action which needs to be implemented long before that. Indeed, selection of a final remedy would have already occurred and would be into the implementation phase by the time this interim remedy could begin. If you have any questions or need additional information please let me know.

Sincerely,

Seth Phillips, Project Manager
Remedial Action Section
Groundwater Quality Division
517-335-3390

cc: Mr. Hogarth/Mr. Willson/Ms. Kerbawy

EXHIBIT 2

MICHIGAN ENVIRONMENTAL PROTECTION REPORT

METAMORA LANDFILL SITE
Dryden Road
Metamora Township, Lapeer County

PROGRESS REPORT #9
April 16, 1987

Contact: Mr. Seth Phillips
Department of Natural Resources
Environmental Response Division
Remedial Action Section
P.O. Box 30028
Lansing, MI 48909
517-373-8448

The Michigan Department of Natural Resources (DNR) and the U.S. Environmental Protection Agency (EPA) are initiating actions at the Metamora Landfill site to determine the impact of pollutants released to the environment and identify means of effectively resolving environmental and health concerns associated with the site. This report is the ninth in a series of periodic reports which will be issued by the DNR to ensure that area residents are kept fully informed of progress made and future plans. Persons wishing to be added to the mailing list to receive these reports should contact the Environmental Response Division, Remedial Action Section at the address listed above.

Drum Investigation

As reported in the previous progress report, the DNR completed its "test pitting" investigation of the two known areas of drum disposal at the Metamora Landfill. Approximately 200 drums were excavated during this operation in December, 1986. Drums contained waste materials of a variety of types. Drums were in varying conditions, some still intact and others broken, rusting and leaking. From inspection of the materials in the drums, we believe that most of the wastes are paint and paint related materials. Such materials include paint sludges, paint bases and thinners.

Analyses of the wastes indicate that much of it is flammable, as might be expected with paint materials. Other characteristics analyzed for include: reactivity, corrosivity, pH (acid or base), EP Toxicity (a hazardous waste parameter involving the metal and pesticide content of wastes) and PCB's (polychlorinated biphenyls). The EP toxicity information is not complete yet. Little of the waste material was reactive or corrosive and strong acids or bases were not found. Some of the wastes did contain high metal content, as might be expected with paints which often use metals in their bases (e.g. lead based paint) or in pigments. Some of the wastes also displayed concentrations of PCB's.

EXHIBIT 2

Department of Natural Resources
Environmental Protection Bureau
Box 30028
Lansing, Michigan 48909

We are very encouraged by what we found during this work. Our previous drum estimates for these two areas were as high as 20-25,000 drums. We now believe that far fewer drums exist in these areas, perhaps 6-7,500 drums. However, we can not know for certain how many drums exist until we complete the full excavation of the area.

Drum Area Cleanup

Based on the decision made last fall, DNR is proceeding with development of the technical specifications for the full excavation and removal of the drums and wastes in the two known drum disposal areas. The Record of Decision (ROD) signed by EPA for this cleanup called for all excavated material to be incinerated in off-site hazardous waste incinerators.

Research conducted, as part of this design work, on the available capacity of existing incinerators has caused DNR and EPA staff concern. Current hazardous waste incineration capacity nationwide is limited. Since much of the excavated wastes from Metamora will be solid or semi-solid material, this capacity problem becomes more severe. Few incinerators are willing to accept large quantities of solid wastes. It currently appears that if existing capacity must be utilized, it could take as long as ten years to complete incineration of the excavated wastes.

DNR and EPA staff are discussing possible alternatives to resolve this situation. As the agencies clarify the issues involved with these various options, public discussion of these options will be initiated. It is clear that any of these options will likely entail a delay in the implementation of cleanup of the drum disposal areas. In summary, the currently available options appear to be:

1. Continue with the current design project. - While the incinerator capacity problem seems clear, without attempting to secure a cleanup contract which includes the requisite capacity, we cannot be sure that the capacity is, in fact, unavailable. This approach would require the DNR to complete the design and specification package currently being developed and attempt to procure a cleanup contractor. This process cannot be completed before September, 1987. If our current capacity assumptions prove correct, no cleanup contract could be awarded at that time. DNR and EPA would then need to develop an alternative strategy, prepare a new design package and initiate a new procurement process.

2. Other treatment approaches - The solid waste stream expected from the Metamora drum cleanup would generate a large volume of material in a variety of conditions containing a variety of contaminants. This presents significant problems to designing potential alternative treatment approaches. Most treatment technologies for solid waste require strict, detailed design and operating parameters to accommodate specific waste characteristics. The varied nature of this waste stream makes determination of appropriate treatment options difficult. It is likely that to be effective many different

wells, conducting a soil gas investigation and a series of aquifer characteristic tests. These efforts will continue through the summer. We hope that these studies will provide sufficient information about the contamination problem and the environmental characteristics of the site to allow us to proceed to the Feasibility Study phase. However, given the size of the Metamora site and its complex geology, there are concerns that some of these investigations as currently planned (Particularly the soil gas effort) may fail to produce sufficient information to completely define the nature and extend of contamination and the environmental characteristics of the site. In such an event, investigative efforts beyond those currently planned may possibly be needed. Following completion of the site investigations, the feasibility study will be conducted to evaluate potential remedial options for the entire site leading to selection of a final cleanup remedy.

Subsequent progress reports will outline the status of these studies.

PEPPER, HAMILTON & SCHEETZ

ATTORNEYS AT LAW

123 SOUTH BROAD STREET
PHILADELPHIA, PA 19109
215-893-3000

10 SOUTH MARKET SQUARE
HARRISBURG, PA 17108
717-255-1155

824 MARKET STREET
WILMINGTON, DE 19801
302-652-2007

38TH FLOOR
100 RENAISSANCE CENTER
DETROIT, MICHIGAN 48243-1157
313-259-7110
DEx (#3606) 313-259-6034

1777 F STREET N.W.
WASHINGTON, D.C. 20006
202-842-8100

606 SOUTH OLIVE STREET
LOS ANGELES, CA 90014
213-617-8151

5 GREAT VALLEY PARKWAY
MALVERN, PA 19355
215-251-0777

WRITER'S DIRECT DIAL NUMBER

April 7, 1987

File No.
30988-16

Michigan Department of
Natural Resources
Office of Superfund
P.O. Box 30028
Lansing, Michigan 48909

Dear Freedom of Information Officer:

Pursuant to the Freedom of Information Act, MCL §15.231 et seq., I am requesting copies of all documents and records regarding the Metamora Landfill site, including, but not limited to, the following:

1. All documents referenced on the attached "Metamora Sanitary Landfill Chronology;"

2. All records regarding Metamora Landfill licenses, inspections and compliance status;

3. All documents concerning the December 1986 drum excavation and removal, including, but not limited to, mass spectrometer results, and geological logs and field notes from both EPA the staff and its contractors;

4. A list of all groundwater wells on- and off-site used by the State in assessing conditions at the site;

5. Any assessment of the potential adverse health effects which may be presented by the site, including, but not limited to, risk or endangerment assessments; and

6. Any aerial photography taken or compiled by the MDNA or EPA or their contractors regarding the site.

EXHIBIT 3

If you decide to deny this request, in whole or in part, I expect to receive written notification of this decision.

In the event that you determine that some portion of the requested documents is exempt from release, I request that you release any reasonably segregable portion of the information which is not exempt. In addition, if you determine that some or all of the file is exempt, I request that you advise me as to what specific documents are being withheld, and state the applicable exemption and explain why it applies in this case.

I understand that there will be a charge for these copies. Please send the copies and the bill to my attention.

Very truly yours,

Thomas P. Wilczak

TPW/dmm
Enclosure
TPW103b

PEPPER, HAMILTON & SCHEETZ

ATTORNEYS AT LAW

123 SOUTH BROAD STREET
PHILADELPHIA, PA 19109
215-893-3000

10 SOUTH MARKET SQUARE
HARRISBURG, PA 17108
717-255-1155

824 MARKET STREET
WILMINGTON, DE 19801
302-652-2007

36TH FLOOR
100 RENAISSANCE CENTER
DETROIT, MICHIGAN 48243-1157
313-259-7110
DEX (#3806) 313-259-8034

1777 F STREET N.W.
WASHINGTON, D.C. 20006
202-842-8100

606 SOUTH OLIVE STREET
LOS ANGELES, CA 90014
213-617-8151

3 GREAT VALLEY PARKWAY
MALVERN, PA 19355
215-251-0777

May 5, 1987

Michigan Department of Natural Resources
Office of Hazardous Waste
P.O. Box 30028
Lansing, Michigan 48909

Dear Freedom of Information Officer:

This letter is to supplement my Freedom of Information Act request of April 7, 1987, pursuant to the Freedom of Information Act, M.C.L.A. §15.231 et seq.

Regarding the Metamora Landfill Superfund site, I am requesting all the documents listed as "references" in the attached "Documentation Records for Hazardous Ranking System," except those listed in references 2, 6 and 10. (The attached "Documentation Records for Hazardous Ranking System" was originally incorporated in the Hazardous Ranking System sheets for Metamora Landfill, reviewed by Anne C. Sause on August 18, 1983.) As to those listed references which are telephone conversations, I am requesting all records of those conversations, including, but not limited to, reports, memoranda, notes, tape recordings or other documentation.

Since these documents were cited in the attached "Documentation Records for Hazardous Ranking System," they are part of the public record by incorporation, and any privilege which they may have had has been waived.

Additionally, I am requesting certain materials and documents cited in the attached "Progress Report #9." Specifically, I am requesting the following:

1. All analytical results of the materials analyzed as a result of the December 1986 drum excavation;

2. All reports, memoranda or other documentation regarding the calculation of the new drum estimate of 6-7,500 drums;

3. All reports, memoranda or other documentation regarding the various possible option alternatives being discussed by the EPA and MDNR for the Metamora Landfill site;

4. All work statements, requests for proposals (RFPs) or contracts for any "separate simultaneous study" to examine the other cleanup options outlined in Progress Report #9; and

5. All reports, memoranda, studies, or other documents regarding "research conducted . . . on the available capacity of existing incinerators".

Furthermore, I am requesting all records, memoranda, correspondence, reports or other documents regarding any revisions, modifications or changes to the Metamora Landfill Site Work Plan dated March 1986.

Moreover, I am requesting certain materials and documents cited in the Record of Decision ("ROD"), and the accompanying Summary of Remedial Alternative Selection and Responsiveness Summary for Metamora Landfill, dated September 30, 1986. Specifically, I am requesting the following:

1. All reports, memoranda or other documentation regarding "the directive from U.S. EPA headquarters" to favor excavation and incineration, or other permanent destruction alternatives, at Metamora Landfill specifically or Superfund sites generally, as referenced at pages 2 and 4 of the Responsiveness Summary; and

2. The Phased Feasibility Study (PHS) for the Spiegelberg, Michigan site which "estimated that the on-site incineration

alternative would cost more than off-site incineration," as referenced at page 6 of the Responsiveness Summary.

Finally, I am requesting a copy of the Action Memorandum, or any other memoranda or documents which authorized the expenditure of funds for the RI/FS at Metamora Landfill.

If you decide to deny this supplemental request, in whole or in part, I expect to receive written notification of the decision. In the event that you determine that some portion of the requested documents is exempt from release, I request that you release any reasonably segregable portion of the information which is not exempt. In addition, if you determine that some or all of the file is exempt, I request that you advise me as to what specific documents are being withheld, and state the applicable exemption and explain why it applies in this case.

I understand that there will be a charge for these copies. Please send the copies and the bill to my attention.

Very truly yours,

Thomas P. Wilczak

TPW/mdk
Enclosures

TPW174

June 23, 1983

DOCUMENTATION RECORDS
FOR
HAZARD RANKING SYSTEM

INSTRUCTIONS: The purpose of these records is to provide a convenient way to prepare an auditable record of the data and documentation used to apply the Hazard Ranking System to a given facility. As briefly as possible summarize the information you used to assign the score for each factor (e.g., "Waste quantity = 4,230 drums plus 800 cubic yards of sludges"). The source of information should be provided for each entry and should be a bibliographic-type reference that will make the document used for a given data point easier to find. Include the location of the document and consider appending a copy of the relevant page(s) for ease in review.

FACILITY NAME: Metamora Landfill

LOCATION: 1911 Dryden Rd., Metamora, MI 48455

References

) Sause, Anne, E&E, Inc; 8/18/83 phone conversation with Dan Schultz, Mich. Department of Natural Resources, Groundwater Div.

) Lungren, Rick; 8/13/82 memo to John Kinnidy, Solid Waste Enforcement Section. Subject: Metamora Landfill, Dryden Rd., PEAS #1377-82.

) Federal Register; Friday July 16, 1982; Part V. Environmental Protection Agency, National Oil and Hazardous Substances Contingency Plan.

) Mursch, Beth, Resource Recovery Div.; July 20, 1982 memo to John Kennedy Environmental Enforcement Div. Subject: Metamora Landfill.

) Resource Recovery Division, Mich. Dept. of Natural Resources, Magnetic Survey. Metamora Landfill. Work conducted between June 30, 1982 and July 2, 1982.

) Keck Consulting Services, Inc.; Hydrogeological Investigation - Metamora Landfill, Feb. 2, 1979.

) Sroonian, Sandra, E&E, Inc; Site Inspection Report, July 21, 1983.

) U.S. Geologic Survey Map; Metamora, Mich. Quadrangle; printed 1965, photorevised 1980.

U.S. Dept. of Commerce, Bureau of the Census, 1980 population figures State of Michigan.

) Lipinski, Leonard; Sept. 23, 1982 memo to file. Subject: Metamora Landfill; Lapeer County; Barrel Sampling.

Sause, Anne, E&E Inc; 8/24/83 phone conversation with Greg Eagle; Environmental Conservation Officer. Mich. Dept. of Natural Resources.

MICHIGAN ENVIRONMENTAL PROTECTION REPORT

METAMORA LANDFILL SITE
Dryden Road
Metamora Township, Lapeer County

PROGRESS REPORT #9
April 16, 1987

Contact: Mr. Seth Phillips
Department of Natural Resources
Environmental Response Division
Remedial Action Section
P.O. Box 30028
Lansing, MI 48909
517-373-8448

The Michigan Department of Natural Resources (DNR) and the U.S. Environmental Protection Agency (EPA) are initiating actions at the Metamora Landfill site to determine the impact of pollutants released to the environment and identify means of effectively resolving environmental and health concerns associated with the site. This report is the ninth in a series of periodic reports which will be issued by the DNR to ensure that area residents are kept fully informed of progress made and future plans. Persons wishing to be added to the mailing list to receive these reports should contact the Environmental Response Division, Remedial Action Section at the address listed above.

Drum Investigation

As reported in the previous progress report, the DNR completed its "test pitting" investigation of the two known areas of drum disposal at the Metamora Landfill. Approximately 200 drums were excavated during this operation in December, 1986. Drums contained waste materials of a variety of types. Drums were in varying conditions, some still intact and others broken, rusting and leaking. From inspection of the materials in the drums, we believe that most of the wastes are paint and paint related materials. Such materials include paint sludges, paint bases and thinners.

Analyses of the wastes indicate that much of it is flammable, as might be expected with paint materials. Other characteristics analyzed for include: reactivity, corrosivity, pH (acid or base), EP Toxicity (a hazardous waste parameter involving the metal and pesticide content of wastes) and PCB's (polychlorinated biphenyls). The EP toxicity information is not complete yet. Little of the waste material was reactive or corrosive and strong acids or bases were not found. Some of the wastes did contain high metal content, as might be expected with paints which often use metals in their bases (e.g. lead based paint) or in pigments. Some of the wastes also displayed concentrations of PCB's.

Department of Natural Resources
Environmental Protection Bureau
Box 30028
Lansing, Michigan 48909

We are very encouraged by what we found during this work. Our previous drum estimates for these two areas were as high as 20-25,000 drums. We now believe that far fewer drums exist in these areas, perhaps 6-7,500 drums. However, we can not know for certain how many drums exist until we complete the full excavation of the area.

Drum Area Cleanup

Based on the decision made last fall, DNR is proceeding with development of the technical specifications for the full excavation and removal of the drums and wastes in the two known drum disposal areas. The Record of Decision (ROD) signed by EPA for this cleanup called for all excavated material to be incinerated in off-site hazardous waste incinerators.

Research conducted, as part of this design work, on the available capacity of existing incinerators has caused DNR and EPA staff concern. Current hazardous waste incineration capacity nationwide is limited. Since much of the excavated wastes from Metamora will be solid or semi-solid material, this capacity problem becomes more severe. Few incinerators are willing to accept large quantities of solid wastes. It currently appears that if existing capacity must be utilized, it could take as long as ten years to complete incineration of the excavated wastes.

DNR and EPA staff are discussing possible alternatives to resolve this situation. As the agencies clarify the issues involved with these various options, public discussion of these options will be initiated. It is clear that any of these options will likely entail a delay in the implementation of cleanup of the drum disposal areas. In summary, the currently available options appear to be:

1. Continue with the current design project. - While the incinerator capacity problem seems clear, without attempting to secure a cleanup contract which includes the requisite capacity, we cannot be sure that the capacity is, in fact, unavailable. This approach would require the DNR to complete the design and specification package currently being developed and attempt to procure a cleanup contractor. This process cannot be completed before September, 1987. If our current capacity assumptions prove correct, no cleanup contract could be awarded at that time. DNR and EPA would then need to develop an alternative strategy, prepare a new design package and initiate a new procurement process.

2. Other treatment approaches - The solid waste stream expected from the Metamora drum cleanup would generate a large volume of material in a variety of conditions containing a variety of contaminants. This presents significant problems to designing potential alternative treatment approaches. Most treatment technologies for solid waste require strict, detailed design and operating parameters to accommodate specific waste characteristics. The varied nature of this waste stream makes determination of appropriate treatment options difficult. It is likely that to be effective many different

approaches would be needed simultaneously. Each approach would require development and extensive testing. Discussions with design engineers on this subject indicate that appropriate and effective technologies other than incineration are not readily available, and that development of viable treatment approaches would be a long, difficult task at best.

3. Landfill the solid waste in an approved hazardous waste landfill. Landfill capacity for solids disposal is less of a problem than incineration capacity. It is also likely to be significantly less expensive than incineration approaches. However, the Superfund law contains language directing cleanups away from landfilling remedies favoring instead permanent remedies such as waste treatment or destruction. This philosophy is a sound one intended to reduce our use of land burial and move the nation toward destruction/detoxification of its wastes.

   EPA has suggested that landfilling might be acceptable if the solids are first treated to stabilize or detoxify them and/or a thorough analysis done to show that the wastes to be landfilled will generate no contaminants or could not harm the environment if contaminants were lost from a failed landfill. However, as discussed above, adequate treatment approaches to the waste are unlikely to be available or viable. If a successful demonstration could be made on untreated wastes, it would argue against removing the waste from the site in the first place.

4. On-site incineration - Development of an incineration facility at the cleanup site would resolve the incineration capacity issue. Design of such an incinerator would be complex and time-consuming, but is technically viable. It is likely that such a cleanup would be quicker and less costly than off-site incineration since we would control the capacity. However, all design and emission considerations would need to be developed and a thorough waste analysis completed to ensure the effectiveness and environmental safety of such an operation.

   In order to conclusively determine the available commercial incineration capacity, and therefore the feasibility of off-site incineration, DNR will proceed with the current design project. However, anticipating that other approaches may be needed, DNR will also contract for a separate simultaneous study to further examine the other options outlined in this report. This study should provide sufficiently detailed information to permit a decision to be made on an alternate approach if it becomes necessary.

Further Site Investigations

With Spring approaching, we are now resuming the remainder of our site investigation efforts. Included in this work plan are: Collection and analysis of drum samples, groundwater monitoring well samples, soil samples, surface water and sediment samples, installation and sampling of additional groundwater monitoring

wells, conducting a soil gas investigation and a series of aquifer characteristic tests. These efforts will continue through the summer. We hope that these studies will provide sufficient information about the contamination problem and the environmental characteristics of the site to allow us to proceed to the Feasibility Study phase. However, given the size of the Metamora site and its complex geology, there are concerns that some of these investigations as currently planned (Particularly the soil gas effort) may fail to produce sufficient information to completely define the nature and extend of contamination and the environmental characteristics of the site. In such an event, investigative efforts beyond those currently planned may possibly be needed. Following completion of the site investigations, the feasibility study will be conducted to evaluate potential remedial options for the entire site leading to selection of a final cleanup remedy.

Subsequent progress reports will outline the status of these studies.

STATE OF MICHIGAN

JAMES J. BLANCHARD, Governor

DEPARTMENT OF NATURAL RESOURCES

STEVENS T. MASON BUILDING
BOX 30028
LANSING, MI 48909

GORDON E. GUYER, Director

May 20, 1987

Mr. Thomas P. Wilczak
Pepper, Hamilton and Sheetz
36th Floor
100 Renaissance Center
Detroit, Michigan 48243

Dear Mr. Wilczak:

I am in receipt of your supplemental request under the Freedom of Information Act (FOIA) for material from the Metamora Landfill file. In accordance with instructions from Dr. Lawrence Halfen I am attempting to coordinate your requests with his to avoid unnecessary duplication. This letter is to explain some of this coordination in relation to your request and to respond to certain items in your FOIA request.

1. Dr. Halfen has already requested and will receive all currently available analytical data from samples collected from the drums excavated in December, 1986. No data has been received from the National Contract Laboratory Program and so this data is not available. The available data include various characteristic information and a limited amount of specific compound analysis. I will not send this data to you as it is being sent to Dr. Halfen.

2. As previously discussed, the calculation of drum numbers and associated drum information will all be contained in a technical memorandum being prepared by our investigation contractor. I have made a note to send you this report when it is finaled which I will do. I have no other documents pertaining to the information requested by you in this regard and so will not be sending anything to you until the report is available.

3. You requested documentation regarding various alternatives to off-site incineration being discussed between MDNR and U.S. EPA. There are no such documents. Discussions to-date between the agencies have been by telephone. EPA wishes for MDNR to proceed with the current design and procurement action rather than to consider other options until such time as the current option is proved not to be viable.

4. A copy of the request for work plan for the "separate simultaneous study" to examine other drum cleanup options will be sent to you.

5. Copies of memos in the file pertaining to our concerns about commercial incineration capacity will be sent to you.

6. All RI/FS work plan documents and revisions are being sent to Dr. Halfen already.

Your FOIA request also addressed certain items pertaining to the Record of Decision (ROD) for this site. The following responds to these requests.

1. There are no documents, etc. which outline EPA's directive to favor incineration over other cleanup options. The Phased Feasibility Study (PFS) discussed several options only two of which involved total waste destruction, off-site and on-site incineration. EPA made clear in several telephone discussions that total destruction (non-disposal) options were to be the only options they would support. This was due to language being proposed at that time in the reauthorization of the Superfund law requiring remedy selections to favor such options. This language was subsequently adopted.

2. The Spiegelberg PFS will be provided.

Based on a phone conversation with Bill Walsh of your office on 5/19/87, copies of the cooperative agreement files and of memos authorizing use of State funds for this project will be sent.

The materials indicated herein which will be sent to you are being duplicated along with the other items in your first response. This material will be forwarded as soon as possible.

Sincerely,

Seth Phillips, Project Manager
Remedial Action Section
Environmental Response Division
517-373-8448

Technical Report
Concerning the Metamora Municipal Landfill, Lapeer County, Michigan

Prepared by:

Lawrence N. Halfen, Ph.D.
ENVIRONMENTAL CONSULTATIONS
519 Charlotte, N.W.
Grand Rapids, Michigan 49504

September, 1987

TABLE OF CONTENTS

1.0 Introduction

1.1 Purpose

The purpose of this report is to:

(a) evaluate the existing data at the Metamora Landfill site ("Site" or "Landfill") to determine its adequacy;

(b) determine whether sufficient information was available upon which to base any remedial decision;

(c) provide a professional judgment concerning how many drums exist at this Site;

(d) evaluate the effects of MDNR's prior excavation test pit activities;

(e) assess the likelihood of chemical migration from the Site;

(f) assess the public health risks, if any, from the Site; and

(g) evaluate briefly the remedial options, particularly excavation and incineration.

The conclusions in this report are based upon:

- the existing raw data, including the results from the December 1986, test pit excavation;
- direct observations at the Site;
- EPA, MDNR, and E.C. Jordan technical memoranda;
- agency guidance, policy, and regulations;
- the general scientific literature;
- in this expert's best professional judgment, based on 20 years of experience in the environmental field; and
- interviews and conversations with various persons, including Eugene Parrish (former site operator) and EPA and MDNR personnel.

1.2 Summary

The Metamora Landfill has not been adequately investigated. An informed decision as to a final course of action to deal with the Site, therefore, is not possible now. The existing ROD is flawed and the remedial alternative selected therein represents an expensive and ineffective alternative.

Substantial and significant new information is now available. In this expert's professional judgment, this new information, in and of itself, requires the EPA to gather additional information and reconsider all of its remedial alternatives before proceeding to implement a remedy. This conclusion is reinforced by the inadequacies and errors in the original remedial selection process.

Originally, E.C. Jordan grossly overestimated the number of drums on this site due to the use of unrealistic assumptions. MDNR test pit activities demonstrate that there are fewer drums than anticipated.

The test pit excavations also graphically demonstrate how excavation creates its own risks. During this activity, volumes of previously contained wastes were disposed of directly into the soils. The present method of storing the excavated drums in staging areas also exposes these drums to the weather and provides an opportunity to generate leachate, thereby releasing chemicals into the environment.

Existing data indicate that there is no present exposure; therefore, there is no present risk. New data overwhelmingly demonstrate that the Landfill is underlain by a substantial clay/till layer. This clay layer provides a substantial barrier to migration. There is no evidence

(well log, water quality data, or remote sensing information) which indicates a plume exists. Groundwater containing chemicals apparently exists in limited geographic pockets or pools.

Future risk is unlikely because there is no hydrogeological connection between the surface overburden groundwater that might contain chemicals from the Site and the bedrock groundwater that is used for drinking water. Even the risk presented by downgradient overburden groundwater on Site is not significant. These concentrations are generally less than ARARs and, for chemicals without ARARs, less than concentrations that correspond to the 10^{-5} upper-bound lifetime cancer risk level or the reference dose.

There is not sufficient information available to make a final remedial decision at this point. The following general conclusions can be made concerning the remedy selection process and the EPA's choice of excavation and off-site incineration:

- EPA's Record of Decision ("ROD") fails to consider numerous reasonable in situ containment remedies;
- excavation and either landfilling or incinerating do not provide substantially greater protection of public health than in situ containment remedies or the no action alternative. In fact, in this expert's opinion, the risk of implementing excavation and either landfilling or incineration may be substantial, and will be significantly greater than the risk of the no action alternative or the risk of implementing in situ containment remedies;
- excavation and incineration of soil have not been attempted on this scale, and therefore, is an unreliable technology;
- landfilling shifts the risk to a new location, but does not significantly reduce that risk;

- excavation and incineration do not destroy the metals in the soil and in fact could result in higher concentrations. This option, therefore, presents the same risk after implementation of the remedy (albeit an insignificant risk) from dermal exposure to metals as an in situ containment remedy or the no action alternative;

- off-site landfilling or incineration involve risks during transportation;

- off-site incineration capacity is insufficient to implement the remedy selected by the EPA; and

- excavation and either landfilling or incineration are substantially more costly than equally protective and reliable in situ containment remedies.

There are a number of alternatives not considered by E.C. Jordan that provide equal or greater protection of public health at a substantially lower cost. There is insufficient information at this time, however, to select among the no action alternative and various in situ remedial alternatives. These alternatives should be considered by the EPA when it reopens the remedy selection process.

2.0 Site Description and History

The following will describe the location of the Site, the Landfill's history, the hydrogeological setting, the extent of chemical migration and the EPA's decision-making process.

2.1 Site History

The Metamora Landfill is located one-half mile northwest of the Village of Metamora in Michigan (See Figure 1). The area is primarily rural. The nearest downgradient drinking water well is 1,500 feet to the north and is screened in a deep bedrock aquifer, which is confined by a thick overlying layer of clay.

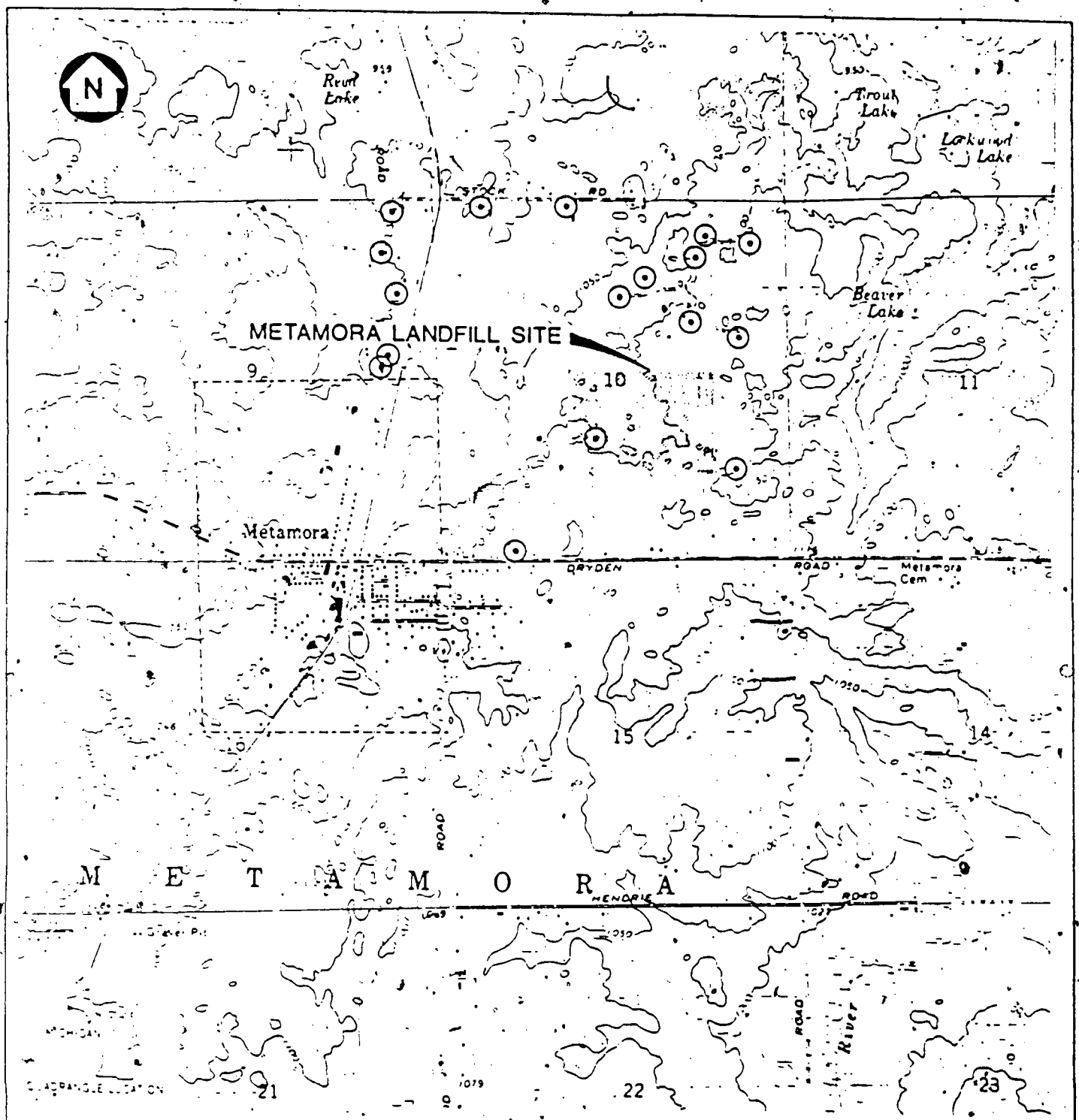


FIGURE 1
SITE LOCATION MAP

E.C. JORDAN CO.

A brief chronology has been compiled describing the history of the Landfill, based on the written records reviewed to date and interviews with the former site operator and present operator of a transfer station on the Site on February 19 and 25, 1987, ("E. Parrish Interviews").

Chronology

1955: Russell Parrish began operating a municipal landfill on his property. The Landfill was intended to accept municipal and commercial refuse. Parrish was encouraged to operate the landfill by the Metamora Township. Apparently, the Township had indicated that it might even condemn the Parrish's land. Initially, Parrish's Landfill was operated in concert with the Township

1955-Onward: The Landfill was operated like many other municipal landfills in the United States. Based on existing records and interviews, it would appear that the Landfill was initiated and operated in accordance with then applicable law. Different areas were used at different time periods until the area was filled. Generally, a soil cover was placed over the material disposed of during the day. The E. C. Jordan Phased Feasibility Study (August, 1986) ("PFS") identified five areas of waste disposal (numbered I through 5). For convenience, this report will use these same designations. The overwhelming majority of materials accepted for disposal at the landfill consisted of municipal and commercial refuse (e.g., old refrigerators, sinks, washing machines, automobile parts, tires, and even a huge quantity of pickles) (interview with former operator, observations of Area 5 at the Landfill which has over a 100 foot vertical face that is exposed; the results of the test pit excavations performed to date; and E. Parrish's business records).

1966: The Landfill received a Sanitary Landfill License under Michigan Act 87.

1979-1980: Keck Consulting Services performed several studies in support of E. Parrish's attempt to obtain a Solid Waste Management Act permit.

1981: MDNR denied an application for expansion of the Landfill to receive solid wastes pursuant to Michigan Act 641.

1981: Eight drums were uncovered in Area 4 during excavation to construct a transfer station. MDNR sampled the drums. Several chemicals were qualitatively identified in the analysis, but no concentrations were determined. MDNR reburied the drums on site.

1982: MDNR excavated test pits in Areas 1 and 4 and uncovered a limited number of drums. These drums also contained chemicals and were reburied on the site.

1985: E.C. Jordan, a consultant to MDNR, performed a limited, preliminary site investigation.

1986: Jordan completed the PFS documenting the results of its preliminary investigation and evaluating a limited set of remedial alternatives.

1986: EPA issued a Superfund Record of Decision selecting excavation and off-site incineration as the remedy.

1986: MDNR's contractor excavated test pits and took samples in December (described in more detail below).

1987: DNR Progress Report #9 was issued. This report provides the initial results of the test pit excavation field work and some new results concerning the availability of off-site incineration.

2.2 Site Geology and Hydrogeology

The geology of the site consists of approximately 250 feet to 350 feet of overburden, i.e., surficial deposits, overlying the Marshall Sandstone bedrock formation, which is the primary water-bearing aquifer in the region (PFS at p.14). The overburden contains water which flows at

various velocities depending upon the permeability of the soil. This overburden groundwater (called the surficial aquifer) is perched in portions of this region, i.e., there are pockets of groundwater in relatively permeable soil overlying and surrounding an area of the overburden that has soil that is relatively impermeable. (Keck, at 7, 1979). The groundwater in a perched water table does not migrate substantial distances unless there is a pathway of permeable soil connected to the perched water table.

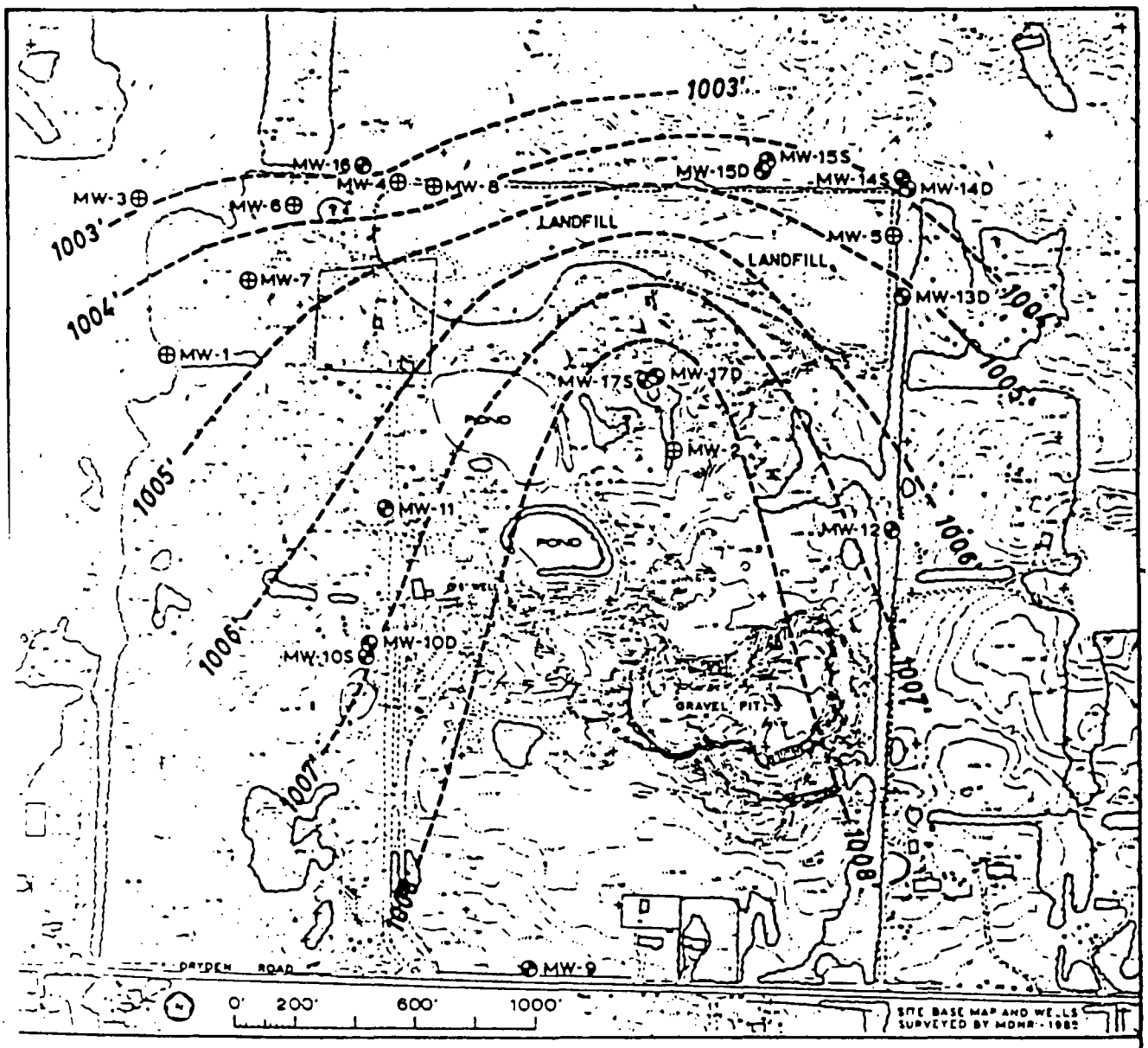
The overburden at the Landfill is a glacial drift material consisting of various thicknesses of clay, sand and gravel (Keck Report, at 6, 1979). A seismic survey conducted at the site in 1987 indicates that

> the till is continuous under the site and that the minimum thickness of this deposit is approximately 150 feet . . .[attached to this Report as Figure 2]. The till, because of its presumed hydraulic properties, serves as an aquiclude between the upper surficial aquifer and the underlying Marshall Sandstone, the major water-bearing aquifer for the region. [E.C. Jordan Draft Technical Memorandum, at p.7, February, 1987].

E.C. Jordan concluded that the survey was successful and correlated with existing well log data (Jordan, at p.7, 1987).

The PFS attempted to contour the groundwater elevations (Figure 3) to indicate the direction of groundwater flow, and speculated concerning the groundwater velocity (PFS, at p.22). In this expert's opinion, the PFS' conclusions concerning groundwater velocity are inconsistent with prior data and based on insufficient data. The recent remote sensing data confirms this view.

FIGURE 2



(?) MAGNETIC ANOMALIES

⊕ PREVIOUSLY-EXISTING SITE WELLS

"SHALLOW" WELLS, THIS INVESTIGATION

"DEEP" (SOIL) WELLS, THIS INVESTIGATION

-1003'- INFERRED ELEVATION OF THE WATER TABLE 09-16-85 - MSL DATUM

FIGURE 3 - SITE AREA

INTERPRETIVE WATER TABLE ELEVATION

SURFICIAL AQUIFER

ECJORDANCO

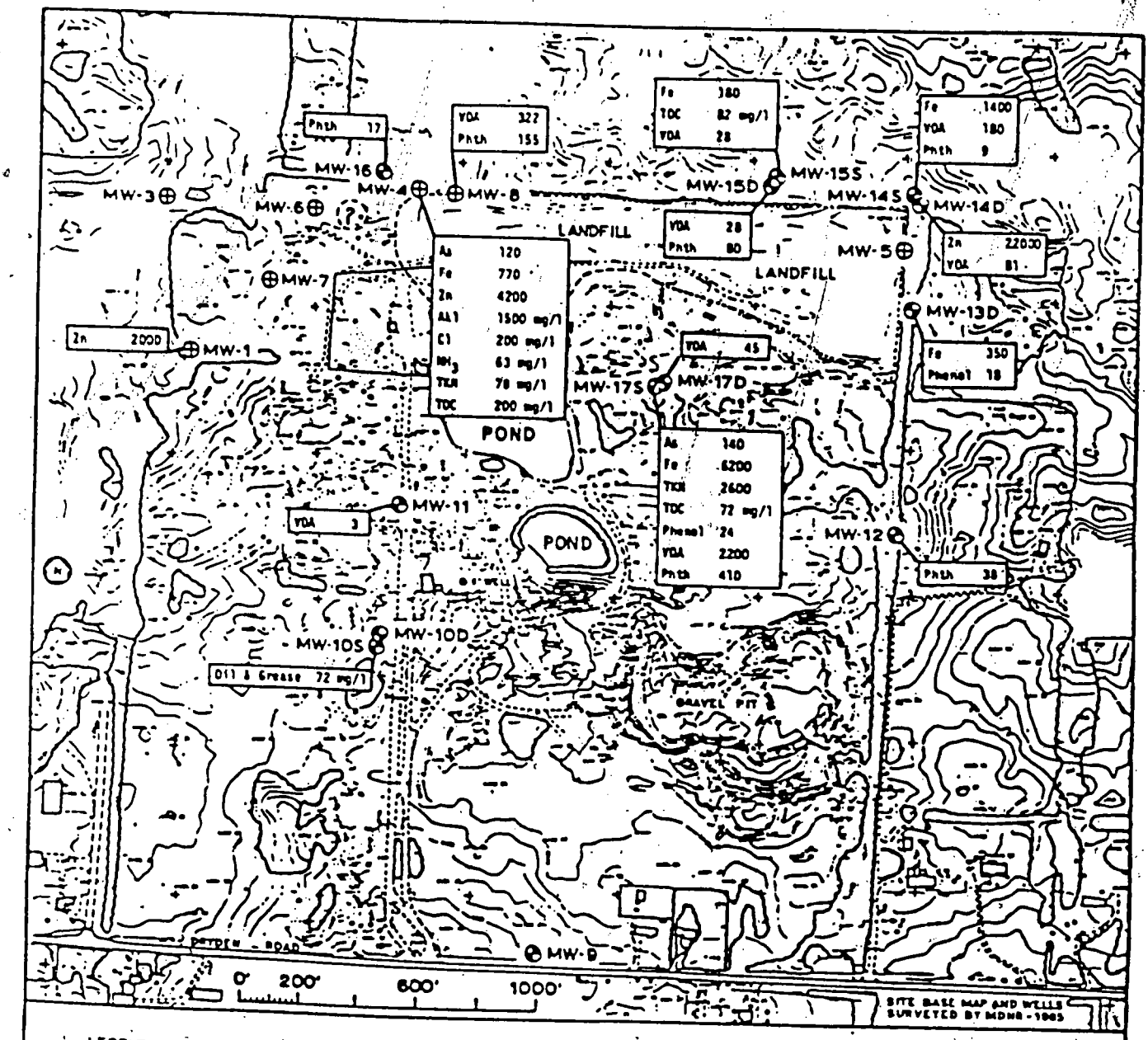
2.3 Chemical Data

The chemical data indicate no consistent pattern of contamination (Figure 4). Most wells show no contamination and only three shallow wells, located in the municipal waste disposal area itself, wells 14s, 15s and 17s, show concentrations of any note (See Figure 4 and PFS at Table 2.6). MDNR monitored all of the nearby downgradient drinking water wells and none contained any chemicals related to the site.

The test excavation information indicates that drums were disposed of at the site. These drums contain chemicals which are now regulated as "hazardous substances", at least when those substances are above a certain level.

It is unknown whether the contents of the drums were regulated as hazardous substances at the time of disposal. In this expert's opinion, however, it is unlikely that they were. The EPA did not issue its initial hazardous waste regulations until May, 1980. The site was essentially closed in 1980 before the EPA regulations were issued. Also, Eugene Parrish asserts that no drums were accepted from at least 1972 on, when he operated the site (E. Parrish Interview).

It must also be recognized that all municipal landfills contain chemicals regulated as hazardous substances because a number of household products, such as dust sprays, cleaners and Chlorox, contain chemicals regulated as hazardous substances. (EPA, at 3-6, 1986g).



LEGEND

NOTE: Only elevated concentrations of contaminants of interest above background are presented. Concentrations are in micrograms per liter unless otherwise noted.

FIGURE 4 SITE AREA

CONTAMINATION IN GROUNDWATER (SURFICIAL AQUIFERS)

EC JORDAN CO

It is clear from examination of the site, as well as interviews with the site operator, that the vast majority of material sent to the site was municipal and commercial refuse such as refrigerators, stoves, automobile parts, and other metallic objects.

2.4 Migration of Chemicals

In previous studies of the Landfill, the existing chemical and remote sensing data are in remarkable agreement with each other. All of this information indicates that there has not been any significant migration of chemicals from the site in over thirty years of operation.

For example, the 1979 Keck Study (at p.7) concluded that "clay barriers act to prevent or retard vertical percolation of surface-source contaminants over much of the area." Well logs from the area indicate a thick clay layer exists beneath the Landfill, as does the seismic data.

The chemical data indicate no consistent pattern of chemical migration even though the Landfill is over thirty years old. A resistivity survey was performed in 1986 precisely to determine if there was a contaminant plume in the overburden. (Jordan at p.5, 1987).

Jordan concluded that the

> resistivity data do <u>not</u> indicate the presence of a conductive contamination plume along the northern toe of the Landfill. If a sufficiently conductive contamination plume exists in this area, it should have been possible to detect with the program which was implemented. The lack of a conductive contaminant plume is consistent with previous water quality data.

and may indicate that a contamination plume is not a factor of serious concern at the Metamora Landfill. (emphasis added) [Jordan, at p.5, 1987a].

In this expert's judgment, all of the existing information strongly indicates that, even thirty-three years after operations at the Landfill were initiated, there has been virtually no migration horizontally or vertically.

As a matter of prudence, however, the Remedial Investigation at this site should include installation of additional groundwater wells, groundwater quality analyses, and permeability tests to confirm the existing data. There is, however, no present risk and a significant future risk appears unlikely (See Section 6.0).

2.5 Summary of The Phased Feasibility Study and ROD

The PFS contains a flawed evaluation of the hydrogeology of the site. Even so, based on more recent information, this evaluation has been rendered irrelevant (See discussion below). The PFS also estimated that there were 35,000 drums buried at the landfill (25,000 in Areas 1 and 4 and 10,000 in Areas 2, 3, and 5). Recent information also demonstrates that these are gross overestimates (See Section 3.1).

The PFS evaluated the following potential remedial alternatives:

	Cost
o No action;	$ 432,000
o Excavation and Land Disposal on Site;	$ 5,600,000
o Excavation and Land Disposal off Site;	$11,500,000
o Excavation and Incineration off Site; and	$41,500,000
o Excavation and Incineration/ Land Disposal off Site	$12,000,000

The PFS recommended excavation and off-site incineration, ostensibly because excavation and on-site disposal would be "uncertain" due to problems in permitting and, because the selected alternative is only slightly more expensive than the next option, yet provides for destruction and volume reduction for a portion of the waste. (PFS, at p.3).

On September 30, 1986, the Regional Administrator signed the ROD selecting excavation and off-site incineration as the remedy for the site (at a cost of approximately $41.5 million). A Summary of Alternatives (at p.5), accompanying the ROD, indicated that one of the major rationales for rejecting an on-site remedy was the need to comply with State permit requirements. The only on-site containment alternative considered was construction of a Subtitle C RCRA facility.

3.0 New Information

New information is now available that fundamentally changes the underlying assumptions used in the PFS and EPA's selection of a remedy: This new information indicates that:

- there are significantly fewer drums at the site than previously indicated, i.e., 24 to 30% of the original estimate by MDNR's new estimate (Progress Report #9) by 20% of the original estimate by E.C. Jordan's estimate (Jordan, 1987a), and less than 10% of the original estimate by this expert's calculation;
- there has been no significant migration of chemicals in the thirty-three years since Landfill operations began (See Section 2.4);
- migration of chemicals is unlikely in the future (See Section 4.0);
- the risk presented by the site even without remedies is probably zero because there is no downgradient hydrogeological connection between

the surficial aquifer and aquifer used for drinking water. Even for the surficial aquifer, the risk is low (less than 10^{-5}) and this aquifer is not used for drinking water supplies immediately north (downgradient) from the site. This risk level is lower than the risk level typically considered acceptable (Section 4.0); and

- there is no off-site incineration capacity available, and the costs of incineration are significantly higher than indicated in the PFS.

3.1 The Number of Drums at the Site

MDNR excavated "preliminary" test pits at the Landfill in December, 1986. Approximately 200 drums were excavated at that time and their contents sampled. On April 26, 1987, the MDNR issued Progress Report #9 detailing these efforts. This Progress Report and an independent analysis indicate that there are significantly fewer drums than the EPA originally believed existed. The MDNR "now believes that far fewer drums exist in these areas, perhaps 6,000-7,500 drums." Id. at 2. The EPA originally assumed there were 25,000 drums buried in Areas 1 and 4. MDNR personnel have indicated, however, that no formal calculation has been performed. (Personal conversation).

Jordan originally estimated that there were 35,000 drums at the Site (25,000 in Areas 1 and 4 and 10,000 in all other areas). Jordan's estimate was based on the following assumptions:

- all deposits of drums were 10 feet thick;
- the drums were buried in a random orientation with the space between the drums occupying 50% of the volume of the drum deposits;
- all drums were whole and uncrushed; and
- the number of drums in the area is the product of the magnetic anomaly reading, the 10-foot thickness and the 50% packing factor which is then divided by the volume of a single drum.

3.1.1 Methodology

Many of these assumptions are unrealistic and do not correspond to the facts as they are now known. The MDNR acknowledged this when they revised the estimate of the number of drums in Areas 1 and 4 from 25,000 to 6,000 to 7,500 (Progress Report #9). Surprisingly, E.C. Jordan's new estimate of the number of drums is lower than the MDNR's, i.e., 4,900 compared to 6,000 to 7,500 (Jordan 1987b).

The following is this expert's analysis of the problems with the original assumptions and proposed more realistic assumptions. For the sake of simplicity, this analysis will essentially use the E.C. Jordan methodology in estimating the number of drums; where appropriate, however, the more appropriate assumption will be used.

3.1.2 Drum Deposit Thickness

Jordan's assumption that all deposits are 10 feet thick is arbitrary. There is no justification or explanation for this figure in any document. This assumption also suggests that the drums were buried in a solid mass, which may not have been the case. A decrease of this factor to 5 feet would reduce the drum numbers by 50%. In this expert's judgment, 5 feet would be more realistic.

3.1.3 Orientation of the Drums

According to the MDNR's own study, it is thought that drums were co-disposed with general refuse. Under these circumstances, it is an

unrealistic assumption that 50% of the volume in the area of drum disposal is due to drums.

Even in Area 1, records show that there was significant tire and other refuse disposal in the same area where drum disposal apparently occurred. The space occupied by the tires and various other refuse is not factored into these calculations. In this expert's judgment, a 25% volume is more reasonable.

3.1.4 Whole or Crushed Drums

Review of the MDNR records for past drum excavations at this site indicates that not all of the drums discovered on site have been whole or uncrushed. A significant number of drums recovered in every attempt to excavate drums at this site have been crushed. The crushed drums probably were placed in the Landfill in that condition, according to the site operator. The presence of crushed drums will result in a more positive magnetometer reading over an area than if only full drum disposal occurred.

This is not to say that there are no full drums on this site. Assuming that all of the drums are whole, however, is contrary to the known facts and therefore inappropriate.

3.1.5 The Presence of Other Metallic Objects

E.C. Jordan assumed in its original calculations that all positive readings in the magnetometer survey were the result of drums. This ignored the possibility of disposal of other types of ferrometallic wastes which has now been confirmed. Approximately 400 tons

of white goods were sent to the Site each year (E. Parrish Interview). This commercial waste included iron-containing scrap, automobile parts, agricultural equipment, steel-based domestic garbage, and tires (which can give a positive reading on a magnetometer, especially if those tire deposits are close to the surface of the landfill, as in the case in Area 1).

Parrish also indicated that, in the early days of the Landfill operation, metal had virtually no value and was co-disposed with wastes. Even present-day examination of the Site reveals water tanks, car bodies, and white goods, such as those exposed at various locations on the property.

This type of refuse will result in magnetic anomalies during a magnetometer survey. None of this volume of material was considered in the Jordan evaluation assumptions.

3.1.6 A More Reasonable Worst Case Estimate of The Number of Drums

In my opinion, realistic "worst-case" assumptions would include using a 5-foot packing layer, a 0.25 packing factor, and an assumption that 25% of the positive readings in the magnetometer survey were due to white goods. These assumptions would place the worst-case total Site drum estimate (approximately 3,000) at less than 10% of the original estimate of 35,000 drums. This figure, however, is still a worst-case estimate because many drums were crushed, some drums were filled with non-hazardous solids, and there was significant disposal of metallic objects.

3.2 New Hydrogeology and Plume Information

More comprehensive and reliable information is now available concerning the clay layer beneath the site and the degree of chemical migration, if any, at the site (See Section 2.2 to 2.4, above). In this expert's professional judgment, the data existing on September 30, 1986, did not indicate that there was plume, nor did it indicate that significant migration was likely in the future.

The new information, however, makes that conclusion virtually undeniable. This information, therefore, means that there is little or no future risk from this site, in this expert's judgment (See Section 4.0). This information alone, therefore, requires reconsideration of the extremely expensive and ineffective remedy selected by the EPA.

3.3 Availability of Incineration

The MDNR's own evaluation, and this expert's review of published information, and this report's evaluation indicate that there is not sufficient off-site incineration capacity at the present time to implement the EPA-selected remedy.

3.3.1 MDNR Evaluation

The MDNR has investigated the availability of off-site incineration since the ROD was signed. This investigation concluded that current hazardous waste incineration capacity nationwide "is limited" and, if existing capacity must be utilized, it could take as long as ten years

to complete incineration of the excavated wastes (Progress Report #9, at p.2). Also, appropriate and effective technologies other than incineration "are not readily available" and the development of other treatment approaches would be "a long, difficult task at best." Id.

Nevertheless, the MDNR indicates that it will proceed with the current design of an excavation and incineration remedy. The MDNR also will contract for a separate simultaneous study to examine other remedial options. That study is intended to provide information to "permit a decision to be made on an alternate approach if it becomes necessary." Most importantly, the MDNR staff recommended that the design of the excavation and off-site incineration remedy not be continued and the MDNR "pursue a new approach, either landfilling of the solids or on -site incineration." (Progress Report #9).

3.3.2 Review of Published Information

A review of the available published literature also indicates that there is not sufficient off-site incineration capacity to allow implementation of the ROD.

As a result of increasing Superfund activity and a variety of new EPA regulations (e.g., EPA 1986b),

> the amount of hazardous waste that might be reduced to commercial incineration . . . are expected to result in an excess of demand over existing capacity of commercial incineration facilities of 215-306% for liquid wastes alone . . . . Solid hazardous waste and Superfund cleanup residues would further increase the shortfalls. [Oppelt, at p.317-318, 1986].

The supply of waste management alternatives is fixed in the short term by the length of time it takes to design, build and, most importantly,

obtain a permit for such facilities.

The supply is even more limited, however, because the EPA Superfund regulations now limit which existing landfills and incinerators can receive hazardous wastes from Superfund sites. EPA regulations require Superfund removal and remedial actions "that involve storage, treatment, or disposal of hazardous substances, pollutants or contaminants at off-site facilities shall involve only such off-site facilities that are operating under appropriate federal or State permits or authorizations and other legal requirements." Code of Federal Regulation, Volume 40, Parts 300.65(g), 300.68(a)(3). The EPA's policy also is that "no CERCLA [Superfund] hazardous substances shall be taken off-site to a RCRA facility if the receiving Region's Administrator determines that the facility has significant RCRA violations or other environmental conditions that affect the satisfactory operation of the facility." Memorandum from J. Winston Porter, Assistant Administrator, to Regional Administrators, Regions I-X, Re: CERCLA Compliance with Other Environmental Statutes (Oct. 2, 1985), in 50 Fed. Reg. 47,949 (Nov. 20, 1985).

The EPA has noted that "the Agency's 'Off-Site Policy' for disposing CERCLA waste contains stringent criteria that could render some existing capacity unavailable for the management of CERCLA wastes." 50 Fed. Reg. at 40,584. This policy has been incorporated into Section 121 of the Superfund Amendments and Reauthorization Act of 1986.

The EPA has also announced that it will shutdown any solid waste incinerator that does not meet the RCRA regulations based on field tests

that are required to be performed before November 8, 1989. (BNA 1986c). This position will further limit the supply of incinerators available to destroy soils.

The supply of off-site incineration capacity will also tend to grow more slowly in the future because the new regulatory requirements are more stringent, are more costly to achieve, and require longer permit processing. For example, EPA officials have noted that

> increasingly, it is not enough that you satisfy the Environmental Protection Agency. You may also have to convince the public. [BNA, at p.1278, 1986b].

Also, it has been noted by the EPA that

> permitting and siting difficulties are significant impediments to the development of commercial incinerator capacity through the use of industrial kilns for waste disposal. Consequently, little growth of available commercial incineration capacity may be expected over the short term. [Oppelt at p.318, 1986].

3.3.3 Evaluation of Availability of Incineration

This review allows one to conclude that incineration capacity is not presently available to treat substantial amounts of soil from the Site. The following is not an exhaustive evaluation. All incineration facilities are regulated by the EPA. The most exhaustive data base is the EPA's own files. The EPA, not an independent consultant, is, therefore, in the best position to supply factual information concerning this question.

There are a limited number of commercial incineration facilities

that accept hazardous waste. Most facilities are not available because they are captive incinerators, i.e., they handle only the in-house wastes from the owner's own facility. Other incinerators are eliminated from consideration in this case because they can treat only liquid wastes as opposed to soils.

Among the potential commercial facilities there is:

- the SCA incinerator in Chicago, Illinois. This facility is permitted to incinerate RCRA and PCB wastes. It is approximately 300 miles from the Landfill;
- the Rollins incinerator in Texas. This facility is also permitted to treat RCRA and PCB wastes;
- the ENSCO facility in El Dorado, Arkansas. This facility is 1,090 miles away and is also permitted to incinerate RCRA and PCB wastes; or
- one facility in Calvert City, Kentucky (640 miles away) and one in East St. Louis (590 miles away).

All of the current incinerators have substantial backlogs. A facility would be required to disrupt their business relationships with hundreds of established customers to treat the Metamora Landfill soils. Furthermore, RCRA and PCB regulations limit the amount of time a facility can store RCRA and PCB wastes. It is, therefore, unlikely that either the incineration facility or their regular customers could, as a practical matter, delay incineration of their own wastes for the substantial length of time it would take to incinerate the soils from the Metamora Landfill.

The greater the distance between the incineration location and the Landfill, the less available an incinerator is as a practical matter. Long distances not only increase the risks, costs and logistical problems of treating the wastes and soil, but they increase the likelihood that some state or local government may object to the transportation or incineration of the soils.

4.0 Preliminary Qualitative Evaluation of the Risk To Human Health that May Be Presented By the Site

A preliminary qualitative evaluation of human health risks derived from this Site must include consideration of the methodology employed in determining those risks, the present risks currently recognized at this Site, the future risks which may be created as activities proceed at this location and the limitations of the risk assessment process.

4.1 EPA's Assessment

The mere presence of a known or suspected carcinogen does not present an unacceptable risk. Potential for exposure, as well as the intensity and duration of that exposure, must also be considered. The EPA's Summary of Alternatives simply compares the highest concentrations in any well. EPA guidance concerning the performance of exposure and risk assessments requires the use of 70-year average concentrations at the point of exposure, not the highest level in a contaminatd well (PHEM at p.29).

The Summary of Alternatives also states that there is a "1 x 10^{-6} acceptable risk level established by the EPA." EPA guidance allows consideration of alternatives which leave a residual risk of between 10^{-4} to 10^{-7}. The MDNR's surface water quality program uses a 1 x 10^{-5} acceptable risk level (See Rule 57 Committee Draft Report, Attachment V. This draft report was developed by the MDNR and is currently under evaluation). The EPA uses MCLs as "applicable or relevant and appropriate requirements" ("ARAR").

The EPA's Guidelines for Carcinogen Risk Assessment (EPA, 1986a) state that "Guidelines do not encourage the use of worst-case assessments, but rather the development of realistic assessments based on the best data

available." The EPA's evaluation of risks does not follow EPA Superfund guidance. The EPA used a well in the heart of the landfill which contains chemicals at concentrations that are substantially higher than other wells at the site or in the vicinity. Therefore, this well in no way characterizes average conditions and is located at a point where drinking water will not be extracted from the surficial aquifer now, or in the future. This well does not represent reasonable characterization of groundwater quality at the nearest point of exposure (PHEM, at p.29).

4.2 Present Risk

There can be no risk without exposure. By the EPA's own admission, chemicals from the site have not yet entered the nearest drinking water wells. The present risk, therefore, is zero.

4.3 Future Risk

The chemicals have not migrated in the surficial overburden aquifer from areas near the deposition of the municipal refuse in approximately 33 years since refuse disposal began. There is at least 150 feet of clay (and usually more) beneath the site.

The nearest downgradient drinking water wells are screened in the Marshall Sandstone bedrock, which is beneath the surficial aquifer. Not only does no present route of migration exist, but the existing data indicate that none is likely in the foreseeable future.

No precise estimate of worst-case contamination travel times

are possible, but, in this expert's professional judgment, the length of time it would take chemicals to travel to the present wells is likely to be hundreds or thousands of years, if at all. This report concludes that the concentration at that point may not be significant. The surficial aquifer is not even likely to be used as a drinking water source downgradient of the Landfill because of the low permeability in the overburden.

If one examines the level of contamination in the surficial aquifer, however, even this groundwater presents no significant risk. The future risk in the unlikely event that someone used the downgradient surficial aquifer for drinking water can be evaluated qualitatively by comparing the measured concentrations in downgradient overburden wells on site with the EPA's ARARs or a risk-based value (Table 1).

The EPA considers maximum contaminant levels to be ARARs. (PHEM, at p.9). For those chemicals without MCLs, the concentration that corresponds to the 10^{-5} upper-bound lifetime carcinogenic risk level, as calculated by the EPA in its water quality criteria, is used in this evaluation to provide a rough risk comparison.

This general risk evaluation indicates that the Landfill presents no significant risks, even if no remedy were implemented. The concentration of chemicals in the representative downgradient overburden (surficial) wells on the Landfill site are below MCLs, i.e., it can be used for drinking water (Table 1). Additionally, where there are no ARARs, the concentration of chemicals in the representative downgradient overburden groundwater is less than the 10^{-5} upper-bound lifetime risk level (i.e., assuming someone drank two liters of this water every day for 70 years).

In most cases, even the highest concentrations in any overburden well are lower than MCLs, the 10^{-5} upper-bound risk level, or the reference dose. In a few isolated wells in the refuse disposal area, the highest water concentration is above the ARAR, the concentration that corresponds to the 10^{-5} upper-bound lifetime risk level, or the reference dose. These wells are located in pockets where refuse was disposed of and do not represent a plume of chemicals. It is unrealistic, inappropriate, and contrary to the EPA's policy (PHEM, at p.29) to compare health-based standards to groundwater concentrations in the refuse area itself, because that assumes someone is drinking this water.

In general, the inherently low risk of the pockets of groundwater within the refuse, coupled with the low potential for migration, indicate that the future risk from this Landfill is extremely low, if not zero.

This risk evaluation substantially overestimates the risks because it:

- uses groundwater wells on the site rather than the nearest point of exposure;
- ignores the lack of hydrogeologic connection between the surficial aquifer and the aquifer used for drinking water wells;
- assumes that no remedy will be installed at any time; and
- disregards completely several processes which serve to retard the movement of chemicals in groundwater, e.g., dilution, adsorption, and biodegradation. These processes act to reduce the plume's concentration (PHEM, at p.41). EPA

> Superfund guidance, as well as good science, requires that these processes be considered. (See PHEM at p.41).

4.4. Uncertainties in the Risk Assessment Process

Uncertainties and limitations in risk assessment methodology must be fully understood to place quantitative risk assessment into an appropriate context.

4.4.1 Uncertainties in the Exposure Estimate

EPA guidance and good science require that EPA systematically consider the extent of chemical fate and transport in each environmental medium in order to account for the behavior of the chemicals at a site (PHEM at p.38).

> In general, after a substance is released, it first moves vertically down through the unsaturated soil zone to the groundwater. Then, after initial mixing in the groundwater, the substance travels horizontally because of the advective flow of the groundwater underlying the site. The primary processes that affect the fate and transport of contaminants in these two zones are advection (including infiltration and leaching from the surface), dispersion, sorption (including reversible adsorption, ion exchange, complexation, and precipitation), and degradation. As a released substance flows away from the source area, these processes act to reduce its concentration. (Emphasis added.) [PHEM at p.48].

The risk evaluation in Table 1 substantially overestimates the future risk because it: (a) uses the surficial groundwater concentration directly underneath the site, rather than the concentrations from the deep bedrock aquifer at the nearest drinking water well; assumes that there is a

TABLE 1: Risk Comparison

	Range of Overburden Groundwater Concentrations* (ppb)	Number of Well Locations With Detectable Levels	Concentration Overburden Groundwater** Well 11 (ppb)	PHEM*** 10^{-5} risk or ADI (ppb)	EPA Proposed or Final MCL (ppb)
Methylene Chloride	N.D.-79+++	(5)	3.3	(1.9)	N.A.
1,1-Dichloroethane	N.D.-95	(3)	N.D.	Insf. data	N.A.
1,2-Dichloroethane	N.D.-46	(2)	N.D.		5+
Toluene	N.D.-660	(1)	N.D.	-	2,000++
Benzene	N.D.-23	(2)	N.D.		5+
Ethyl Benzene	N.D.-1,500	(1)	N.D.	-	680++
Phenol	N.D.	(0)	N.D.	3,500	N.A.
Trichloroethylene	N.D.-13	(1)	N.D.	-	5+
Trichlorofluoro-methane	N.D.-200	(3)	N.D.	N.A.	N.A.
1,1,1-Trichloro-ethane	N.D.-12	(3)	N.D.	-	200+
Diethylphthalate	N.D.-10	(2)	N.D.	434,000	N.A.
Dioctylphthalate	N.D.-410	(1)	N.D.	N.A.	N.A.
Bis (2-ethylhexyl) phthalate	N.D.-240	(2)	N.D.	21,000	N.A.
Di-n-butylphthalate	N.D.-38	(2)	N.D.	44,000	N.A.

N.A.: Not Available
N.D.: Not Detected

* Table 2 from Summary of Alternatives. Although the Summary of Alternatives, lists Trans-1,2-Dichloroethane at N.D. to 360 ppb, no such chemical can exist. This entry, therefore, must be an error.

** This concentration is a worst-case overburden concentration and does not represent the likely future exposure levels.

*** As required by EPA guidance, EPA maximum contaminated levels ("MCLs") are used if available. Where there is no MCL, EPA water quality criteria are compared. Superfund PHEM, at 46, 54. The EPA water quality criteria provide water concentrations which correspond to a lifetime cancer risk level of 10^{-5} to 10^{-7} (for carcinogenic efforts) or the acceptable daily intake ("ADI") (for non-carcinogenic effects). For the reasons cited in the text, the concentrations shown in Table 1 are upperbound 10^{-5} lifetime cancer risk level for carcinogens and are shown for comparison purposes. This comparison overestimates the risk to the population around the Metamora Landfill because no one is drinking water with any chemicals from the site in it and, therefore, the present risk from the site is zero. Concentration in parenthesis is based on a surrogate chemical.

\+ EPA, National Primary Drinking Water Regulations; Synthetic Organic Chemicals; Monitoring for Unregulated Contaminants, Final Rule, 52 Fed. Reg. 25,690, 25,694 (July 8, 1987).

++ Superfund PHEM, supra note 137, at 54. The reference dose or acceptable daily intake is used for chemicals with non-carcinogenic effects.

+++ Methylene chloride is a common laboratory contaminant and may not be an actual field result. This report, therefore, does not consider these results.

hydrogeological connection between the surficial aquifer and the Marshall Sandstone; and (c) ignores degradation, adsorption, and other factors which will decrease the concentration of chemicals in the groundwater, if they migrate at all; and (d) assumes that no remedy will be implemented.

It is impossible to estimate precisely the decrease in concentration which is likely because of factors which have been ignored. This report concludes that the decrease is likely to be at least two to three orders of magnitude, and possibly greater. Furthermore, if a reasonable *in situ* containment remedy were installed, the risk would be even less.

A reasonable *in situ* remedy, *e.g.*, a cap or a cap and a groundwater purge well system, would prevent the migration of contaminated groundwater from the immediate vicinity of the site; again, the risk would be zero or virtually zero.

4.4.2 Limitations in the Risk Estimate

The uncertainties inherent in the risk assessment process can be summarized as follows:

> It is emphasized that all estimates of carcinogenic risk and hazard index are dependent on numerous assumptions, and many uncertainties are inherent in the risk assessment process. Probably without exception, information on Site history and Site characterization data will be lacking in some areas. Most toxicity information is derived from animal studies, and reputable scientists disagree about how to interpret these data. A single toxicity parameter based on an animal study does not convey the route of administration of test doses of the suspect chemicals, the organ(s) in which the response occurred, or the severity of endpoints in the animal experiment used to calculate the dose-response relationship. Consequently, extrapolation to humans is a source of

> uncertainty. Many toxicity studies are done at high doses relative to exposures associated with waste disposal sites; extrapolation from high to low doses also increases the uncertainty of risk numbers. Exposure modeling is based on many simplifying assumptions that add to the uncertainty. Often the quality or quantity of site-specific chemical monitoring data is inadequate. The additivity of toxicant risks and the additivity of doses of the same toxicant from different exposure routes are additional assumptions and additional sources of uncertainty. Consequently, the results of the baseline evaluation should not be taken as characterization of absolute risk. An important use of these results is to highlight potential sources of risk at a site so that they may be dealt with effectively in the remedial process. [PHEM, at p.80, 1986].

The results of quantitative risk assessment are not a measure of the actual or real cancer risk but a "plausible upper limit to the risk that is consistent with some proposed mechanisms of carcinogenesis . . . . The true value of the risk is unknown and may be as low as zero." (EPA, at p.33,998, 1986a). The risk may be as low as zero because a worst-case, upper-bound risk scenario is unlikely to underestimate risk, rather, it is likely to overestimate risk.

4.4 Risk Management Comparisons

The risk assessment process does not conclude with the production of a risk level, no matter how qualified that number may be. Risk assessment, as performed by the EPA, is comprised of two parts: (1) the risk assessment i.e., the estimation of a risk level; and (2) the risk management decision i.e., the choice of an acceptable risk level. (EPA, at p.33,993, I986a).

The EPA generally determines the extent to which a risk should be

minimized so that "the residual risk is reasonable for society to accept" (EPA, at p.13,594, 1987a), i.e., to "protect against significant or unreasonable public health risks" (EPA, at p.13,586, 1987b). EPA regulatory actions, therefore, do not necessarily eliminate all public health risks, but minimize those risks without causing unreasonable social or economic impacts (EPA, at p.13,586, 1987a).

Superfund, in fact, "does not direct the EPA to eliminate all risk" (Letter from L. Thomas, EPA Administrator, to Honorable James J. Florio (May 21, 1987)). The EPA's CERCLA policy states that the target total individual carcinogenic risks resulting from exposure at a Superfund Site may range anywhere from 10^{-4} to 10^{-7} (EPA, 1985a and PHEM at p.91).

The EPA often uses the 10^{-5} upper-bound lifetime cancer risk level as an acceptable risk management level, even when large populations are exposed to this level of risk (See Rodricks 1987 and Travis 1987, Attachment V). The MDNR also uses the 10^{-5} risk level as an acceptable risk level (Attachment IV).

5.0 MDNR Test Pit Excavation

The MDNR initiated test pit excavation in December, 1986. This activity consisted of digging a pit for the purpose of identifying, removing and sampling drums at the site. The activities involved: constructing a staging area; digging the test pits; removing the drums; storing of the removed drums; and covering the excavation. This report concludes that a number of the actions relating to this excavation were not

implemented in the manner required by good waste management practices and have resulted in worsening conditions at the site.

The greatest concern is that it appears that in planning and implementing this activity, there was not sufficient thought and care taken to minimize spillage of chemicals from the drums. Review of the records (Attachments II, and III) of this activity indicates that the MDNR did not require a spill control plan or require E.C. Jordan to clean up any spills which actually occurred in the field. As a result, the chemicals in some of the drums were literally poured into the ground and covered over with soil (See photographs and field notes taken during the test pit excavation; Attachments II and III).

Such actions are not good waste management practices and may have subjected a private party to some penalty or other action from a government agency if a private party had performed in this matter.

As a result of the test pit excavation, therefore, chemicals are pooled in the soil and are free to migrate. Migration is more likely now because: chemicals are no longer in drums; the surface area over which chemicals are spread has increased; the permeability of the soil in the area of the test pit excavation probably has increased because the soil was disturbed; and infiltration of rainwater over the previously excavated area is probably greater because the permeability of the soil has been increased.

The drums that were removed are also presently being stored in an improper manner. These drums are in the former staging area, a flat area

with a berm around it. As a result of the berm and the nature of the soil underneath this area, rainwater now collects and pools within the bermed areas. As can be seen from the photographs (Attachment III., Photograph 12), water has reached levels that are higher than the bottom of the barrels. Leachate is being created and allowed to percolate into the ground. This condition has existed for over eight months.

In sum, the MDNR activity at the site has worsened, not bettered conditions at the Landfill.

6.0 EPA's Process of Selecting A Remedy At the Metamora Landfill

The new information concerning the Landfill illustrates that the information originally available during the EPA's remedy selection process was inadequate and unreliable as the basis for remedy selection.

Before a remedy can be selected at the site, the EPA must determine the rate of groundwater migration, the full extent of existing groundwater contamination, if any, the ability of the natural soils to retard migration, the risks of each alternative remedial alternative, and the cost of each remedy. Knowledge of these factors is needed to gauge the effectiveness of remedial alternatives, risks from implementation of various alternatives and cost effectiveness of the remedial alternatives. No meaningful decision can be made until the RI/FS is completed.

The proper sequence for making scientific decisions is to:

gather appropriate data, evaluate that data, gather additional data until the data collected is adequate, and then and only then, make a decision. The substantial changes in facts in this evaluation only underscore the need for a careful, thoughtful decision-making process. The decision to select a $41.5 million excavation and off-site incinceration option without a completed RI/FS is particularly inappropriate, inefficient, and could result in more harm than good (See Section 7.0 below).

7.0 Evaluation of Excavation and Incineration Compared to No Action or In Situ Containment

The National Oil Pollution and Hazardous Waste Contingency Plan ("NCP") requires that EPA select the most cost-effective remedial alternative from among remedial alternatives that provide substantially similar levels of reliability and protection of the public health.

The present risk presented by the Landfill is zero since there is no present exposure. Future exposure is unlikely, given the lack of migration in the last 33 years and the nature of the soils surrounding and beneath the Landfill. As a rough indicator of the lack of risk presented by the Site, some of the downgradient overburden groundwater wells on Site indicate concentrations in the surficial aquifer are generally less than ARARs, less than 10^{-5} for carcinogenic effects or less than the EPA reference dose for noncarcinogenic effects.

Cost also is important in deciding whether CERCLA's Fund balancing test applies (EPA must decide whether "the need for protection of

public health and welfare and the environment" at the Site "is outweighed by the need for action at other sites that may present a threat to public health or welfare or the environment, considering the amount of money available in the Fund"). EPA regulations provide that an alternative that far exceeds the costs of other alternatives evaluated and that does not provide substantially greater public health or environmental protection or technical reliability shall usually be excluded from further consideration. [EPA Code of Federal Regulations, Volume 40, Part 300.68(a)(1)].

The EPA's original remedy selection process was biased by a failure to consider a number of reasonable, lower cost in situ containment remedies. The no action alternative and the in situ containment remedies adequately protect public health (See Section 4.0 above), in part because there is no significant risk even if no remedy is implemented.

The EPA also failed to select the most cost-effective remedial alternative from among even the limited alternatives considered. Excavation and on-site incineration (at a cost of $5.6 million) should provide essentially the same or more protection of the public health than excavation and off-site incineration. On-site incineration is more protective because it avoids the risks involved in the transportation of large quantities of waste and soils.

A detailed evaluation of excavation and incineration compared to in situ containment remedies is beyond the scope of this evaluation. There is insufficient information upon which to base any valid choice of remedies at this time. From a scientific viewpoint, the new information now

available clearly requires a re-evaluation of all of the remedial alternatives.

The E.C. Jordan evaluation of excavation and incineration was cursory and incomplete. The following general comments are provided to assist the EPA in its re-evaluation of remedial alternatives.

Excavation and incinceration:

- may involve substantial risks associated with: (a) the release of chemical vapors and chemical-laden soil during the excavation; (b) the emission of toxic chemicals from the incinerator stack during incineration; and (c) the potential exposure to incinerated soils after their incineration;
- may involve risks associated with possible accidents during the excavation and transportation of substantial quantities of soil when incineration occurs off site;
- will destroy only some of the organic chemicals and none of the metals;
- will not substantially reduce the toxicity of the metals in the soils. In fact, incineration will result in a higher concentration of metals in the incinerator ash than in the original soils; and
- will be much more costly than the no action alternative or any reasonable in situ containment alternative (See Table 2).

Based on existing information, excavation and incineration are not cost-effective, and do not provide any additional protection of the public health compared to the no action alternative or in situ containment. In addition, such remedies present significant additional risks not associated with in situ containment remedies. Selection of a remedy involving excavation and either landfilling or thermal destruction is not

justified based upon the available data.

There is insufficient information at present to select between the no action alternative and various reasonable *in situ* containment alternatives.

7.1 Risks From Excavation

Air emissions will consist primarily of dust and volatile organic chemicals. For example, the EPA Responsiveness Summary acknowledges that there will be air emissions from the excavation. The Responsiveness Summary asserts without explanation or justification that the health and safety plan will protect the public health during excavation.

Excavation will necessitate removal of the surface cap and continual disturbance of the municipal waste and any chemicals which may be in the Landfill. The emissions of volatile organic chemicals are likely to be considerable during the excavation and during vehicular movement, (See U.S. ENVIRON 1985). The volatilization of chemicals is primarily affected by the vapor pressure of the compound, the surface area exposed to the atmosphere, the wind velocity, air temperature, and the chemical properties of the substance. Vapor and dust levels will generally decrease with distance from the site. The major pathways of exposure would be inhalation of vapor and dust generated by the excavation, and ingestion of contaminated dust.

These emission levels and ambient air concentrations can be roughly predicted through the use of various air models (EPA 1986b). The

lifetime upper-bound carcinogenic risk level can be estimated from the ambient air concentrations. The predicted chemical concentration in air can be compared to ARARs, the 10^{-5} lifetime upper-bound risk level or EPA's reference dose (i.e., the acceptable daily intake value for non-carcinogenic effects). Generally, the EPA must use the same exposure and risk assessment techniques to assess the risks from implementing excavation that it uses to assess the risk attributable to a no action alternative.

Both the effectiveness of various health and safety measures and the reduction in risk level can be estimated. The EPA must provide some level of assurance that the health and safety measures proposed would in fact result in the reduction of the risk to acceptable levels before excavation is implemented.

7.1.1 Other Risks From Excavation

Excavation may also present significant risks resulting from:

1. the exposure of wastes to greater rainwater infiltration during excavation which would increase the migration of chemicals from the site and, thereby, increase the risk from the site;

2. the volatilization of chemicals from the large volumes of groundwater which would need to be collected and treated. This collection and treatment of water will also add substantially to the costs;

3. the creation of a conduit, which does not now exist, for chemicals to migrate to the groundwater, thereby worsening site conditions; and

4. the exposure of the workers to chemicals during excavation.

The excavation performed by the MDNR to date has demonstrated the adverse effects of excavation. The process of excavation has disturbed and ruptured previously whole drums, causing the chemicals inside those drums to seep into the ground. During the excavation, the MDNR personnel acknowledged that noticeable odors were prevalent. (Personal conversation with MDNR personnel).

7.2 Assessment of Transportation Risks

In addition to the risks associated with the actual excavation to to residents in proximity to the Site, there are risks which result from the transportation of the municipal refuse, soil, and other materials off Site. This risk could increase the number of people potentially exposed to the soil and refuse. Chemical waste landfill or incinerator sites in several states could potentially receive the liquids and soil from the Site.

The soil may be transported to the ultimate disposal site either by road or by rail. These two methods of transport raise slightly different issues that would need to be addressed in an EPA risk assessment during its re-evaluation of remedies.

7.2.1 Truck Transportation

Much of the route over which excavated wastes would be transported would be residential areas. The approximate number of dump truck trips required to transport tons of waste and contaminated soil

should be estimated. Based upon accident rates published by the U.S. Department of Transportation ("DOT") Federal Highway Administration and the length of the route, the EPA could estimate the likelihood or chance that an incident involving a spill would occur somewhere along the route during the period of time in which excavation and truck hauling would occur.

According to statistics compiled and published by the U.S. Department of Transportation (US DOT ACCIDENTS) large trucks are involved in about 451 accidents for every 100 million vehicle miles traveled. In 1981, vehicles carrying hazardous materials were involved in 1,868 accidents in the United States, which caused 1,604 injuries, 202 deaths, and $31 million in property damage. Information on the frequency of chemical spills resulting from highway traffic accidents is also collected by the EPA's Office of Emergency Response.

The EPA could apply these statistics to the projected transportation needs for off-site disposal of materials from the Landfill. Unlike the health risk assessment process, this calculation results in an actuarial-based estimated number of accidents and injuries. Although the number of actidents is not certain to occur, it is considerably more certain than estimated incremental increases in cancer risk levels.

As a general matter, risks from transportation accidents are likely to be larger than those posed by on-site containment. The potential for highway accidents may be greater in the winter due to wet and icy road conditions. The concentration of volatile chemicals in the air after a spill, however, is likely to be higher in the summer because of the higher temperatures and increased volatization.

An accidental release of contaminated materials excavated from the site can be hazardous to people, animals, vegetation, and other components of the surrounding environment. Two types of air pollution from the spilled soil would be of concern: vapors (volatile organic chemicals) and dust (particulates).

The transport contractor would presumably use the most effective means possible to expeditiously clean up any spill of contaminated material that might occur. Even if a spill were immediately covered with a tarpaulin, however, some amount of chemicals and soil would likely disperse into the environment. Refuse and soil, then, could potentially be deposited in residential yards, gardens, play areas, farmland, and other outdoor areas. Some volatile organic compounds would also be released into the air, exposing nearby residents.

The spill could occur directly into a body of water. A spill of refuse or soil (or the release of runoff from a spill pile) directly into a stream or river could potentially affect fisheries, recreation, and drinking water supplies.

The likelihood of such a spill can be estimated from accident rates and the percentage of the trip which traverses such waterbodies. A worst-case analysis, however, would consider the effect of a spill into bodies of water, even if it were a low probability event.

There would be a steady flow of trucks near the Metamora Landfill for the length of the excavation project. The EPA could estimate the frequency of truck traffic, either when the trucks are leaving the site with contaminated soil, or when they are returning to be reloaded. This truck traffic will result in increased diesel emissions, noise for 8-10 hours per day, and additional traffic safety problems.

7.2.2 Rail Transportation

There are no railway yards in the immediate vicinity of the Metamora Landfill. Trucks could be used to transport the excavated material to a railyard and the waste and soil could be transported by rail to the landfill or incinerator. The EPA could estimate the probability of accidents by truck from the Landfill to the railroad yard (See Methodology, discussed above), by railroad from the loading point to the railroad yard where the material is unloaded (See accident reports of the Association of American Railroads concerning statistical trends in rail accidents since 1978), and by truck again from the unloading point to the incinerator or redisposal point. Numerous train shipments would also be required.

At each point, an accident could occur. The EPA should assess the likelihood and effects of such spills using the same type of analysis described above.

7.3 Assessment of Long-term Risks of Off-site Disposal and Off-site Incineration

In addition to the local risks and transportation risks, excavated materials could be disposed of in a landfill or incinerator off site will transfer those risks from the Metamora Landfill to the site of the reburial or incineration.

While the wastes and soil would be disposed of in an EPA permitted landfill or an EPA permitted incinerator, virtually no hazardous

waste landfill or incinerator in the United States is considered free from environmental and health risks.

For example, all incinerators generate chemicals during incineration (called products of incomplete combustion or "PICs"), which are often of greater or equal concern than that of the parent compound. Operational changes in field conditions could result in the incomplete combustion of PCBs or other organics. Compounds such as 2,3,7,8-tetrachlorodibenzo-p-dioxin ("dioxin") and polynuclear aromatic hydrocarbons (PAHs) have been reported in the air emissions of facilities incinerating some of the organic compounds found on the Site. (See generally, EPA 1985b). Under some conditions, the risks from the emissions of PICs could exceed the risks from the no action alternative.

Designing waste incinerators for materials such as the soil at the Landfill is difficult. The soil is heterogeneous. Changes in consistency and grain size could cause soil particles to remain in clusters, inhibiting the dispersion of the material in the unit and leading to inadequate combustion of the chemicals of concern present in the soil. The concentration of these chemicals within the soil can also be expected to vary, which could also affect incinerator performance and lead to incomplete combustion. The result could be a failure of the unit to reduce the toxicity of the soil to levels which would permit the soils to be placed back on the Site.

Chemicals will also be released while processing the soil for incineration. This process involves grinding the soil into uniform sizes.

7.4 Continuing Threat From Municipal Waste

At the Metamora Landfill, the EPA intends to leave municipal refuse in place. Many of the same types of chemicals that are present in typical industrial wastes are also present in municipal wastes. To the extent that any chemicals are migrating from the Landfill, chemicals which the EPA considers hazardous will continue to migrate from the municipal refuse into the soil and groundwater near the Landfill, even if the EPA excavates all of the industrial waste that may be at the site.

The remedy chosen by the EPA, therefore, is not likely to change the extent to which the Site presents a potential source of groundwater contamination. Removal of industrial wastes, therefore, may provide a false sense of assurance.

7.5 Costs of Incineration

The costs of hazardous waste management varies greatly depending upon the technology employed. For example, the cost of deep well injection, landfilling and incineration of toxic liquids, ranges from $0.08 to $1.20 per gallon; $1.00 to $2.50 per gallon; and $2.10 to $8.30 per gallon, respectively, that is, costs vary by a factor of 10 to 100 depending upon treatment technique. (EPA, at p.3-7, 1986). The type of treatment or disposal, therefore, can be a more important factor than the increase in volume in estimating costs.

The EPA recently conducted its sixth survey of the hazardous waste management industry and concluded that:

> although the market remains quite competitive, rapidly rising demand for certain services and significant cost

> increases have resulted in large price increases . . . From 1983 to 1984, 25 to as much as 90 percent across all management technologies, with some increases of up to 135 percent reported. From 1984 to 1985, respondents report increases of 30 to 100 percent for land disposal services, and from 60 to 400 percent for treatment services. The largest price increases were reported for incineration services. [EPA, at p.3-7, 1986f].

Both increasing demand and decreasing supply will continue to increase costs. Costs for transporting, treating, or disposing of hazardous wastes can vary substantially from one part of the country to another and from waste to waste, but some trends can be discerned.

Dr. J. Winston Porter, Assistant Administrator for Solid Wastes and Emergency Response (highest level EPA Superfund official), was quoted at a conference as saying "there's probably not enough money in the world to clean up all the [Superfund] sites permanently." (BNA 1986a). Gene Lucero, Director of the EPA's Office of Waste Programs Enforcement, which enforces Superfund, estimated that the SARA could increase the average cost of cleanups to $30 to $50 million, and when long-term groundwater cleanup is involved, the costs could be between $300 to $600 million, an increase of 3 to 60 fold. Id. at 779.

Other groups familiar with the Superfund program estimated that the requirement for incineration remedies could increase cleanup costs by a factor of 10. (BNA 1986b).

7.6. Reliability/Availability

Excavation of a site of the size of the Metamora Landfill has not been demonstrated. Such an enterprise, therefore, can only be

characterized as unproved and unreliable. The MDNR, E.C. Jordan and this report indicate that no off-site incineration capacity is available.

7.7 Lack of Benefits

There is no significant benefit to excavation of the Landfill primarily because the underlying risk is negligible or de minimis. In this case, there is no present risk and there is unlikely to be any significant migration in the foreseeable future. If lateral migration occurs, it still would not effect the drinking water aquifer because it is covered by 150 feet of clay in the vicinity of the Landfill (See Section 2.3).

7.8 Conclusion

No specific remedy can be chosen at this site because of inadequate information. Any re-evaluation of remedies should take into account the very considerable negative factor usually associated with excavation and incineration. Excavation and incineration would be unwise and a waste of money, and could increase the overall risk to the public.

TABLE 2

SUMMARY OF EVALUATION FACTORS
REMEDIAL ACTION ALTERNATIVES

Alternative Description	Protective of Public Health	Reliability	Risks During Implementation*	Benefits	Costs
No Action	Yes, no significant risk.	No Problems	None	-	Lowest
Reasonable in situ containment (e.g., Monitoring and Fencing, Permeable Cover, and Impermeable Cover)	Yes.	No Problems	None	Allows cost-effective action when necessary. Further reduces already low groundwater	Low
Excavation, Landfill Soils Off Site	May not be	Untried on this scale	Release of Volatiles and particulates; Safety; Transportation Accidents.	None, simply moves the location of risk	High (typically ten times higher than in situ)
Excavation, Landfill Soils On Site	May not be	Untried on this scale	Release of volatile and particulates Safety;	None, simply delays excavation and leakage	High (typically, ten times in situ)

TABLE 2

Alternative Description	Protective of Public Health	Reliability	Risks During Implementation*	Benefits	Costs
Excavation, and Incineration On Site and Disposal of Ash On Site	May not be	Excavation untried on this scale, Performance of incineration on this scale not documented	Release of Volatiles; and particulates; Emission from Incinerator; Safety	Permanently Destroys Large Portion of Organics in Soil	Enormous (typically ten times in situ).
Excavation, and Incineration On Site and Disposal of Ash Off Site	May not be	Excavation untried on this scale, Performance of incineration on this scale not documented	Releases of Volatiles, and particulates; Emission from Incinerator; and Safety; Transportation Accidents	Permanently Destroys Organics in Soil	Enormous (typically ten times in situ)
Excavation, and Incineration Off Site and Disposal of Ash Off Site	May not be	Performance of incineration on this scale not documented	Releases of Volatiles; and Particulates; Emmissions; during incineration; Safety; Transportation Accidents.	Permanently Destroys Organics in Soil	Highest (typically much more than ten times in situ)

* Release of volatiles and particulates refers to the potential public health risks related to the chemicals released into the atmosphere during the excavation of soils. The risks apply to all excavation scenarios, whether used with incineration or landfill disposal.

Safety refers to workers health and safety concerns related to excavation, incineration, transportation and disposal activity.

Emissions during Incineration: refers to the potential public health risks associated with the incineration of Site soils, including the formation and emission of toxic compounds (e.g., dioxin, PAHs) during operation of the unit.

Transportation Accidents refers to the risk that a certain number of accidents may occur during the transportation of chemical-laden soil from the Site to an off-site facility for landfilling or thermal destruction.

APPENDIX A: REFERENCES

References

Association of American Railroads - Accident Reports

BNA, High Cost of Permanent Superfund Cleanups to Result in Interim Action, Porter Says, Envl't. Rep., Current Developments, 789 (Sept. 26, 1986) (BNA 1986b).

BNA, Incineration Could Increase Cleanup Costs Under Superfund Battlefield, Moreland Says, Envl't Rep., Current Developments 709 (Sept. 12, 1986) (BNA 1986a).

BNA, EPA Official Says Waste Incineration Must Meet EPA Rules and Win Public Acceptance, Envl't Rep. Current Developments 1278 (Nov. 28, 1986) ("BNA" 1986").

Crawford, M., Hazardous Waste: Where to Put It, Science 235:156-158 (Jan. 9, 1987).

Dept. of Transportation, Bureau of Motor Carrier Safety. Accidents of Motor Carriers of Property, 1980-81, (Aug. 27, 1982) (DOT 1982).

Dept. of Transportation, ACCIDENTS

Dragun, J., Groundwater Contamination - Part 1 Transport and Transformation of Organic Chemicals (Chem. Eng. 65, Nov. 26, 1984).

Environmental Protection Agency, Guidance on Studies Under CERCLA (EPA/540/G-85/003 June, 1985) (EPA 1985a).

Environmental Protection Agency, Health Assessment Document for Polychlorinated Dibenzo-p-dioxins (Report No. EPA-600/8/84-014f Aug. 1985) (EPA 1985b).

Environmental Protection Agency, Superfund Public Health Evaluation Manual. Office of Emergency and Remedial Response, Office of Solid Waste and Emergency Response (October, 1986) ("PHEM").

Environmental Protection Agency, Guidelines for Carcinogen Risk Assessment. Federal Register, Sept. 24, 1986, p.33992-34003 (EPA 1986a).

Environmental Protection Agency. Guidelines for Exposure Assessment. Federal Register, Sept. 24, 1986, p.34042-34054 (EPA) 1986b).

Environmental Protection Agency, Record of Decision, Metamora Landfill (Sept. 30, 1986) (EPA 1986c).

Environmental Protection Agency, Summary of Alternatives for Metamora Landfill (Sept. 30, 1986) (EPA 1986d).

Environmental Protection Agency, Hazardous Waste Management System; Land Disposal Restrictions, Final Rule, 51 Federal Register, Nov. 7, 1986, p.40,572 (EPA 1986e).

Environmental Protection Agency, Office of Policy Analysis, Final Report, 1985 Survey of Selected Firms in Commercial Hazardous Waste Management Industry, 307 (Nov. 1986) ("EPA" 1986f).

Environmental Protection Agency, Subtitle D Study Phase I Report (Oct. 1986) ("EPA") 1986g).

Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants; Coke Oven Emissions from Wet-Coal Charged by By-product Coke Oven Batteries. Proposed Rule and Notice of Public Hearing, 52 Federal Register, April 23, 1987, p.13586-13606 (EPA 1987a).

Environmental Protection Agency, Burning of Hazardous Waste in Boilers and Industrial Furnaces, Proposed Rule, 52 Federal Register, 1698-17050 (May 6, 1987) (EPA 1987b).

Jordan, E.C., Phased Feasibility Study, Metamora Landfill Site (August, 1986) ("Jordan 1986"),

Jordan, E.C, Draft Technical Memorandum (February 6, 1(Jordan, 1987a).

Jordan E.C., Technical Memorandum #2 (1987) (Jordan 1987b).

Keck Consulting Services, Report re: Hydrogeological Investigation Metamora Landfill (February 2, 1979) ("Keck 1979").

Kimbrough, R. and M. Simonds. 1986. "Compensation of Victims Exposed to Environmental Pollutants." Archives of Env. Health 41:185-187 (May/June, 1986) ("Kimbrough 1986").

Letter from J. Atwell, E.C. Jordan, to MDNR, re: Metamora Landfill On-site Intineration (October 16, 1986) (forwarding a draft Report).

Michigan Department of Natural Resources, Progress Report #9, Metamora Landfill Site (April 16, 1987) ("MDNR Progress Report #9").

Michigan Department of Natural Resources, Test Pit Inspection Logs (1986).

Michigan Department of Natural Resources, Test Pit Excavation Photographs (1986).

Michigan Department of Natural Resources, Rule 57 Advisory Committee Report (1982).

Memorandum from MDNR staff to MDNR supervisory personnel re: Metamora Landfill Operable Unit Remedial Design at 1-2 (March 9, 1987).

National Highway Traffic Safety Adinistration, Large-Truck Accident Causation (July, 1982) (NHTSA 1982).

Oppelt, E. Timothy, (EPA) Hazardous Waste Destruction, Envl't Sci. Techn. 20:312, 317-18 (1986) (citing EPA, Assessment of Incineration as a Treatment Method for Liquid Organic Hazardous Wastes - Background Report [1]: Assessment of the Commercial Hazardous Waste Incineration Market (No. 1985-5260778/3076, 1985).

Porter, J. Winston (EPA Assistant Administrator for Solid Waste and Emergency Response), Statement before the Subcommittee on Superfund and Environmental Oversight, Committee on Environment and Public Works, U.S. Senate (June 25, 1987).

Porter, J. Winston (EPA Assistant Administrator for Solid Waste and Emergency Response). Memorandum on Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements (July 9, 1987).

Powell, Robert L. et al., Risks from Chemical Releases Associated with Proposed Excavation of the Hyde Park Landfill (Prepared for U.S. EPA, Region II (1985) ("ENVIRON 1985").

Rodrick, J. et al., Determination of Significant Risk In the Regulation of Chemical Carcinogens, Toxic Law Report, p. 1337-1340 (1987) ("Rodricks 1987").

Thomas, Lee, EPA Administrator, Letter to Honorable James J. Florio (May 21, 1987).

Travis, et al., Cancer Risk Management, Envl't. Sci. Techn. 21:5, 45-420 (1987) ("Travis 1987").

STATEMENT

OF

QUALIFICATIONS AND EXPERIENCE

Lawrence N. Halfen, Ph.D.
ENVIRONMENTAL CONSULTATIONS
519 Charlotte, N.W.
Grand Rapids, Michigan 49504

ATTACHMENT I

EDUCATION

B.S. (cum laud), 1965. Biology and Chemistry.
University of Wisconsin.

Ph.D., 1970. Biological Chemistry.
University of Oregon.

Post Doctoral Fellowship (1970-1972).
Industrial Organic Chemistry & Process Biochemistry.
The Technical University of Norway.

ACADEMIC APPOINTMENTS

Senior Instructor of Biology,
University of Oregon, 1968-1970.

Assistant Professor of Botany (Instrumental Methods),
The Ohio State University, 1972-1974.

Visiting Assistant Professor of Botany & Plant Pathology
(Phycology/Limnology),
Michigan State University, 1974-1979.

Assistant Professor of Biology (Instrumentation),
Vassar College, 1974-1979.

Adjunct Visiting Professor of Civil Engineering,
Michigan Technological University, 1980-1981.

Technical Advisor on Curriculum for the College of
Environmental Health & Allied Sciences,
Ferris State College, 1983-1984.

PROFESSIONAL EXPERIENCE

Independent Environmental Consultant, 1965-1979.
Vice President & General Manager, EDI, 1979-1982.
Independent Environmental Consultant, 1982-Present.

PROFESSIONAL SOCIETIES, OFFICES & HONORS

American Association for the Advancement of Science
American Chemical Society
Norwegian Biochemical Society (Fellow)
American Society of Plant Physiologists
Scandinavian Society of Plant Physiology
Japanese Society of Plant Physiologists

Lawrence N. Halfen

Professional Societies, Offices & Honors (Continued)

American Society for Limnology & Oceanography
Phycological Society of America (Technical Review Board Member)
Society for Theoretical Biology (Technical Review Board Member)
National Association of Environmental Professionals

Technical Advisor for Chemical Hazards,
Grand Rapids Fire Department.

Commissioner, State of Michigan Toxic Substance Control Commission (Governor's Appointment, 1982-1984).

National Award of Merit of the Consulting Engineer Council, 1980. Woodland Park, Michigan, Chemical Clean-up, Environmental Services.

Consulting Engineer Council of Michigan 1982 Award of Merit for the Lakeview Square Shopping Center Environmental Management Plan involving Trout Habitat Design.

PUBLICATIONS

More than 20 peer-reviewed contributions to the scientific literature.

Examples include the following:

1. Halfen, L.N. Sunset Lake: One Year Later. Vassar Quarterly 73:16-17, 1976.

2. Halfen, L.N. "Gliding Movements," In: W. Haupt and M. Feinlieb (Eds.) Encyclopedia of Plant Physiology. New series Volume 7, Physiology of Movements. Springer-Verlag, pages 250-267, 1979.

3. Halfen, L.N. A study of gliding motility in the blue-green alga Oscillatoria princeps. 176 pp., 1977. Otto Koeltz Antiquariat Wissenschaftliche Buchandlung, Koenigstein, West Germany. (Entire thesis published as a historical document.)

4. Thompson, E.S. and L.N. Halfen. A Case Study: The cleanup of a chemical spill. Consulting Engineer 55(3): 106-111, 1980.

5. Halfen, L.N. "A Discussion of Ground Water Monitoring," In: J.A. Borchardt and W.J. Redman (Eds.) Sludge and Its Ultimate Disposal. Ann Arbor Science, Ann Arbor. Pages 241-259, 1981.

L.N. Halfen

MONOGRAPHS

Total macrophyte survey of Gull Lake, Michigan. 80 pp., Summer, 1973. Prepared for the W.K. Kellog Biological Station, Michigan State University.

Survey of point-source discharges on the Vassar College campus. 40 pp., 1974-1975. Prepared for use by Vassar College to comply with EPA statutes.

Woodland Watercourse: Cary's Challenge. 90 pp., Summer, 1975. A research report submitted to the Cary Arboretum on a summer research program evaluating pollution on the East Branch of Wappinger's Creek in Dutchess County, New York. Subsequently incorporated into the holdings of the library of the Cary Arboretum of the New York Botanical Garden.

An Ecological Evaluation of the East Branch of Wappinger's Creek. 211 pp., 1975-1976. Prepared in association with six ecology students. An overview of community structure in the watercourse. Results contained in the official data records of the New York State Department of Environmental Conservation and also deposited in the library of the Cary Arboretum of the New York Botanical Garden.

An Ecological Evaluation of Whaley Lake, Dutchess County, New York. 63 pp., 1977. A student-based environmental study subsequently incorporated into the official data record of the New York State Department of Environmental Conservation.

Environmental Management Program: RCRA Compliance. 185 pp., 1984. A multimedia environmental management package for compliance with Federal regulations. Now in nationwide use.

Hazardous Materials Management: OSHA Compliance. 200 pp., 1985. A compliance package designed to satisfy Federal and State Right-to-Know statutes. Presently in use in six states.

NOTE: More than 200 technical reports have been developed in the course of project completion. These are usually confidential and of limited circulation. A series of six video proprietary programs are now in use in the following areas:

RCRA Compliance	CERCLA-Superfund
RCRA Small Quantity Generators	TSCA
NPDES Programs	OSHA

L.N. Halfen

REPRESENTATIVE PROJECT EXPERIENCE

-Chemical and environmental management of seven Chessie System derailments where hazardous chemicals were spilled:

Woodland Park, MI	Vinylidene Chloride
Pearl, MI	Styrene Monomer
Silverwood, MI	Hydrochloric Acid
Bridgman, MI	Fluorosulfonic Acid
Wyoming, MI	Diesel Fuel
Ludington, MI	Phenol
Fowlerville, MI	Sevin IV
Southern Indiana	Arsenic

-Project director for more than forty lake and stream studies and/or restorations.

Examples:

Whaley Lake, New York
Jernesvannet, Trondelag, Norway
Sunset Lake, New York
Wappinger's Creek, New York
Oakridge Trout Hatchery, Oregon
Diamond Lake, Michigan
Orchard Lake, Michigan
Minges Brook, Michigan
Brookings Lake, Michigan

-Design and implementation of more than 200 ecological/environmental monitoring programs for industrial clients involving all compartments of the ecosystem.

-Management of industrial and hazardous waste disposal activities including analytical support, transportation coordination, disposal acceptance and regulatory compliance for more than 100 clients.

-Developed an analytical and environmental services group of degree holding professionals from an initial staff of three with a business dollar volume of less than $100,000 to a maximum of fourteen with a business volume of almost $600,000. This business development was done in three years and incorporated into an established engineering firm.

-Creation and implementation of marketing programs for analytical services, environmental studies and hazardous waste management which has created the above-mentioned increase in business volume.

Representative Project Experience (Continued)

-Organization and application of State and Federal hazardous materials management regulations for service, educational, health care and industrial clients including PIPP Plans, SPCC Plans, RCRA Training Programs, OSHA Compliance and Contingence Plans.

-Expert testimony and litigation support services in more than 40 cases over the last 15 years.

-Training programs and on-site hazardous materials management audits for more than 50 service, research and industrial concerns throughout this country and Canada.

Further project details are available on request.

REPRESENTATIVE CLIENTS

Public

Detroit Wastewater Treatment System
Village of PawPaw
Lincoln Township, Newaygo County
Grand Rapids Fire Department
State of Michigan Department of Natural Resources
Greater Gratiot Development Authority
City of Jackson Development Authority

Professional

Mercy Hospital, Muskegon, Michigan
Western Michigan Poison Control Center
Blodgett Hospital, Grand Rapids, Michigan
Sacred Heart Hospital, Eau Claire, Wisconsin
St. Francis Hospital, Eugene, Oregon
Currently on retainer for ten law firms.

Industrial

General Motors
Teledyne, Inc.
TRW
Lacks Industries
American Seating Company
CWC Textron, Inc.
Eaton Corporation
Steelcase, Inc.

L.N. Halfen

Representative Clients (Continued)

S.D. Warren Paper Company
Total Petroleum Company
Sea Ray Boats
Chrysler Motor Company

Service

City Sand & Gravel, Inc.
Liquid Disposal, Inc.
Grand Traverse Overall Supply Company
Chessie System
Consumers Power Company
Grand Trunk & Western Railroad
Valley City Refuse Disposal, Inc.

TELEDYNE FACILITIES SERVICED

Teledyne Abco Distributing, Melrose Park, Illinois
Teledyne Avionics, Charlottesville, Virginia
Teledyne Brown Engineering, Huntsville, Alabama
Teledyne Continental Aircraft Engine, Toledo, Ohio
Teledyne Canada, Ontario, Canada
Teledyne Continental Motors - Aircraft Products, Mobile, Alabama
Teledyne Continental Motors - General Products, Muskegon, Michigan
Teledyne Continental Motors - Industrial Products, Muskegon, Michigan
Teledyne Crittenden, Gardena, California
Teledyne Electronics, Newbury Park, California
Teledyne Firth-Sterling, Huntsville, Alabama
Teledyne Gurley, Troy, New York
Teledyne Hastings-Radist, Hampton, Virgnia
Teledyne Industrial Diecast, Chicago, Illinois
Teledyne Inet, Torrance, California
Teledyne Kinetics, Solana Beach, California
Teledyne McKay, York, Pennsylvania
Teledyne MEC, Palo Alto, California
Teledyne Metal Finishers, Cleveland, Ohio
Teleydne Micronetics, San Diego, California
Teledyne Microwave, Mountian View, California
Teledyne Monarch Rubber, Hartville, Ohio
Teledyne Neosho, Neosho, Missouri
Teledyne Ohio Steel, Lima, Ohio
Teledyne Pines, Aurora, Illinoia
Teledyne Post, DesPlaines, Illinois
Teledyne Readco, York, Pennsylvania

L.N. Halfen

Teledyne Facilities Serviced (Continued)

Teledyne Rodney Metals, New Bedford, Massachusetts
Teledyne Ryan Aeronautical, San Diego, California
Teledyne Ryan Electronics, San Diego, California
Teledyne Sprague Engineering, Gardena, California
Teledyne Total Power, Memphis, Tennessee
Teledyne Wah Chang, Huntsville, Alabama
Teledyne Wisconsin Motor, Milwaukee, Wisconsin

TRW FACILITIES SERVICED

TRW Vehicle Safety Systems Division, Washington, Michigan
TRW Vehicle Safety Systems Division, Romeo, Michigan
TRW Steering and Suspension Division, Sterling Heights, Michigan
TRW Steering and Suspension Division, Portland, Michigan
TRW Ross Gear Division, Lafayette, Indiana
TRW Revere Mold & Engineering, Roseville, Michigan

SUPERFUND SITE ACTIVITIES

Conservation Chemmical Company, Missouri
Alburn, Inc., Illinois
Berlin & Farro, Michigan
G & H Landfill, Michigan
LDI, Michigan
Metamora Landfill, Michigan
Butterworth Landfill, Michigan
Folkertsma Landfill, Michigan
Environmental Conservation & Chemical Corp., Indiana

Department of Natural Resources
Environmental Hazard Control Unit
Drum Inspection Log

Drum # 1K1 Date 12/19

Site Metamora Time 3:35 PM.

Type of Contents: ____SOLID ____LIQUID ____SLUDGE ____LAB PACK

____EXPLOSIVE OTHER ____

Color ____ Size of Grain ____

pH ____ ____PAPER ____METAL

Drum Size: X 55-gallon ____42-gallon ____30-gallon ____5-gal.

Other Overpacked

Amount of Contents: ____full ____three-fourths ____one-half

____one-fourth ____less than one-fourth

Sample Method: ____Pipette ____Trowel ____Other ____

Sampled By: ____

Drum Markings (include DOT stamp): ____

____

Additional Comments: Leaking fluid in backhoe bucket - carbon color from the crushed drum like being overpacked, contents lost to ground soil scraped up and placed in overpack drum containing contents of drum

Recorded By: KC from Harry

Location of Drum On-Site

Test Pit Layers

Description	Depth
1K1	8 feet

ATTACHMENT II

Department of Natural Resources
Environmental Hazard Control Unit
Drum Inspection Log

PITC 0 Drums Removed

Drum # _____ Date 12/16

Site METAMORA LANDFILL Time ?

Type of Contents: ____SOLID ____LIQUID ____SLUDGE ____LAB PACK

____EXPLOSIVE OTHER _____

Color _____ Size of Grain _____

pH _____ ____PAPER ____METER

Drum Size: ____55-gallon ____42-gallon ____30-gallon ____5-gallon

Other _____

Amount of Contents: ____full ____three-fourths ____one-half

____one-fourth ____less than one-fourth

Sample Method: ____Pipette ____Trowel Other _____

Sampled By: _____

Drum Markings (include DOT stamp): _____

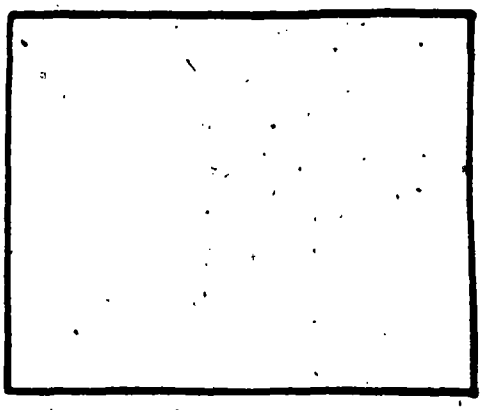
_____

Additional Comments: ABOUT 25' UP THE SIDE, A FEW DRUMS WERE BROKEN OPEN BY THE BACKHOE, A BLACK OILY SUBSTANCE FILLED UP THE PIT. IT WAS DECIDED TO CLOSE THE PIT AND NOT DISTURB ANY OF THE DRUMS

Recorded By: B. Hersey

****

Location of Drum



LAYERS

Designation	State

1

SITE AND LOCATION Metamora LF COUNTY Lapeer DATE 12/16/86

SITE OPENING TIME (24 HR. BASIS) 630 SITE OPENED BY R. IRVIN

SITE CLOSURE TIME (24 HR. BASIS) ______ SITE CLOSED BY ______

SAFETY LEVEL(S) UTILIZED A ☐ B ☒ C ☐ D ☐ OTHER (EXPLAIN) in work area

DNR STAFF ON SITE S. Phillips, R. Taszreak, W. Herzeg, R. Irvin

CONTRACTOR (SPECIFY) AND CONTRACTOR STAFF ON SITE H Griffon, B Smith, W. Fielhauer, M Stewart, M. Gregory, J Simons, D. Kuirsch, -CGES
Kim Kind, J. Marzdico, C Kielty, J. Simonson -ECJ

OTHER PERSONS ON SITE ______

WAS CONTRACTOR DAILY WORKSHEET VERIFIED FOR ACCURACY? YES ☐ NO ☐

EXPLAIN ANY DISCREPANCIES ______

SITE ACTIVITIES - DESCRIBE AND SIGN EACH ENTRY WITH TIME (INCLUDE ALL SITE SAMPLING)

Work continuing in Pit 1-B. Numerous drums w/ materials
many buried. Weather is 32° light s wind cloudy w/
Inspected Area 4: - not all drums in staging area taken
- area needs to be picked up
- Soil cover needed on pits to
cover exposed refuse & contaminated soil
Rick talked w/ reporter from Tri-City times yesterday
after I left. I will take back some air bottles to exchange
canister
Worked with ECJ on weather station. They are checking
it 3 times / day & shutting it off ~~at~~ between times
All pits on side of Area 1 complete - mostly burnt drums
will start work on top tomorrow

Department of Natural Resources
Environmental Hazard Control Unit
Drum Inspection Log

Drum #24 Date 12-9-86

Site Matamoras Time _____

Type of Contents: ____SOLID ____LIQUID ____SLUDGE ____LAB PACK

____EXPLOSIVE OTHER _____

Color _____ Size of Grain _____

pH _____ ____PAPER ____METER

Drum Size: X 55-gallon ____42-gallon ____30-gallon ____5-gall

Other _____

Amount of Contents: X full ____three-fourths ____one-half

____one-fourth ____less than one-fourth

Sample Method: ____Pipette ____Trowel Other _____

Sampled By: _____

Drum Markings (include DOT stamp): _____

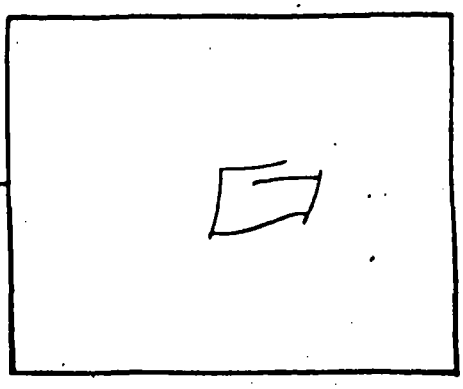
_____

Additional Comments: composite of soil taken from drums

Recorded By: TRO

****

Location of Drum On-Site



Test Pit Layers

Description	Depth
4B24	8'-9'

FIELD PHOTOGRAPHY LOG SHEET

PAGE 26 OF 28

Area 1 pit D startup

DATE: 12/4/86 TIME: 1337

DIRECTION: S

WEATHER: Cloudy

SITE: Matamoros

CAMERA # Canon LENS # 50 mm

TYPE FILM: Kodak ASA 200

ROLL # 2 FRAME # 29

PHOTOGRAPHED BY:

Herzog

DESCRIPTION:
(Include sample # if applicable)

Drum 1 D1 Ford Cabell

****

DATE: 12/4/86 TIME: 1339

DIRECTION: S

WEATHER: Cloudy

SITE: Matamoros

CAMERA # Canon LENS # 50 mm

TYPE FILM: Kodak ASA 200

ROLL # 2 FRAME # 30

PHOTOGRAPHED BY:

Herzog

DESCRIPTION:
(Include sample # if applicable)

[illegible] from drum 1 D1

FIELD PHOTOGRAPHY LOG SHEET

DATE: 12/17/84 TIME: 10:30

DIRECTION: _____

WEATHER: _____

SITE: Aetamora

CAMERA # Canon LENS # 55mm

TYPE FILM: ASA 200

ROLL # 3 FRAME # 3 ✓

PHOTOGRAPHED BY:

Herceg

DESCRIPTION:
(Include sample # if applicable)

1 F8 - leaking black liquid

****

DATE: 12/17/84 TIME: 10:35

DIRECTION: _____

WEATHER: fog

LABEL "RED SPOT"

SITE: Aetamora

CAMERA # _____ LENS # 55mm

TYPE FILM: Kodak ASA 200 ✓✓

ROLL # 3 FRAME # 4, 5

PHOTOGRAPHED BY:

Herceg

DESCRIPTION:
(Include sample # if applicable)

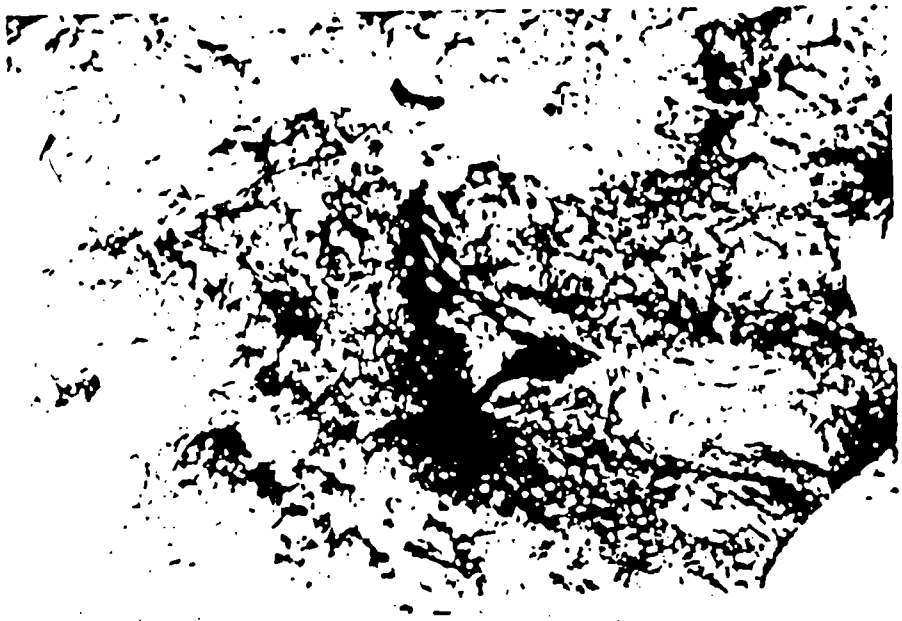
R...0 1F9 - Oil...

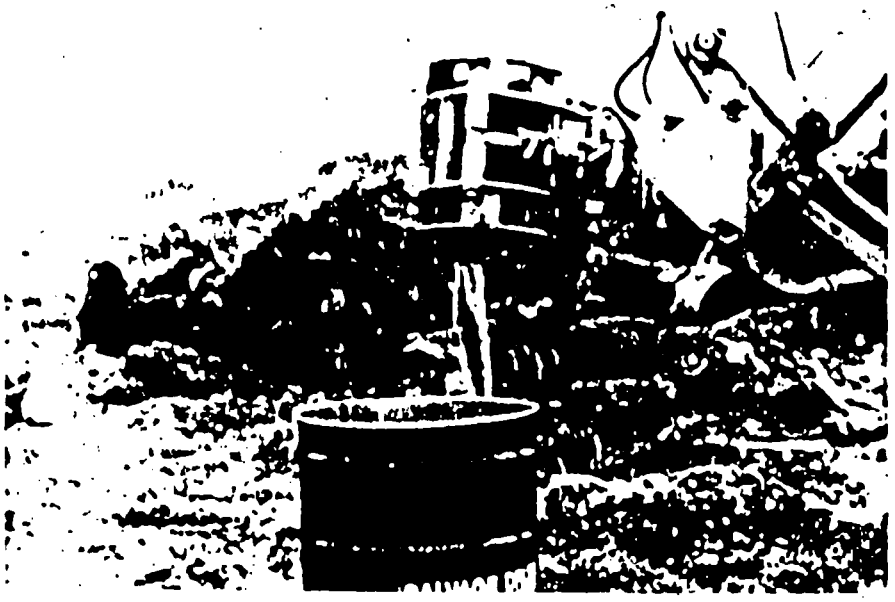
MDNR TEST PIT PHOTOGRAPHS (#1-10) AND
HALFEN PHOTOGRAPHS OF STORED DRUMS (#11,12)

ATTACHMENT III

DEVAMORA LANDFILL SITE PHOTOS

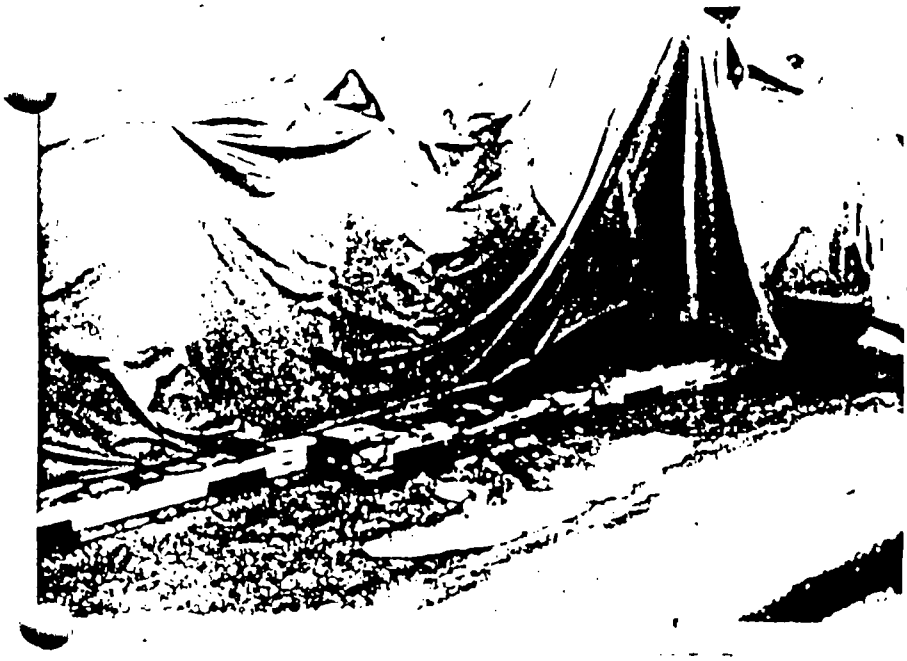
Photographs #1-10 were taken by MDNR during test pit excavations, and were selected from a larger group of photographs.
Photographs #11 and #12 were taken by Dr. L. Balfen during his 3/23/87 site inspection.

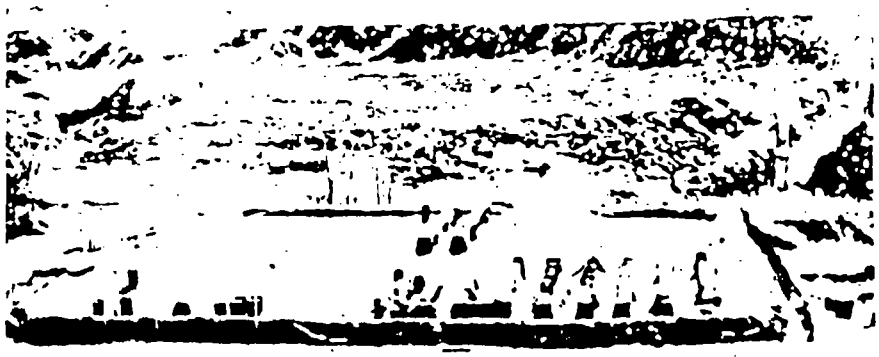


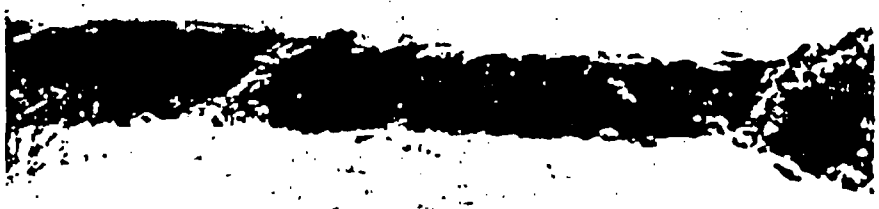


6

7







MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

May 28, 1982

TO: Members, Rule 57 Advisory Committee

FROM: Rich Powers, Chairman

SUBJECT: June 14, 1982, Committee Meeting

The next meeting of the Rule 57 Advisory Committee will be held at 10:00 a.m. June 14, 1982, in the 8th Floor South Conference Room, Mason Building, Lansing.

The purpose of the meeting will be to review the redraft of the committee recommendations to the Water Resources Commission. We should be able to cover the sections reviewed in-depth at the last meeting (Introduction, Procedure, Minimum data, and Carcinogenicity) fairly rapidly. A more detailed review may be needed for the following sections: aquatic acute and chronic toxicity, human life cycle safe concentration, terrestrial life cycle safe concentration, and bioconcentration fact or calculations. I have also drafted a memorandum for your consideration which would transmit the draft recommendations to the Water Resources Commission Executive Secretary and ask for public comment.

Our schedule to get the draft to the Water Resources Commission by their July 15, 1982 meeting allows for one more committee meeting the last week in June if absolutely necessary. Draft recommendations should be mailed to the Water Resources Commission by July 6, 1982.

cj

Enclosure (committee members)

Note: Appendix C will be mailed later.

ATTACHMENT IV

TO: Robert J. Courchaine, Executive Secretary, Water Resources Commission

FROM: Rule 57 Advisory Committee

SUBJECT: Draft Recommendations

Attached are draft recommendations from the Rule 57 Advisory Committee. The Committee has spent considerable time reviewing, discussing, debating and revising these recommendations. The Committee has encountered numerous highly technical, complex and value-laden issues during this process. The attached recommendations represent the best judgment of the committee on procedures for implementation of proposed Rule 57 which would adequately protect the environment and public health.

The committee respectfully requests that the draft recommendations be public noticed and that the record for public comment remain open for a period of 60 days. Constructive comments providing alternations and supporting data would be especially appreciated. Committee requests the opportunity to review the public comments and make revisions in the recommendations where necessary. Final recommendations would then be submitted to the Commission. It is felt that a broad review by all interested parties is appropriate and necessary at this point.

Respectfully submitted.

Jacqueline Anderson

Richard A. Powers

William E. Cooper, Ph.D.

Richard R. Rediske

Jay I. Goodman, Ph.D.

Paul Tomboulian, Ph.D.

Rolf Hartung, Ph.D.

Crosby E. Tompkins, Ph.D.

John L. Hesse

Thomas Newhof

RP:clp

DRAFT

DRAFT

Rule 57 Advisory Committee Report

on

Proposed Surface Water Quality-Based

Effluent Limitation Derivation Procedures

for Chemical Substances

May 10, 1982

Revised: May 28, 1982

DRAFT

TABLE OF CONTENTS

Office of Toxic Materials Control

DRAFT

DRAFT

Rule 57 Advisory Committee Report

INTRODUCTION

Description of Problem

The manufacture and use of chemicals have increased dramatically since World War II. Total U.S. production of synthetic organic chemicals was less than 1 billion pounds in 1941. U.S. production of the top 50 organic chemicals alone was over 170 billion pounds in 1978 (Toxic Substance Strategy Committee-1980). The Chemical Abstract Services has listed over 5 million chemicals. The chemical inventory conducted by the U.S. Environmental Protection Agency under the authority of Section 8 of the Toxic Substance Control Act (P.L. 94-469) lists over 44,000 chemical substances which have been manufactured, imported, or processed for a commercial purpose in the U.S. since January 1, 1975 (EPA 1979). This inventory does not identify all chemical substances currently in U.S. commerce. Chemical substances such as pesticides, food additives, pharmaceuticals and cosmetics were excluded from the inventory by regulation. Approximately 2000 Michigan industries discharging to the waters of the state or municipal sewer systems reported the manufacture or use of over 2 billion pounds of Critical Materials alone in 1981. These same industries reported discharging between 5.6 and 8 million pounds of Critical Materials in the same year. Total manufacture, use, or discharge of all chemicals in Michigan is unknown, but can be assumed to be considerably higher than the above figures.

DRAFT

Chemicals have become a vital part of our modern life. Chemicals and chemical products are involved in virtually every aspect of our daily lives. Agricultural chemicals, including feed additives, growth regulators, pesticides, fertilizers, and pharmaceuticals, have played a large part in the dramatic increases in agricultural productivity achieved over the past few decades. Plastics constitute a major portion of the components used to produce consumer goods such as automobiles and household appliances which have greatly changed our lives. Pharmaceuticals have contributed to increased longevity and the improved health of our citizens. Cosmetics, soaps, deodorants, and other personal hygiene products are all a direct result of the chemical industry. Chemicals play perhaps an even more important, if less obvious, role in many production and manufacture processes as raw materials, intermediates, catalysts, and solvents. The life style we currently enjoy would be impossible without man-made chemicals.

Most chemicals, when manufactured or used under the appropriate conditions, present little risk of adverse impacts on human health or the environment. However, many chemicals, if improperly manufactured, used or handled or if involved in accidents and spills, can cause severe damage. Michigan has experienced a series of incidents which provide stark testimony to this fact. Unsafe industrial manufacture, use and disposal of DDT, PCB, dieldrin and mercury have led to widespread environmental contamination and warnings against consumption of certain Michigan fish. Recently, new chemical contaminants such as toxaphene and chlorinated dioxins have been found in Great Lakes Fish. Warnings have been issued against consumption of any fish from large sections of the Pine, Chippewa, Tittabawassee, and Saginaw Rivers, due to PBB contamination. The PBB incident, largely

attributable to improper handling of the chemical, had the greatest impact on the economy, agricultural industry, and people of Michigan of any chemical contamination episode ever experienced in the U.S. The International Joint Commission (1978) has identified over 400 chemicals in biotic and abiotic components of the Great Lakes ecosystem. Many major groundwater aquifers in Michigan have been found to be contaminated by chlorinated industrial solvents due to improper use and disposal of these chemicals. Many of these solvents are carcinogens. Clean up of these problems, in order to restore the groundwater to a safe usable resource, will cost hundreds of millions of dollars. Several aquifers are so badly contaminated they may never be reclaimed.

It is clear that past manufacture, use, handling and disposal practices for chemicals have resulted in contamination of the environment with these chemicals. It is often very difficult to quantitate adverse impacts on humans and the environment from these chemicals. Acutely toxic effects, such as fish kills, are fairly obvious. Fortunately, these gross impacts are no longer common. Some impacts, such as contamination of fish, result in loss of value of the resource. Other impacts, such as impairment of reproductive ability in fish eating birds, have a direct effect on organisms in the ecosystem. Unfortunately, the methods and resources available are often not adequate or sensitive enough to quantitate these subtle impacts on a timely basis. For example, human epidemiology studies can detect increased cancer incidences over background rates at only one in one hundred, at best. Genetic mutations, which can leave changes in the genome of a population or birth defects in individuals, are almost impossible to document with certainty. It is similarily difficult to detect subtle chronic effects on humans and aquatic organisms.

However, over time, these impacts could have a profound impact on humans and the environment. To date, there have been no verified adverse impacts on humans in Michigan from drinking water contaminated with toxic chemicals. Ambient concentrations of toxic chemicals must be low enough to assure that there are no adverse impacts in the future. After the fact testing for adverse impacts, given the irreversibility of some impacts and the insensitivity of the testing methods, it is not an acceptable alternative.

Exposure to toxic substances has been linked to adverse health impacts in humans in spite of the inherent difficulties of carrying out these studies. Most of the data available is from the work place. This is likely due to emphasis on occupational health, the higher incidences of adverse effects due to relatively large exposures and the relative ease of studying those workers compared to people exposed due to the environmental contamination. For example, vinyl chloride, benzene and asbestos has been occupationally linked to increased cancer rates. Dibromochloropropane and kapone have caused sterility in workers. The Japanese have documented adverse impact on humans through exposure to fish contaminated with mercury and rice oil contaminated with PCB.

Cancer is often the primary concern to people of all of the hazards associated with the exposure to toxic substances. Acute, chronic, mutagenic, and teratogenic affects are recognized by scientists, trained health professionals and governmental staff as serious concerns. However, cancer is most feared by the public due to its insidious nature, the lack of knowledge of its causes and cures, the severe pain and suffering often associated with the disease, its position as the second leading

cause of death in the U.S., and the great emphasis given the disease by the media. The Toxic Substances Strategy Committee (1980), after an in-depth analysis, reported that both the incidence and mortality rates for cancer in the U.S. are increasing, due primarily to lung cancers. This committee reported that even after adjustment for age, cancer is the only major cause of death in the U.S. that rose continuously from 1900 to 1978. It has been estimated that 80 to 90 percent of all cancers may be caused by environmental factors. These factors include diet, personal habits, occupational exposures, and environmental exposures. There is much controversy at the present time over the relative importance of the various factors. Many cancers may in fact be the result of several of these factors acting together. However, toxic substances have been unequivocally shown to be one of the causes of cancer.

DRAFT

The large volume of chemical substances used and discharged to the environment in Michigan and the potential of these toxic substances to cause adverse impacts on the public health and environment make it prudent public policy to develop regulatory programs to limit exposure to these substances. Reducing exposure to toxic substances will reduce risk of adverse impacts from these toxic substances. However, zero risk is not usually a realistic or attainable goal, especially for carcinogenic substances. Society must be willing to incur some additional risk of injury to human health or the environment in order to continue to enjoy the benefits derived from the manufacture and use of chemicals.

Background on Rule 57 Advisory Committee

Act 245, P.A. 1929 as amended (the Water Resources Commission Act) is

DRAFT

the basic water pollution control legislation for Michigan. Sections 2, 5, and 7 of the act empower the Water Resources Commission (WRC) to issue permits to control pollution of the waters of the state and to restrict the constituents of discharges to assure compliance to state standards. Section 6(a) of the Act makes it unlawful to discharge into the waters of this state any substance which is or may become injurious to the public health, safety or welfare, the use of the waters, or livestock, wildlife plants or aquatic life.

Rule 1057 of the Part 4 Rules (Table 1) promulgated in 1973 pursuant to Act 245 states that the concentrations of toxic substances in the waters of the state shall not exceed safe concentrations as determined by applying application factors, based on knowledge of toxic substances and organisms to be protected, to the appropriate effect end point. Toxic substances are defined as substances in concentrations or combinations which are or may be harmful to plant or animal life.

Michigan Department of Natural Resources staff began a review of the Water Quality Standards in 1973 to determine which standards required revision. A series of draft revisions and public hearings were held between 1976 and the present. It was decided that Rule 1057 needed revision to reflect the vast increase in knowledge of toxic substances developed since 1973. The latest version of draft Rule 1057 (Table 2) was developed by staff in response to comments received in public hearings on earlier versions. The draft states that the Water Resources Commission shall determine concentrations and quantities of toxic substances which do not present an unacceptable risk of injury to the public health

DRAFT

TABLE 1: Rule 1057 of the Water Quality Standards

(1) Toxicity of undefined toxic substances not specifically included in subrules (2) and (3) shall be determined by development of 96 hour TL_m's or other appropriate effect end points obtained by continuous-flow or *in situ* bioassays using suitable test organisms. Concentrations of undefined toxic substances in the waters of the state shall not exceed safe concentrations as determined by applying an application factor, based on knowledge of the behavior of the toxic substances and the organisms to be protected in the environment, to the TL_m or other appropriate effect end point.

(2) For all waters of the state, unless on the basis of recent information a more restrictive limitation is requred to protect a designated use, concentrations of defined toxic substances, including heavy metals, shall be limited by application of the toxic substances recommendations contained in the chapter on Freshwater Organisms, "Report of the National Technical Advisory Committee to the Secretary of the Interior, Water Quality Criteria, 1968", or by application of any toxic effluent standard, limitation or prohibition promulgated by the administrator of the United States Environmental Protection Agency pursuant to section 307 (a) of the United State Public Law 92-500, whichever is more restrictive.

(3) In addition to the standards prescribed in subrules (1) and (2), waters of the state used for public water supply shall, at the point of water intake, not exceed the permissible inorganic and organic chemicals criteria for raw public water supply in "Report of the National Technical Advisory Committee to the Secretary of the Interior, Water Quality Criteria, 1968", except that chlorides shall be limited to the same extent as prescribed by rule 1051(2).

DRAFT

III. Determination of an Acceptable Level of Risk

The determination of an acceptable level of risk is a complex socio-economic issue in which many factors need to be considered. The Rule 57 Advisory Committee has recommended that an estimated risk level of 10^{-5} (1 in 100,000) be used for deriving water quality based effluent limitations for the discharge of carcinogenic chemicals. Consideration of economic issues is beyond the scope of this committee. However, the committee feels that the risk associated with exposure to carcinogenic chemicals in ambient water should generally be below that of common everyday risks. Table 1 lists some of these common risks which can be used for comparison. Cancer risks were extrapolated using a linear, non threshold model.

Considering the present lifetime cancer risk, an additional 10^{-5} risk will be nondetectable even by the most sophisticated epidemiological methods. Epidemiology studies are generally very insensitive to detecting low levels of cancer due to problems such as small populations at risk and a relatively high background cancer rate. Detection of any increased cancer incidence would therefore be indicative of a failure of the protective measures (e.g. the animal model was not appropriate) utilized.

DRAFT

TABLE F.1

COMPARISON OF EVERY DAY RISKS[1]

Risk of Death	Risk/Year	Risk/Lifetime[2]
Motor Vehicle (in 1975)	2.2×10^{-4}	1.5×10^{-2}
Skiing - 40 hrs/yr engaged in sport	3×10^{-5}	2.1×10^{-3}
Canoeing - 40 hrs/yr engaged in sport	4×10^{-4}	2.8×10^{-2}
Rock Climbing (U.S.) - 40 hrs/yr engaged in sport	1×10^{-3}	6.8×10^{-2}
Fishing (drowning) - averaged over fishing licenses	1×10^{-5}	7×10^{-4}
Drowning (all recreational causes - U.S.)	1.9×10^{-5}	1.3×10^{-3}
Bicycling	1×10^{-5}	7×10^{-4}
Extrapolated Cancer Risks		
One transcontinental flight/year (cosmic ray risk)	5×10^{-7}	3.5×10^{-5}
Average U.S. diagnostic medical X-ray (radiation risk)	1×10^{-5}	7×10^{-4}
One diet soda/day (saccharin)	1×10^{-5}	7×10^{-4}
Four tablespoons peanut butter/day (aflatoxin)	4×10^{-5}	2.8×10^{-3}
Smoker, cancer only	1.2×10^{-3}	8.1×10^{-2}
Smoker, all effects (including heart disease)	3×10^{-3}	1.7×10^{-1}
Person in room with smoker	1×10^{-5}	7×10^{-4}

[1] From Wilson, Richard 1979

[2] Risk/Lifetime = $1-(1-P)^{70}$ (P = Risk/year)

DRAFT

IV. Expert Committee for Complex Issues

An expert committee consisting of members with educational and professional experience in the area of carcinogenicity should be established to evaluate any complex issues which may arise and cannot be handled by these procedures. Issues which the committee might address include claims that a chemical is acting through epigenetic mechanisms, intermittent discharge of carcinogens, species adjustment factors, and other highly technical questions. Following evaluation of each issue the expert committee would make their recommendations to staff.

CS:amk

ANALYSIS AND PERSPECTIVE

DETERMINATION OF SIGNIFICANT RISK IN THE REGULATION OF CHEMICAL CARCINOGENS

By Joseph V. Rodricks, Grover C. Wrenn, and Susan M. Brett*

Risk assessment is now the basis for most important regulations concerning potentially hazardous substances. Although the uncertainties in risk assessment are large, there appears to be no useful alternative to its use. Even considering the uncertainties, risk assessment is the most powerful device available to organize and express what can be stated about risks that are not subject to direct observation and measurement, but which nevertheless may be of concern. Risk management is the term applied to the process of deciding whether a risk requires reduction, identifying the options for risk reduction, selecting the means for and objectives of risk reduction, and implementing those means. Risk management incorporates not only risk information, but also information on technical feasibility, cost, and other social benefits, as well as political factors. The extent to which this additional information influences risk management decisions largely depends upon the requirements of applicable statutes and the habits of thinking that have evolved within the responsible regulatory agencies.

Although there have been numerous studies of and commentaries on most elements of the risk assessment-risk management process, at least one element appears to have escaped detailed analysis: the determination of whether a given predicted risk poses a significant threat to the public health and of the extent to which risk reduction is needed to achieve public health protection. Because determinations that a risk is "significant" or "insignificant" trigger or halt regulatory action, it would seem important to more thoroughly consider their bases. In this article, we have described briefly policies of three major regulatory agencies — the Food and Drug Administration, the Environmental Protection Agency, and the Occupational Safety and Health Administration — in regulating exposures to carcinogens. We have also described what these agencies have themselves concluded regarding the magnitude of risk that should be considered a significant public health concern.

Food And Drug Administration

Risk assessment has been used by FDA primarily as a basis for regulating substances added to or contaminating food, although recently FDA has extended this practice to other classes of products.

The FDA was the first government agency formally to incorporate risk assessment into regulatory decision-making. In 1973 FDA proposed to define the maximally acceptable concentration of food residues of carcinogenic drugs used in food-producing animals as that which would produce a lifetime carcinogenic risk no greater than one-in-one hundred million (10^{-8}).

Insignificant Risks

In effect, FDA was saying that food residues of carcinogens in this particular class of regulated agents could be present below the maximally acceptable concentration without jeopardizing the public health. Although in response to public comments FDA later changed the maximally acceptable lifetime risk to one-in-one million (10^{-6}) and modified the risk assessment methodology (to the linear-proportional form currently in use), risk assessment became firmly lodged as a regulatory tool.

FDA has adopted this same approach for other classes of regulated substances that are carcinogenic and has even extended the approach to cover some directly added food ingredients, in apparent defiance of the "zero-risk" requirements of the Delaney Clause. In all these cases FDA has insisted its goal has been to satisfy the statutory requirement that substances added to food must be "safe," which, in the context of food law, has generally been defined as "reasonable certainty of no harm."

FDA has further insisted that the benefits of food and color additives cannot be considered in its regulatory decisions — an additive can be introduced into food only if it has been shown to be safe. A position has thus evolved within FDA that a carcinogen can be considered safe as long as exposure to it is restricted to levels posing

* Joseph V. Rodricks is a senior principal, Grover C. Wrenn is president, and Susan M. Brett is project manager at ENVIRON Corp., Washington, D.C.

insignificant risks. The application of this principle to substances subject to the Delaney Clause will be subjected to judicial review in the coming months.

Predicted lifetime cancer risks less than 10^{-6} have been defined by the agency as *insignificant* in several of its decisions. In a 1979 reproposal of the animal drug residue regulation, FDA stated that "a risk level of one-in-one million over a lifetime imposes no additional risk of cancer to the public." FDA also has stated that a level of a substance that presents no more than a one-in-one million lifetime risk of cancer "can properly be considered of insignificant public health concern" and is "the level that represents no significant carcinogenic burden in the total diet of man."

Finally, it should be recognized that FDA has found lifetime cancer risks greater than 10^{-6} for certain classes of inadvertent food contaminants — PCBs, polychlorinated dioxins, and aflatoxins — as acceptable, given the technical and cost limitations on reducing such risks.

Environmental Protection Agency

For carcinogenic pesticides that are subject to the Federal Insecticide, Fungicide and Rodenticide Act, EPA is required to perform a risk-benefit analysis.

It appears that in most cases EPA has used 10^{-6} lifetime risk as a rough guide to significant risk decisions, but the agency has allowed risks greater than 10^{-6} when benefits were large and has acted against pesticides posing risks less than 10^{-6} when benefits were seen as negligible. It is not clear what the upper limit in risk acceptance is for pesticides regulated under FIFRA, but there are several decisions in which EPA has accepted lifetime risks as high as approximately 10^{-6}.

It should be noted that EPA usually considers qualitative evidence — particularly the quality and strength of the animal bioassay data — along with the quantitative risk estimates in its discussions of risk significance. Also, many of the actions against pesticides involved significant risks of toxicity other than carcinogenicity.

Carcinogenic Air Pollutants

Of relevance in determining what constitutes significant public risk is EPA's treatment of non-occupational risks in its regulatory decisions under Section 112 of the Clean Air Act, which provides for promulgation of National Emissions Standards for Hazardous Air Pollutants (NESHAPs). EPA has agreed with the Supreme Court's view, expressed in the "Benzene" decision (see below), that "safe" is not equivalent to "risk-free," and determined that "standards under Section 112 should protect against *significant* public health risks."

EPA explained in its notice withdrawing proposed regulations of radionuclides from elemental phosphorus plants and other sources that two measures of risk provide important information about significance. The first, "nearby individual risk," refers to the "estimated increased lifetime risk from a source that is faced by individuals who spend their entire life (*sic*) at the point where predicted concentrations of the pollutant are highest." The second, "total population impact, refers to the aggregate risk to all exposed persons in terms of total yearly fatalities."

These two estimates — individual risk and population impact — together provide a superior description of a risk than either alone. EPA has explained, because "nearby individual risk" tells us the highest risk to which anyone is subject, but not how many persons face this risk. (In fact, the number is usually small, for "generally few people reside at the points of maximum concentrations and spend their whole lives at such locations.") Conversely, "total population impact . . . describes the overall health impact" of a substance, but says nothing about the most exposed individuals.

EPA has found the maximum individual risks and total population risks from a number of radionuclide and benzene sources too low to be deemed significant. For instance, benzene emissions from maleic anhydride process vents created maximum individual risks of about 80 per million, but an aggregate public health impact of only about 0.03 extra cancer cases per year. Radionuclides from Department of Energy facilities expose a person who accrues lifetime exposure to a plant's most concentrated emissions to a risk greater than 1 in 10,000, while, in the aggregate, only 0.08 extra cancer cases would be predicted to occur yearly, or roughly one case every thirteen years.

Drinking Water

In a recent interpretation of the Safe Drinking Water Act, EPA has proposed that, for "non-threshold toxicants" contaminating drinking water, such as carcinogens, no safe level of exposure can be established.

The agency proposed zero exposure as the goal (Recommended Maximum Contaminant Levels) for such contaminants, and then proposed Maximum Contaminant Levels (MCLs) based on considerations of technical feasibility.

Under this approach, it can be presumed MCLs would have to be reduced whenever it became technically feasible to do so. This approach explicitly rejects the use of risk assessment and any notion of a finite risk that can be considered insignificant.

Superfund and RCRA

Although no clear pattern has yet emerged, EPA appears generally to seek cleanup levels for carcinogenic contaminants of superfund sites that ensure lifetime risks less than 10^{-6}. In the agency's official superfund guidance documents, risk goals are stated to fall in the range of 10^{-4} to 10^{-7}, but so far emphasis has been placed on the 10^{-6} figure.

Most of the information about risks predicted at superfund sites appears in the so-called Remedial Investigation-Feasibility Study (RI/FS) technical documents prepared after site investigations. Based on these documents, EPA prepares decision documents (Records of Decision) in which the choice of cleanup plans is described.

We have recently reviewed 140 Records of Decision on superfund remedial actions issued from 1982-1985.

...and risk assessment information described in this small fraction of these documents. It is thus difficult to determine the extent to which risk information plays a role in the selection of remediation options and, particularly, whether the costs of cleanup are commensurate with the magnitude of risk reduction achieved (*i.e.*, whether remediation is cost effective). This conclusion is, however, limited by the fact that Records of Decision issued in the past year have not been reviewed to determine if the early trends have changed.

Risk assessment may acquire increased importance in the superfund program in the next several years. The first reason is the evolution of the risk assessment process, and its increased acceptance in the regulatory community as a decision-making tool. The second reason is the passage of the Superfund Amendments and Reauthorization Act. In the new Section 121, Congress attempts to provide direction to EPA in determining cleanup standards and selecting remedial actions. With the new amendments, risk assessment may be needed to establish the cleanup standards, because the law explicitly requires the selection of a "remedial action that is protective of human health and the environment." It is difficult to envision such actions being taken without the use of risk assessment.

The conferees stated that "in determining the appropriate level of cleanup the President first determines the appropriate level of environmental and health protection to be achieved and then selects a cost-efficient means of achieving that goal."

The use of risk assessment in the Resource Conservation and Recovery Act program is also evolving. RCRA requires EPA to protect human health and the environment in regulating hazardous waste management practices, without explicitly stating any level of protection. Although the use of risk assessment in the hazardous waste regulatory program has been minimal to date, senior EPA managers expect that its use will increase in the future. Three areas are worth watching.

The first area involves the establishment of alternate concentration limits (ACLs). EPA has the authority through a petition process to set less stringent groundwater standards for RCRA facilities if the agency finds that meeting these ACLs will not pose a substantial present or future hazard. EPA must consider the exposure potential and the health risks involved. To date, EPA has not issued an ACL, however, EPA expects to do so in the future and is currently evaluating what is an acceptable level of risk.

The second area involves corrective actions that will be required for continuing releases at permitted facilities and for releases beyond facility boundaries. To date, no corrective action standards have been established, but EPA has indicated that risk assessment will be used in setting standards for such corrective actions.

The third area involves the listing and delisting of wastes. Wastes are currently listed as hazardous based on their source, and specific generators of these wastes may petition EPA to delist their wastes. To date, EPA has used a simplified exposure model to evaluate the petitions. Rather than continuing with this approach, EPA is developing the use of a different listing procedure. This would involve a concentration-based definition of what is hazardous under RCRA and what is not.

Toxicity would be assessed based on the concentration and potency of the constituents in the waste. This approach, it is hoped, would eliminate the need for delisting; a substance would either be hazardous or not depending on its concentration.

Occupational Safety And Health Administration

OSHA is the primary agency charged with assuring worker health and safety. OSHA is required to find risks significant before it may seek to regulate them. As the Supreme Court ruled in *Industrial Union Department, AFL-CIO v. American Petroleum Institute* (the "Benzene" case), the Secretary of Labor, before promulgating any safety or health standard, must "make a finding that the workplaces in question are not safe."

However, "safe" is not the equivalent of "risk-free." There are many activities that we engage in every day — such as driving a car or even breathing city air — that entail some risk of accident or material health impairment; nevertheless, few people would consider these activities "unsafe." Similarly, a workplace can hardly be considered "unsafe" unless it threatens the workers with a significant risk of harm. (448 US at 642) (1980)

As the Supreme Court noted, individuals face a multiplicity of risks in activities they do not consider unsafe. In determining the level of occupational risk that constitutes a significant risk, an approach suggested by the Court — comparison of the risk in question to other common occupational risk levels — has been used by OSHA. The Court also suggested a lifetime occupational cancer risk of 1 in 1,000 as a "rule of thumb" for identifying significant risk.

Some risks are plainly acceptable and others are plainly unacceptable. If, for example, the odds are one in 1 billion that a person will die from cancer by taking a drink of chlorinated water, the risk clearly could not be considered significant. On the other hand, if the odds are one in 1,000 that regular inhalation of gasoline vapors that are 2 percent benzene will be fatal, a reasonable person might well consider the risk significant and take appropriate steps to decrease or eliminate it. (448 US at 655)

Safe Risk Level

A 1-in-1,000 lifetime risk level is in the range of other fatality hazards in jobs commonly thought of as "safe." On the basis of data collected by the Bureau of Labor Statistics for 1984, the average lifetime risk of a work-related death in private sector establishments with 11 or more employees is 2.9 per 1,000 (assuming 45 years of employment). Risks of some specific occupations considered by OSHA are presented in the accompanying chart. It should be remembered that these are directly measured risks, and have more certainty than the predicted risks of occupational cancer.

Health standards promulgated by OSHA generally

have stopped short of regulating occupational cancer risks below 1 in 1,000, largely because of feasibility limitations. The residual lifetime risks (i.e., those remaining after implementation of OSHA's revised Permissible Exposure Limit) associated with the inorganic arsenic and ethylene oxide standard are, in OSHA's estimation, 8 per 1,000 and 1 to 2 per 1,000, respectively. Further, the residual risks associated with the proposed benzene standard are, according to OSHA, 5 to 16 per 1,000.

Emerging Trends

Although our review of significant risk decisions is not exhaustive, several trends emerge. With one important exception, two federal regulatory agencies (EPA, FDA) now appear to recognize the notion of "insignificant" or *de minimis* risk.

At least in the past five years there appears to be no case in which predicted lifetime cancer risks $< 10^{-6}$ have been subjected to regulation, with the possible exception of some pesticides judged to provide insignificant benefits. Although agencies and offices within those agencies have described the concept of *de minimis* risk in different ways and with varying degrees of explicitness, there appears to be almost universal acceptance of the concept.

The exception to this trend is, of course, the EPA's Drinking Water Office, which rejects as unsafe, at least in principle, any finite risk of carcinogenesis, no matter how small. The Office does, however, accept finite exposures to carcinogens because of technical limitations.

Decisions on cleanup goals at most superfund sites appear to be based on risk analysis, but the magnitude of risk reduction achieved at superfund sites as a function of cost is not readily identifiable from agency decision documents. The new superfund law is likely to lead the agency to consider risk information more fully in decision making. Risk assessment is likely to become an increasingly important decision-making tool under RCRA.

Insignificant Occupational Risk

OSHA has not judged any occupational carcinogenic risk to be clearly insignificant, but has not sought to regulate predicted lifetime risks below about 10^{-3}. It appears that, at least in practice, OSHA is prepared to find some level of occupational risk insignificant.

The other emergent trend is that the regulatory agencies have found lifetime risks to the general population greater than 10^{-6}, sometimes up to about 10^{-4}, as acceptable, either because of cost or feasibility constraints or because the size of the exposed population was small. Even the Office of Drinking Water accepts risks in this range for the trihalomethane contaminants produced as a byproduct of chlorination.

Except for EPA decisions under the CAA, as described above, we can find no evidence that agencies regard general population risks greater than 10^{-4} as clearly insignificant; rather, risks greater than 10^{-4} are often described as "acceptable" because reductions to the clearly negligible range are either technically infeasible or too costly.

Lifetime Risks† of Work-Related Deaths In Selected Industries

Assume 45-year working lifetime* and death rates for 1984. Use of data for other years will yield slightly different estimates.

	Lifetime Risks/1,000
Mining	18.6
Construction	10.3
Transportation and Public Utilities	7.6
Agriculture	7.3
Manufacturing	2.6
Services	1.8
Wholesale and Retail Trade	1.4
Finance, Insurance, Real Estate	0.9

†Bureau of Labor Statistics figures were converted to lifetime risks to permit comparison with lifetime risks predicted for chemical carcinogens.

SUMMARY OF DEVELOPMENTS

FEDERAL LEGISLATION

Criminal Sentencing

NEW GUIDELINES INCLUDE CHANGE IN SENTENCES FOR ENVIRONMENTAL CRIMES

New guidelines for criminal sentencing presented to Congress April 13 by the U.S. Sentencing Commission increase the chances for jail sentences for white collar criminals, including those involved in environmental crimes.

The commission prepared guidelines that set a basic offense level for a crime, including "offenses involving the environment," and then allow federal district courts to apply adjustments in determining an appropriate criminal sentence.

The guidelines, which were approved by 6 votes to 1 vote, restore some discretion to judges, and address some topics, such as multiple counts, which had not been the subject of much elaboration before. The guidelines were developed under the Sentencing Reform Act of 1984.

The commission established offense levels, similar to a point system, for offenses. Courts, in imposing a sen-

ES&T FEATURES

Cancer risk management

A review of 132 federal regulatory decisions

Curtis C. Travis
Samantha A. Richter
Oak Ridge National Laboratory
Oak Ridge, Tenn. 37831

Edmund A. C. Crouch
Richard Wilson
Harvard University
Cambridge, Mass. 02138

Ernest D. Klema
Tufts University
Medford, Mass. 02155

Various federal agencies are responsible for promulgating regulations and standards to protect the public from exposure to environmental carcinogens. Although many factors are considered in the decision to regulate a carcinogen, one important issue concerns the probability that individuals in an exposed population will develop cancer.

What has not been clear, however, is the level of cancer risk that triggers regulation, or whether there is consistency within and between agencies in arriving at the risk decisions that underpin regulatory action. We have retrospectively reviewed the use of cancer risk estimates in prevailing federal standards and in withdrawn regulatory initiatives to determine whether any simple patterns emerge to correlate risk level with regulatory action. Our results show that there are definite patterns and a surprising degree of consistency in the federal regulatory process.

The sources of the data reviewed are notices of proposed or final regulations found in the *Federal Register* and in published and unpublished regulatory support documents, all of which are in the public domain. Three measures of risk are considered: *Individual risk* is measured as an upper-limit estimate of the probability that the most highly exposed individual in a population will develop cancer as a result of a lifetime of exposure. The *size of the population* exposed to the hazards is considered. Finally, *population risk* is measured as an upper-limit estimate of the number of additional incidences of cancer in the exposed population. Federal agencies compute population risks (as measured by the number of cancer deaths per year) by one of two methods: by multiplying maximum individual risk by population size or by accounting for variations in individual exposure levels and adding up the resulting figures for an entire population. Almost one-third of the population risk estimates reviewed here were calculated using the first method, although the second method is preferable.

Knowledge of two additional terms, de manifestis and de minimis, is important to understanding the patterns that emerge from the data. *De manifestis* risk, literally a risk of obvious or evident concern, has its roots in the legal definition of an "obvious risk"; one that is instantly recognized by a person of ordinary intelligence. *De minimus* risk has been used for a number of years by regulators to define an acceptable level of risk that is below regulatory concern. This term stems from the legal principle, *de minimis non curat lex*; "the law does not concern itself with trifles."

Table 1 lists 132 regulatory decisions for which at least one of these measures of risk was estimated prior to regulation of the substance in question. The methods used by federal agencies for estimating individual risk are generally considered to overestimate risk; they assume maximum exposure and a linear no-threshold dose-response function. For example, the population risk estimate for saccharin (Number 100 in Table 1) is listed as 1200 cancer deaths annually, although the Food and Drug Administration (FDA) states that this is an upper-limit risk estimate and the actual risk is between zero and 1200.

The published maximum risk estimates have been taken at face value; any errors in the estimates or interagency differences in the approach to risk analysis are not considered impor-

TABLE 1
Preregulatory risk levels for chemical carcinogen exposures

Chemical decision[a]	Agency	Individual lifetime risk (per 10^6)	Exposed population size (millions)	[illegible]	Reference
Public					
Acrylonitrile					
1. Food	F	0.01	[illegible]	[illegible]	48-FR-39836
2. Air	E1	386	230	[illegible]	50-FR-24312
Aflatoxins					
3. Corn	F	70	30	80	FDA Docket No. 78N-0048
4. Peanuts	F	3	200	36	
5. Aluminum tris	E2	0.098	—	—	48-FR-60632
6. Amiben	E2	0.801	—	—	46-FR-17229
Amitraz					
7. Apples[e]	E2	0.2	220	6	44-FR-2678
8. Pears	E2	0.2	220	6	44-FR-2678
Arsenic					
9. Primary lead smelters	E1	6.7–167	—	0.008–0.1	48-FR-33112
10. Primary zinc smelters	E1	0.1–6	—	0.005–0.008	48-FR-33112
11. Zinc oxide plants	E1	20–200	—	0.008–0.02	48-FR-33112
12. Chemical manufacturers	E1	4–80	—	0.0008–0.1	48-FR-33112
13. Secondary lead smelters[e]	E1	21–345	—	0.04–4	48-FR-33112
14. High copper smelters[e]	E1	2366–38,000	0.07	1–12	48-FR-33112
15. Low copper smelters[e]	E1	430–6902	0.85	2	48-FR-33112
16. Glass manufacturers[e]	E1	64–1600	4.2	0.07–1	48-FR-33112
17. Asbestos[e]	[illegible]	[illegible]	—	—	51-FR-3738
18. *Benomyl*	E2	0.7	—	—	47-FR-46747
Benzene					
19. Maleic anhydride plants	E1	[illegible]	10	0.02	49-FR-8386
20. Ethylbenzene styrene plants	E1	[illegible]	2.6	0.08	49-FR-8386
21. Storage vessels	E1	[illegible]	[illegible]	0.04	49-FR-8386
22. Coke byproduct[e]	E1	[illegible]	[illegible]	2	49-FR-23522
23. Fugitive emissions[e]	E1	[illegible]	[illegible]	0.5	49-FR-23498
24. Equipment leaks[e]	E1	[illegible]	—	0.1	49-FR-23498
25. Paint strippers[e]	C	[illegible]	—	—	43-FR-21838
26. *Butadiene*[e]	E1	7000–60,000	[illegible]	18.5	50-FR-41466
27. C.I. Vat Orange[illegible]	[illegible]	0.068805	—	—	50-FR-20406
28. Carbon tetrachloride[e]	E1	780	[illegible]	70	50-FR-32621
29. Chloroalkylidenethiocarbamate[e]	E2	0.2	—	—	46-FR-27973
Chlorobenzilate					
30. U.S. population[e]	E2	[illegible]	200	6	44-FR-9648
31. Florida population[e]	E2	[illegible]	[illegible]	0.9	44-FR-9648
Chloroform[e]					
32. Water	E1	[illegible]	—	2	50-FR-39626
33. Waste	E1	[illegible]	—	0.6	50-FR-39626
34. Chlorinated benzenes	E1	[illegible]	6.5	0.0095–0.007	50-FR-32626
35. *Chlorothalonil*	E2	2	—	—	49-FR-45863
36. *Chromium*[e]	E1	1200–16,000	220	290	50-FR-24317
37. Cinnamyl anthranilate[e]	C	0.7	—	—	47-FR-22545
38. Coke oven emissions[e]	E1	300–5800	0.12	2–6	41-FR-46742
39. *Cypermethrin*	E2	0.1	—	—	50-FR-1112
40. *Cyromazine*	E2	0.1	—	—	49-FR-18120
41. *Diallate*[e]	E2	10	—	—	PD #4, 1982
1,2-Dibromo-3-chloropropane					
42. Peanuts[e]	E2	60	220	1960	44-FR-65151
43. Vegetables[e]	E2	60	220	1960	44-FR-65151
Dimethylnitrosamine					
44. Baby bottles[f]	[illegible]	0.004	[illegible]	[illegible]	FDA Docket No. 83D-0414
45. Paper, paperboard	[illegible]	0.0006	—	—	50-FR-4643
46. *1,4-Dioxane*	[illegible]	0.0000086	—	—	50-FR-36972
Epichlorohydrin					
47. Air	[illegible]	[illegible]	[illegible]	0.005	50-FR-24575
48. Dimethylamine	[illegible]	0.0000068	—	—	48-FR-13018
49. Polyamide	[illegible]	0.009	—	—	49-FR-13021
50. *Ethalfluralin*	E2	0.4	—	—	49-FR-811
51. *Ethylene bisdithiocarbamates*	E2	50	220	—	47-FR-47669
Ethylene dibromide					
Soil fumigant					
52a. Food[e]	E2	1	230	38	48-FR-46228
52b. Water[e]	E2	5	230[g]	25	PD #4, 1983
53. Stored grain fumigant	E2	100	—	—	PD #4, 1983
54. Spot grain fumigant[e]	E2	24	230	790	48-FR-4452
55. Quarantine fumigant[e]	E2	30	230	380	48-FR-46228
56. *Ethylene oxide*[e]	E2	200	—	66	50-FR-40286
Formaldehyde					
57. High school teachers	E4	3	0.089	0.02	49-FR-21870
58. High school students	E4	0.03	3.8	0.01	49-FR-21870
59. College teachers	E4	7	0.1	0.1	49-FR-21870
60. College students	E4	0.3	2.9	0.1	49-FR-21870
61. Medical students	E4	40.6	40.079	40.006	449-FR-21870
62. Dental students	E4	40.3	40.0215	40.001	449-FR-21870
63. Nursing students	E4	0.3	0.245	0.01	49-FR-21870
64. Mobile homes[e]	E4	18	4.2	8	49-FR-21870
65. Homes (non-urea-formaldehyde foam insulation)	E4	10	100	160	49-FR-21870
66. Rural air	E4	0.3	58	2	49-FR-21870
67. Urban air	E4	3	160	80	49-FR-21870
68. Particle board	E4	20	—	0.01	49-FR-21870
69. Homes (urea-formaldehyde foam insulation)	E4	6	1.8	1.3	49-FR-21870
70. Urea-formaldehyde insulation[e]	C	9–30	1.8	23	48-FR-[illegible]88

Chemical deletion	Agency	Individual lifetime risk (per 10⁶)	Exposed population, size (millions)	Annual control cost	Reference
FD&C Yellow #6 (food)	—	0.04	—	—	50-FR-36774
71. 4-Aminoazobenzene	F	0.00005–0.001	—	—	50-FR-36774
72. 4-Aminobiphenyl	F	0.01	—	—	50-FR-36774
73. Aniline	F	0.000004	—	—	50-FR-36774
74. Azobenzene	F	0.00002	—	—	50-FR-36774
75. Benzidine	F	0.03	—	—	50-FR-36774
76. 1,3-Diphenyltriazene	F	0.0004	—	—	50-FR-36774
Gasoline products					
77. Bulk terminals[a]	E2	200–400	—	1–8	48-FR-31706
78. Service stations[a]	E2	4.4–7.2	—	3–6	48-FR-31706
79. Self-serve[a]	E2	8–9	—	20–30	48-FR-31706
80. *Lead acetate*	F	0.02	—	—	48-FR-72112
Lindane					
81. Ornamental uses	E2	0.8	0.08	—	48-FR-46382
82. Dog dips[a]	E2	0.4	16	—	PD #4, 1980
83. Shelf paper	E2	2	11	—	PD #4, 1980
84. Methoxychlor	E2	0.006	—	—	48-FR-49117
Methylene chloride					
85. Decaffeinated coffee	F	0.1	3.7	0.06	50-FR-51551
86. Aerosol cosmetics[a]	F	10	—	—	50-FR-51551
87. Air[a]	E1	10	—	—	50-FR-42037
88. 4,4'-Methylenedianiline	E4	0.1–2	0.09	—	48-FR-42866
89. Methylenebis (o-chloroaniline)	E4	0.3	0.05	—	48-FR-22954
90. Metolachlor	E2	0.1	—	—	47-FR-23932
91. Oryzalin	E2	0.06–0.9	—	—	48-FR-45854
92. 2,2'-Oxydianiline	F	0.007	—	—	48-FR-37618
93. Oxyfluorfen (perchloroethylene) diet	E2	0.1	—	—	47-FR-27118
94. Pentachlorophenol[a]	E2	100	0.02	—	48-FR-28668
95. *Polycyclic organic matter*	E3	7–28	288	300+	49-FR-31660
Radionuclides					
96. Department of Energy facilities	E5	70	64	0.07	50-FR-5190
97. Nuclear Regulatory Commission, non-DOE facilities	E5	2	—	0.001	50-FR-5190
98. Elemental phosphorus	E5	100	3	0.06	50-FR-5190
99. Radon-222 uranium mill tailings[a]	E5	1000	—	3–8	51-FR-6362
100. Saccharin	F	40	229	600–1200	42-FR-19996
Tetrachlorodibenzo-p-dioxin					
101. Local[a]	E2	26	0.00004	0.06	48-FR-48434
102. General[a]	E2	0.2	220	7.8	48-FR-48434
p-Toluidine					
103. D&C Green #5, #8	F	0.008	—	—	47-FR-24278
104. Diet	F	0.007	—	—	47-FR-14136
105. Contact lenses	F	0.00001	—	—	48-FR-13020
106. D&C Red #8, #7	F	0.003	—	—	47-FR-57681
107. *Trichloroethylene*[a]	E1	9	—	—	50-FR-52442
108. *Trifluralin*	E2	0.06	—	—	PD #4, 1985 (OTS, 1982)[c]
109. *Trihalomethanes*[a]	E3	40	230	340	47-FR-9798
Vinyl chloride					
110. Ethylene dichloride–vinyl chloride monomer plants[a]	E1	280	5	0.9	50-FR-1182
111. Polyvinyl chloride plants[a]	E1	900	5	16	50-FR-1182
112. Food (polymers)	F	0.01	—	—	51-FR-4173
113. *Vinylidene chloride*	E3	80	—	0.07	50-FR-32632
Occupational					
Amitraz					
114. Pears	E2	19	0.0002	0.0042	44-FR-2678
115. Apples[a]	E2	19	0.0005	0.009	44-FR-2678
116. *Arsenic*[a]	O	200–300	—	300	48-FR-1864
Asbestos					
117. 20 Fibers/cm[b]	O	17,000	0.4	150	49-FR-14129
118. 2 Fibers/cm[b]	O	6400	0.4	90	49-FR-14129
119. *Benzene*[a]	O	4400–18,200	0.08	44–180	50-FR-50512
120. *Chlorobenzilate*	E2	140	0.07	0.01	44-FR-9548
1,2-Dibromo-3-chloropropane					
121. Citrus[a]	E2	9300	—	6.05	Final PD, 1979
122. Cotton[a]	E2	10	—	0.091	44-FR-65151
123. Peaches[a]	E2	360	—	0.8	44-FR-65151
124. Pineapple	E2	9	—	0.001	49-FR-1558
125. Soybeans[a]	E2	9	—	0.01	44-FR-65151
Ethylene dibromide					
126. OSHA[a]	O	7000–11,000	0.0008	1.8	48-FR-46958
127. Soil fumigant[a]	E2	3600	0.014	0.7	48-FR-48228
Spot grain fumigant					
128. Mills/conveyors[a]	E2	2000	0.018	9	49-FR-4452
129. Applicators[a]	E2	10,000	0.008	9	PD #4, 1984
130. Quarantine fumigant[a]	E2	30,000	—	0.5	PD #4, 1984
131. *Ethylene oxide*[a]	O	6300–11,000	0.07	70	49-FR-25734
Tetrachlorodibenzo-p-dioxin					
132. Rights-of-way brush[a]	E2	350	0.006	0.1	48-FR-48434

[a] Agency acted to reduce risk.
[b] No regulatory decision has been made.
[c] Office of Toxic Substances, EPA.

Agency key
C = Consumer Product Safety Commission
E = Environmental Protection Agency
E1 = Office of Air Quality Planning and Standards
E2 = Office of Pesticide Programs
E3 = Office of Drinking Water
E4 = Office of Toxic Substances
E5 = Office of Radiation Programs
F = Food and Drug Administration
O = Occupational Safety and Health Administration

Source key
FR = Federal Register
PD = Position Document

tant for our analysis. All that matters is that when the regulatory decision was made, risk managers were presented with these estimates as the best available upper-bound estimates.

Categories of risk

Figure 1 presents preregulatory levels of maximum individual risk for regulatory decisions involving public exposure to chemical carcinogens. Two patterns are apparent. First, every chemical with an individual risk above 4×10^{-3} (four chances in 1000 that a chronically exposed individual will develop cancer) was regulated. Second, except for one FDA decision (Number 44 in Table 1), no action was taken to reduce individual lifetime risk levels that were below 1×10^{-6}.

The Delaney Clause of the Federal Food, Drug and Cosmetic Act Food Additives Amendment of 1958 states: "No additive shall be deemed safe if it is found to induce cancer when ingested by man or animal." Despite this, in all 11 decisions made between 1980 and 1985 involving indirect carcinogenic food additives, FDA set standards but did not require existing risk levels to be reduced. FDA has recently argued that the Delaney Clause permits use of carcinogenic food additives with cancer risks below 1×10^{-6}, a decision that is being challenged in court. Our analysis shows that FDA's reasoning is consistent with historical practice.

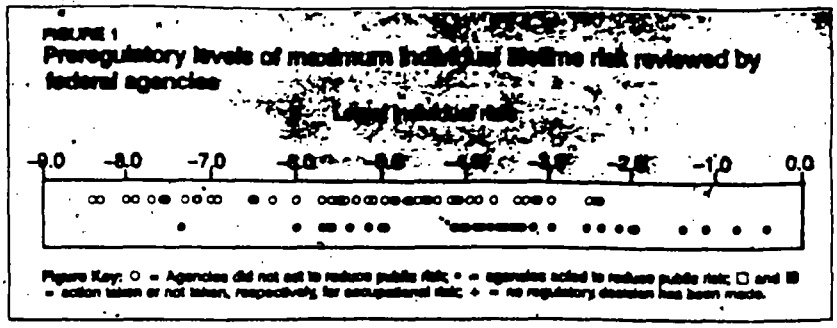
Figure 2 presents 58 cases in which estimates of both individual risk and population size were available at the time a regulatory decision was made. Estimated exposed populations ranged from 9700 to 230 million, the latter for the total U.S. population. There does not appear to be a strong correlation between the size of the population exposed and the likelihood of regulation. This conclusion is contrary to that reached by Milvey, who stated that the de minimis risk level is a function of the size of the population at risk (*1*). To further investigate this question, we review estimates of individual and population risk.

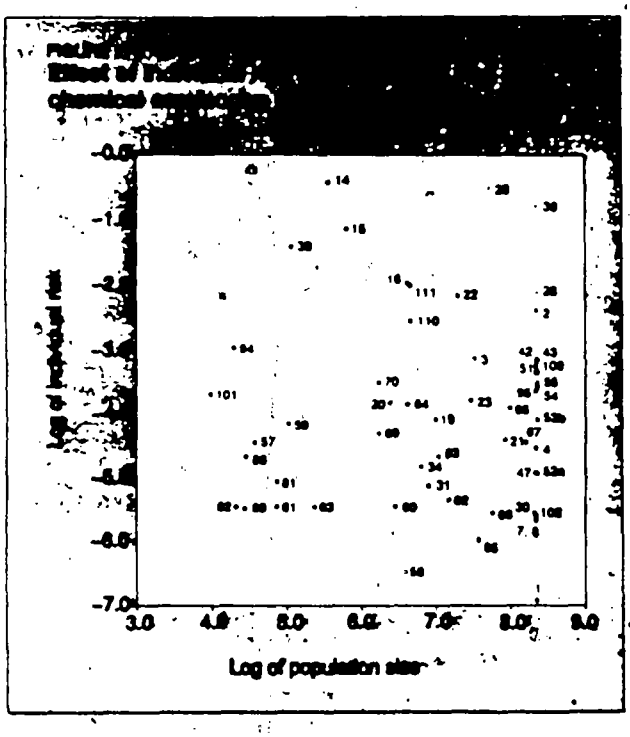
Figure 3 presents decisions for which individual and population risk estimates were available at the time of regulation. Three categories of risk can be identified. De manifestis risks are those that are so high that agencies almost always acted to reduce them, and de minimis risks are so low that agencies almost never acted to reduce them (*2*). The risks falling into the area between these extremes were regulated in some cases but not in others.

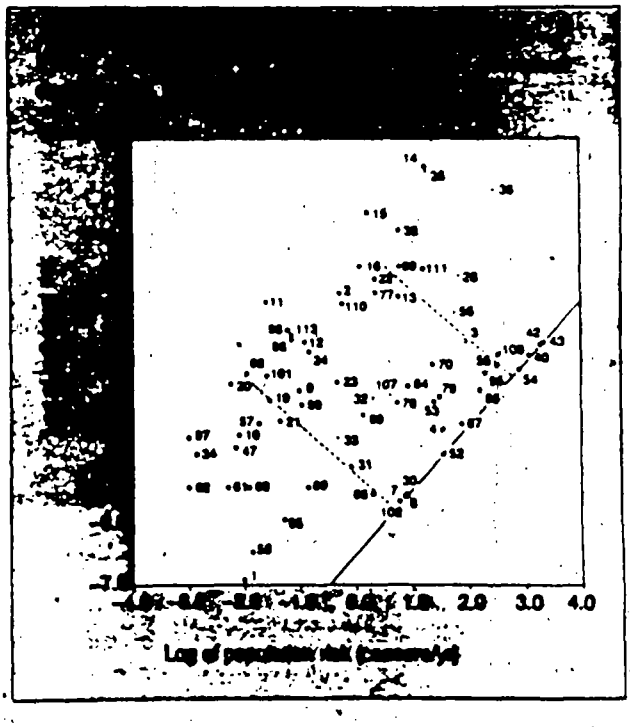
Figure 4 shows 19 occupational decisions that have been added to Figure 3 to provide data on small populations at high individual risk; no other data exist for these cases. It is assumed that decisions to regulate occupational exposures can be used to aid in defining de manifestis and de minimis risk levels because public exposures to carcinogenic substances should be regulated at least as stringently as occupational exposures are.

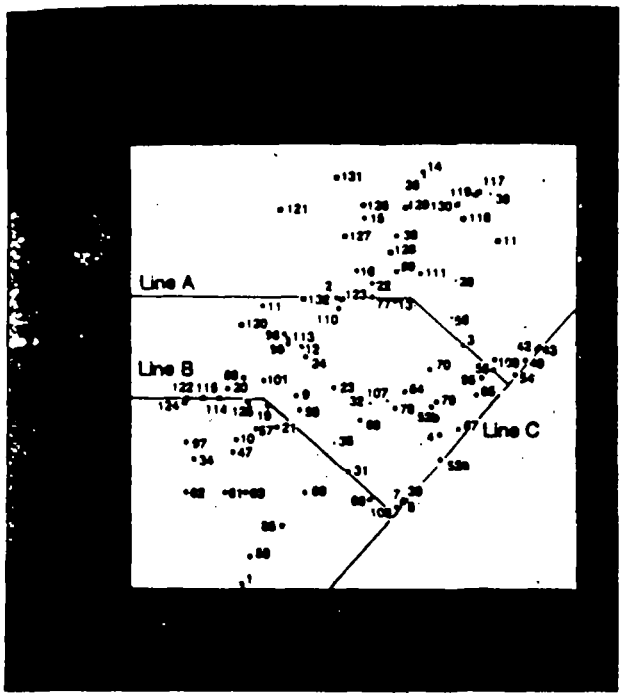
Line A of Figure 4 defines the de manifestis level; above this line, federal agencies always acted to reduce risk. For exposures resulting in a small-population risk, the de manifestis level is approximately 4×10^{-3}. As population risk approaches 250 cancer deaths (which could only occur in a population the size of the entire United States) the de manifestis level drops to about 3×10^{-4}. Line B shows the de minimis level. Below this line, no action has ever been taken to reduce risk. Line B indicates that for small-population effects, regulatory action was never taken for individual risk levels below 10^{-4}. For effects resulting from exposures to the entire U.S. population, the level of acceptable risk drops to 10^{-6}. Line C is the area beyond which no data can fall. Figure 4 is essentially an analysis of the Reagan administration's regulatory decisions; only six decisions in Figure 4 occurred before 1980.

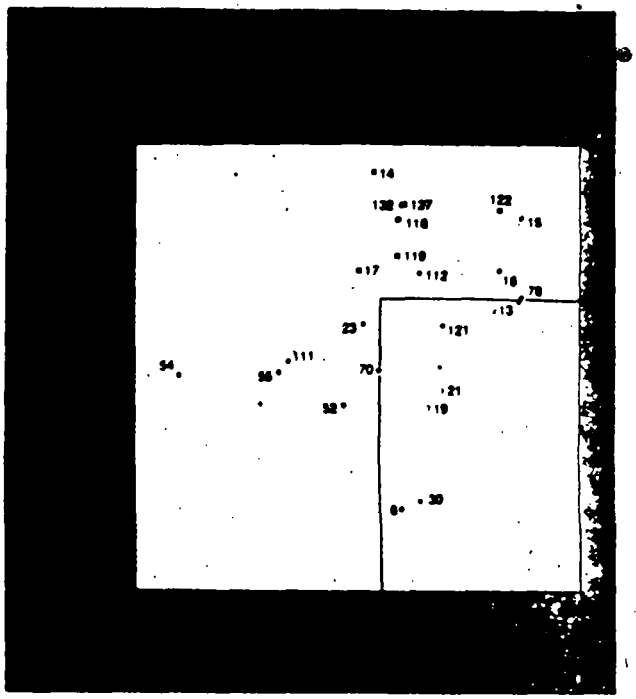
Figure 4 raises two questions. First, what justification is given by regulatory











agencies for not regulating chemicals in the de minimis category of risk? Second, what justification is given for regulatory decisions involving chemicals in the region between the de manifestis and de minimis levels? The primary answer given by federal agencies to the first question, as defined in Figure 4, is insignificant population risk. Table 2 shows those regulatory decisions that cited insufficient risk as the reason not to regulate. EPA's most explicit statement on the use of population effects in setting acceptable levels of risk is found in its decision on radionuclide standards (Table 1, Numbers 96–99).

In declining to regulate natural radionuclide emissions from elemental phosphorus plants (with an individual risk of 1×10^{-3}), the EPA decision states, "If risk to the most exposed individuals were the only criterion for judgment, this relatively high risk might well have led to a decision to regulate. However, this risk must be weighted against both the low aggregate risk [0.06 cancer deaths per year] and against other factors," such as cost (*3*).

Only two decisions in the de minimis region of Figure 4 consider factors other than small-population risk. Arsenic emissions from zinc smelters and benzene emissions from storage vessels are regulated by Section 112 of the Clean Air Act, the enforcement of which is heavily influenced by available technology. At the time of regulation, these two sources were already controlled with the best available technology (BAT), and further regulation could have resulted in shutdown of the industry (*4*, *5*).

Analysis of regulatory decisions involving chemicals in the region between the de manifestis and de minimis levels indicates that cost effectiveness is the primary determinant of regulation. Figure 5 shows the cost effectiveness (cost per life saved) of regulating exposures to 23 chemicals vs. their preregulatory individual lifetime risk. Substances with individual risks above the de manifestis level were regulated regardless of cost.

In the region between the de manifestis and de minimis levels, substances with risk reduction costs of less than $2 million per life saved were regulated; substances that cost more were not regulated. This conclusion is based on limited data, but it is consistent with EPA guidance suggesting that regulation is warranted if the cost per life saved does not exceed $1.5 million (*6*).

The two major factors that influence the magnitude of cost, and by extension the decision to regulate, are the availability of substitutes (for example, decisions 8 and 30) and whether emissions currently are controlled by BAT (for example, decisions 9–13 and 19–21).

In reviewing the regulatory decisions of the past decade, two trends are apparent. First, there is an increased use of quantitative risk analysis, which extrapolates animal data to humans. Between 1976 and 1980, quantitative risk analysis was used in regulatory decisions involving only eight chemicals; from 1981 to 1985 the number of decisions increased to 53. Second, there are indications that the definition of de minimis is changing.

Prior to 1980, it was generally agreed that the de minimis risk was 10^{-6} per lifetime risk, regardless of population. Figure 4 indicates that for small-population risks, the de minimis risk is now considered to be a 10^{-4} lifetime risk. However, every decision in the de minimis region of Figure 4 was made after 1983.

Regulatory guidelines

The Environmental Protection Agency has specifically requested assistance in developing a quantitative rule for incorporating population risk into the decision-making process (*7*). EPA has suggested a de minimis individual lifetime risk level of 10^{-5} to 10^{-4} for small populations and 10^{-7} to 10^{-6} for large populations. Although no such explicit standard has been developed, we can see that there are simple rules that can be used to guide regulatory decisions. These guidelines incorporate individual risk, population risk, and cost effectiveness into a single framework, even though it is recognized that no absolute rules are possible.

Guideline 1. There is a de manifestis individual lifetime risk level that is a function of population risk, as shown in Line A of Figure 4. Above this level, regulatory action should be taken to reduce risk.

Guideline 2. There is a de minimis individual lifetime risk level that is a function of population risk, as shown in Line B of Figure 4. Below this line, regulatory action generally need not be taken.

Guideline 3. In the region between the de manifestis and de minimis levels, regulatory action should be taken if the

TABLE 2
Decisions citing insignificant population risk as the reason not to regulate

Chemical	Individual risk	Population risk (cancer/yr)	Agency comments
Arsenic			
Zinc oxide	3×10^{-3}	0.02	*Total cancer incidence, even on a national basis, is likely to be small compared to the incidence associated with smoking and diet.*
Secondary lead smelters	3×10^{-3}	6	
Primary lead smelters	1×10^{-4}	0.1	
Chemical manufacturing	6×10^{-4}	0.1	
Zinc smelters	2×10^{-6}	0.008	
Radionuclides			
Elemental phosphorus	1×10^{-9}	0.06	*This risk [10^{-9} individual risk] must be weighed against both the low aggregate risk and against other factors.*
Vinylidene chloride	8×10^{-4}	0.07	*Magnitude of the public health risk is small.*
Radionuclides			
Department of Energy facilities	7×10^{-4}	0.07	*[Population impact] insufficient to warrant regulation.*
Nuclear Regulatory Commission, non-DOE	2×10^{-6}	0.001	
Formaldehyde			
Teachers	7×10^{-6}	0.1	*[Population risk below one cancer risk per year, which is] insignificant risk of widespread harm.*
Students	3×10^{-6}	0.001–0.1	
Chlorinated benzenes	1×10^{-6}	0.007	*Health risk is not sufficient to warrant regulation.*
Epichlorohydrin	1×10^{-6}	0.001	*Relatively low aggregate risk.*

cost is below $2 million per life saved.

These guidelines have significant implications, for example, concerning remedial action at hazardous-waste sites. Most such sites pose risk to only a limited geographic area, where population risks presumably are small. Past regulatory actions by EPA indicate that 10^{-4} would be the de minimis risk level for these areas.

Perhaps the most surprising aspect of our study is the consistency found among federal agencies' methods in the use of cancer risk estimates for regulatory decisions. With the possible exception of FDA decisions concerning de minimis risks, the history of federal decision making indicates that all agencies are fairly consistent in their implicit definitions of de manifestis and de minimis levels of risk. If the above three guidelines were adopted explicitly, consistency with past decisions would be maintained and the process of regulatory decision making would be simplified considerably.

Acknowledgment

Oak Ridge National Laboratory is operated by Martin Marietta Energy Systems, Inc., under contract De-AC05-84OR21400 for the U.S. Department of Energy.

This article was reviewed for suitability as an *ES&T* feature by Daniel Byrd, EPA, Washington, D.C. 20460; Lester Lave, Carnegie-Mellon University, Pittsburgh, Pa. 15213; and David Salsburg, Pfizer Central Research, Groton, Conn. 06340.

References

(1) Milvey, P. *Risk Anal.* **1986**, *6*, 69–79.
(2) Byrd, D. M.; Lave L. B. In *De Minimis Risk*; Whipple, C.G., Ed.; Plenum: New York, in press.
(3) *Fed Regist.* **1983**, *49*, 43906.
(4) *Fed Regist.* **1982**, *48*, 33112.
(5) *Fed Regist.* **1983**, *49*, 8386.
(6) "Guidelines for Performing Regulation Impact Analysis," EPA 230/01-84-0003; EPA: Washington, D.C., 1983.
(7) *Fed Regist.* **1985**, *51*, 1602.

Curtis C. Travis is director of the office of risk analysis at Oak Ridge National Laboratory. He has a Ph.D. in mathematics from the University of California at Davis, and has been involved in the field of risk analysis for more than a decade. Travis is editor of Risk Analysis.

Samantha A. Richter is on the research staff of the office of risk analysis at ORNL. She holds an M.S. from the University of Tennessee. Among other topics, her research concerns carcinogenic risk of chemicals. She is also involved in matters of risk communication.

Edmund A. C. Crouch is a research associate in the department of physics at Harvard University. He received a B.A., an M.A., and a Ph.D. from Cambridge University. His current research is on risk analysis, particularly that involving the carcinogenicity of chemicals.

Richard Wilson is Mallinckrodt Professor of Physics at Harvard University. He received B.A., M.A., and D.Phil. degrees from Oxford University. His research is on high-energy particle physics, nuclear physics, medical applications of particle beams, nuclear reactor safety, and risk analysis.

Ernest D. Klema recently retired as professor of engineering science at Tufts University. He was a visiting scholar at Harvard when this article was being compiled. Klema plans to teach and do research at ORNL on heavy-ion detectors.

INFORMATIONAL MEMORANDUM

FROM: Lawrence N. Halfen, Ph.D.

TO: Counsel of Record

RE: Meeting with Seth Phillips
April 30, 1987
MDNR Headquarters, Lansing, MI

I. Introduction

In the following paragraphs, I will relate statements made at the meeting which was held at the Stevens T. Mason Building on April 30, 1987. I met with Seth Phillips beginning at approximately 9:00 o'clock a.m. at his office on the eighth floor of the Mason Building. Seth and I had a lengthy conversation regarding the various aspects of the Metamora project. Following this initial period of discussion which lasted approximately two hours, we reviewed those Metamora Landfill files which were available under the Freedom of Information Act. Copies of files were requested which will be discussed in the succeeding paragraphs. Other files were denied in accord with DNR's earlier FOIA denial stemming from enforcement activities.

II. Statements

1. At the meeting, Mr. Phillips acknowledged that he is the author of the Michigan Environmental Protection Report, Progress Report No. 9, which was issued on April 16, 1987. He stated that the text of this report was submitted to the USEPA for comment. He reminded me that the MDNR is the lead agency on this project. He stated that the USEPA requested some changes in the text which the MDNR agreed to make. He regards this document as an MDNR publication and he did not feel that the USEPA had approval rights over the contents of this report.

2. Mr. Phillips indicated that approximately 200 drums were excavated during their on-site activities at Drum Disposal Areas No. 1 and 4. Approximately half of these drums were

EXHIBIT 5

sampled for subsequent analytical workup. It was his professional judgment that the majority of material found in the drums included paint thinners, paint bases and paint related materials. Approximately half of the drums were sampled. One set of samples was sent to USEPA contract ("CPL Program") laboratories for analyses using the CERCLA analytical protocols. Other samples were sent to laboratories which were not part of the CPL Program of the USEPA. The purpose in performing the non-CPL analyses was to obtain information about the drum constituents at an earlier point in time and also to obtain additional data about the materials contained in the drums. Swanson Environmental Laboratories was one of the contractors that was used by the MDNR to evaluate organic chemicals and PCB content of the drums. The data from the USEPA contract laboratories has not been made available as of this date. A significant portion of the analytical data from the MDNR contract laboratories was available at the time of our conversation. This laboratory data was requested under my FOIA request. Mr. Phillips indicated that he would be willing to supply this information. He further stated that he did not believe these documents would be of any assistance in helping us identify other PRPs at this site.

3. He stated that these analytical results indicate the presence of a number of Aroclors of PCBs contained in drums at the landfill. These materials were apparently found associated with drums rather than with an electrical appliance such as a transformer or capacitor. Mr. Phillips was asked whether their excavations revealed electrical equipment. He responded in the negative.

4. Excavation activities at the site resulted in the production of field logs/notes on the part of the contractor which covered each drum that was found and removed. Notes were also taken to document the photographs of the drums which were taken. Mr. Phillips reviewed these files to determine whether there were any documents contained therein which would provide identity information for PRPs as yet unlisted. Having removed this information from the file, he provided me with these documents. I reviewed these materials and concluded that these would be very useful for our evaluation and requested copies of both the field notes and the photography log notes made by the E.C. Jordan Company. Many of these notes revealed that drums were in poor shape and/or damaged as a result of the excavation activity. As a direct consequence of this, materials were spilled from drums. These notes document such problems.

5. I asked Mr. Phillips whether he was of the opinion that the activities of the MDNR were of such a nature that they could have actually made the site worse by damaging existing

containers which heretofore had not leaked. It was his opinion that the only way that an accurate evaluation of the drum population at the site could be made was by excavating drums and determining their contents. He did state, however, that there were situations where materials were spilled and that such activity could have made the situation somewhat worse. I asked Mr. Phillips if this program allowed the contractor or the MDNR to minimize such spills or, if they did occur, provide for their cleanup. He said that E.C. Jordan was aware that spills could occur. They had sheets of plastic and other materials which could be used to collect spilled material. He also noted that overpacks were available. Marginal drums were put in overpacks as quickly as possible. He did acknowledge that it was possible for materials to have migrated from the worksite and migration may have occurred. I asked him whether such material would have routinely been cleaned up. He indicated that in most cases he expected this would be the case, although MDNR did not have someone on site at all times.

6. In the progress report, Mr. Phillips indicated that it may be necessary to down scale the estimate of drums in Areas No. 1 and 4 collectively from an original figure of 20,000 to 25,000 drums to as low as 6,000 to 7,500 drums. Mr. Phillips was asked whether the original MDNR estimates of between 35,000 and 37,000 drums on the site in total would be adjusted as a result of this new estimate. He responded that the MDNR now estimated that approximately 17,000 drums were present at the whole site (approximately 7,000 drums from areas 1 & 4 and 10,000 drums from all other areas). He noted, however, that these figures were only estimates and at the present time he had no good handle on how accurate those numbers were. He stated that the MDNR had no firm information as to the actual drum count for Areas No. 2, 3 and 5 and only these estimates for Areas No. 1 and 4.

7. Mr. Phillips said that there was evidence of a fire in the face of Drum Area No. 1. This is supported by the fact that a number of containers were in very poor condition. They also found tires that were partially or largely charred as if consumed in combustion events. He did not find fire evidence in Drum Area No. 4.

8. Mr. Phillips stated that the Phased Feasibility Study, undertaken by the MDNR, was necessary to support the Record of Decision (ROD) for this site which was ultimately signed and authorized by the USEPA in September, 1986. Mr. Phillips further added that the test pitting activity was a component of the RI/FS for this site and paid for by the State in that fashion. Mr. Phillips indicated that the test pitting activity is completed at this point in time, subject to the actual site cleanup activities which are planned to begin in the

fall of 1987. At that time, all of the drums in Drum Areas No. 1 and 4 are slated for removal. I asked Mr. Phillips whether there was the possibility of down scaling the cost estimates for this site in light of the new knowledge about reduced drum numbers in these new areas. Mr. Phillips acknowledged that there are fewer drums in those areas. He also stated that costs may not be reduced simply because the cost of subsequent treatment and disposal of these wastes is continually escalating. He also indicated that there may be cost enhancement for drum management at this site which is related to the finding that there may be more PCBs in the area than was originally estimated.

9. I asked Mr. Phillips whether the USEPA had provided the $41,500,000 which was estimated for this site when the ROD was signed. I also asked whether these funds were being expended at the present time to conduct further activities which were outlined in the Progress Report. Mr. Phillips said that none of the $41,500,000 had been provided by the USEPA and that an allocation had not even been set up as of this point. He indicated that a grant application was not as yet completed. He stated that the State of Michigan is financing these activities from their own funds and from limited USEPA grants. The USEPA apparently has provided Michigan assurances that State funds expended at the site will be credited to the Michigan share of the remedial action costs which the State must provide when the clean up occurs.

10. The MDNR is presently designing the remedy selected under the ROD. This design program is funded through the ROD. I requested, pursuant to FOIA, copies of the ROD, the Phased Feasibility Study Final Report, documents associated therewith, non-exempt documents that were developed during the test pitting activity and other documents related to the consideration of alternatives described in Progress Report No. 9. The MDNR has taken the position that certain documents are "enforcement sensitive" and therefore exempt from FOIA. The MDNR, therefore, will not release such documents.

11. Mr. Phillips and Beth Mersch, the geologist assigned to this site, have become involved in a local lawsuit in the Metamora area involving a property approximately 1500 feet east of the Metamora Landfill Site which is under lease to Ajax Sand & Gravel Company of Detroit. The Greater Detroit Area Council of Boy Scouts has arranged to have Ajax mine gravel on this property. As a result of this gravel mining operation, a lake basin is to be constructed which would be subsequently used by the Boy Scouts as an aquatic resource. Opponents of this project object to this proposal because it will result in heavy vehicle traffic, dust and congestion in the Metamora area. In attempting to block the development of this project, these

JUNE 1989

FICHE #007

interests have sought support from the MDNR in terms of attempting to demonstrate that chemicals from the Metamora Landfill would result in contamination of groundwater and the lake on the Boy Scout property. Mr. Phillips has established two files in the State filing system which relate to this litigation. One of these files contains the system which relates to this litigation. One of these files contains the Act 346 (Inland Lake and Streams Act) Permit Application of Ajax Sand & Gravel which has been approved by the MDNR. This permit is required for those applicants who are interested in modifying surface water features of the State of Michigan. This file indicates that this permit application was properly submitted by the gravel company and has been approved by the Inland Lakes and Streams Section of the MDNR. The second file involves a preliminary draft by those MDNR individuals associated with the Metamora Landfill which suggests that there is a possibility of contamination flowing from the Metamora site to the Boy Scout property. This might occur due to a significant modification of groundwater flow in the immediate area resulting from the construction of the lake. These documents are not supported by data. The technical rationale which would demonstrate such a potential connection has been put on paper. Copies of both of these files were requested from Mr. Phillips.

12. In his Progress Report No. 9, Mr. Phillips indicated that the MDNR was going to investigate alternative methods of disposal and management of the site as part of their future activities. In their opinion, the existing ROD allows them to engage in a design project for the selected remedy which is documented in the ROD. Their view is that this program also authorized them to proceed with various soil gas analyses and well construction activities over the summer months which Mr. Phillips indicated is ongoing. Also authorized and underway is a series of well sampling and analysis. The purpose of the sampling is to build a data base for water quality at the site. The MDNR has performed a survey of local land ownership. A copy of this land ownership information was requested as part of the FOIA request which I submitted.

13. Mr. Phillips further elaborated that it is the intention of the MDNR to undertake a study using a MDNR contractor other than E.C. Jordan to evaluate alternative treatment methodologies and site management schemes outside of the ROD. Mr. Phillips was asked how this was going to be paid for and whether it was an activity that was authorized under the ROD. Mr. Phillips stated that it was MDNR's intention to have this study done for the MDNR and to have this information available for future management options. He indicated that this study would be paid for by State funds entirely and not involve any Federal expenditures. When asked whether there would be an

opportunity for comment from PRPs, interested citizens or interests outside of the MDNR or its contractor, Mr. Phillips responded that this is going to be a strictly MDNR activity. He indicated that he did not see a role for PRPs or citizens in the development of this study. He further stated that PRPs had been given an opportunity at the beginning of site activities to assume responsibility for all these actions. This opportunity was declined by the PRPs.

14. Mr. Phillips was advised that the documents which he had prepared for Mr. Wilczak's FOIA request should be sent to Mr. Wilczak. Mr. Phillips indicated that the aerial photographs which Tom Wilczak had requested would be somewhat delayed because those took longer to be reproduced. Those documents which I requested at this meeting I directed him to send to me directly with the understanding that those documents being sent to me would also satisfy Mr. Wilczak's FOIA request. Mr. Phillips requested that I send him a letter so indicating that by satisfying my request he was also satisfying Mr. Wilczak's FOIA request. A copy of the letter which was sent to Mr. Phillips is appended to this document.

15. Mr. Phillips indicated that it was his concern that we should not visit the site without MDNR staff being present. He stated that his concern was basically that the MDNR wanted to be in a position to assure themselves that we were not engaging in any activity which would compromise the site in any way. I stated to Mr. Phillips that having had experience not only as a private consultant, but also as a State official in visiting many sites of this type, that I was completely aware of how to behave at such locations. I also pointed out to him that I had a thorough familiarity with safety procedures. I assured Mr. Phillips that under no circumstance did we, in any of our on-site activities, enter any MDNR enclosure, otherwise compromise any activity which the MDNR had underway at the site or in any way tamper with or adversely affect the site. Mr. Phillips indicated that he believed that this accurately represented what we did during our visit to the Metamora site. He pointed out further that there are areas at this site that he believes are dangerous or present other problems. He requested that we notify the MDNR of any plans that we have for visiting the site and that we arrange to have MDNR staff available during those activities. I indicated that the only hazards that I was aware of were the height of the landfill face and the drums which were exposed by the MDNR. I pointed out to Mr. Phillips that I had written authorization from the owner of record of the property to be able to enter upon that property and to bring people with me as long as they were conducting appropriate business. He made a copy of the Parrish Permission Document for his files. I pointed out to him that every time that I had been on

the property other people were present disposing of garbage. Other people also visit the site regularly to meet with friends who work at the site. I indicated that few, if any of these people, seek or receive MDNR permission. Furthermore, if MDNR was concerned about unauthorized activities at the site and dangers, these people were at greater risk. I indicated to him that I assumed both of us would have to exercise some judgment in regard to this request, but that I was more than willing to cooperate with him to the extent that I would advise him of my intentions to be on the site before the fact and leave the option as to whether he wishes to react to that situation entirely up to him.

16. I asked Mr. Phillips if he had ever had the opportunity to investigate the history of the site or collect detailed information about the landfill beyond the limited chronology which he had originally prepared. He indicated that this had not been a high priority for him at the current time since he was quite busy with the technical and field management of the site. He has not attempted to interview the members of the Parrish family or any of the past employees of the landfill.

17. I also asked Mr. Phillips if he had ever taken the trouble to follow up upon the remark which was originally made by John Shauver of the Enforcement Division of the MDNR regarding pickles at the landfill. Mr. Shauver originally told me that he observed a "mountain of pickles" at this site once when he was working on a Berlin and Farro problem. I advised Seth Phillips of this remark more than a year ago and he recalled that conversation. Apparently, he did not consider the remark seriously enough to follow up.

This represents a summary of the significant matters which were discussed in our conversation on April 30, 1987. Please do not hesitate to contact me if there are questions which are generated as a result of the review of this material.


6

Michigan Environmental Law Journal

ENVIRONMENTAL LAW SECTION

State Bar of Michigan

Vol. 6, No. 2 | Issue 12 | April 1987

William C. Fulkerson, Chairperson
P.O. Box 30028
Lansing, Michigan 48909
(517) 335-4226

Jeffrey K. Haynes, Editor
860 W. Long Lake Road, Suite 200
P.O. Box 980
Bloomfield Hills, Michigan 48013
(313) 540-8388

Richard S. Baron, Assistant Editor

TABLE OF CONTENTS

EXHIBIT 6

COMMENTS FROM THE CHAIR

William C. Fulkerson, Chairperson

The start of a new year does not pass without some reflection. In the field of environmental law, change can be expected. Much of the legislative base is less than a decade old. Refinement by the courts and legislature will continue. The emphasis has shifted from the visible blight of pollution of the air and water to more discreet problems. We are now concerned with minute quantities of toxics and risk assessment. Today's issues are "how clean is clean" and parts per billion of contaminants in drinking water. Environmental law is technology driven. More so than in any other area, science is directing the future course of environmental law.

In this era of legislative and technical sophistication, lawyers face new concerns. For example; a client wants to buy an abandoned gas station for a pizza carryout business; or, an industrial client has negotiated for the merger of a three-plant electroplating company. These are no longer just real estate or corporate questions. The environmental considerations are very important, if not pivotal, in the decision to go forward with business transactions.

In the coming year, through programs and the Journal, we hope to increase your awareness of current issues. We can do a better job if you share your experiences with us. Let us know about your circuit court cases. Turn your legal research or brief into a short article. If you need technical or editorial assistance in writing an article, contact me or Jeff Haynes. We can find someone to help you put the finishing touches on your work. A good deal of our success is tied to the willingness of our members to share information. We look forward to hearing from you in the coming year.

• • • • • • • • • • • • •

ARTICLE

COMPARISON OF THE REQUIREMENTS OF THE NCP AND SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986

William J. Walsh
Pepper, Hamilton & Scheetz
Washington, D.C.

TABLE OF CONTENTS

I. INTRODUCTION

This article outlines the cleanup standards and requirements of the existing National Oil and Hazardous Substances Pollution Control Plan ("NCP"), 40 CFR Part 300, and compares those requirements with the requirements in the newly enacted Superfund Amendments and Reauthorization Act of 1986 ("SARA").[1]

II. PREEMPTION OF OTHER FEDERAL, STATE AND LOCAL ENVIRONMENTAL LAWS

EPA interpreted the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA" or "Superfund"), 42 USC Section 9601 et seq, as preempting other Federal and state public health and environmental statutes:

> **EPA has determined that the requirements of other Federal environmental and public health laws, while not legally applicable to CERCLA response actions, will generally guide EPA in determining the appropriate extent of cleanup at CERCLA sites as a matter of policy.**[2] These laws were enacted with the goal of protecting public health and the environment. Regulations developed under these laws have imposed requirements that EPA and other Federal agencies deemed necessary to protect public health and the environment. Because protection of public health and the environment is also the goal of CERCLA response actions, other Federal environmental and public health laws will normally provide a baseline or floor for CERCLA responses. The revised NCP and the Appendix to the preamble containing the policy concerning CERCLA Compliance with Other Environmental Statutes (the Compliance Policy), therefore, provide, subject to five enumerated exceptions, that a cost-effective remedy will be selected from a range of alternatives that attain or exceed applicable or relevant and appropriate requirements. State and local environmental laws, while not applicable or relevant and appropriate to CERCLA response actions, will be considered by EPA in selecting response actions.
>
> • • •
>
> EPA notes first, as a legal matter, that CERCLA response actions are not subject to State requirements for the same reason that CERCLA responses are not subject to Federal requirements. In enacting CERCLA, Congress has preempted those requirements with respect to sections 104 and 106 response actions.[3] [emphasis added]

III. REMEDIAL SELECTION CRITERIA OF THE PRESENT NCP

EPA must use the general requirements of the NCP to determine remedies at CERCLA sites. The NCP defines remedial actions as:

> . . . those responses to releases that are consistent with permanent remedy to prevent or minimize the release of hazardous substances or pollutants or contaminants so that they do not migrate to cause **substantial danger** to present or future public health or welfare or the environment.[4]

In selecting the appropriate remedy, the Remedial Investigation and Feasibility Study ("RI/FS") evaluates, among other things, alternatives that:

> . . . attain applicable or relevant and appropriate Federal public health and environmental requirements;
> . . . exceed applicable or relevant and appropriate Federal public health and environmental requirements;
> . . . do not attain applicable or relevant and appropriate Federal public health and environmental requirements but will reduce the likelihood of present or future threat from the hazardous substances and that provide significant

> protection to public health and welfare and the environment. This must include an alternative that closely approaches the level of protection provided by the applicable or relevant and appropriate requirements.

The NCP states that:

> The appropriate extent of the remedy shall be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment. Except as provided in 300.68(i)(5), this will require the selection of a remedy that attains or exceeds applicable or relevant and appropriate Federal public health and environmental requirements that have been identified for the specific site.

EPA must consider "cost, technology, reliability, administrative and other concerns, and their relevant effects on public health and welfare and the environment." 40 CFR 300.68(i)(2).

A. Permanent Remedy Versus Containment

The selection of a "final" remedy for a CERCLA site is determined by applying the factors for the selection of remedies set forth in CERCLA to the facts of a particular case and making a "risk management" decision or judgment concerning how those factors should ultimately be balanced. Even though the same factors are cited in SARA, SARA makes definite, although relatively small, shift toward permanent remedies. Section 121(b) of SARA, 100 Stat 1672, requires that:

> [r]emedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principal element, are to be preferred over remedial actions not involving such treatment.

On the other hand, SARA also provides that:

> The offsite transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available.

These requirements somewhat shift the emphasis of Superfund cleanup. CERCLA, prior to SARA, disfavored offsite disposal and destruction of wastes:

> unless the President [EPA, in this case] determines that such actions (A) are more cost-effective than other remedial actions, (B) will create new capacity to manage, in compliance with subtitle C of the Solid Waste Disposal Act, hazardous substances in addition to those located at the affected facility, or (C) are necessary to protect public health or welfare or the environment from a present or potential risk which may be created by further exposure to the continued presence of such substances or materials.

Now, offsite redisposal of hazardous waste is even less favored, but offsite destruction of such wastes receives a preference.

The amendments require that EPA perform an assessment of the various alternatives. In making this assessment and selecting a remedy, EPA must consider: (a) "the long-term uncertainties associated with land disposal"; (b) "the goals, objectives, and requirements of the Solid Waste Disposal Act"; (c) "the persistence, toxicity, mobility, and propensity to bio-accumulate of such hazardous substances and their constituents"; (d) "short and long-term potential for adverse health effects from human exposure" (i.e., a risk assessment on the potential health effects of residual discharges or concentrations, if any, from the soil on the site after a "non-permanent" remedy is installed); (e) "long-term maintenance costs"; (f) "the potential for future remedial action costs if the alternative remedial action in question were to fail"; and (g) "the potential threat to human health and the environment associated with excavation, transportation, and redisposal, or containment."[10] Additionally, EPA "may take into account the degree of support for such remedial action by parties interested in such site" (i.e., the public) and may select an alternative even if it has not "been achieved in practice at any other facility or site that has similar characteristics."[11] EPA then selects

> a remedial action that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum

> extent practicable. If [EPA] selects a remedial action not appropriate for a preference under this subsection, [EPA] shall publish an explanation as to why a remedial action involving such reductions was not selected.

A "non-permanent" remedy may be chosen; however, EPA must then document the reason why[13] and review the effectiveness of the remedial action "no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented" and implement additional remedial action if necessary.[14]

Clearly, the amendments do not prohibit selection of a "non-permanent" remedy, particularly if the costs are substantial and the incremental benefits relatively small. EPA's prior policy was somewhat, but not dramatically, different. The "NCP does not have a technology-forcing effect. Instead, the provisions ensure that when existing technologies are available, they will be identified and used if appropriate."[15] EPA's view was that:

> permanent solutions (e.g., "destruction, neutralization, or immobilization of wastes") should be preferred over the alternatives, "only to the extent that they are more cost-effective than other alternatives over the anticipated life of the response." However, the use of permanent solutions (in some cases, those that exceed applicable or relevant and appropriate requirements) may be the most cost-effective response and should be encouraged.[16]

The two key questions, then, are: (1) what is a permanent remedy and (2) when is it appropriate to select a non-permanent remedy. The question of what is a "permanent" remedy is not as simple as it might appear at first glance. The word "permanent" is not defined in the statute nor the legislative history. The problem that Congress ostensibly was attempting to remedy by inclusion of this reference was the false assurance provided by removing wastes from one location, only to have them leak out again at a new location after redisposal.[17] The fact that many landfills which have received wastes from Superfund remedial actions and are now leaking is mentioned throughout SARA's legislative history.[18]

Excavation and thermal destruction surely is one permanent remedy. They are feasible, albeit expensive, when addressing liquid wastes contained in drums or lagoons where they can be removed and destroyed through incineration or some other process. However, at a site where there has been the historic spillage of chemicals on soil or extensive migration of liquids from a landfill or lagoon, particularly migration into bedrock formations, it is much more difficult, if not impossible, to collect all such liquids for ultimate disposal or destruction.

Although the contaminated soil theoretically can be excavated and incinerated, this process is inherently risky (in some cases, the risk of excavation strongly outweighs the risks of containment),[19] extremely costly,[20] time-consuming, and in effect utilizes the nation's finite incineration capacity to detoxify relatively low level wastes. Several courts have rejected excavation or excavation and incineration as solutions to complex landfill problems.[21] Liquid chemicals which have migrated into bedrock cannot even be excavated and the only practical choice is some type of containment.

The question then arises concerning whether a remedy which contains the spread of chemicals and actively withdraws a substantial quantity but perhaps not even a majority of chemicals for incineration over a long period of time is a "permanent" remedy. Although implementation of the remedy may take a long time, such a remedy, if it met all applicable and relevant and appropriate federal and state requirements, would substantially reduce the volume, toxicity and mobility of chemicals, albeit in a more controlled manner over a longer period of time than excavation and immediate incineration. The plain fact is that in many of the more complex situations, there are no "quick" solutions.

A remedial program that collects for ultimate treatment or destruction the liquid wastes and contaminated groundwater would seem to satisfy the intent of Congress. The plain language of the statute and the legislative history of SARA support the view that remedies which substantially immobilize chemicals or collect and destroy chemicals should be considered "permanent" remedies within the meaning of Superfund. For example, SARA refers to remedial actions which have as a "principal element" treatment in "whole or part" that "permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants."[22]

This permanent treatment, therefore, need not be the only element of the remedial action; the significant reduction could relate to part of the remedy. The statute does not require complete elimination of the volume, toxicity, or mobility of the chemicals, but simply a significant reduction. Most telling is the fact that a treatment technique need only significantly reduce the mobility of the hazardous substances, as opposed to totally eliminate the potential for migration.

Also, the plain meaning of the term "permanent" is not synonymous with quick or instantaneous. It would therefore seem to be consistent with a "permanent" remedy to have a remedy that took one or more decades to implement. At some point, when such a remedy had collected as much of the chemicals at the site as practicable, it would be appropriate to revisit the issue of whether additional remedies are necessary and whether the quantity of chemicals remaining at the site is sufficient to require reviewing the remedies at the site every five years as required by Superfund.

Another general remedy that probably should be considered a "permanent" remedy is immobilization in place. As indicated above, immobilization is considered by EPA to be a permanent remedy.[23] The legislative history of SARA also indicates that Congress contemplated immobilization as a permanent remedy, although to obtain a covenant not to sue, "permanent immobilization" must "change the fundamental nature and character of such substances. Placing the substance in a permanent storage container or other containment method would constitute a permanent immobilization technology covered by this paragraph."[24] At some sites, for example the Florida Power and Light case, EPA has accepted a remedy at an industrial site that mixes chemical-laden soil with a concrete type substance. This remedy results in fixing the chemicals.

Such immobilization changes the fundamental nature of the soil. Experience with similar structures constructed with similar material by the ancient Romans and Greeks would seem to indicate that such fixation in place may last for thousands of years.[25] Again, clearly such a remedy would significantly reduce the mobility of the chemicals. Whether thousands of years can be considered sufficiently long to be "permanent" cannot definitively be determined now, although a reasonable person might agree that such a remedy is permanent at an industrial site.

It will remain a matter of judgment what precise combination of "permanent," containment, collection, destruction or immobilization of chemicals at any particular site will be considered by EPA a "permanent" remedy. It should be noted that Dr. J. Winston Porter, the EPA official chiefly responsible for implementing Superfund, noted at a conference in September 1986 that "there's probably not enough money in the world to clean up all the [Superfund] sites permanents" and predicted that most remedies would involve containment.[26]

B. **Applicable or Relevant and Appropriate Federal Requirements**

A central element of selecting a Superfund remedy is a determination that the residual level of chemicals or chemical discharges after implementation of a remedy protect human health and the environment. Unless an exception applies, the applicable or relevant and appropriate Federal public health and environmental requirements dictate the selection of the remedy. The NCP specifies that "selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment" requires

> selection of a remedy that attains or exceeds applicable or relevant and appropriate Federal public health and environmental requirements that have been identified for the specific site.[27]

SARA incorporates this concept.[28] The NCP also requires the consideration of other Federal advisories and guidance and state public health and environmental requirements. Note that:

> "Consider" should not be interpreted to mean "disregard." EPA may give standards in the "to be considered" category full force and effect. Moreover, especially in a Fund-financed remedial action, the views of a State will be accorded great weight. If the lead agency does not use pertinent State standards, or substantially adjusts them, it must document the basis for adjusting or not using them.
>
> Nonetheless, EPA believes the lead agency should not be bound by stricter State standards, nor should the Fund necessarily bear the additional cost of attaining stricter State standards.[29]

The NCP and SARA effectively incorporate into the Superfund a host of Federal and generally applicable and promulgated State regulations, requirements, and criteria which were not otherwise legally applicable.[30]

As described below, however, there are provisions which allow flexibility in meeting these requirements and even in determining which requirements are applicable or relevant and appropriate. The determination of whether there is a relevant and appropriate Federal human health or environmental requirement must be made on a "case-by-case" basis and may involve the "exercise of the lead agency's best professional judgment."[31]

1. Applicable requirements

> "Applicable" requirements means: those Federal requirements that would be legally applicable, whether directly, or as incorporated by a Federally authorized State program, if the response actions were not undertaken pursuant to CERCLA section 104 or 106.[32]

There is no definitive list of such requirements and when they would apply. EPA has stated that:

> The characteristics of CERCLA sites are too varied and unpredictable for EPA to specify, by regulation, which Federal requirements are "applicable." Such a determination necessarily will be made on a case-by-case basis. Therefore, an important part of the remedial investigation/feasibility study (RI/FS) process will be the utilization of the list of potentially applicable or relevant and appropriate requirements contained in the Appendix to this preamble. "Applicability" is to be determined objectively: if, because of the nature of the CERCLA site, the requirement would apply but for the implied repeal of other environmental and public health requirements contained in CERCLA, it is "applicable." For example, the PCB Requirements, which are listed in the appended policy as potentially applicable or relevant and appropriate requirements, would not be applicable to an uncontrolled waste site that did not involve the release of PCBs and would be applicable or relevant and appropriate to sites that do involve the release of PCBs. Once a requirement is determined to be applicable, it will be applied in the same manner as it would be applied otherwise.[33]

EPA, however, is drafting guidance on this topic, and has produced an initial list of potentially applicable and relevant and appropriate requirements.

2. Relevant and appropriate requirements

> "Relevant and appropriate" requirements are: those Federal requirements that, while not "applicable," are designed to apply to problems sufficiently similar to those encountered at CERCLA sites that their application is appropriate. Requirements may be relevant and appropriate if they would be "applicable" but for jurisdictional restrictions associated with the requirement.[33]

The preamble to the NCP states that:

> By adding the phrase "and appropriate," EPA emphasizes that non-applicable requirements will be used only when they are appropriate to the CERCLA site.
>
> For purposes of clarification, EPA points out that relevant and appropriate requirements are intended to have the same weight and consideration as applicable requirements.
>
> The reason that the concept of "relevant requirements" was added to the concept of "applicable requirements" was that it was anticipated that jurisdictional limitations of requirements developed under other statutes might prevent otherwise useful requirements from being named as "applicable." EPA does not believe that the definition of "relevant" needs enumerated criteria because, as discussed below, the decision of what is relevant can only be made on a site-by-site basis.
>
> For example, RCRA requirements could be relevant even with respect to hazardous waste disposed of prior to November 19, 1980, the effective date of EPA's RCRA Subtitle C regulations, 40 CFR Parts 260-265. The date on which the waste was disposed or managed is not germane to the determination of what response action will adequately protect public health and welfare and the environment. The jurisdictional date would not be grounds for determining that a requirement is not relevant and appropriate to a particular site. Similarly, although the Subtitle C regulations differ according to whether a hazardous waste facility has a RCRA permit (40 CFR Part 264) or is operating under interim status (40 CFR Part 265) remedies will generally have to be consistent with the more stringent Part 264 standards, even though a permitted facility is not involved. The Part 264 standards represent the ultimate RCRA compliance standards and are consistent with CERCLA's goals of long term protection of public health and welfare and the environment.
>
> In determining the relevance of a requirement, the lead agency must determine that the requirement is appropriate. As the definition states, other requirements are appropriate if they are designed to apply to problems sufficiently similar to those problems encountered at CERCLA sites. For example, the RCRA groundwater protection standards are designed to prevent contamination of groundwater from discrete hazardous waste facilities and to remedy any contamination resulting from those facilities and thus would be appropriate in those situations. However, these standards may not be appropriate to address situations encountered at CERCLA

sites of area-wide ground water contamination from unknown sources. In emphasizing the need to determine what requirements are appropriate, EPA does not suggest that a cost-benefit analysis should be performed, comparing remedies that meet other Federal requirements and those that do not. Rather, the only question to be answered is whether the requirement under consideration is appropriate to the situation presented at the CERCLA site.

When a requirement is determined to be "relevant and appropriate," it will be applied in the same manner as it would be otherwise, subject to the qualifications discussed previously for applicable requirements. However, the **determination of "relevant and appropriate" requirements, even more so than "applicable" requirements, can be made only on a case-by-case basis, through the RI/FS process.** It is not possible to determine which requirements are appropriate without analyzing the characteristics of the site and other problems associated with the responses.[36]

3. **Where There Are No Applicable Or Relevant And Appropriate Requirements**

The NCP also provides that:

> If there are no applicable or relevant and appropriate Federal public health or environmental requirements, the lead agency will select that cost-effective alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and the environment, considering cost, technology, and the reliability of the remedy.[37]

The Preamble to the NCP notes that:

> From experience with other sites, EPA estimates that in most cases, applicable or relevant and appropriate requirements will be available to guide lead agency decisions (e.g., RCRA technology-based design and operating standards). **Where insufficient Federal environmental or public health standards exist to determine the appropriate extent of remedy, the lead agency will conduct a risk assessment for that specific site.** This risk assessment may be based on data from advisories, State standards, or other Federal requirements considered during the feasibility study, or may require a review of other scientific information concerning the threat posed by the substances in question. Chapter 5 of EPA's 'Guidance on Feasibility Studies Under CERCLA' (April 1985) describes EPA's approach to risk assessment. Additional guidance on risk assessment is forthcoming. Specifically, the additional guidance will provide advice on how to conduct exposure assessment and risk characterization at CERCLA sites.[38]

If the Agency analysis determines that:

> Federal public health and environmental requirements are not applicable or relevant and appropriate, the analysis shall, as appropriate, **evaluate the risks of the various exposure levels** projected or remaining after implementation of the alternative under consideration.[39]

The NCP also requires a site-specific risk assessment to determine the extent of the remedy, inter alia, when applicable or relevant and appropriate requirements may not be adequate "to reduce risk to an acceptable level."[40] Dr. Winston Porter, EPA's Assistant Administrator for Solid Waste and Emergency Response, emphasized the need for risk assessments in hazardous waste site cleanups in a speech when he stated that EPA was "wedded to the concept of risk-based pollution control."[41] Section 121(d)(4)(D) of SARA allows the use of risk assessment methodology to modify an applicable or relevant and appropriate requirement when such requirement was derived using risk assessments.[42]

For example, the Food and Drug Administration food tolerance level for polychlorinated biphenyls ("PCBs") for fish is 2 ppm. Risk assessments could be used to convert this food tolerance level to a soil cleanup level. However, risk assessment could not be used to lessen the RCRA technical requirements for caps.[43]

C. **Exceptions**

There are five exceptions that obviate the need to meet applicable or relevant and appropriate federal public health and environmental requirements: (1) if the remedy is not a final remedy at the site (e.g., temporary storage); (2) in government financed cleanups, where the need to protect public health and welfare and the environment at the site in question is outweighed by the need to act at other sites considering the amount of money available in the Fund; (3) technical impracticality (e.g.,

placing a cap on a steep slope); (4) if the alternative would present unacceptable environmental impacts (e.g., as in the case of adverse health impacts caused by excavation of old landfills); and (5) where there is a strong interest in obtaining an expedited cleanup through litigation and it is unlikely that the litigation would result in the alternative.[44]

The Preamble to the NCP notes that:

> [T]he second exception to EPA's policy on compliance with other laws applies where it would be technically impractical to implement the "applicable" requirement. Some commenters asked if cost would be a consideration in the determination of what is impractical.
>
> This exception is intended to give EPA flexibility to avoid situations where the rigid imposition of requirements under other laws would lead to absurd or illogical results. The primary consideration in determining whether a particular alternative is practical is whether the option is logical and reliable in the long term. Cost may play a role in making this determination. For instance, in the example described in the preamble to the proposed rule (see 50 FR 5866), the placement of a cap on a steep slope was cited as being technically feasible but impractical because of long-term problems with maintaining the integrity of the cap. While long-term maintenance of the cap would probably be feasible, it could only be accomplished at inordinate cost and the remedy still would not be reliable over the long run.
>
> EPA emphasizes that the determination of technical practicality is not based on a cost-benefit analysis.[45]

IV. COSTS

The Superfund statute and the NCP require EPA to consider costs to some degree in selecting remedies. The NCP states that:

> The appropriate extent of the remedy shall be determined by the lead agency's selection of a cost-effective remedial alternative that effectively mitigates and minimizes threats to and provides adequate protection of public health and welfare and the environment.[46]

Additionally,

> For each alternative, the cost of implementing the remedial action must be considered, including the operation and maintenance costs. An alternative that far exceeds the costs of other alternatives evaluated and that does not provide substantially greater public health or environmental protection or technical reliability shall usually be excluded from further consideration.[47]

This cost-effective test under the NCP means that:

> if all the remedies examined are equally feasible, reliable, and provide the same level of protection, the lead agency will select the least expensive remedy.[48]

EPA explained the Preamble to the NCP that

> because costs are required to be considered an important criterion for selecting a remedy from among available alternatives (section 300.68(g)(i)), the NCP does not have a technology-forcing effect. Instead the provisions ensure that when existing technologies are available, they will be identified and used if appropriate.[49]

The Preamble to the NCP also states that:

> EPA agrees . . . that permanent solutions (e.g., "destruction, neutralization, or immobilization of wastes") should be preferred over other alternatives, "only to the extent that they are more cost-effective than other alternatives over the anticipated life of the response."[50]

However, cost is not the primary factor:

> The approach embodied in today's rule is to select a cost-effective alternative from a range of remedies that protects the public health and welfare and the environment.[51] First, it is clear that if all the remedies

examined are equally feasible, reliable, and provide the same level of protection, the lead agency will select the least expensive remedy.[52] Second; where all factors are not equal, the lead agency must evaluate the cost, level of protection, and reliability of each alternative. In evaluating the cost of remedial alternatives, the lead agency must consider not only immediate capital costs, but also the costs of operating and maintaining the remedy for the period required to protect public health and welfare and the environment.[53] For example, the lead agency might select a treatment or destruction technology with a higher capital cost than long-term containment because treatment or destruction might offer a permanent solution to the problem. The reliability of various alternatives will be taken into account in the present worth comparison of alternatives to the maximum extent possible, including the cost of such factors as the long-term operation and maintenance and the integrity of physical structures.

Finally, the lead agency would not always select the most protective option, regardless of cost. The lead agency would instead consider costs, technology, reliability, administrative and other concerns, and their effects on public health and welfare and the environment. This allows selection of an alternative that is the most appropriate for the specific site in question.

In revising the NCP, EPA does not intend to lessen the role of cost or cost-effectiveness in selecting CERCLA remedies, nor does EPA believe that the promulgated language reduces the importance of cost in the remedial process. In fact, cost is the first factor enumerated in section 300.68(i)(2) for selecting the appropriate extent of remedy.[54]

EPA also stated that:

> *In promulgating standards under other environmental laws, EPA has generally imposed requirements deemed necessary to protect public health and welfare and the environment. Where applicable or relevant and appropriate, EPA believes that those requirements must be met in order to achieve an effective CERCLA remedy. Only after the lead agency determines, by the selection of applicable or relevant and appropriate requirements, that adequate protection of public health and welfare and the environment will be achieved, is it appropriate to consider cost-effectiveness.*[55]
>
> Thus, the lead agency must develop one or more alternatives that attain applicable or relevant and appropriate requirements. As necessary or appropriate, the lead agency will also examine alternatives that exceed those applicable or relevant and appropriate standards. Although alternatives that do not meet the requirements may also be examined, they are only developed for possible use if one of the five enumerated exceptions applies; such alternatives have no bearing on the selection of a cost-effective remedy when the exceptions are not operable.[56]

Finally, EPA noted that:

> Some commenters stated that EPA's requirement of compliance with applicable or relevant standards conflicts with cost-effectiveness because it would not balance risks and costs. However, while CERCLA requires a cost-effectiveness of alternatives analysis that takes both risks and costs into account, EPA believes that such an analysis should weigh risks and costs only with respect to remedies that adequately protect public health and welfare and the environment, except where the costs are sufficiently great that the Fund-balancing exception is invoked.[57] Such an analysis is entirely different from the risk/cost balancing referred to by the commenters. The lead agency must select a remedy that adequately protects public health and welfare and the environment, unless Fund balancing comes into consideration. Fund balancing will be used only where the costs of implementing a remedy that attains or exceeds applicable or relevant and appropriate requirements will be disproportionately costly and Fund monies could be used more productively at another site where a response is necessary. Furthermore, CERCLA's legislative history indicates that Congressional sponsors of CERCLA dismissed the notion of a cost-benefit test for the NCP. (126 Cong. Rec. S16427 (1980).[58]

In sum, in a Superfund cleanup process, the lead agency must select a remedy that adequately protects public health and welfare and the environment, unless Fund balancing comes into consideration. Fund balancing will be used only where the costs of implementing a remedy that attains or exceeds applicable or relevant and appropriate requirements will be disproportionately costly and Fund monies could be used more productively at another site where a response is necessary. Furthermore, CERCLA's legislative history does not support the notion of a cost-benefit test for the NCP.[59]

V EXAMPLES

A. Soil Cleanup Levels

The question of "how clean is clean" has a significant impact on all aspects of CERCLA cleanups, but it has perhaps its greatest impact on selecting soil cleanup levels when the CERCLA remedy involves removal of wastes and/or soil for treatment and disposal or incineration. EPA's draft guidance, Records of Decision and other documents demonstrate a good deal of flexibility in applying this provision.

EPA's Superfund policy on soil cleanup level is that EPA has

> adopted an exposure or risk-based approach to soil cleanup: substances above back ground may be left without a cap, provided an analysis is conducted that indicates materials will not migrate to contaminate groundwater in excess of groundwater protection standards established for the site and direct contact through ingestion or inhalation does not result in a risk to health.[50]

EPA also explained its policy on how the relevant and appropriate requirements in the Preamble to the NCP are applied:

> EPA believes that a combination of the relevant and appropriate RCRA storage and disposal closure regulations provides an approach to CERCLA cleanup actions that is both flexible and consistent with RCRA.
>
> The RCRA surface impoundment closure rules, 40 CFR section 264.228 and accompanying preamble, provide two closure options. The first option, for storage surface impoundments, **requires that all waste residues and contaminated liners and subsoils be removed or decontaminated.** The second option, for disposal surface impoundments (where contaminated materials remain after closure), resembles the requirements for closure as a landfill whereby a final cover is placed over the unit, and post-closure requirements apply, such as maintenance of the final cover, groundwater monitoring, and corrective action if the groundwater protection standards are violated. The significant regulatory difference between storage and disposal unit must be maintained and monitored, corrective action taken if needed, and a notice provided in the deed and plat that the site was used for hazardous waste, whereas for storage units there are no maintenance, monitoring, follow-up corrective action, or notice requirements. That is, a storage closure is one where enough removal and decontamination has occurred that no further action is needed to protect human health or the environment.
>
> An approach that is consistent with the RCRA storage closure requirements and provides flexibility to CERCLA cleanup actions can best be demonstrated through an example. At the Crystal Chemical Company site in Texas, EPA has tentatively determined that **offsite soil** contaminated with arsenic may be cleaned up to a 100 parts per million (ppm) level, pending verification monitoring. The 100 ppm level has been determined by the Agency for Toxic Substances and Disease Registry (ATSDR) of the Center for Disease Control, Department of Health and Human Services, to be a safe level based on direct ingestion of the contaminated soil by a child. The verification monitoring means that ground water will be monitored to confirm that the residuals in the soil will not result in unsafe levels (i.e., will not exceed the drinking water standard for arsenic, 0.05 ppm) in ground water.
>
> The RCRA storage closure requirements to 'remove or decontaminate' contaminated soils will be relevant or appropriate in the Crystal Chemical case as well as many other CERCLA cleanup actions. Under RCRA, cleanup to background levels certainly satisfies this requirement. **EPA believes, however, that a site-specific limited risk-assessment approach to determine acceptable levels of removal makes sense.** Such an approach would take into account (a) the storage versus disposal dichotomy discussed above (i.e., no further need for action after storage closure to provide protection of human health and the environment); and (b) all the routes of exposure addressed by the disposal closure and post-closure care requirements (i.e., direct contact, wind dispersal, surface water, ground water, and bioaccumulation). Thus, such an approach would need to minimize the uncertainties associated with contaminant fate and transport, and focus primarily on the waste characteristics themselves, in a manner comparable to the RCRA delisting process. This approach could base the risk of exposure on **water quality standards (surface water) or health-based limits, such as acceptable daily intakes (ADI's), or public health advisories issued by the ATSDR.**[51]

B. Groundwater Cleanup Levels

Similar flexibility exists in applying groundwater requirements to CERCLA sites, e.g.,

EPA's RCRA regulations require attainment of concentration limits in the ground water 40 CFR section 264 94 Under the RCRA regulations, the concentration limit may be set at the SDWA MCL, or at "background." Alternatively, an alternate concentration limit (ACL) may be set at a level that EPA determines will not pose a substantial present or potential hazard to human health and the environment.

• • •

The ACL mechanism gives EPA flexibility in developing a CERCLA response. For instance, where the aquifer is of concern as a source of drinking water, the ACL could be set on the basis of what would be safe to drink. If the ACL were lower than the existing concentration of contaminant(s) in the aquifer, the lead agency could clean up the aquifer to that ACL. Alternatively, an ACL could be set on the basis of exposure. If consumption of the ground water would be restricted by the use of institutional controls, or if the aquifer were clearly unsuited for use as drinking water, the ACL could be set without regard to drinking water considerations, or at a level that takes account of controls at the point of use.

The above discussion illustrates how RCRA requirements may be applied in a flexible manner. However, even where ground water will not be used for drinking water, and no other contamination routes exist that would threaten human health or the environment, RCRA would still require the **establishment of an ACL and ground water monitoring for all Appendix VIII constituents**. These requirements **may not be appropriate in some CERCLA situations**, and thus would not be applied unless 'applicable' (i.e., **a RCRA facility was causing the ground water contamination**).[4]

Congress has removed some of this flexibility. Section 121(d)(2)(B)(ii) of SARA states that an ACL cannot be used to determine a cleanup if the point of exposure is beyond the facility boundary, unless: (1) the point of entry is known; (2) the discharge or residual levels of chemicals to surface water would not result in a statistically significant increase in the existing concentration of these chemicals in the water or fish; and (3) there are enforceable requirements that prevent usage of the groundwater between the facility boundary and its point of discharge. As a practical matter, an ACL can still be used in many situations. Where the surface water is relatively pristine, this provision will have its most significant effect. In effect, this provision articulates a non-degradation policy. In situations where there is an existing discharge from a site to a river which also have upstream point source industrial discharges and/or nonpoint sources, virtually any remedy will decrease the level of chemicals in the river. In many cases, the discharge from the downstream landfill would not create a statistically significant increase because traditionally substantially high levels of discharge have been allowed in implementing the Clean Water Act and often nonpoint source runoff can contribute significant loading to a river.

VI. CONCLUSION

One needs to become very familiar with the substance of these Federal requirements and be creative in determining or arguing where the acknowledged flexibility in the NCP should be and needs to be exercised to avoid plainly illogical of inordinately expensive results. Site specific risk assessments in some cases will provide the support for this flexibility.

FOOTNOTES

1 PL 99-499, 100 Stat 1613 (Oct 17, 1986) ("SARA").

2 SARA Section 121(e), 100 Stat 1676, incorporates the principle that no federal, state and local permits are required and the policy that "applicable" and "relevant and appropriate" provisions of Federal and state environmental laws must be utilized in selecting a final remedy at a Superfund site. The legislative history of SARA points out that Superfund does not "establish a system of preemption" although it does "create circumstances under which State requirements may be avoided." Conference Report on SARA, H R Rep No 962, 99th Cong, 2d Sess, 248 (Oct 3, 1986) (Conference Report). The effect is the same: no state or local permits are required and only certain state "applicable and relevant and appropriate" requirements are necessary for a Superfund remedial action to meet the new Section 112 cleanup standards.

3 50 FR 47,912, 47,917, 47,923 (Nov 20, 1985) (emphasis added).

4 40 CFR 300.68(a)(1) (emphasis added).

5 40 CFR 300.68(f).

6. 40 CFR 300.68(i)(1) (emphasis added).

7. Risk assessment is the "quasi-scientific" process that the government uses to determine a "worst case," upper bound estimate of the lifetime risk from exposure to a given concentration of a chemical. A risk management decision is the decision concerning what level of risk is acceptable after cleanup (or, stated another way, "how clean is clean")

8. SARA Section 121(b)(1), 100 Stat 1672.

9. Section 101(21) of the original Superfund, 42 USC 9601(21) (emphasis added).

10. SARA Section 121(b)(1), 100 Stat 1672.

11. SARA Section 121(b)(2), 100 Stat 1673. As a practical matter, the public will almost always want the landfill dug up and put somewhere else or destroyed. Wishing it does not make it possible to perform such a remedy. However, using "unproven" technology may clash with the desire to expedite cleanups. If a technology has not ever been used before, a research and development project will have to be performed, in essence, before that technology can be implemented at a site.

12. SARA Section 121(b)(1), 100 Stat 1672-1673.

13. **Id.**

14. SARA Section 121(c), 100 Stat 1673.

15. 50 FR at 47,929.

16. Id (emphasis added).

17. There is no doubt that in the abstract, if the "real world" problems of having to order priorities and address problems within the limits of both human and financial resources is ignored, destruction of hazardous wastes is preferred. However, in the "real world" of the decision making required by Superfund, costs must be considered; there are not unlimited resources, and everything is not a number one priority.

18. E.g., Conference Report, **supra** note 2, at 248. Conference on HR 2005, SARA, Joint Explanatory Statements of the Committee of Conference, H 9032, H 9103 (Oct 3, 1986).

19. EPA has evaluated the risks, feasibility, length of time and cost of excavation and incineration of historic landfills at several sites. See Response to Public Comments in **United States v Hooker Chemicals & Plastics Corp, ("S" Area Landfill)** Civ No 79-888 (WD NY, filed May 1984) and Response to Public Comments on Stipulation Concerning Requisite Remedial Technology, Section 3.0, **United States v Hooker Chemicals & Plastics Corp, ("Hyde Park Landfill")**, Civ No 79-989 (WD NY, filed March 28, 1986).

20. Even the best cost estimates, i.e., assuming incineration permits can be obtained expeditiously and there are no legal challenges, indicate that excavation and incineration of 500,000 cubic yards could cost from $100 million to several billion dollars. Id at 20. The best estimates for the time it would take to excavate a large site is from 5 to 15 years. See also D'Appolonia, **Decontamination Assessment for Land and Facilities at Rocky Mountain Arsenal** (June 1984), D'Appolonia, **Review and Assessment of Incineration as a Decontamination and Transportation Volume Reduction Technique for Rocky Mountain Arsenal** (October 1983); and General Accounting Office's Report, **Selected Aspects of Cleanup, Plan for Rocky Mountain Arsenal** (August 1984) (criticizing the D'Appolonia reports, in part, for underestimating the incineration costs).

21. **United States v Vertac**, Civ Nos LR-80-109, 110 (D Ark July 8, 1984); **United States v Hooker Chemicals & Plastics Corp**, 40 F Supp 1067, 1078-79 (WD NY 1982) (approval of the Hyde Park Consent Decree); **United States v Hooker Chemicals & Plastics Corp**, 607 F Supp 1052, 1067-70 (WD NY 1982), **aff'd** 776 F 2d 410 (CA 2, 1985) (approving the "S" Area Landfill Consent Decree); **United States v Hooker Chemicals Corp**, Civ No 79-989C (WD NY Aug 11, 1986) (approving a stipulation specifying additional remedies determined necessary as a result of implementing the Hyde Park Consent Decree).

22 SARA Section 121(b)(1), 100 Stat 1672 (emphasis added).

23 50 FR at 47,929.

24 Conference Report, **supra** note 2, at 255, which also indicates that secure containment in above ground containers is not a permanent remedy.

25 Bossell, "Not in my Backyard," **The Amicus Journal** 42, 43 (Fall 1982).

26 "High Cost of Permanent Superfund Cleanups to Result in Interim Actions, Porter Says," **BNA Environment Reporter**, Current Developments, at 778 (Sept 26, 1986).

27 See 40 CFR 300.68(i)(1).

28 SARA Section 121(d), 100 Stat 1673-1676.

29 50 FR at 47,923. SARA also requires Superfund remedies to satisfy the substance of duly promulgated State applicable and relevant and appropriate requirements which are generally applicable and, in fact, are generally applied throughout the state. SARA Sections 121(d)(2)(A)(ii), 121(d)(2)(C), 100 Stat 1673, 1674.

EPA has taken the position that the NCP makes the applicable and relevant and appropriate Federal requirements enforceable even in a private party cleanup. EPA will seek to justify a selection of a remedial alternative based on this policy. The preamble to the NCP, the EPA draft guidance on this topic and conversations with EPA personnel indicate a great deal of flexibility. Clearly, mere advisories have no binding effect, although the court may give some weight to these advisories in deference to EPA's technical expertise. Congress, however, has incorporated EPA's policy in Section 121 of SARA; therefore, these requirements now are legally enforceable. There still is a gray area as to what is a relevant and appropriate requirement. Based on the present NCP, present EPA policy and SARA, that determination is made on a case-by-case basis.

31 50 FR at 47,918, 47,919. See **generally** Draft EPA Guidance on CERCLA Compliance With Other Environmental Statutes (December 10, 1985).

32 40 CFR 300.6.

33 50 FR at 47,918 (emphasis added).

34 See EPA, Draft Guidance on CERCLA Compliance With Other Environmental Statutes (Dec 10, 1985).

35 40 CFR 300.6.

36 50 FR at 47,918-47,919 (emphasis added).

37 40 CFR 300.68(i)(3)

38 50 FR at 47,920 (emphasis added).

39 40 CFR 300.68(h)(2)(iv) (emphasis added).

40 50 FR at 47,919. When a private party is implementing the remedial action, however, a range of alternatives need not be evaluated if "a specific, more limited range of alternatives has been negotiated with the lead agency pursuant to action under Section 106 of CERCLA [Superfund's "imminent and substantial endangerment" enforcement authority]. 40 CFR 300.68(i).

41 "High Cost of Permanent Superfund Cleanups to Result in Interim Actions, Porter Says," **Toxic Law Reporter, Current Report** at 451 (Sept 24, 1986).

42 Conference Report, **supra** note 18, at 249.

43 See also text in section V(B), which describes the limitations on the use of risk-based alternate concentration limits in Section 121(d)(2)(B)(ii) of SARA.

44 40 CFR 300.68(i)(5). Section 121(d)(4) of SARA expressly incorporates the first four of these exceptions. Since the fifth exception is simply an articulation of the Agency's inherent authority to settle litigation, it should still apply. The determination of what is obtainable in litigation has probably changed due to the statutory amendments, e.g., one can obtain compliance with applicable or relevant and appropriate federal and state requirements. EPA's interpretation of this provision, however, may not agree with the foregoing interpretation.

45. 50 FR at 47,920 (emphasis added).

46. 40 CFR 300.68(i)(1) (emphasis added).

47. 40 CFR 300.68(g)(1) (emphasis added).

48. 51 FR at 47,921 (emphasis in original).

49. 50 FR at 47,929 (emphasis added).

50. 50 FR at 47,929.

51. Section 121 of SARA also expressly incorporates cost effectiveness. See also Conference Report, supra note 2, at 245 "The provision that actions under Sections 104 and 106 must be cost-effective is a recognition of EPA's existing policy as embodied in the National Contingency Plan."

52 In the amendments, the term "cost-effective means that in determining the appropriate level of cleanup the President (EPA) first determines the appropriate level of environmental and health protection to be achieved and then selects a cost-effective means of achieving that goal" (emphasis added). Id.

53. The new statute also requires consideration of future operation and maintenance costs. SARA Section 121(b)(1)(E).

54. 50 FR at 47,921-47,922 (emphasis added).

55 The same point is made in Conference Report, supra note 2, at 245.

56 50 FR at 47,921 (emphasis added).

57 This policy is also now incorporated into Superfund. Section 121(d)(4)(F) of SARA; Conference Report, supra note 2, at 245.

58 50 FR at 47,922 (emphasis added).

59 50 FR at 47,922 (emphasis added); as indicated above, see also 126 Cong Rec S16427 (1980); this intent was reaffirmed by SARA.

60. EPA, Draft Guidance On CERCLA Compliance with Other Environmental Statutes at 4-5 (December 1985). EPA is revising this guidance to reflect SARA.

61. 50 FR at 47,423 (emphasis added). SARA allows the use of risk assessment where there are not applicable or relevant and appropriate Federal or state requirements and allows EPA to convert a water quality standard into a soil action level using risk assessment.

62. 50 FR 47,922 (emphasis added).

• • • • • • • • • • • • •

Risk Assessment
Legal

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF KENT

FRANK J. KELLEY, Attorney General for the State of Michigan, Frank J. Kelley, ex rel Michigan Natural Resources Commission, Michigan Water Resources Commission, and Howard A. Tanner, Director of the Michigan Department of Resources,

Plaintiffs,

VS

CASE NO. 80-30139-CE

CHEMCENTRAL/GRAND RAPIDS, a Michigan Corporation,

Defendant.

HONORABLE GEORGE V. BOUCHER
Circuit Judge

OPINION AND JUDGMENT

At a session of said court held at the Hall of Justice in the City of Grand Rapids, Kent County, Michigan this 3 day of May, A.D. 1984.

Present: HONORABLE GEORGE V. BOUCHER
Circuit Judge

REC'D & FILED

MAY 3 1984

KENT COUNTY CLERK

Entered Journal No. 77 Page 111

In 1977 water in an open ditch running beside 28th Street in the city of Wyoming, Kent County, was found to be chemically contaminated. The ditch ran into an open county drain, referred to as the Cole Drain. The Defendant, a distributor of industrial and commercial chemicals, now known as Chemcentral/Grand Rapids, has had a storage and transfer facility approximately 1,000 feet south of the ditch since 1957. Groundwater seeps very slowly under the facility toward the ditch and drain.

By Complaint filed April 16, 1980, the Plaintiff state agencies charged the Defendant with pollution under several theories and sought multiple forms of relief: injunction, reimbursement of expenses, a hydrogeologic survey, correction of contamination, institution of a monitoring program, civil penalty of $10,000 per day "for each day of Defendant's pollution impairment, and destruction of environment," damages "for the pollution, impairment, and destruction of the environment," costs, a restrictive covenant on Defendant's property, and an order to obey the law.

The dispute was tried before the Court for 10 days in February and March of this year. It soon became clear that the principal issues were these: source of materials found in the ditch, their injurious or polluting nature, the measures and standards for clean-up, and what, if any, costs, penalties, and damages should be assessed.

The Court has carefully reviewed the testimony of the 17

witnesses who appeared at trial, the 70 exhibits received in evidence, and the arguments and written submissions of counsel. It is satisfied that, although it might have organized the material a little differently, Defendant's proposed findings of fact and law succinctly, correctly, and fully recount the Court's determination of the facts and accurately set forth the proper conclusions of law. The findings contain a sensible clean-up program which should adequately safeguard the public health and environment at a justifiable cost.

The only quibble the Court has, a very minor one, with the Defendant's proposed findings is in reference to paragraph 3 on page 1. Two of the several types of PCB's found in the groundwater are probably traceable to Defendant's plant.

The Court, therefore, adopts as its own for this Opinion and Judgment the entire 13-page Chemcentral/Grand Rapids Proposed Findings of Fact and Law filed with this Court on March 5, 1984, with corrected page 9, with the above correction of paragraph 3. A copy is attached hereto and incorporated herein. For clarification the trial exhibits identified in the findings only by number are as follows, in the order of their first appearance in the findings: Exhibit 7, Site Map prepared by Williams and Works; Exhibit 53, Shutdown Criteria; Exhibit 38, copy of Water Quality Criteria Documents, Environmental Protection Agency, Federal Register, Volume 45, Number 231, Friday, November 28, 1980, pages 79318-79379; Exhibit 34, Rule 57

Advisory Committee Report on Proposed Surface Water Quality Standard Deviation Procedures for Chemical Substances, December 14, 1982; Exhibit 35, Staff Report, Process to Derive Water Quality-Based Effluent Limitations for Chemicals, Michigan Department of Natural Resources, Environmental Protection Bureau, January 7, 1983; Exhibit 33, Michigan Critical Materials Register.

No costs, penalty, or damages are assessed against the Defendant. In addition to the reasons recited in paragraph 12 of the attached findings, the following considerations justify that decision:

A. Costs are not warranted where, as here, neither party has prevailed in full and the equities were not completely with either party. Three Lakes Association vs. Fessler, 101 Mich App 170 (1980).

B. Although other potential equitable remedies come to mind, the parties presented their cases solely in terms of a court-ordered clean-up program at the expense of the Defendant. No proofs were presented which could support a money award for damage to the environment under Sec 10(2) of the Water Resources Commission Act, MSA 3.529(1)(2).

C. The bulk of the State's proofs came from materials gathered as part of an investigatory study made at the initiative and expense of the Defendant. The State went out and gathered virtually no evidence on its own.

D. Although quite obviously a number of the pollutants found in the ditch did not and could not have come from Defendant's plant, the State steadfastly refused to investigate the possibility of other sources of contamination in the heavily industrialized area in which the Defendant's facilities are located. It was only after the Defendant introduced at trial a number of recent photographs showing apparent spills on the grounds of neighboring companies that a Department of Natural Resources official expressed any interest in inspecting those sites.

Entered Journal No. 79 Page 3-114

E. The only actual impact on the environment proved throughout the entire trial was the apparent absence for a period of time of "aquatic life" along a short distance of the county drain. After remedial action taken by the United States Environmental Protection Agency in 1979 the insects and other organisms in the category of aquatic life returned. It wasn't even clear that this effect resulted from Defendant's chemicals rather than from arsenic used in the spraying of weeds along the highway by some agency other than the Defendant or from other contaminants not traceable to Defendant.

F. Although some of the contaminants were identified as toxic or carcinogenic, no proofs were submitted that any of the contaminated groundwater is being used, or is likely to be used, for drinking water or that any of the contaminants found in the ditch are having an effect, or are likely to have an effect, on human health. Likewise, no proofs were offered on danger or tolerance levels from any of the contaminants or the extent to which any of them may appear naturally in the environment. Other than the minimal effect on aquatic life in the nearby drain, the Court was left simply to speculate on what, if any, toxic effect can be expected from the types and quantities of pollutants found in the ditch.

The Court Reporter has asked that the exhibits retained by the Court at the conclusion of trial remain in her custody until all required transcripts have been filed or it appears that no transcripts will be required. At that time Mr. Cruel is requested to obtain the exhibits and divide them, as appropriate, among the parties.

It is so ordered and adjudged.

Examined, Countersigned & Entered

Dorothy Durkit
Deputy County Clerk

George V. Boucher, Circuit Judge
Kent County, Michigan

Entered Journal No. 47 Page -4- 115

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF KENT

FRANK J. KELLEY, Attorney General for the State of Michigan, Frank J. Kelley, ex rel Michigan Natural Resources Commission, Michigan Water Resources Commission, and Howard A. Tanner, Director of the Michigan Department of Resources,

Plaintiffs,

vs. File No. 80-30139-CE

CHEMCENTRAL/GRAND RAPIDS, a Michigan Corporation,

Defendant.

CHEMCENTRAL/GRAND RAPIDS

PROPOSED FINDINGS OF FACT AND LAW

CHOLETTE, PERKINS & BUCHANAN

By: Grant J. Gruel, Esq.
600 Old Kent Building
Grand Rapids, Michigan 49503
(616) 774-2131

MCDERMOTT, WILL & EMERY

By: Louis M. Rundio, Jr., Esq.
111 West Monroe Street
Chicago, Illinois 60603
(312) 372-2000

9/13/84

PROPOSED FINDINGS OF FACT AND LAW

1. Various contaminants have been found in the groundwater aquifer which runs generally north under CHEMCENTRAL/Grand Rapids' plant toward 28th Street. North of 28th Street a portion of the groundwater aquifer intersects an east-west ditch (the 28th Street ditch) which is partially sealed off from Cole Drain. Cole Drain flows north and is adjacent to the ditch to the west. The underground aquifer continues past the 28th Street ditch and ultimately enters Cole Drain. At the point where the groundwater enters Cole Drain, it becomes surface water. Cole Drain flows to Plaster Creek, which flows to the Grand River. The Grand River then empties into Lake Michigan.

2. The various contaminants found in the groundwater and in the 28th Street ditch include organic chemical compounds, heavy metals, oils, phenols, PCBs, pesticides, and cyanide.

3. Some of the chemical contaminants found in the groundwater aquifer are traceable to CHEMCENTRAL/Grand Rapids' plant. Plaintiffs have failed to establish by a preponderance of the evidence that heavy metals, oils, phenols, PCBs, pesticides, and cyanide are traceable to CHEMCENTRAL/Grand Rapids. Specifically, the Court finds that at least a substantial portion if not all of the following chemicals found in the groundwater emanated from defendant's property: methylene chloride, 1,1,1 trichloroethane, TCE, tetrachloroethylene, toluene, 2-propanone, 2-propanol, isophorone, di-n-butyl phthalate, butyl benzyl phthalate, and bis-(2-ethyl hexyl) phthalate. These chemicals are handled in bulk by defendant and susceptible to leaks or spills during the transfer processes at defendant's plant.

4. The specific chemicals attributable to defendant entered the ground, inadvertently, through sudden and accidental losses of product over a period of time from 1957, when the plant was constructed, to approximately 1978 or 1979, with the vast majority of chemicals entering the ground at and around defendant's plant between 1957 and the early 1960s from an undetected construction flaw in a pipe used to transfer liquid chemicals between tank trucks or rail cars and defendant's bulk storage tanks. This construction flaw was repaired as soon as defendant located the problem after noting significant chemical inventory losses. After that, bulk transfer procedures resulted in some product loss to the ground at and around defendant's plant until implementation of a PIPP plan was started in the fall of 1978.

5. The inadvertent losses of product at defendant's plant were not "discharges" for which a permit was required under Section 7 of the Water Resources Commission Act, as amended, 1929 P.A.245 (MSA 323.10); instead, these losses were unanticipated and unintended spills occurring during transfer of bulk fluids.

6. The Court finds that under Section 10 of the Water Resources Commission Act, as amended, 1929 P.A. 245 (MSA 323.10) and that under Section 2(1) of the Anderson-Rockwell Environmental Protection Act, 1970 P.A. 127 (MSA 14.528 (202) (1)), defendant, without regard to fault, must take reasonable steps to abate the groundwater contamination originating from its plant.

7. The Court finds, legally and factually, it must impose the following equitable remedy against defendant company and it finds that the remedy constitutes an appropriate and sufficient abatement program for the contamination originating

at defendant's plant. Therefore, the judgment of this Court is as follows:

A. Defendant shall, by December 31, 1984:

1. Complete the definition of the plume of contamination north of the 28th Street ditch through the installation, and appropriate analysis of samples, taken from up to five observation wells to be constructed north of the 28th Street ditch between that point and where the groundwater enters Cole Drain.

2. Design and construct a system of eight to ten purge wells located in the area north of defendant's property. Such purge wells shall capture the plume of contamination originating from defendant's plant as that plume is defined by defendant's consultant based on hydrogeological work completed and to be completed. Defendant shall take the necessary steps to obtain easements and permission for the installation of such wells.

3. Design and construct an air stripping treatment system to treat the purged groundwater to the extent necessary for discharge to the City of Wyoming Publicly Owned Treatment Works (POTW).

4. Negotiate with the City of Wyoming, without any interference or intervention whatsoever from plaintiffs or any of their employees or agents, the conditions and

terms for the discharge of purged groundwater to the Wyoming POTW.

5. Operate the groundwater purge system until the shutdown criteria established by this Court have been met.

6. Make two borings into the clay beneath the groundwater aquifer to a depth of 20 feet into the clay to confirm the depth of the clay underlying the aquifer. If a lower aquifer is reached within the 20 feet, drilling shall continue as necessary to determine the extent of the lower aquifer. Defendant shall employ such boring techniques as are necessary to protect a lower aquifer from cross contamination. If a lower aquifer is found it will be sampled and analyzed. If any contamination in the lower aquifer originated from defendant's plant, defendant shall design and implement an abatement program for such contamination.

B. Defendant shall also equip its air stripping treatment system with a carbon absorption air emission control to control air emissions and shall operate the air emission control pending a study by defendant of risk levels associated with uncontrolled emissions from the treatment system. Upon completion of that study, defendant may apply to this Court for relief from the requirement that the air emission control be maintained on the airstripper treatment system. Such an application shall

include relevant data regarding risk levels associated with the actual emissions.

C. Defendant shall by December 31, 1984, excavate and remove the water, soil, and sediment from the 28th Street ditch and dispose of same in accordance with applicable Federal and State laws. Thereafter, defendant shall fill and grade the 28th Street ditch.

D. Defendant shall:

1. Conduct a study, by December 31, 1984, of the unpaved areas at defendant's plant site where escapes of product have occurred in the past in order to determine the feasibility of removal of any areas of highly contaminated soil or the feasibility of treatment of areas of highly contaminated soil in order to speed up the remedial activities.

2. Defendant shall maintain the impervious surfaces which are in place at its plant over areas of suspected soil contamination, and shall either keep such areas within the purge system or shall monitor groundwater eminating from such areas after they are elaminated from the purge system. Defendant will reinstitute purging of such areas if they cause contamination in groundwater in excess of the level determined under the procedure illustrated in Exhibit 53. Should defendant remove the impervious surfaces or fail to maintain such surfaces

it shall remove or treat contaminated soil beneath them.

E. Defendant shall:

1. Establish a monitoring program under which each purge well will be sampled and analyzed quarterly for the volatile fraction of priority pollutants and under which monitoring wells 16, 21, 23, and 24 (as per Exhibit 7) will be sampled and analyzed semi-annually for the volatile fraction of priority pollutants. In addition, defendant shall sample and analyze the monitoring wells more frequently prior to and as a part of a determination that contaminants in the groundwater have been reduced to levels determined under the procedure illustrated in Exhibit 5J.

2. Annually measure elevations in appropriate purge and monitoring wells in order to determine the effectiveness of the purge system.

3. Sample and analyze the influent and effluent of its treatment system twice each month for the first quarter following start-up of the treatment system and quarterly thereafter.

8. Plaintiffs' Complaint is statutory in origin. The Michigan Water Resources Act of 1929, §6(a), (MSA § 323.6(a)) makes it unlawful for any persons directly or indirectly to discharge into the waters of the State any substance which is or may become injurious to the public health, public safety or welfare or fish and aquatic life. Section

11(b) (MSA § 323.11(b)) was specifically amended by P.A. 197[illegible], with an effective date of April 15, 1973, to include groundwaters. Prior to that amendment, groundwaters were not included within the statutory definition of waters of the State. In 1970, the Anderson-Rockwell Environmental Protection Act, 1970 P.A. 127 (MSA §14. 528(201) et seq.)created jurisdiction in this Court where declaratory and equitable relief is sought by entities including plaintiffs. Section 2(2) enables this Court, where a standard for pollution fixed by rule or otherwise, by an agency of the State, is involved, to do the following:

A. Determine the validity, applicability, and reasonableness of the standard.

B. When a Court finds a standard to be deficient, direct the adoption of a standard approved and specified by the Court.

9. Plaintiffs' employees Truchan, Hayes, and Venman have admitted that the standard by which groundwater contamination is judged by plaintiff is not a written standard, but is instead an oral policy conceived by plaintiffs' staff employees. Essentially, the oral policy is that a person who puts any contaminants into the groundwater must completely extract those contaminants down to a level of non-detection within available detection technology, irrespective of cost or any other factor, including risk evaluation. The Court determines from the evidence and exhibits in this case that plaintiffs' oral policy is not a properly promulgated rule or, alternatively, is a standard fixed by rule or otherwise within the definition of the Anderson-Rockwell Environmental Protection Act, and that this standard is void and illegal in contravention of the Michigan Administrative Procedures Act, MCLA 24.201-24-315, and as reviewed in County of Delta v. DNR, 116

Mich. App. 458 (1982), at page 468. Accordingly, it is the duty and responsibility of this Court, from the evidence and exhibits it has heard during this lengthy trial, to direct the adoption of a standard which will be applicable to the defendant in this case with reference to the cleanup of the groundwater which will be the future and continuing obligation of the defendant.

10. The Court is persuaded by a clear preponderance of the testimony and exhibits which it has received, that a risk evaluation standard is appropriate. Such an approach to standard-setting is supported by the methodology adopted by the U. S. Environmental Protection Agency in its water quality criteria for 64 priority pollutants or pollutant categories (including almost every substance mentioned in this lawsuit) and as demonstrated to the Court in Exhibit 38. Additionally, Exhibits 34 and 35 demonstrate to this Court that a risk evaluation approach has been recognized and endorsed for surface water by the Michigan Rule 57 Committee as well as by the staff of the real party in interest in this case, Michigan Department of Natural Resources. Further, the Michigan Water Resources Commission Critical Materials Register Exhibit 33 specifically utilizes a hazard assessment methodology with reference to placing chemical substances on the list. The Court is also persuaded by the reasoning and holding of the United States Supreme Court in Industrial Union v. American Petroleum Institute, 448 U.S. 607 (1980), in which it struck down an OSHA regulation concerning potential hazards of benzene because the administrative agency failed to recognize risk considerations during its standard-setting procedures.

11. Defendant may discontinue purging groundwater when it is no longer contaminated, as measured against the following standard:

A. The Court has determined that certain specific chemical compounds have entered the groundwater from defendant's plant and contributed at least in part to the contamination of groundwater moving under defendant's plant. For each of these compounds which is a suspected carcinogen, as defined in Exhibit 38, defendant shall, using the methods and results contained in Exhibit 38, ascertain that concentration of the compound in water which is hypothesized as resulting in an incremental increase in cancer risk over a lifetime of exposure of one in one hundred thousand (expressed as a risk level of 10 to the minus five or 10^{-5}).

B. For each other compound defendant shall, using the methods and results contained in Exhibit 38 or such other competent scientific evidence as necessary, ascertain the concentration of the compound in water which constitutes the No Observable Adverse Effect Level (NOAEL). Provided that if Exhibit 38 contains a level for any compound based on taste or odor (organoleptic) data lower than the NOAEL, then that level shall be used.

C. Using Exhibit 53 as an illustration defendant shall implement the following method of determining when it can shutdown all or a portion of its purging operation:

1. Defendant shall compute for each compound that concentration in the groundwater which will not, when groundwater enters Cole Drain, result in the surface water in Cole Drain containing the compound at a level exceeding the applicable 10^{-5}

risk level NOAEL. The level in Cole Drain shall be measured immediately downstream of the mixing zone for the groundwater entering Cole Drain. The mixing zone is defined to be that segment of Cole Drain calculated by reasonable scientific methods as the portion of the drain which ultimately receives the groundwater involved in this Court ordered cleanup.

2. After the above threshold level is achieved, the purge well system, or a portion of same, may be shut down by the defendant when either of the following additional events occurs for each compound:

a. The level of a compound in groundwater is equal to or less than the 10^{-5} risk level or NOAEL as appropriate for the particular compound; or

b. When the level of the compound has been reduced to the point of diminishing return as specifically calculated in accordance with the methodology set forth in Exhibit 53, being the asymtotic curve method using an angle to the tangent line of sixty degrees, all in accordance with the method illustrated in Exhibit 53 (incorporated in its entirety in this judgment for ease of reference).

12. Plaintiff has urged that the Court impose penalties upon the defendant. The Court recognizes that it has the

authority to impose penalties under the enabling statutes upon which plaintiffs' Complaint is based, but the Court also recognizes that it has broad discretion in making that determination. The Court has determined from the evidence and exhibits in this case that defendant did not intentionally or willfully contaminate the groundwater flowing beneath its plant. Further, the statute of limitations, MCLA 600.5809(1), limits the period of time for which penalties may be sought to a two-year period, which in this case would be that period of time from and after April 16, 1978. All of the significant events leading to contamination that is properly chargeable to the defendant occurred at a time prior to April 16, 1978. Further, when the defendant became aware that it was required to have a PIPP plan in 1978, a plan was devised and implemented to the satisfaction of the MDNR over a period of time that was not unreasonable. Since April 16, 1980, when this Complaint was filed, the inability to resolve this case by settlement is not properly chargeable to the defendant, and the delay between the filing of the Complaint and the trial date is not properly chargeable to the defendant, plaintiffs having failed to ever praecipe this case for trial, which resulted in the original trial setting in mid-1983 by the Kent County Court Administrator, and not by the plaintiffs. The Court also has considered expenses incurred by defendant for consultants' work to date (approximately $80,000); the cost of instituting a PIPP plan (approximately $425,000); remedial expenses to be incurred (estimated to be $586,000, not including the cost of cleanup of the 28th Street ditch or the cost of the soil investigation at defendant's plant); and future monitoring and operating expenses (estimated to be $100,000 per year). In addition, the Court recognizes that defendant's remedial program will remove

contaminants which are not attributable to defendant. Accordingly, the Court finds that penalties are inappropriate and none shall be awarded.

13. Plaintiffs' Counts II, III, and IV although setting forth different theoretical causes of action, all merge in the opinion of this Court into a cause of action seeking to compel defendant to undertake remedial activities and to respond in damages and penalties. Accordingly, the findings of fact and remedy apply to all three Counts.

14. Plaintiffs' Count I claims a cause of action for discharges without a permit. The spills and leaks which occurred at plaintiffs' plant were inadvertent, unintended, and irregular. They were not events for which the statute contemplated a discharge permit. In addition, a substantial number of the spills and leaks occurred prior to April 13, 1973, the date after which a permit was required under §7 of the Water Resources Commission Act, as amended, 1929 P.A. 245, MSA §323.7. Plaintiffs' Count I claim lacks support in both law and in fact and is hereby dismissed.

15. Plaintiffs' Count V claims a cause of action for common law nuisance. Nuisance requires actual damage and requires proofs different from those damages claimed under the Water Resources Commission Act. This cause of action is not supported either factually or legally in this case, and is hereby dismissed.

16. Plaintiffs' Count VI claims a cause of action for Violation of the Public Trust. The 1963 Constitution, Article IV, Section 52, and the Anderson-Rockwell Environmental Protection Act do not establish or recognize a cause of action for alleged violation of the public trust. Alternatively, such a cause of action is merged into plaintiffs' Counts II, III, and IV, so as not to require any further ruling or relief by this Court in this judgment.

17. Plaintiffs' cause of action as set forth in Count VII, Unjust Enrichment, is hereby dismissed, for the reason that unjust enrichment, under Michigan Law, is both legally and factually unsustainable. Defendant corporation has not been allowed to profit or enrich itself, inequitably, at another's expense, and has not retained money or benefits which in either justice or equity belong to another. See Embrey v. Weissman, 74 Mich App 138 (1977) and McCreary v. Shields, 333 Mich 290 (1952).

18. On December 31, 198-, and on or before December 31st of each year thereafter, defendant shall file and appropriately serve a satisfaction of judgment report.

Respectfully submitted.

Grant J. Gruel, Esq.

Louis M. Rundio, Jr., Esq.

A. The Court has determined that certain specific chemical compounds have entered the groundwater from defendant's plant and contributed at least in part to the contamination of groundwater moving under defendant's plant. For each of these compounds which is a suspected carcinogen, as defined in Exhibit 38, defendant shall, using the methods and results contained in Exhibit 38, ascertain that concentration of the compound in water which is hypothesized as resulting in an incremental increase in cancer risk over a lifetime of exposure of one in one hundred thousand (expressed as a risk level of ten to the minus five or 10^{-5}).

B. For each other compound defendant shall, using the methods and results contained in Exhibit 38 or such other competent scientific evidence as necessary, ascertain the concentration of the compound in water which constitutes Acceptable Daily Intake (ADI) as calculated from No Observable Adverse Effect Level (NOAEL). Provided that if Exhibit 38 contains a level for any compound based on taste or odor (organoleptic) data lower than the NOAEL, then that level shall be used.

C. Using Exhibit 53 as an illustration defendant shall implement the following method of determining when it can shutdown all or a portion of its pumping operation:

1. Defendant shall compute for each compound that concentration in the groundwater which will not, when groundwater enters Cole Drain, result in the surface water in Cole Drain containing the compound at a level exceeding the applicable 10^{-5}

Brief Communication

Compensation of Victims Exposed to Environmental Pollutants

RENATE D. KIMBROUGH, M.D.
Center for Environmental Health
Centers for Disease Control
Public Health Service
U.S. Department of Health and Human Services
Atlanta, Georgia

MARSHALL SIMONDS, Esq.
Goodwin, Proctor & Hoar
Exchange Place
Boston, Massachusetts

ABSTRACT. The sponsors of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), also known as "Superfund," agreed that more information was needed regarding legal remedies for injuries to persons from exposures to hazardous wastes. There has been a rush in Congress and some states to introduce "victims' compensation" bills to facilitate recovery for personal injury from exposure to hazardous waste sites. Such approaches are overly simplistic and totally disregard the reach and shortfall of scientific data.

OVER THE PAST DECADE our investment of people and money in efforts to investigate the complex relationships between human health and exposure to suspected environmental pollutants has accelerated dramatically. The basic techniques for the ongoing search for answers are those of the animal investigator and the epidemiologist. Properly done animal experiments and epidemiologic studies provide a basis for identifying associations between various human health risks and environmental factors, from which public health policies are developed to minimize the risks to future populations.

Unfortunately, environmental health issues are the subject of intense and emotionally charged public concern. Consequentially, such issues have invariably become media events. Such an atmosphere is hardly conducive to considered scientific evaluation. Too often the investigations themselves and the results seem to have been fashioned to satisfy not the dictates of science but the public demands for action. That public concern and political pressure may well lead to hasty and flawed scientific conclusions should surprise no one.

The concerns which prompt this article are several. First, the public demands for relief from the perceived risks of exposure to environmental contaminants are too often based on exaggerated fears of the risks involved. Such fears follow inevitably from the fundamental public misunderstanding of what scientists have been able to learn about the existence, nature, and extent of such risks. Second, the political responses, in the form of the proposed victims' compensation bills, reflect not only a misunderstanding of available scientific knowledge, but also a misuse of that scientific knowledge. Unless the scientists themselves insist that the knowledge gained be used in a sound manner, the public interests cannot be served.

Research into environment-health relationships are infinitely complex and our understanding of those relationships is still primitive. The techniques which produce estimates of risk are often based on mathematical models that have not been substantiated by experimental or epidemiological data. The demands from the public and their political leaders have focused on the issues of causality and culpability. Who or what has caused these health risks? Who should be held responsible? Except in a handful of cases, science cannot answer these questions of individual causation.

The political response to intensifying public concern can be measured by the legislative actions of the last decade dealing with occupational health and environmental pollution. The latest, and most ambitious, of these

EXHIBIT 8

enactments is the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), also known as "Superfund." The sponsors of this legislation agreed that more information was needed regarding legal remedies for injuries to persons from exposure to hazardous wastes. Accordingly, Section 301(e) of Superfund required that a study be conducted of the adequacy of the legal remedies for injuries from hazardous wastes.

A study group was formed which has issued its report. The study group recommended federal legislation providing a two-tier compensation system. One tier would leave the present judicial remedies largely untouched and the other would establish an alternative federal administrative compensation program modeled on state workmen's compensation and federal black lung compensation programs. In the latter case, limits would be placed on recoveries, but causation could be proved merely by demonstrating exposure to a chemical described in a governmentally produced health effects report as a potential cause of the claimed condition. In response, there has been a rush in Congress and some states to introduce "victims' compensation" bills to implement or expand upon the study group's recommendations.

The victims' compensation bills begin with the premise that scientific proof exists to establish the causal nexus between exposure to a pollutant and the claimant's disease. The problem is seen, not as an absence of such proof, but rather as the difficulty and expense the claimant must confront in bringing that proof of causation to the courtroom. To ease those burdens for the claimants, the bills declare that henceforth the courts shall accept as scientific proof of causation evidence of a type that the scientific community itself does not accept.

Some of the bills also specify the types of evidence which could be utilized to make the required demonstration of connection between exposure and injury. Four of the bills would authorize a court to consider relevant any evidence tending to establish the connection, including but not limited to the following: (1) an increase of incidence of the injury or disease in the exposed population above that incidence which is otherwise probable (without regard to confounding factors), (2) results of pertinent epidemiological studies (without regard to the size of the sample), (3) results of pertinent animal studies, (4) results of pertinent tissue culture studies, (5) results of pertinent microorganism culture studies, and (6) results of laboratory or toxicologic studies.

This effort, however, will lead to judgements which are scientifically untenable. The bills provide in essence that evidence of the type developed by scientists for risk assessment purposes shall be admitted and relied upon in a courtroom to prove that it is "reasonably likely" that an environmental contaminant to which the individual claimant was "exposed" caused his or her disease. But, except in rare cases, like asbestosis, for which a modified standard of proof probably is not required, such scientific evidence can rarely establish that a particular individual's disease was "reasonably likely" to have been caused by a particular agent.

The reasons for concern about this legislative misuse of scientific learning are easily illustrated. There are tens of thousands of chemicals for which potential environmental health risks might be described. Some of these chemicals are virtually ubiquitous in the environment. Many have multiple uses entailing nonenvironmental as well as environmental exposures, and many of the potential and perceived effects on health are indistinguishable from commonly and naturally occuring illnesses ranging from headaches and anxiety to cancer. No array of legislative remedies can hope to provide equitable and, cost effective remedies for the plethora of risks confronting the industrial society. To achieve that could involve the evaluation and payment of claims for virtually all of the diseases suffered by virtually all of the people. Impossible expectations will be created. The price tag for satisfying such expectations is incalculable. The Federal experience since 1969 with the Black Lung Benefits Act provides some insight into potential costs. As reported in the hearing on H.R. Subcommittee of the House, Committee on Energy and Commerce, at the time of enactment in 1969 the Black Lung Act was estimated to involve a total cost of between $40 million and $385 million. By 1982 costs to the Federal Government alone had reached $2 billion.

Diseases generally recognized as being caused by specific chemical or physical agents

Most illnesses that science has recognized as being caused by particular chemicals are encountered as occupational diseases. Other examples include effects of mishandling or over-exposure to pesticides (including germicides), acute and chronic poisoning episodes, and idiosyncratic and allergic reactions to prescribed or over-the-counter drugs. Occupational cancers which have been recognized as being preventable and some which are compensated at least in some countries are listed in Table 1. Indeed for some diseases there is no other known cause. Such diseases include asbestosis, radiation sickness, caisson's disease (decompression illness), and mesothelioma, which is usually caused by asbestos. While the diseases in this category are not numerous, it seems clear that no legislative relief from conventional standards of scientific proof is needed for claims involving these diseases. The required knowledge is at hand and the proof is available.

Diseases that may or may not be caused by chemicals

The chemicals-disease link is strong, but not unique in the case of some materials. Vinyl chloride causes a rare cancer of the liver, the angiosarcoma, but this outcome may also be caused by certain arsenicals and androgenic anabolic steroids.[1,2] Chloracne, a skin disease, is caused by a number of halogenated aromatic hydrocarbons.

With other diseases, it becomes more difficult to establish what caused the illness. Benzene is associated with a higher incidence of aplastic anemia and myelogenous leukemia in workers who have been exposed to high concentrations of the solvent. Aplastic anemia and myelogenous leukemia are also relatively prevalent in the

Table 1.—Occupational cancers for which compensation is given in various countries

Country	Nickel refining (chromate manufacture) (lung)	Asbestos (lung)	Asbestos (nasal sinuses)	Polycyclic hydrocarbons (pleura, peritoneum)	Polycyclic hydrocarbons (lung)	Benzene (haematopoietic system)	Wooden furniture manufacture (nasal sinuses)	Aromatic amines (e.g. 4-aminodiphenyl (bladder), benzidine)	Arsenic (skin)	Arsenic (liver)	Vinyl chloride (skin)	Vinyl chloride (lung)
Australia												
Belgium												
Denmark												
Federal Republic of Germany												
France												
German Democratic Republic												
Ireland												
Italy												
Japan												
Switzerland												
United Kingdom												

general population which makes it difficult to determine in the individual case whether this was a spontaneous or an induced occurrence. A similar difficulty arises with lung cancer. A number of industrial chemical agents have been shown to induce lung cancer such as nickel, bischloromethylether, arsenic, chromium, uranium and ferric oxide; however, the most common cause is smoking. Hence in the individual case where the worker was a smoker, it is difficult or impossible to determine whether the industrial exposure or the smoking was the major contributing factor. Additional examples are given by Rutstein et al.[3]

For these examples, the uncertainties are not nearly as great as they are for most cancers, chronic diseases and untoward reproductive effects. The incidence of these diseases, specifically of cancer, varies in different parts of the world.[4,5] It is thought that these variations are largely caused by "environmental" factors. In most instances, such factors are not industrial chemicals, rather, nutritional factors and personal habits appear to have the greatest impact.[6,7]

Notwithstanding such epidemiological findings, clinical observations make it obvious that people differ widely in their susceptibility to the oncogenic effects of environmental chemicals.[8] For instance, many heavy smokers do not develop lung cancer, and examples of lung cancer are available in nonsmokers with no industrial exposure. Additionally, genetic predisposition to cancer exists as exemplified in familial polyposis of the colon, which carries a high risk of cancer of the colon.[9,10]

In addition to cancer, many other acute and chronic diseases with potential or perceived chemical causes occur relatively frequently in the general population. Among these are heart disease and stroke in conjunction with arteriosclerosis, diabetes, emphysema, chronic obstructive lung disease, arthritis, and neuromuscular disorders, to name a few. Other concerns are malformations and other untoward outcomes of pregnancy. In addition, emotional problems, infertility, and psychological disorders are often reported by people who fear their health has been damaged by exposure to "unknown" chemicals. For all of these diseases it is impossible, in most situations, to demonstrate that chemical exposure was associated with any of these problems. Although it is theoretically possible that any amount of a chemical may cause some effect, in practice it must be recognized that at very low concentrations, many competing elements come into play and the contribution of individual chemicals to adverse health effects may be of no consequence.

Our understanding of the causes of cancer and how some cancers may be prevented and the incidence of others may be reduced has increased. This does not mean that with current knowledge we can predict whether an individual will develop cancer or why one person will contract the disease while another in a similar situation will not. In certain industrial situations, exposure to high concentrations of carcinogens has undoubtedly led to cancer in workers. This has been accepted by a number of countries (Table 1) and has resulted in legislation in these countries.[11] However, the situation is much more

tenuous for the general population who inadvertently may come in contact with industrial chemicals because they bioaccumulate and appear in the food chain because they are emitted into the atmosphere or because they are present in landfills that have started to leak.

There are no scientifically well-documented examples where exposure to low-level environmental concentrations of man-made chemicals has resulted in a higher incidence of cancer. One such situation occurred at the Love Canal chemical dump in Niagara Falls, New York. From 1947 to 1952, Hooker Chemical Company dumped more than 20 000 metric tons of chemical wastes into the canal. In 1953 the company closed the landfill and sold the property to the local board of education, which developed the area for residential use. In 1978 local residents became concerned that chemicals were leaching from the canal into adjacent soil. Sampling of air, soil, and groundwater led to the identification of chemicals in the basements of several homes adjacent to Love Canal. Eventually, more than 200 chemicals were identified.

In January 1980, under U.S. Environmental Protection Agency (EPA) auspices, a chromosome study was initiated and reported in May 1980 as showing chromosome damage in 11 of 36 persons tested.[1] This report stirred much scientific controversy. Despite these criticisms, the report was partly responsible for the Federal government's designation of the Love Canal neighborhood as a disaster area. Eventually, a second chromosome study was conducted. It did not show an increased incidence of abnormal chromosomes among previously exposed residents.[2]

Most of the chemicals in the dump site to which the population around Love Canal could have been exposed are rapidly metabolized and excreted. No precise exposure data are available for the population living in the area. The only chemical found at Love Canal that is known to be toxic at extremely low concentrations and that is also persistent is 2,3,7,8-tetrachlorodibenzodioxin (TCDD), but actual human exposure to it was not demonstrated. Since exposure cannot be equated with proximity to a chemical, the presence of this chemical should not be used for statistical and epidemiologic assessments of potential risk.

Body burdens

The general population carries body burdens of trace amounts of a variety of halogenated aromatic compounds, phathallates, and metals.[14,15] The mere fact that a chemical has been identified in human body fluids or tissues is not tantamount with disease. On the contrary, age and disease may affect the distribution of persistent chemicals.

To illustrate, in recent studies it has been found that both mean total DDT (1,1,1-trichloro-2,2-bis[p-chlorophenyl] ethane), and PCB (polychlorinated biphenyl) levels increase with age in serum[16,17] and in adipose tissue[18] suggesting that distribution of these compounds is affected by age, or that, for certain xenobiotics, a steady state may not be reached during the average lifetime of humans. Changes in the serum lipid composition with age may also affect the distribution of lipid soluble chlorinated aromatic compounds. Furthermore, studies have been published showing that levels of chlorinated hydrocarbons are higher in tissues from patients with terminal cancer, hepatitis, and in stillborn infants.[19-21] It cannot be concluded from such studies that a causal relationship exists between body burdens and disease.

A further limitation on investigations of exposure to environmental chemicals results from the lack of baseline data in the general population. Even for such simple parameters as liver function tests, no good baseline information is available. More sophisticated tests, such as chromosome studies, are not yet part of the mainstream of medical practice. Finally, we lack knowledge about the significance for an individual's personal health of some of the effects we measure, such as sister chromatid exchanges, chromosome breaks, elevated urinary excretion of D-glucaric acid, to give a few examples.

Conclusion

In attempting to deal with the problems of victim's compensation, a number of basic facts should be considered. Following cessation of exposure to chemicals, recovery often occurs. For instance, it has recently been shown that the workers who became sterilized following occupational exposure to dibromochloropropane may recover their reproductive function after cessation of exposure.[22]

It is also known that at low doses of a chemical, health effects may be minimal, or there may be no health effects in a given individual. We all ingest on a daily basis small amounts of lead, cadmium, mercury, and arsenic because of a natural background of these elements in our environment. Such very low daily doses do not result in illness. However, if through human activity exposure is increased, then illness may develop.

The response to chemicals varies among species. For instance, if it has been shown that a particular chemical causes a tumor in a specific organ of rodents, that does not necessarily mean that the same type of tumor would be produced in humans nor is it presently established whether all of the chemicals that have now been shown to be carcinogens in rodents would also cause cancer in humans.

For public health purposes, these types of carcinogens are regulated to prevent illness. Such regulations do not necessarily imply that humans who have had exposure to trace amounts of such chemicals will develop cancer in the future nor can the cancer incidence of the general population be explained by such exposures. For most of the other chronic illnesses, no animal models exist which would suggest that such chronic illnesses are caused by the exposure to synthetic chemicals, particularly in minute quantities.

Most of the acute and chronic toxic effects of chemicals are quite specific and in order to determine whether a chemical has caused a specific health effect, the procedures that are normally used in differential diagnosis should also be applied for chemical exposure. When such judgements are made, it should be determined whether the dose that the individual received could have caused the illness, whether the exposure and latency

period were long enough whether the disease has ever been described before as having been caused by this particular chemical or whether an animal model exists in which the administration of the suspect chemical has caused the illness in question

Before such an evaluation is made it should be determined whether a claim is justified Such examinations cannot be conducted in a litigation situation.

A system needs to be developed where competent scientists, and more specifically physicians well-versed in differential diagnosis and in toxicology, determine whether the claim made by a patient is convincing. Settling such claims in court is not workable. Often the judgements made in such cases are dependent not so much on scientific facts but on the skills of the lawyers and on the sympathy of the jury rather than the objective findings in the case No jury has the competence to understand the very complex issues of "toxic tort" cases Even experts will not always be able to determine precisely what events caused the development of disease

Proper use of scientific data can lead to important public health benefits To press such data into service to respond to public fears and political opportunities arising out of individual health concerns would be neither scientific nor responsible. This is an issue on which, to paraphrase Socrates, "it is as essential to the law as it is to science to speak truly." The victims' bills simply do not

While scientists have no greater claims to wisdom about the proper goals of our society than do any other constituency, scientists do have a special claim to understand both the reach and the shortfall of scientific data and a special obligation to guide the proper use of those data

• • • • • • • • • •

Parts of this paper were presented before the litigation section of the American Bar Association Meeting July 7-12 1985 Washington D C

Opinions expressed in this article are those of the authors and do not necessarily reflect policies of the Centers for Disease Control

The assistance of Donald S Berry Esq is gratefully acknowledged

Submitted for publication September 23 1985 accepted for publication November 22 1985

Requests for reprints should be sent to Renate D Kimbrough M D Center for Environmental Health Centers for Disease Control Public Health Service U S Department of Health and Human Services Atlanta GA 30333

• • • • • • • • • •

References

1 Falk H Thomas L B Popper H and Ishak K G 1979 Hepatic angiosarcoma associated with use of androgenic anabolic steroids *Cancer* 11 1120

2 Falk H Caldwell G G Ishak K G and Thomas L B [illegible] Arsenic related hepatic angiosarcoma *Am Ind Med* 2 43

3 Rutstein D D Mullan R J Frazier T M Halperin W E Melius J M and Sestito J P 1983 Sentinel health events (occupational) 1983 A basis for physician recognition and public health surveillance *Am J Public Health* 73 1054-62

4 Doll R Muir C and Waterhouse J 1970 *Cancer Incidence in Five Continents* Vol 2 Berlin and New York International Union Against Cancer

5 Doll R and Peto R 1981 The causes of cancer Quantitative estimates of avoidable risks of cancer in the United States today *J Natl Cancer Inst* 66 1193-308

6 Reddy B S Cohen L A McCoy G D Hill P Weisburger J H and Wynder E L 1980 Nutrition and its relationship to cancer *Adv Cancer Res* 32 237-345

7 Ames B N 1983 Dietary carcinogens and anticarcinogens oxygen radicals and degenerative diseases *Science* 221 1256-64

8 Mulvehill J J 1980 Clinical observations of ecogenetics in human cancer pp 809-813 In Harris C L moderator Individual differences in cancer susceptibility *Ann Intern Med* 92 809-25

9 Veale A 1965 Intestinal polyposis series 40 In *Eugenics Laboratory Memoirs* London Cambridge University Press

10 Utsunomya J Maki T Iwana T Matsunaga Y Ichikawa T Shimomura T Hamaguchi E and Aoki N 1974 Gastric lesions of familial polyposis coli *Cancer* 34 745-54

11 Montesano R and Tomatis L 1976 Legislation concerning chemical carcinogens in several industrial countries *Cancer Res* 37 310-6

12 Kolata G B 1980 Love Canal False alarm caused by botched study *Science* 208 1239-42

13 Heath C W Nadel M R Zack M M Jr Chen A T L Bender M A and Preston R J 1984 Cytogenetic findings in persons living near the Love Canal *JAMA* 251 1437-42

14 Kimbrough R D 1982 Disposition and body burdens of halogenated aromatic compounds possible association with health effects in humans *Drug Metab Rev* 13 485-97

15 Kimbrough R D 1983 Determining exposure and biochemical effects in human population studies *Environ Health Persp* 48 [illegible]-9

16 Kreiss K Zack M Kimbrough R D Needham L K Smrek A L and Jones B T 1981a Cross-sectional study of a community with exceptional exposure to DDT *JAMA* 245 1926-30

17 Kreiss K Zack M Kimbrough R D Needham L K Smrek A L and Jones B T 1981b Association of blood pressure and PCB level in cross-sectional community study *JAMA* 245 2505-9

18 Unger M and Nordberg G F 1979 (Suppl) Distribution of PCB and DDT among human tissues *Arch Ind Hyg Toxicol* 30 537-43

19 Radomski J L Deichmann W B and Clizer E E 1968 Pesticide concentrations in the liver brain and adipose tissue of terminal hospital patients *Cosmet Toxicol* 6 209-20

20 Unger M and Olsen J 1980 Organochlorine compounds in the adipose tissue of deceased people with and without cancer *Environ Res* 23 257-63

21 Curley A Copeland M F and Kimbrough R D 1969 Chlorinated hydrocarbon insecticides in organs of stillborn and blood of newborn babies *Arch Environ Health* 19 628-32

22 Lantz G D Cunningham C R Huckins C and Lipshultz L I 1981 Recovery from severe oligospermia after exposure to dibromochloropropane *Fertility and Sterility* 35 46-53

March 9, 1987

TO: Andrew Hogarth, Chief, Remedial Action Section

FROM: Seth Phillips, Remedial Action Section

SUBJECT: Metamora Landfill Operable Unit Remedial Design

Per your request, this memo outlines the current situation relative to the interim cleanup proposed for the Metamora Landfill.

Background

During 1986, the DNR conducted a Phased Feasibility Study (PFS) through its contractor, E.C. Jordan, funded by a Superfund Cooperative Agreement from EPA. This PFS evaluated the known and potential threat to public health and the environment posed by the known drum disposal areas at the Metamora Landfill site. This study concluded that the two known drum disposal areas presented a significant enough threat to warrant a remedial action prior to implementation of a final site remedy. This threat was based on the presence of chemical compounds in wastes and in the ground water in concentrations exceeding recommended and/or established health effects criteria for carcinogenicity and the fact that residential groundwater users (potential receptors) were located downgradient and close to the sources of these contaminants.

EPA signed a Record of Decision (ROD) subsequent to this PFS which called for excavation of the wastes in these two areas as a source control measure. The ROD required that the excavated wastes and grossly contaminated soils be disposed in their entirety through incineration at RCRA compliant incineration facilities off-site. With EPA authorization DNR proceeded, through E.C. Jordan to develop the specific design and specification package for this remedial action with the intent that it be part of the bid package needed to procure a removal contractor.

Issue

As part of the design project, E.C. Jordan has been contacting RCRA incinerators to determine various technical requirements for shipping and disposing of the wastes from this cleanup and to determine available capacity and costs for incineration. Much of the waste expected to be generated by this cleanup will be solid materials including contaminated soils. DNR staff have also been active in this research effort.

The information generated by this effort has made clear that our previous suspicions about capacity were accurate. Capacity at existing incinerators for solid waste material is very small. The estimated current capacity, if all of [illegible], indicates that it would take

EXHIBIT 9

approximately 3 years to complete the transportation and incineration of the solid waste expected to be generated by this cleanup project. Contacts with these incinerators, however, reveal that it is highly unlikely that all of this capacity could be made available for these wastes. While no direct estimate is available, it appears that capacity would be made available only on an occasional basis and in limited amounts. Due to these facts we estimate that the actual time required for incineration of these wastes could range from five to ten years or longer.

This situation would require the DNR to either develop a long-term contract for maintenance of the storage facility necessary to store these wastes and for the transportation and disposal of the wastes or to go through an on-going procurement process to provide these needs. DNR will also then be responsible for management of a long-term waste storage facility. Management of this situation will prove costly and difficult, especially over such a long-term.

Options

Based on discussions with our contractor, DNR staff and EPA Superfund staff, the following options are available:

1. Continue with Current Design - The capacity situation described above is based on non-bid contacts. Only through completion of the bidding process can we firmly establish the exact nature of this situation even though we believe that our estimate of it is correct. We could complete the development of this design, complete procurement and then determine an appropriate course of action.

   This approach will answer the questions. However, if our assumptions are correct, we will only succeed in delaying implementation of a remedy which we believe is needed. If procurement fails to produce a solution, we would then need to go back into the planning process to develop a new alternative, procure a new design contractor, prepare a new design and go through another procurement process. Additional public participation activities and EPA modification of the current ROD would also be required. Failure of procurement will also result in significant lost money as well as time. Relations with DNR procurement staff are likely to be harmed by conducting a complex procurement which is expected to fail.

2. Landfilling of Solids - During the PFS, DNR's original recommendation was to landfill the solid wastes generated by the cleanup at RCRA landfills. This is likely to be less of a capacity problem and certain to be less costly then incineration. EPA refused to permit landfilling of these wastes in reaction to anticipated (and now enacted) language in Superfund discouraging land disposal in favor of permanent destruction type remedies.

   In current discussions with EPA they continue to oppose landfilling of the solids. They agree that landfilling could be proved feasible but first DNR must conduct extensive and expensive studies to demonstrate the leachability and chemical characteristics of the

wastes to show that they could be safely landfilled and that in the event of landfill liner failure would not pose an environmental risk. These analyses could be undertaken but might never adequately demonstrate the requisite conditions. In fact, to be successful such a demonstration must counter the position of the PFS that these wastes should be removed from the site. Further, this effort would greatly delay the cleanup. Development of a new design, additional public participation and EPA modification of the ROD would be necessary as above.

3. Other treatment of solids - Brief discussions with our design engineers has indicated that other treatment options do not seem feasible. This is due to the varied nature of the waste stream, the large volume of soils involved and the very high costs generally associated with treatment of solid waste. Considerable additional study and analysis (obviously also additional cost) would be required to further evaluate this possibility. As above the other delays associated with contracting a new design and changing the ROD would be required.

4. On-site incineration - EPA has always favored this approach to this cleanup. In the PFS, DNR opposed this position because of the many permit and siting issues which would delay implementation for several years. The reauthorization of Superfund created at the Federal level an exemption from the requirement to obtain permits for on-site remedies. DNR has not determined whether permits are to be required at the State level for such actions. Selection of on-site incineration would meet the least resistance from EPA but would require the Department to conduct significant public participation. Procurement of a new design contractor and design would be needed before implementation could begin resulting in at least six months or longer delay. No construction of on-site incinerators to address contamination site cleanup has yet been pursued in Michigan. It is likely that substantial public controversy would develop from such a change in direction by DNR.

Recommendation

DNR staff have always felt landfilling of the solid wastes from this cleanup was the most appropriate course of action. Staff continues to believe that landfilling should be pursued if EPA can be convinced to accept such an approach without the extensive level of study and analysis which they currently indicate would be needed and which present a circular argument against cleanup.

If a landfilling approach does not seem feasible, pursuit of an on-site incinerator appears to be the next best option. However, this option is probably feasible only if Act 64 and Act 348 permits are not required. Development of technical requirements akin to permit conditions should be developed and applied to such an alternative if no permit is required. Additionally such an approach is likely to be feasible only if significant public controversy can be avoided in its selection. Otherwise significant delay and perhaps permanent roadblocks to its implementation may result. Extensive and effective community involvement must be

undertaken early to gauge this condition and hopefully to develop a supporting consensus for this approach.

cc: Ms. Kerbawy ✓
Mr. Willson

Design file

February 27,1987

To: Metamora Landfill ~~RI/FS~~ Design File
From: Seth Phillips, Project Manager
Subject: Issues on Operable Unit Design and Record of Decision

The Record of Decision (ROD) developed subsequent to the Phased Feasibility Study(PFS) of the Metamora Landfill NPL site called for excavation of drums and associated saturated soils from the two know areas of drum disposal at the site (Areas 1 and 4) with incineration of all waste and soils at off-site compliant RCRA incinerators. Through DNR's LOE contractor, E.C. Jordan design of this "operable unit" has been underway. During development of this design research into available incineration capacity has confirmed our earlier suspicions regarding the viability of the approach called for in the ROD.

While incineration of incinerable liquids is not expected to pose a significant problem, capacity to accept incinerable solids and in particular solids not amenable to incineration is almost nil. Jordan research has indicated that theoretically available capacity for these solids at existing incinerators could accomodate these materials but that it would take approximately 1,000 days of incineration if all available capacity could be captured. Their research as well as research done by DNR staff has strongly suggested however, that few of these incinerators would make even this small amount of capacity available to our solids incineration program. The reality appears to be that interminent shipments of small volumes of solids would be required as capacity became available over a protracted period estimated to be potentially as long as ten years in order to dispose of these wastes through off-site incineration.

On Wednesday, Febraury 25, 1987 I discussed this problem with Ron Willson and Claudia Kerbawy. I suggested that we should not continue with this current design and should instead pursue a new approach, either landfilling of the solids or on-site incineration of them. During development of the PFS, DNR had originally recommended landfilling of the solids. Ron and Claudia agreed with this outlook. The issues involved with changing the approach are substantial enough to requrie elevated discussions however.

On Thursday, Febraury 26, 1987 Ron Pete Ollila and myself met with Andy Hogarth to discuss this matter. Andy directed that we continue with the current design project for the moment while he elevates that matter to Del Rector for discussion. That meeting is supposed to happen on Friday, February 27,1987.

ENGINEERS &
SCIENTISTS

--63-97
3.67.1

February 3, 1987

FEB 10 1987

Mr. Seth Phillips, Project Administrator
Remedial Action Section
Groundwater Quality Division
Michigan Department of Natural Resources
PO Box 30028
Lansing, MI 48909

Dear Seth:

Subject: Metamora Landfill Drum Removal Operable Unit

I am submitting this letter to document information we have collected from commercial incineration facilities regarding available capacity to handle solid wastes. I am also sending a copy of the minutes from our January 20 meeting and a revised schedule which is substantially accelerated. The schedule represents a very ambitious approach and in order to meet the proposed dates, all major substantive issues will need to be resolved during or shortly after our next meeting. We would like to schedule this meeting for the week of February 23, preferably on Tuesday afternoon or Wednesday. We would also like to get a copy of the MDNR prequalified bidder list.

Since our meeting to discuss the specifications for the drum removal operable unit, we have contacted a number of incineration facilities to determine the available capacity for handling solid wastes and metal drums. As a result of these contacts, several changes in approach will be necessary in the specifications as detailed in the following paragraphs.

1 Onsite Storage

After speaking with a number of incineration facilities (see Table 1) we have come to the conclusion that capacity is currently limited and will likely be more limited as we approach the project date. At the present time, no incinerator facility can process more than 200 to 400 drums per week. For the estimated 15,000 drums of soil and waste at Metamora, this would require 38 to 75 weeks. In addition, commercial facilities have limited storage space onsite, usually 5 to 10 days' inventory. In light of these constraints, we are planning to design semi-permanent onsite storage areas, large enough for the total expected volume of excavated wastes packed in 15- or 30-gallon plastic containers. These areas will be designed to meet the technical requirements of RCRA and Act 64. At present we are considering a double-lined area with an open-sided structure to divert rainfall and snow. This facility will be located in a clean area and will undergo a RCRA closure at the conclusion of the contract. The specifications will contain a provision for maintenance of the storage area during its useful life, payable on a monthly basis.

2 Disposal of Drums

Discussions with commercial incineration facilities and clean-up contractors indicate that currently no capacity exists to incinerate metal drums. Only one facility was located which had a capacity to handle drums and the status of this facility with respect to RCRA and TSCA permits is questionable. There is a possibility that within a year other facilities may be able to handle a metal waste stream, but we do not recommend proceeding on the basis of assumptions about the future. The consensus of cleanup contractors was that drums could be cleaned, shredded or crushed, and shipped to a RCRA landfill. In light of this, a requirement that the drums be incinerated may result in an unbiddable job. We realize this may require an amendment to the ROD and want to alert you to this possibility.

3. Bulking of Solid Wastes

Under the current DOT requirements for transporting solid wastes, it is not permissible to bulk flammable solids for shipment. With this in mind, we envision the following scheme for packaging the waste material:

a. Drums containing liquids will either be overpacked for shipment to the incineration facility, or bulked for shipment in vacuum tank trucks.

b. Drums containing solids will either be overpacked for shipment to the incineration facility or repacked in plastic 15- and 30-gallon drums.

c Soils will either be bulked in rolloffs or packed in 30-gallon plastic drums for shipment to the incineration facilities.

d. Drums will be cleaned, crushed and bulked for shipment to a RCRA landfill.

e. Water from the staging area will be collected in vacuum tanks and shipped to an appropriate facility for treatment.

As a result of the information cited above, we are continuing to develop the specifications with the following assumptions:

1. A storage facility capable of containing all of the excavated wastes will be constructed in a clean area onsite. This facility will include a cover and will be built to conform with RCRA and Act 64 requirements. The contractor will maintain this facility for the duration of the contract. At the conclusion of the contract, the storage area will undergo a RCRA closure.

2. Drums will be cleaned, crushed or shredded, and transported to a RCRA landfill.

3. Wastes will be prepared for shipment as described in the paragraph above.

Due to the aggressive schedule for this project, we will continue work based on the assumptions outlined in this letter. A final decision on these matters will need to be made by the date of our next meeting if we expect to remain on schedule.

Please contact me with any further questions, and to schedule our next meeting.

Sincerely,

E.C. JORDAN CO.

Roger Hathaway
Project Engineer

JRH:sks

TABLE 1
DRUM AND SOLIDS CAPACITY
AT
SELECTED FACILITIES

COMPANY NAME/CONTACT	ACCEPTABLE SOLIDS FEEDS	CAPACITY (current available)	COMMENTS
Chemical Waste Management SCA Incinerator Chicago, IL Bruce Marti (312) 646-5700	Solids must be packed in plastic 30 gallon drums at excavation site. PCBs accepted, not metals. No bulk shipments.	This volume represents a large portion of total capacity for a six month period. It would probably take 8-12 months to handle this. Only 3 days storage capacity on site	Drums are crushed and landfilled. Strict limits on metals in feed.
Chemical Waste Management Trade Waste Incinerator Sauget, IL Ollie Beckly (618) 271-2804	Can accept 55 gallon drums for repacking into fiber. No PCBs. No bulk shipments.	Total capacity is 40 drums/day. 6 month lead time to schedule solids. Limited to a total of 2000 drums on site at any time	Drums are crushed and landfilled, cannot shred and burn. Repackage waste for SCA incinerator
Rollins Environmental Services Bridgeport, NJ Cathy Marion (609) 467-3105	Solids packaged in fiber packs. Limited repackaging facilities on site. No bulk shipments. No PCBs.	Could accept 30 drums/day, depending on weight and content. Limited storage space on site.	Drums are crushed and landfilled, no shredding or burning.
GSX/Stablex/Thermal Chem Columbia, South Carolina Phillip Warren (803) 329-9690	Solids in metal or fiber drums. metal drums repacked into fiber. No bulk shipments. No PCBs.	Total capacity--200 drums/day. Could accept 80-100 drums/day. Capacity expected to be filled with landfill ban and Superfund wastes in the future	Drums are crushed and landfilled, no shred and burn. Accept waste from OH Materials jobs
ENSCO El Dorado, Arkansas Tom Scott (501) 863-7173	Solids in metal drums, fiber drums. Soils in bulk rolloffs-limited quantities. Can repack drums or feed soils in bulk.	Currently limited. Hope to install bulk handling system to handle soils and shredded drums within 6 months	Currently drums are crushed and landfilled. Soil can be bulked
Ross and Sons Grafton, Ohio (216) 748-2171	Will not quote on drums. Must know contents of each drum.	Solids capacity full for forseeable future. Will not quote on any new jobs	Will not accept EPA/Superfund wastes
Marine Shale Processors Louisiana Pink Frady (504) 767-0984	Soils, flammable solids, drums. Drums are shredded and burned. Soils are fed in bulk. No PCBs.	Last month handled 3000 drums and 3000 tons soil. Operating at 25% capacity. Currently in violation of RCRA storage permit	This is an aggregate production plant--not a RCRA or TSCA disposal facility. Have demonstrated DREs. Can handle bulk wastes
OH Materials Findlay, OH Bill Buchanan (800) 338-4508	Suggested that we package solids in incinerable containers on site	Felt that capacity will be a definite problem once Superfund monies become available. Suggested we provide ample on site storage	
SCA/Chemical Waste Management Model City, NY Art Pethybridge (716) 754-8231	Indicated that some material may have to be packed in 15 gallon containers. This would mean staging/sampling before repackaging. Suggested splitting drums in ½ length-wise to remove solids	Felt that capacity of incinerating empty drums would be a serious problem. He though that on-site shredding would be necessary	

ENGINEERS & SCIENTISTS

261 Commercial Street P.O. Box 7050
Portland, Maine 04112
207) 775-5401 Telex 94-4329

4465-97

March 2, 1987

Mr. Seth Phillips
Remedial Action Section
Department of Natural Resources
Stephens P. Masons Building
Lansing, MI 48912

Dear Seth:

Subject: Available Capacity at Commercial Incineration Facilities

This letter presents a summary of information collected during a series of recent phone conversations with commercial incineration facility representatives. As a part of the conceptual design process for the Metamora Landfill Drum Removal Operable Unit, I have contacted several commercial facilities to discuss available capacity and handling requirements for contaminated soils and solid hazardous wastes. My discussions have left me with a number of general impressions including the following:

1) Commercial facilities are currently operating near capacity. All of the facilities contacted were operating at or near the solids handling capacity of the unit. The disposal firms have a steady stream of industrial clients which has been increased as a result of the landfill ban on solvents and dioxin wastes. For these reasons, the current available capacity at the commercial facilities contacted averaged approximately 40 drums per day (40 plastic drums, packed with 250 lbs of soil or solid wastes).

2) Available capacity at commercial facilities is likely to decrease in the foreseeable future. At the present time there are approximately 12 commercial facilities which can handle solid hazardous wastes as defined by RCRA. Only four commercial facilities are permitted for wastes containing PCB's in excess of 50 ppm. As mentioned above, all of these facilities are operating near capacity. The remaining available capacity is likely to be taken up by solvent wastes, and the California list wastes as the landfill bans take effect. There will also be competition for capacity from other Superfund sites. As an example, a site the size of Metamora would require the total current available solids handling capacity at the nation's twelve incinerators for one hundred days, assuming that all these facilities continue to operate at full capacity and maintain compliance with regulatory guidelines. The number of commercial facilities is not likely to increase in the near future due to severe limitations imposed by the current permitting process.

3) Commercial facilities are not designed to handle large volumes of solid wastes. The facilities operating commercially are generally designed to handle large volumes of liquid organics and can also handle small charges of solid wastes. The solid wastes must be packaged in incinerable containers; usually 15 and 30 gallon plastic or fiber drums. Solids must meet certain size limitations and

EXHIBIT 11

extra charges are assessed for high ash contents. These operating limitations limit the feed rates of solids.

4) The CERCLA off-site policy places severe limitations on which facilities may be used. The off-site policy requires that off-site shipments are made to disposal facilities which are in current compliance with all RCRA regulations and which have been inspected every six months. Among the nations four permitted PCB incinerators it is not unusual for two or three of the facilities to be out of compliance at any given point in time. While this does not restrict the acceptance of industrial wastes, these facilities are not eligible to accept CERCLA wastes until they demonstrate compliance. This policy could result in a suspension of waste shipments for indefinite periods of time.

These considerations have several implications for the design of the Metamora Drum Removal Operable Unit. First, requirement that incineration capacity be guaranteed may result in a limited number of bids or no bids at all. Very few clean-up contractors are associated closely enough with an incineration facility to guarantee available capacity. Due to the chance for substantial price increases in the future, it is likely that any capacity which is guaranteed will be accompanied by a very high unit price. Even if capacity is guaranteed, a non-compliant incineration facility will be unable to accept the waste.

In addition to the problems with guaranteed capacity, it is likely that the disposal of 40,000 thirty gallon drums will require an extended period of time. At a rate of 40 drums per day, this would require 3 years assuming full time operation and continual compliance. Any interruptions would extend the total disposal time. Once again, additional capacity might be made available, at a price. A bid package which required disposal within a fixed short period of time (e.g. 2 years) would likely result in no bids or inflated bids.

A summary of the information collected from contacts with commercial incineration facilities is presented in Table 1. If I can be of further help, please contact me.

Sincerely,

E.C. JORDAN CO.

Roger Hathaway
Project Engineer

RH/cl
Attachment

TABLE 1
DRUM AND SOLIDS CAPACITY
AT
SELECTED FACILITIES

COMPANY NAME/CONTACT	ACCEPTABLE SOLIDS FEEDS	CAPACITY(current available)	COMMENTS
Chemical Waste Management SCA Incinerator Chicago, IL Bruce Martz (312) 646-5700	Solids must be packed in plastic 30 gallon drums at excavation site. PCBs accepted, not metals. No bulk shipments.	This volume represents a large portion of total capacity for a six month period. It would probably take 8-12 months to handle this. Only 3 days storage capacity on site.	Drums are crushed and landfilled. Strict limits on metals in feed.
Chemical Waste Management Trade Waste Incinerator Sauget, IL Ollie Beckly (618) 271-2804	Can accept 55 gallon drums for repacking into fiber. No PCBs. No bulk shipments.	Total capacity is 40 drums/day. 6 month lead time to schedule solids. Limited to a total of 2000 drums on site at any time.	Drums are crushed and landfilled, cannot shred and burn. Repackage waste for SCA incinerator.
Rollins Environmental Services Bridgeport, NJ Cathy Marion (609) 467-3105	Solids packaged in fiber packs. Limited repackaging facilities on site. No bulk shipments. No PCBs.	Could accept 30 drums/day, depending on weight and content. Limited storage space on site.	Drums are crushed and landfilled, no shredding or burning.
GSX/Stablex/Thermal Chem Columbia, South Carolina Phillip Warren (803) 329-9690	Solids in metal or fiber drums. metal drums repacked into fiber. No bulk shipments. No PCBs.	Total capacity--200 drums/day. Could accept 80-100 drums/day. Capacity expected to be filled with landfill ban and Superfund wastes in the future.	Drums are crushed and landfilled, no shred and burn. Accept waste from OH Materials jobs.
ENSCO El Dorado, Arkansas Tom Scott (501) 863-7173	Solids in metal drums, fiber drums. Soils in bulk rolloffs-limited quantities. Can repack drums or feed soils in bulk.	Currently limited. Hope to install bulk handling system to handle soils and shredded drums within 6 months.	Currently drums are crushed and landfilled. Soil can be bulked.
Ross and Sons Grafton, Ohio (216) 748-2171	Will not quote on drums. Must know contents of each drum.	Solids capacity full for forseeable future. Will not quote on any new jobs.	Will not accept EPA/Superfund wastes.
Marine Shale Processors Louisiana Pink Frady (504) 767-0984	Soils, flammable solids, drums. Drums are shredded and burned. Soils are fed in bulk. No PCBs.	Last month handled 3000 drums and 3000 tons soil. Operating at 25% capacity. Currently in violation of RCRA storage permit.	This is an aggregate production plant--not a RCRA or TSCA disposal facility. Have demonstrated DREs. Can handle bulk wastes.
OH Materials Findlay, OH Bill Buchanan (800) 338-4508	Suggested that we package solids in incinerable containers on site.	Felt that capacity will be a definite problem once Superfund monies become available. Suggested we provide ample on site storage.	
SCA/Chemical Waste Management Model City, NY Art Pethybridge (716) 754-8231	Indicated that some material may have to be packed in 15 gallon containers. This would mean staging/sampling before repackaging. Suggested splitting drums in ½ length-wise to remove solids.	Felt that capacity of incinerating empty drums would be a serious problem. He though that on-site shredding would be necessary.	

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

March 9, 1987

TO: Seth Phillips, Site Management Unit, GQD

FROM: Bill Herceg, Environmental Hazard Control Unit, GQD BH

SUBJECT: Incineration Capacity at Selected Facilities

In discussing incineration capacity with various companies capable of incinerating contaminated soils in addition to semi-solid and liquid hazardous waste, it appears capacity will be a definite problem for the foreseeable future.

The following are limitations common to all the companies contacted:

1. will not accept soils in bulk shipments,
2. all materials will need to be repacked into 30-gallon plastic or fiber drums prior to shipment,
3. have very limited feed rates and consequently limited storage capacity on site,
4. most will not accept PCB contaminated wastes.

It appears, from the sample data received to date, that approximately 50 percent of the waste contains PCB's. Of the companies that will accept PCB's, one will not accept EPA/Superfund wastes, and the others are severely limited in capacity and/or could only accept a small number of drums per day. There is also very limited storage space at these facilities.

cc: Peter Ollila, GQD

EXHIBIT 12

September 16, 1985

Mr. James Atwell
E.C. Jordan Company
562 Congress
Box 7050
Portland, Maine 04112

Dear Jim:

Thank you for your timely submittal of the draft Phased Feasibility Study work plan. My apologies for the delays in my review and response to this plan. There have been a number of issues which I needed to resolve or clarify before I could respond. There are a few revisions needed to this work plan to address these items.

You should delete the provision for you to prepare and provide the Part I and III boilerplate portions of the information for contractors as described on page 26. DMR and the Department of Management and Budget (the State's actual contracting agency) will have to prepare these materials. You should plan on preparing only the specific plans and specifications documents, which we could also change before bidding. You should also be aware the EPA has forbade the State from incurring any expenses associated with the development of the plans and specifications task until such time as a formal Record of Decision (ROD) is entered. Therefore, you should adjust the work plan schedule accordingly.

I am impressed that you think a one week review of the draft PFS report by DMR is possible. I know that you were responding to my request for an expedited schedule; however, I doubt that we can achieve such a goal, especially since EPA review will also be required. You should add a few weeks to this schedule.

The most difficult issue, as I have discussed with you, is the manner of addressing potential soils removal as part of the operable unit remedial action. EPA originally indicated that the PFS Report would have to set specific clean-up targets for contaminated soils which should be removed, and that a model which works backward from groundwater receptors to the source should be included in the PFS. This process, of course, is very difficult to do up front as we do not have any soils contamination information at the drum areas, and will not until such time as excavation begins. What I have suggested to EPA, and believe they will accept, is a PFS task to be implemented at the time excavation begins, if a removal action occurs which will involve evaluating soil sample analyses taken

EXHIBIT 13

at the commencement of excavation to determine the risk posed to potential receptors. This evaluation process would evaluate mobility of material found in the soils, distance to potential receptors, attentuation which might occur in the groundwater, and other pertinent factors to evaluate the risk these soils pose. Using drinking water standards, where available, and risk assessment processes where standards are not available, the evaluation would then set clean-up targets for soils removal.

At this time I do not know whether this task can be done by DNR staff, or needs to be planned for you to undertake. What I would like you to do in the PFS work plan is to include this additional task with a completely separate budget. The scheduling of this task still needs to be resolved. Please outline the methodology model if appropriate and staff you would propose to use as well as schedule needs. The work plan needs to provide that this task be done, unless DNR directs otherwise in the event that we will do it in-house.

Please redraft the PFS in accordance with the comments outlined above, and submit a new draft and budget to me within 15 working days. If you have any questions, please let me know.

Sincerely,

Seth Phillips, Project Manager
Remedial Action Section
Groundwater Quality Division
517/373-8448

SP:cla
cc: Mr. O'Hearn
Ms. Mursch
Mr. Tasgreak