United States
Environmental Protection
Agency

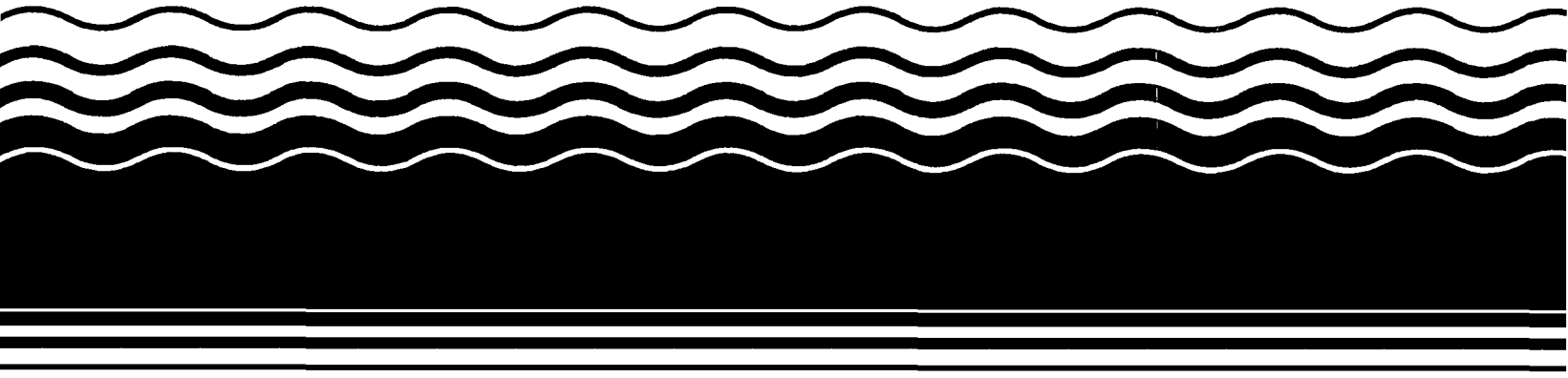
Office of
Emergency and
Remedial Response

EPA/ROD/R05-92/193
April 1992

EPA

Superfund Record of Decision:

Midco II (Amendment), IN



NOTICE

The appendices listed in the index that are not found in this document have been removed at the request of the issuing agency. They contain material which supplement, but adds no further applicable information to the content of the document. All supplemental material is, however, contained in the administrative record for this site.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-92/193	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Midco II (Amendment), IN
First Remedial Action - Amendment

5. Report Date
04/13/92

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Orgainization Name and Address

10. Project/Task/Work Unit No.

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

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

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes
PB93-964102

16. Abstract (Limit: 200 words)
The 7-acre Midco II site is an abandoned chemical waste storage and disposal facility in Gary, Indiana. Land use in the surrounding area is predominantly industrial. The underlying aquifer, which is used primarily for non-drinking purposes, is highly susceptible to contamination from surface sources. From 1976 to 1978, this site was used for treatment, storage, and disposal of chemical and bulk liquid wastes. Onsite pits were used for disposal, from which wastes percolated into and contaminated the ground water. An overflow pipe from a filter bed disposal pit discharged directly into a ditch draining directly into the nearby Grand Calumet River. Additionally, an estimated 10 waste storage tanks were deteriorated and leaking. In 1977, a fire at the site destroyed an estimated 50,000 to 60,000 waste drums. In 1981, EPA installed a fence around the site. From 1984 to 1989, EPA removed all surface wastes, including thousands of drums and numerous tanks of chemical waste; excavated and disposed offsite subsurface soils and wastes from the sludge pits and the filter bed; and extended the site fence. This ROD amends a 1989 ROD that addressed the remaining contaminated soil, pit wastes, and ground water by treatment of an estimated 35,000 cubic yards of soil wastes using solidification/stabilization followed by

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Midco II (Amendment), IN
First Remedial Action - Amendment
Contaminated Media: soil, sediment, gw
Key Contaminants: VOCs (benzene, toluene, TCE, xylene), other organics (PCBs, phenols, PAHs), metals (arsenic, chromium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 71
	20. Security Class (This Page) None	22. Price

Abstract (continued)

onsite disposal; excavation and solidification/stabilization of 500 cubic yards of contaminated sediments followed by onsite disposal; covering the site in accordance with RCRA landfill closure requirements; ground water pumping and injection into a shallow or deep aquifer with or without treatment, depending on treatment studies; and implementing deed and access restrictions. The amended remedy reduces the estimated amount of soil to be treated, as a result of new information on arsenic data and amended soil CALs, further defines the site cover requirements, and further defines the requirements for deep well injection of contaminated ground water. The primary contaminants of concern affecting the subsurface soil, sediment, and ground water are VOCs, including methylene chloride, benzene, toluene, TCE, and xylenes; other organics, including PCBs, phenols, and PAHs; and metals, including chromium, and lead.

The amended remedial action for this ROD includes reducing the amount of soil to be treated with soil vapor extraction and in-situ solidification/stabilization from estimated 35,000 cubic yards to an estimated 18,300 cubic yards because of the amended soil CALs and a determination that arsenic may not be present above background levels; excavation and onsite solidification/stabilization of an estimated 500 cubic yards of contaminated sediments from a ditch adjacent to the northeast boundary of the site; pumping ground water and treating with air stripping and carbon adsorption to site-specific requirements for onsite deep well injection. Contingency measures are added in case if the ground water clean-up action levels for the Calumet Aquifer are technically impracticable to attain; construction of a final vegetated cover over the entire site that is consistent with RCRA closure requirements; and implementation of access and deed restrictions and monitoring. The ground water treatment or underground injection portions of this remedy may be combined with remedial actions for the adjacent Midco I site. The estimated present worth cost for this amended remedial action is $13,000,000, which includes an annual O&M cost of $660,000.

PERFORMANCE STANDARDS OR GOALS: Ground water clean-up standards are not changed from the 1989 ROD. Treatment required prior to DWI are further defined compared to the 1989 ROD, and include at a minimum treatment to ACs, which are required for RCRA delisting. Specific MACs include methylene chloride 31,5 ug/l; trichloroethene 31.5 ug/l; toluene 6,300 ug/l; chromium 630 ug/l; nickel 630 ug/l, and lead 99.5 ug/l. Treatment below the MACs will be required if necessary to protect underground sources of drinking water. Soil treatment action levels are increased from $1x10^{-6}$ and HI=1 in the 1989 ROD to CR=$5x10^{-4}$ and HI=5 in this ROD.

DECLARATION FOR RECORD OF DECISION AMENDMENT

SITE NAME AND LOCATION

Midco II
Gary, Indiana

STATEMENT OF BASIS AND PURPOSE

This decision document presents a description of an amendment to the selected remedial action for Midco II developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent possible the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document amends the Record of Decision dated June 30, 1989.

This decision is based on the contents of the administrative record for the Midco II site. The attached index identifies the items which comprise the administrative record for this Record of Decision Amendment.

The State of Indiana concurs in this amendment to the remedy selection by U.S. EPA for the Midco II site.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDY (AS AMENDED)

The primary reasons for amending the selected remedy at Midco II relate to: 1) a change in the method for determining how much soil will be treated; 2) further definition of the degree of treatment of contaminated ground water that EPA will require prior to deep well injection including a proposal to delist the extracted ground water (the ground water contains listed hazardous wastes as defined in the Resource Conservation and Recovery Act) through this Record of Decision Amendment provided that the extracted ground water is treated to meet specified maximum allowable concentrations (MACs) prior to disposing of the extracted ground water by deep well injection.

The selected remedial action includes:

- On-site treatment of a minimum of approximately 12,200 cubic yards of contaminated soil and waste material, and possibly more dependent upon the results of further sampling, by soil vapor extraction and in-situ solidification/stabilization.

- Excavation and on-site solidification/stabilization of approximately 500 cubic yards of contaminated sediments from the ditch adjacent to the northeast boundary of the site.

- Installation and operation of a ground water pumping system to intercept contaminated ground water from the site. Contingency measures have been added in case it is technically impracticable from an engineering perspective to meet the ground water cleanup action levels.

- Installation and operation of a treatment system (as required) to remove hazardous substances from the extracted ground water, and deep well injection of the extracted ground water following any required treatment. Ground water treatment will be required to the extent necessary to attain maximum allowable concentrations (MACs), which are levels equivalent to those required for delisting a hazardous waste under the Resource Conservation and Recovery Act (RCRA). Treatment beyond the MACs will be required under certain conditions if either the lower Eau Claire or Mount Simon Formation (which are more than approximately 1800 feet below the surface of the site) is an underground source of drinking water (USDW) as defined in 40 CFR 144.3. Alternatively, the ground water could be treated to remove hazardous substances followed by reinjection of the ground water into the Calumet aquifer in a manner that will prevent spreading of the salt plume.

- Construction of a cover over the entire site that is consistent with the closure requirement under Subtitle C of RCRA

- Restriction of site access, and deed restrictions.

- Long term monitoring and maintenance.

The ground water treatment or underground injection portions of the remedial action may be combined with the remedial action for Midco I. For example, the ground water from Midco II may be transported to Midco I for treatment or injection, or vice versa. In this case, the combined treatment or injection shall constitute an on-site action, for purposes of the Off-site Policy and compliance with applicable or relevant and appropriate standards.

DECLARATION

The selected remedy, as modified herein, and including the contingency measures in case EPA determines that it is technically impracticable to meet the ground water cleanup action levels, is protective of human health and the environment, and is cost effective. The selected remedy also attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action, except that some primary Maximum Contaminant Levels will be waived for portions of the Calumet aquifer, provided that it is demonstrated that it is technically impracticable from an engineering perspective to attain these standards and appropriate contingency measures are implemented.

This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Because this remedy will result in hazardous substances remaining on-site, pursuant to Section 121 (c) of CERCLA, a review will be conducted at the site within five years after commencement of the remedial action and at least every five years thereafter to ensure that the remedy continues to provide adequate protection of human health and the environment.

April 13th, 1992

Date

Valdas V. Adamkus

Valdas V. Adamkus
Regional Administrator
Region V

SUMMARY FOR RECORD OF DECISION AMENDMENT

Midco II, GARY, INDIANA

I. INTRODUCTION (for more detailed information on the site location, site description, and the site history, enforcement activities and community relations prior to June 30, 1989 refer to the Record of Decision (ROD) signed on June 30, 1989, Sections I-III)

Midco II operations were primarily conducted on an approximately seven acre area at 5900 Industrial Highway in Gary, Indiana (see Figures 1 and 2) from approximately 1976 through 1978. Operations included temporary bulk liquid and drum storage of waste and reclaimable materials, neutralization of acids and caustics, and on-site disposal via dumping into pits, which allowed percolation into the ground water. One of theses pits, called the filter bed, had an overflow pipe leading into the ditch. Many of the wastes disposed of on-site were from the paint industry, and many contained hazardous substances. In addition, during the operations, wastes were dumped and spilled onto and into the ground at the site. A large fire in August 1977 destroyed thousands of drums containing chemicals on the site, and resulted in additional spillage of chemicals onto the site.

The United States Environmental Protection Agency (EPA) installed a fence at the site in 1981, and completed a removal action from 1984 through 1989 that included removal of all surface wastes including thousands of drums of chemical wastes, and a number of tanks containing chemical wastes, and excavation and off-site disposal of subsurface soils and wastes in the sludge pit and filter bed. Other than the sludge pit and filter bed, the contaminated subsurface soil and ground water were not addressed in the removal action.

A Remedial Investigation/Feasibility Study (RI/FS) was completed by a group of potentially responsible parties (PRPs) (generally PRPs are entities who owned or operated Midco II or sent or transported hazardous substances to the Midco II site) under EPA oversight from 1985 to 1989. The Indiana Department of Environmental Management (IDEM) also participated in oversight of the RI/FS. The RI showed that portions of the subsurface soils, including natural soils and fill material, located within the area outlined in Figure 2 are highly contaminated by a large number of hazardous substances (including volatile organic compounds (VOCs), semivolatile organic compounds, PCBs, metals and cyanide). The fill material consists of sand, slag, cinders, granular material, and a grey silty material mixed with some cultural debris including scrap metal, concrete, wood, bricks,

eprinted from "Remedial Investigation of Midwest Waste Disposal Company, Inc. (Midco II), Gary, Indiana"
/ Environmental Resources Management-North Central

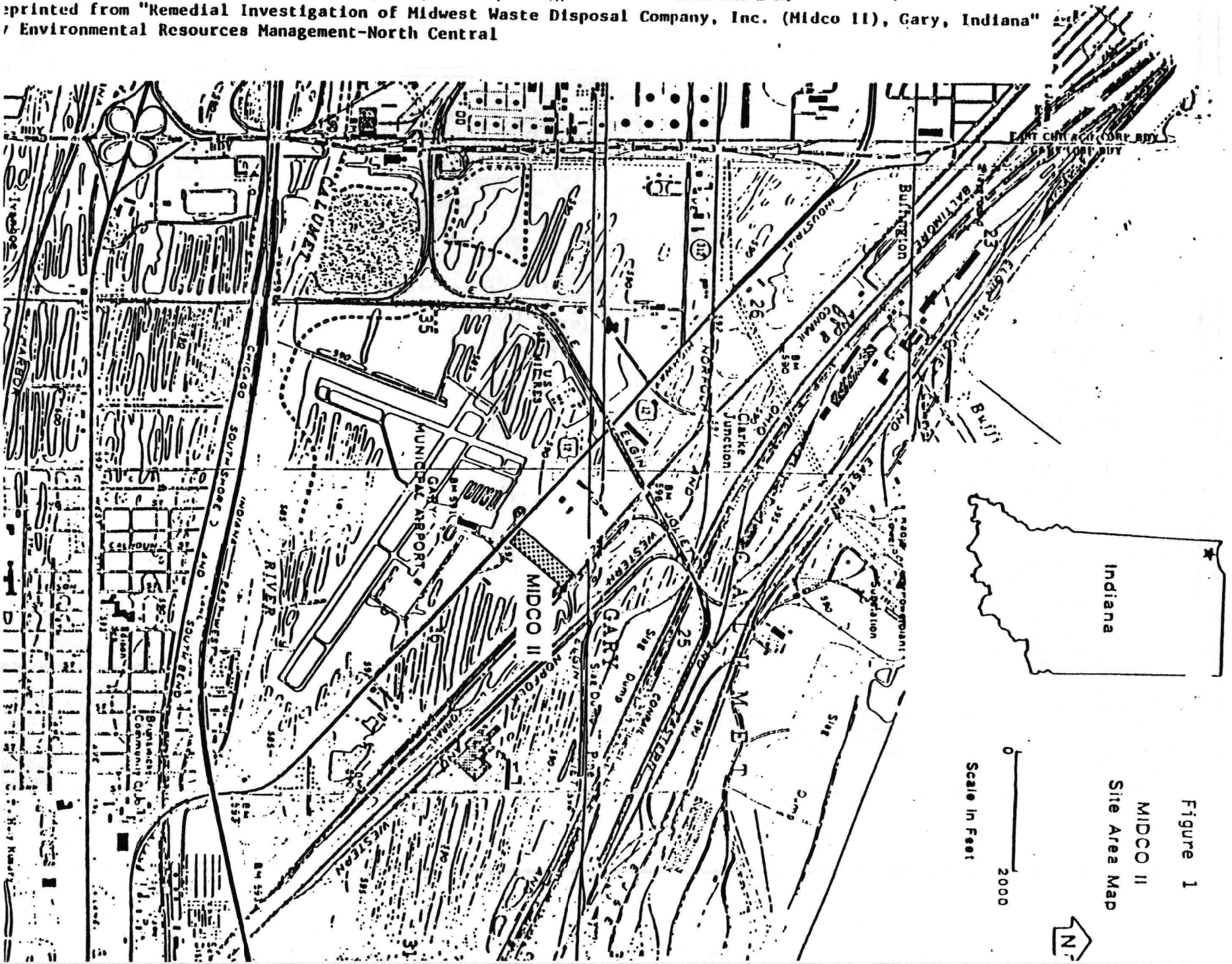


Figure 1
MIDCO II
Site Area Map

FIGURE 2

30' RADIUS
CIRCLE CENTERED ON TEST PIT 11
DETAIL A

30' RADIUS
CIRCLE CENTERED ON TEST PIT 9
DETAIL B

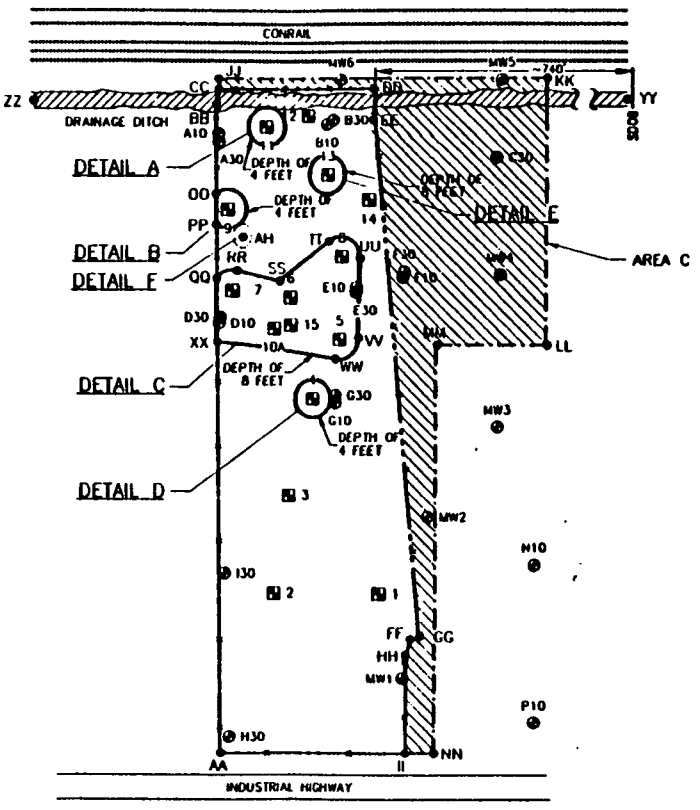
30' RADIUS
CIRCLES CENTERED ON TEST PITS 5,7, AND 8
30' RADIUS
30' RADIUS
DETAIL C

30' RADIUS
CIRCLE CENTERED ON TEST PIT 4
DETAIL D

30' RADIUS
CIRCLE CENTERED ON TEST PIT 13
DETAIL E

APPROX SCALE (ft.)
0 200

SYMBOL LEGEND:
- GRID POINT
- MONITORING WELL LOCATION
- TEST PIT LOCATION
- MINIMUM AREA FOR TREATMENT
- INITIAL FENCE LOCATION
- MINIMUM COVER BOUNDARY
- SOIL SAMPLE COLLECTION AREA AND FINAL FENCE BOUNDARIES
- SOIL PILE
- AREA C
- SEDIMENTS TO BE REMEDIATED



6' HIGH SOIL PILE
DETAIL F

NOTE
1. LINES DEMARKING THE INITIAL FENCE LOCATION AND THE MINIMUM COVER BOUNDARY ARE COINCIDENT.
2. LINES DEMARKING THE INITIAL FENCE LOCATION, MINIMUM COVER BOUNDARY, SOIL SAMPLE COLLECTION AREA AND FINAL FENCE BOUNDARIES ARE COINCIDENT BETWEEN GRID POINTS CC, AA, AND II.

FIGURE 2

MIDCO II REMEDIATION
MIDCO II
GARY, INDIANA
ALTERNATIVE 1

crushed drums and other debris. Ground water below the site is highly contaminated with VOCs, semivolatile organic compounds, metals and cyanide, but at the time of sampling the contaminated ground water did not extend very far from the site cover boundaries outlined in Figure 2. Some surface sediments have also been contaminated. Much of the ground water affected by the Midco II operations is highly saline.

After preparing a Proposed Plan and considering public comments, EPA selected the final remedial actions for the site in the Record of Decision (ROD) signed on June 30, 1989. IDEM concurred in the selected remedy. The final remedial actions were to address the remaining contamination at the site including contaminated subsurface soil, contaminated ground water and contaminated surface sediments. The major components of the remedy selected by EPA in the 1989 ROD included:

- On-site treatment of an estimated 35,000 cubic yards of contaminated soil and waste material by solidification/ stabilization followed by on-site deposition of the solidified material;

- Excavation and on-site solidification/stabilization of approximately 500 cubic yards of contaminated sediments from the ditch adjacent to the northeast boundary of the site;

- Installation and operation of a ground water pumping system to intercept contaminated ground water from the site;

- Installation and operation of a deep, class I, underground injection well for disposal of the contaminated ground water; or if a no-migration petition is not approved by EPA, treatment of contaminated ground water to remove hazardous substances followed by deep well injection; or treatment of the contaminated ground water to remove hazardous substances followed by reinjection of the ground water into the Calumet aquifer in a manner that would prevent spreading of the salt plume;

- Installation of a conduit in the ditch along the site, a final site cover, access restrictions, deed restrictions, and monitoring.

EPA with participation by IDEM conducted a 120 day negotiation period with the PRPs from May until September 1989, but no agreement was reached. In November 1989, EPA issued a Unilateral Administrative Order to a group of PRPs requiring them to implement the remedial action called for in the ROD. This Order became effective on December 29, 1989. However, the PRPs did not agree to implement the Order without addition of conditions that were unacceptable to EPA. On January 8, 1990, the United States filed an Amended Complaint seeking to enforce the Unilateral

Administrative Order, as well as to recover EPA's response costs, punitive damages, and fines.

In 1991, EPA determined that the arsenic data from the Midco II Remedial Investigation was mostly unusable because of an interference with high concentrations of aluminum in many of the samples (see Section III). Because arsenic was an important factor in determining the extent of soil treatment by S/S at Midco II, EPA considered the new information on the arsenic data to be fundamental new information. EPA has therefore reconsidered the 1989 ROD's provisions relating to the extent of soil treatment by S/S, and has at the same time in this ROD Amendment applied new Agency regulations (e.g. the revised NCP issued March 8, 1990, 40 CFR 300.430(a)(iii) "(A) EPA expects to use treatment to address the principal threats posed by the site wherever practicable.... (B) EPA expects to use engineering controls such as containment for waste that poses a relatively low long-term threat....") dealing with the extent of soil treatment at Superfund sites. This ROD Amendment also provides further detail regarding the implementation of various other components of the 1989 ROD. The revisions to the 1989 ROD are discussed in more detail later in this document.

EPA, IDEM, and a group of PRPs have since reached a proposed settlement consistent with this ROD Amendment. This settlement has been embodied in a Consent Decree that is being submitted for public comment concurrently with this proposed ROD Amendment. A detailed Statement of Work that would implement the remedial action that is the subject of the ROD Amendment is incorporated in the Consent Decree that is being lodged with the Federal District Court in Hammond, Indiana for public comment. This ROD Amendment incorporates the elements of the proposed remedial action, as well as providing updated information on the site.

The remedy selected in this ROD Amendment includes the following major components:

- On-site treatment of a minimum of approximately 12,200 cubic yards of contaminated soil and waste material, and possibly more dependent upon the results of further sampling, by SVE and in-situ S/S.

- Excavation and on-site S/S of approximately 500 cubic yards of contaminated sediments from the ditch adjacent to the northeast boundary of the site.

- Installation and operation of a ground water pumping system to intercept contaminated ground water from the site. Contingency measures shall be implemented in case it is determined that it is technically impracticable from an engineering perspective to attain the ground water cleanup action level.

- Installation and operation of a treatment system (as required) to remove hazardous substances from the extracted ground water, and deep well injection of the extracted ground water following any required treatment. Ground water treatment will be required to the extent necessary to attain maximum allowable concentrations (MACs), which are levels equivalent to those required for delisting a hazardous waste under the Resource Conservation and Recovery Act (RCRA). Treatment beyond the MACs will be required under certain conditions if either the lower Eau Claire or Mount Simon Formation (which are more than approximately 1800 feet below the surface of the site) is an underground source of drinking water (USDW) as defined in 40 CFR 144.3. Alternatively, the ground water could be treated to remove hazardous substances followed by reinjection of the ground water into the Calumet aquifer in a manner that will prevent spreading of the salt plume. See Section V.A of this ROD Amendment Summary.

- Construction of a cover over the entire site that is consistent with the closure requirement under Subtitle C of RCRA, access restriction, deed restrictions, and monitoring.

The ROD Amendment is similar to the 1989 ROD to the extent that it utilizes the same remedial technologies for soil and ground water remediation (ie. soil solidification/stabilization, soil vapor extraction, ground water extraction, treatment and deep well injection, and final site cover). The ROD Amendment utilizes different methods from the 1989 ROD for determining the amount of soil that must be treated, further defines the requirements for an effective site cover over soils with low levels of contamination that are not being treated, and further defines the requirements for treatment of ground water prior to deep well injection. It is expected that less soil and ground water treatment (see Section V.A) will be required under the ROD Amendment. In spite of this, the ROD Amendment achieves a level of protection of public health and the environment that is not considered significantly different from what would have been achieved by the 1989 ROD. The ROD Amendment's provisions provide such protection by providing for treatment of principal threats (that is the highly contaminated soils) and mandating an effective site cover over untreated soils that pose a relatively low long-term threat. The site cover will substantially reduce the threat from the soils presenting a relatively low long-term threat: for the direct contact threat by covering the soil with a five foot thick cover; and for the threat of further ground water contamination from the soils above the water table by reducing infiltration through the soils and production of leachate. To maintain its effectiveness, the site cover and solidified/ stabilized material will have to be monitored and maintained.

In contrast, the 1989 ROD provided for treatment of soils posing

a relatively low long-term threat by SVE and S/S. This may have resulted in permanent treatment of some additional contaminants and would have resulted in a reduction of leaching and control of the direct contact threat by the treatment and a cover. However, in spite of the additional treatment, unrestricted future usage of the site would not have been allowed because long term maintenance and monitoring of the solidified/stabilized material and the cover would have been required. Any reduction in protectiveness from the change in the ROD Amendment's soil treatment action levels (see Section V.C) from the 1989 ROD's soil cleanup action levels (see Section IV) are compensated for by taking into account the risk reducing effect from the site cover over untreated soils posing low level threats. The ROD Amendment includes new requirements for the final site cover to ensure its effectiveness. Because the risk reduction and reduction in toxicity or mobility of the additional treatment required in Alternative 8 compared to Alternative 10 is small, it is not considered to be cost effective compared to Alternative 10.

A Proposed Plan has been prepared that briefly describes the remedial alternatives analyzed by EPA, proposes the revised alternative, and summarizes the information relied upon to select this alternative. This proposed ROD Amendment as well as the Proposed Plan will be subject to a public notice, public comment period, and the opportunity for a public meeting, in accordance with the requirements of 40 CFR 300.435(c). In addition, the ROD Amendment and supporting information will be made available to the public in the Administrative Record for this action.

II. PURPOSE OF ROD AMENDMENT

The major purpose of this ROD Amendment is to modify the 1989 ROD's provisions relating to the extent of soil treatment by S/S, as a result of new information on the arsenic data. At the same time, the ROD Amendment applies new EPA regulations (e.g. the revised NCP issued March 8, 1990, 40 CFR 300.430(a)(iii) "(A) EPA expects to use treatment to address the principal threats posed by the site wherever practicable.... (B) EPA expects to use engineering controls, such as containment for waste that poses a relatively low long-term threat....") dealing with the extent of soil treatment at Superfund sites.

This ROD Amendment provides for direct treatment of soils at what are believed to be the more highly contaminated areas of the site, which are the source of the principal threats to ground water, air and dermal contact. Large volumes of soils presenting a relatively low long-term threat will not be treated since (in the context of the conditions at this site) the threats from such soils can be reliably controlled using an effective site cover.

A minimum of approximately 12,200 cubic yards (depicted in Figure 2) will be treated without further sampling, and additional amounts may have to be treated depending upon the results of further sampling.

The action levels for additional soil treatment outside of the areas outlined in Figure 2 are as follows:

cumulative lifetime carcinogenic risk	= 5×10^{-4}
cumulative chronic non-carcinogenic risk index	= 5.0
lead concentration (mg/kg)	= 1000

These action levels were selected taking into account treatment of the minimum area for treament identified in Figure 2, site characteristics and hazardous substances, and current EPA regulations, policies, and guidance. The cover will be over the entire site and will be consistent with RCRA Subtitle C closure requirements. The extent and quality of the site cover under the 1989 ROD was left open (depending upon the success of the treatment).

Another purpose of this ROD Amendment is to further define the requirements for treatment prior to deep well injection of the extracted ground water, including a proposal to delist extracted ground water (following treatment as required) meeting specified maximum allowable concentrations (MACs) in accordance with "A Guide To Delisting of RCRA Wastes For Superfund Remedial Responses" (September 1990) so that the ground water can be injected into the lower Mount Simon formation in compliance with the requirements of RCRA and the Underground Injection Control Program (see Section V.A for further explanation of MACs). In effect, treatment to the MACs would take the place of the 1989 ROD's requirement of treatment to RCRA Land Disposal Restriction (LDR) treatment standards prior to the deep well injection. Treatment beyond the MACs will be required under certain conditions (see Section V.A) if either the lower Eau Claire or Mount Simon Formation (which are more than approximately 1800 feet below the surface of the site) is an underground source of drinking water (USDW) as defined in 40 CFR 144.3.

This ROD Amendment also further defines the remedial actions as follows:

definition of phases and sequencing for ground water and soil treatment;

further definition of performance standards for S/S;

a decision that the in-situ S/S option allowed in the 1989 ROD will be implemented rather than the excavation option;

a decision that the option of deep well injection without

prior treatment, which would require EPA approval of a no-migration petition will no longer be considered (Alternative 7);

contingency measures have been added in case it is technically impracticable to attain the ground water cleanup action levels;

further definition of construction requirements for the site cover;

a determination that air emissions during in-situ S/S and during SVE conducted with the in-situ S/S equipment shall be controlled by carbon adsorption or by another technology that is equally effective;

a determination that in addition to the above if cumulative air emissions from all operations other than excavation at the Facility exceed 3 pounds per hour, carbon adsorption or another technology that is equally effective shall be used in the ground water treatment system and all SVE;

further definition of actions that will be taken to comply with the requirements for protection of wetlands in Executive Order 11990 and Section 404 of the Clean Water Act.

This ROD Amendment also provides updated information on the site in the following section.

III. SITE CHARACTERISTICS AND SUMMARY OF RISKS (this Section updates information on site characteristics and risk in Sections V and VI of the 1989 ROD)

Some new information has been obtained regarding Midco II since the 1989 ROD was signed. This new information is reported in this portion of the ROD Amendment.

Subsequent to completion of the 1989 ROD, EPA became aware that the arsenic concentrations reported for some soil and sediment samples in Midco II the Remedial Investigation, could be inflated due to an analytical interference from high aluminum concentrations in these samples. This was significant because any arsenic concentrations exceeding background would exceed the 1×10^{-5} carcinogenic risk level and require soil treatment by SVE and S/S under the 1989 ROD. In response, EPA investigated this concern and determined that the higher arsenic soil concentrations reported in the RI were unreliable. As a result the actual extent of soil treatment by SVE and S/S required in the 1989 ROD would likely have been considerably less than

estimated in the Feasibility Study dated February 1989.

From an EPA audit of some of the soil data, EPA determined that the arsenic measurements in soil samples with aluminum concentrations greater than 10,000 mg/kg should be considered unusable because an adequate background correction for the aluminum interference was not applied. At Midco II, four soil boring samples, twenty test pit samples and six surface sediment samples exceeded aluminum concentrations of 10,000 mg/kg. These samples generally had the highest arsenic results. Sampling conducted at Midco II during February 1991 confirmed that the aluminum interference caused inflated arsenic results if an adequate background correction was not applied. Without the background correction, arsenic was reported from 313 to 1780 mg/kg in the Midco II soil samples, with the proper background correction (using a Zieman detector) arsenic was reported from less than 9 to 24 mg/kg. This sampling and the analyses of these samples were conducted by some PRPs with EPA oversight and in accordance with procedures approved by EPA.

If arsenic values in the soil samples with aluminum concentrations greater than 10,000 mg/kg are excluded from the risk calculations, the estimated averaged, site-wide, lifetime, cumulative, carcinogenic risk due to ingestion of soils using the future development scenario decreases from 3.3×10^{-4}, as reported in the 1989 ROD, to 5.7×10^{-5} (Table 4-22 of the Addendum to Public Comment Feasibility Study, February 10, 1989). The non-carcinogenic risk index for exposure to soils would change from 2.99 to 1.7. The revised soil risks without arsenic were taken into account in determining the minimum areas for S/S defined in Section V.C, and Figure 2 of this ROD Amendment.

To update the risk assessment calculation procedures for soil risks, EPA asked Planning Research Corporation (PRC) to conduct additional risk calculations using the data from the Midco II Remedial Investigation. The risks reported in the 1989 ROD did not include dermal contact or inhalation modes of exposure to the soils. The results of PRC's calculations are presented in a letter report dated June 21, 1991. The risks were calculated using the average soil concentrations in samples from test pits dug into what was suspected to be the most contaminated areas of the site during the Remedial Investigation and using a dermal contact and inhalation mode of exposure as well as the ingestion mode of exposure used in the Remedial Investigation. It was assumed that a home with a basement would be built on the site and that as a result the residents would be exposed to soil gas from the site. Very high carcinogenic risks to on-site residents were calculated due to inhalation exposures to volatile organic compounds including: methylene chloride (risk = 0.0142); and trichloroethylene (risk = 0.032). Very high non-carcinogenic risks to on-site residents were also calculated due to inhalation exposures to volatile organic compounds including: methylene

chloride (risk index = 2.1); 2-butanone (risk index = 4.1); and toluene (risk index = 440). Not including arsenic or the inhalation mode of exposure, the calculations indicate a cumulative carcinogenic risk from the dermal contact and ingestion modes of exposure to be 1.7 X 10^{-4}; and the cumulative non-carcinogenic risk index to be 5.61. The calculations indicate a cumulative carcinogenic risk to hypothetical construction workers to be 1.1 X 10^{-6} and a cumulative non-carcinogenic risk index to be 2.1. These revised risk calculations provide further support of EPA's remedial action decisions for the Midco II site.

Since the 1989 ROD was completed, the United States Fish and Wildlife Service (U.S. F&W) completed a report entitled: "Summary Addendum Report for the Midco I, Midco II, and Ninth Avenue Dump Hazardous Waste Sites in Gary, Lake County, Indiana", September 1990. In this report, the U.S. F&W concluded that "the various contaminated habitats/media at Midco I, Midco II, and the 9th Avenue Dump sites present a threat to fish and wildlife resources utilizing or exposed to them." This additional documentation provides further support of EPA's remedial action decisions for the Midco II site.

IV. DESCRIPTION OF THE REMEDY SELECTED IN THE 1989 ROD (ALTERNATIVE 8): GROUND WATER PUMPING, TREATMENT AND DEEP WELL INJECTION WITH SOLIDIFICATION/STABILIZATION

The remedy selected in the 1989 ROD (Alternative 7 or 8) combined either ground water Alternative 4A (Alternative 7) or 4B (Alternative 8), with soil treatment Alternative 5E. Implementation of Alternative 7 was contingent upon EPA approval of a no-migration petition pursuant to 40 CFR 268.6 and 40 CFR 148 Subpart C. After the ROD was approved, EPA obtained information from review of the Inland Steel and U.S. Steel no-migration petitions that indicated that it is very unlikely that a no-migration petition would be approved for deep well injection at the Midco II site. Therefore, the subsequent discussion uses only Alternative 8.

Alternative 8 included installation and operation of ground water extraction wells to intercept the contaminated ground water that exceeds the ground water cleanup action levels (CALs) identified in Section X of the 1989 ROD, and installation of a Class I hazardous waste underground injection well into the Mount Simon formation for disposal of the highly saline waste water.

The extracted ground water was to have been treated to remove hazardous substances to the extent required by EPA prior to the deep well injection. While the extent of treatment that would be required by EPA was not fully defined, it was anticipated that

this would at least require meeting Land Disposal Restriction (LDR) treatment standards for listed hazardous waste categories F001, F002, F003, F005, F007, F008, F009. This was anticipated to require treatment of the extracted ground water by air stripping and carbon absorption. However, Alternative 8 included provisions for treating to drinking water standards if required in order to gain approval of the deep well injection. Treating to drinking water standards was anticipated to require metals precipitation, and cyanide oxidation in addition to the air stripping and carbon absorption.

In the 1989 ROD, no mention was made of delisting the ground water because at that time no guidance was available on the level of treatment required to delist ground water. It was anticipated that delisting the ground water would require more stringent treatment than meeting the LDR treatment standards.

Another option that was allowed under Alternative 8 was treatment of the hazardous substances followed by reinjection of the treated ground water back into the Calumet aquifer in a manner that would not spread the salt plume in the Calumet aquifer. The pump, treatment and injection system would be operated until ground water CALs are attained in the Calumet aquifer.

Contaminated subsurface soils located above the water table were to have been treated by S/S (and by SVE if necessary). At the end of the action, all soils exceeding the soil CALs (Section X of the 1989 ROD) located above the water table had to be treated. In addition, S/S would be conducted on highly contaminated materials below the water table that could be handled by localized dewatering. Contaminated soils below the water table that were not treated would be slowly remediated by the ground water extraction system through ground water flushing. The soil CALs were based on contaminant concentrations that would allow for unrestricted future usage of the site, and were defined as follows:

cumulative lifetime carcinogenic risk = 1×10^{-5}
cumulative chronic non-carcinogenic index = 1.0

Under Alternative 8, the S/S of the subsurface soils could have been conducted either by excavation followed by S/S, or by in-situ S/S. Under the excavation option, SVE was required if necessary to meet the LDR treatment standards. Under the in-situ S/S option, SVE was required prior to in-situ S/S to the extent necessary to assure that leachate from the solidified mass would not cause exceedance of the ground water CALs.

Sediments in the areas shown in Figure 2, would be excavated and treated on-site by S/S along with the contaminated soils.

Following the S/S treatment, a conduit would be installed in the

ditch north of the site, and the area treated by S/S would be covered to meet the requirements of RCRA if the excavation and S/S option was used, otherwise the quality of the site cover would depend on the success of the S/S operation. Ground water use restrictions, access restrictions and long term monitoring were also required.

V. DESCRIPTION OF NEW ALTERNATIVE (ALTERNATIVE 10): GROUND WATER PUMPING, TREATMENT AND DEEP WELL INJECTION WITH SOIL VAPOR EXTRACTION AND SOLIDIFICATION/STABILIZATION

A. Ground Water Pumping, Treatment and Disposal

Like Alternative 8 in the 1989 ROD, the new Alternative 10 includes installation and operation of a ground water extraction system to intercept the contaminated ground water that exceeds the ground water CALs, and installation of a deep underground injection well for disposal of the ground water. As stated before, Alternative 10 proposes to delist extracted ground water by meeting specified maximum allowable concentrations (MACs) in accordance with "A Guide To Delisting of RCRA Wastes For Superfund Remedial Responses" (September 1990) so that the ground water can be injected into the lower Mount Simon formation in compliance with the requirements of RCRA and the Underground Injection Control Program. Although the 1989 ROD did not mention delisting of the ground water, it is probable that this same delisting procedure would have been used under Alternative 8, because Alternative 8 was worded broadly enough to allow this procedure, for the same reasons that it is now being proposed for Alternative 10.

The MACs are defined below. For purposes of compliance with RCRA, treatment to the MACs would take the place of the 1989 ROD's requirement of treatment to RCRA LDR treatment standards prior to the deep well injection.

In accordance with the delisting guidance, a Superfund waste can be delisted if it attains or is treated to attain levels that will not cause exceedance of health based levels (HBLs) used for delisting decisions at a hypothetical receptor well using generic assumptions and an appropriate ground water transport model such as the vertical and horizontal spread (VHS) model. The HBLs are set at concentrations of constituents that provide protection for drinking water usage (primary Maximum Contaminant levels (MCLs) from 40 CFR Part 141 are the HBLs when available, otherwise the HBL is set at the 1×10^{-6} carcinogenic risk level or the level that will not cause a non-carcinogenic risk assuming that 2 liter per day is ingested over a 70 year lifetime). The HBLs for this action are listed in Appendix I. The VHS model is often accepted

in the RCRA delisting program for use in estimating the extent to which toxicant leaching from a Subtitle D landfill will be diluted within a surficial aquifer before it reaches a hypothetical receptor well 500 feet down gradient. While these modeling conditions are not designed to fit the conditions for deep well injection at Midco I, they will be used for the delisting demonstration in this ROD Amendment because the delisting determination is generic and is not a site specific determination, and because the results using these modelling conditions are conservative for the disposal in a deep well in this location.

Using the VHS model, the dilution factor derived from the model depends on the volume of the liquid entering the ground water. Because the volume of ground water that will be deep well injected is large, the resulting dilution factor using the model is 6.3. It follows that the Midco II ground water can be delisted if the hazardous substances contained in it are or are treated to be less than 6.3 times the HBLs. The quantity 6.3 times the HBLs will be referred to as the maximum allowable concentrations (MACs). Under Alternative 10, EPA proposes to delist the extracted ground water through this ROD Amendment by providing for treatment of the extracted ground water to below the MACs prior to deep well injection. This delisting satisfies the substantive requirements of 40 CFR 260.20 and 260.22.

The Midco II FS dated February 10, 1989 and the reviews conducted for the FS provide documentation that the ground water can be treated to the MACs. Related information is included in a report entitled Midco I and II Delisting Demonstration, May 16, 1991. In addition, a pilot study shall be conducted using the actual extraction well network. Information from the pilot study will be used to properly design the treatment system to assure that the MACs will be met in the treated ground water. After initiation of the operation, sampling will be conducted on the treated ground water to verify that MACs are being met. This sampling shall be fully defined during the design phase of this project. Since the ground water will be delisted, the deep underground injection well for Alternative 10 will meet the requirements for a non-hazardous injection well rather than requirements for a hazardous injection well. In particular, siting requirements in 40 CFR 146.62 will not be an applicable or relevant and appropriate requirement (ARAR) for Alternative 10.

Some MACs are higher than the LDR treatment standards for the same compound, and some are lower. Generally for the less toxic compounds, the MACs are less stringent than the LDR treatment standards, while for the more toxic compounds the MACs are more stringent. This is summarized for some compounds of concern at Midco I in the following comparison:

COMPOUND	MACS (MG/L)	LDR (MG/L)
acetone	25.2	0.05
chlorobenzene	0.63	0.15
ethylbenzene	4.4	0.05
methylene chloride	0.0315	0.2
methyl ethyl ketone	12.6	0.05
tetrachloroethylene	0.0315	0.079
toluene	6.3	1.12
1,1,1-trichoroethane	1.26	1.05
trichloroethylene	0.0315	0.062
xylene	63	0.05
cyanide	1.26	1.9
chromium	0.63	0.32
lead	0.95	0.04
nickel	0.63	0.44

More compounds are regulated under the delisting procedures than have applicable LDR treatment standards.

The end result of using the delisting procedures is that, while the action is still protective, it may be possible that the MACs can be attained by air stripping alone, while compliance with the LDR treatment standards was expected to require treatment by carbon adsorption in addition to air stripping. However, it is possible that further treatment by carbon adsorption and metal precipitation, or alternative treatment processes will be required to meet the MACs. Waivers of some siting requirements for deep well injection of hazardous wastes (40 CFR 146.62) will not be required once the ground water is delisted.

After the ground water has been delisted and has met the MACs, it will be injected into the lower Mount Simon Formation without further treatment by means of a deep well constructed according to Class I non-hazardous underground injection well requirements if either of the conditions (1 or 2) below is met:

1. Neither the Lower Eau Claire nor the Mount Simon Formations below the well site is a USDW as defined in 40 CFR 144.3.

2. The injection of the ground water will not cause (for each constituent for which a Safe Drinking Water Act Maximum Contaminant Levels (MCL) exists): a) the exceedance of Safe Drinking Water MCLs at the point of entry of the injected ground water into any portion of the Lower Eau Claire Formation or Mount Simon Formation that is a USDW pursuant to 40 CFR 144.3; or b) the exceedance of natural background levels present in any portion of the Lower Eau Clair or Mount Simon Formation that is a USDW pursuant to 40 CFR 144.3--whichever level is least stringent.

Preliminary modelling indicates that injection of the ground water meeting the MACs into the Lower Mount Simon Formation will meet the requirements of 2 above. However, this must be confirmed using information from sampling and testing conducted at the injection well location. If the sampling and testing confirms that the technical premises of the preliminary modelling are reasonably conservative, the delisted ground water meeting the MACs will be injected without further treatment. However, if additional treatment is required to ensure that the requirements of 2 above will be met, sufficient treatment will be provided to ensure that the injection of the ground water will meet the requirements of condition 2 above.

Based on preliminary modelling of the deep well injection, EPA believes that it is unlikely that deep well injection into the lower Mount Simon Formation would cause the exceedance of natural background levels of TDS in the lowermost USDW. However, in the unlikely event that it is determined based on modelling that deep well injection into the lower Mount Simon Formation would cause such an exceedance, this ROD amendment may be reconsidered. This ROD may also have to be reconsidered in the unlikely event that the Lower Mount Simon Formation is a USDW.

Alternative 10 also includes the following:

1. Like Alternative 8, Alternative 10 includes the option of treatment of the extracted ground water for hazardous substances followed by reinjection of the treated ground water into the Calumet aquifer, if the reinjection is conducted in a manner that will not cause spreading of the salt plume.

2. <u>Midco I, Midco II, and the Ninth Avenue Dump may be treated as one site for purposes of permitting and compliance with EPA's Off-site Policy.</u>

   Where two or more noncontiguous facilities are reasonably related on the bases of geography or on the basis of the threat or potential threat to the public health or the environment, the two facilities may be treated as one for purposes of permitting and compliance with EPA's Off-site

Policy (see Section 104(d)(4) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA)). Midco I and Ninth Avenue Dump are located within 200 yards of each other and are 2.5 miles from Midco II. All three facilities are located in the same industrial area on former wetlands that have been partially filled. Midco I and Midco II were part of the same disposal and treatment operation. All three facilities had organic solvents, heavy metals and other hazardous substances disposed on the facility. In addition, Midco I and Midco II have the same requirements for treatment and deep underground injection of the ground water. Therefore, based on the similar geography and threat, the three facilities may be treated as one facility for purposes of permitting and compliance with EPA's Off-site Policy if ground water treatment or deep well injection is combined with Midco II or Ninth Avenue Dump at the Midco I or Midco II sites, or if a pipeline is constructed to transport the extracted ground water (before or after treatment) from Midco I to Midco II or vice versa. Since combined treatment, deep well injection, and transport in a pipeline between facilities would be considered on-site actions, permits and compliance with EPA's Off-site Policy for these actions will not be required since the substantive and administrative requirements of the permits will be incorporated into the review process for this CERCLA action (see Section 121(e) of CERCLA and 40 CFR 300.400(e)).

3. It will be advantageous to place the deep injection well(s) outside of the main areas of contamination from the Midco I and Midco II site because this may lessen the potential for contamination of aquifers below the Calumet Aquifer during the installation of the well, and it will be advantageous to place the deep injection well and ground water treatment facility outside of the main areas of contamination from the Midco I and Midco II sites because that may lessen the potential for conflict with the construction and operations for soil treatment and the site cover. Therefore construction and operation of the deep injection well, and ground water treatment facility on areas in very close proximity but outside of the areas of contamination will be on-site (consistent with the NCP 40 CFR 300.400(e)(1). This will include property at the Indiana Department of Transportation facility located at 7306 West 15th Avenue in Gary, Indiana.

4. The injection well must be constructed, installed, tested, monitored, operated, closed and abandoned in accordance with the substantive requirements and conditions of Subparts A, B, D, and E of 40 CFR 144, and Subparts A, B, and F of and 40 CFR 146.

5. Responses to operational problems and implementation of corrective actions must be in accordance with the substantive requirements of 40 CFR 146.64, 146.67, 144.12, 144.51(d) and 144.55. This includes the requirements for construction, monitoring, reporting, well plugging, and injection well closure as necessary to prevent movement of any contaminant into a USDW, due to operation of the injection well. It also includes implementation of remedial actions to restore any USDW that becomes contaminated as a result of the operation of the underground injection well pursuant to Section 3004(u) and 3008(h) of the 1984 Hazardous and Solid Waste Amendments, and Section 1431 of the Safe Drinking Water Act.

6. Air emissions from an air stripper (or similar device) shall meet the requirements defined in Section V.D.

7. Until the extracted ground water meets the MACs, the extracted ground water shall be managed as a hazardous waste in accordance with the substantive requirements of RCRA.

B. Ground Water Cleanup Action Levels (CALs) and Contingency Measures in Case of Technical Impracticability:

The ground water CALs in Alternative 10 are unchanged from Alternative 8. The ground water CALS are summarized below and calculated in accordance with procedures defined in Appendix II:

Ground water throughout the Calumet aquifer affected by Midco II that exceed any of the following risk-based levels will be recovered and treated (except as provided for in the procedures defined in Appendix II). The ground water pump, treatment and injection system shall be operated until the hazardous substances throughout the Calumet aquifer affected by Midco II have been reduced below each of these risk-based levels (except as provided for in the procedures defined in Appendix II). Applying the CALs throughout the contaminated plume is consistent with F.R., Vol. 53, No. 245, P. 51426.

Cumulative Lifetime Carcinogenic Risk = 1×10^{-5}
Cumulative Non-carcinogenic Index = 1.0
Primary Maximum Contaminant Levels (40 CFR 141)

Chronic Ambient Water Quality Criteria for aquatic life (AWQC) multiplied by a factor of 3.6

The ground water CALs have been selected to be protective for use of the aquifer for residential purposes including drinking water consumption, and to protect aquatic life from recharge of ground water affected by the Midco II site.

Based on information in the Administrative Record, EPA believes that a ground water extraction system can attain the ground water CALs. However, the technical practicability of achieving the ground water CALs from an engineering perspective throughout the Calumet aquifer cannot be fully determined until the extraction system has been implemented and the plume response monitored over time. Before concluding whether it is technically impracticable to attain the ground water CALs, modifications to the design and operation of ground water extraction system will be considered, including:

a) discontinuing operation of extraction wells in areas where ground water CALs are attained;

b) alternative pumping at wells to eliminate stagnation points and to increase contaminant reductions;

c) varied or intermittent operation of the system (pulse pumping) to allow aquifer equilibration and encourage adsorbed contaminants to partition into ground water;

d) physical repositioning of extraction wells to capture alternative flow line/transport pathways to increase contaminant reductions;

If a ground water extraction system cannot meet the ground water CALs after ten years of operation and it is determined based on a demonstration that it is technically impracticable from an engineering perspective to attain the ground water CALs even considering the potential changes to the design and operation of the system listed above, the ground water CALs may be changed to the lowest acheivable levels attainable using ground water extraction technology. In addition, the selected remedy may include the contingency measures described below.

a) additional institutional controls to prevent human access to contaminated ground water (institutional controls may include deed restrictions sought voluntarily from owners or compelled to the extent authorized under any applicable local and State laws);

b) low-level pumping as a long-term gradient control or containment measure to prevent recharge of the surrounding wetlands from exceeding the Ambient Water Quality Criteria for aquatic life, and to prevent human access to the ground water exceeding the CALs that are based on drinking water usage.

Any ARARs based on the primary MCLs that exceed the lowest achievable levels attainable by the ground water extraction technology, will be waived by EPA, if EPA in the future makes a finding of technical impracticability.

C. Soil Treatment:

Alternative 10, like Alternative 8, includes provisions for treatment of the subsurface soils by SVE and in-situ S/S. Highly contaminated subsurface soils located above the water table will be treated by solidification/stabilization (S/S) and soil vapor extraction (SVE). Contaminated soils below the water table will be slowly remediated by the ground water extraction system through ground water flushing. Following is a description of the soil treatment requirements in order of the phases for the soil treatment.

1. Ground water pump and treatment:

The pump and treatment system will operate for a period of up to 36 months before direct soil treatment by in-situ S/S or SVE is initiated. The purpose of this is to attempt to reduce volatile organic compounds (VOCs) prior to the direct soil treatment operations.

2. In-situ S/S and SVE:

Following the initial period of pumping and treatment and successful completion of a treatability study and pilot study on S/S and SVE, portions of the subsurface soils shall be treated by SVE and in-situ S/S. At least the soils in the areas and to the depths labeled minimum area for treatment on the map in Figure 2 (which are believed to include the more highly contaminated soils) will be treated first by SVE and then by in-situ S/S. In addition, soils outside the mapped areas will be sampled to determined whether further SVE and S/S will be conducted.

Sampling will be conducted as defined in Appendix III to determine the full extent of soil treatment outside of the mapped areas. Using these sampling results, the cumulative risks at each sample location will be calculated for the ingestion, dermal contact, and inhalation modes of exposure using the procedures outlined in the Appendix IV. Based on these results, treatment by SVE and S/S will be conducted outside of the minimum areas to be treated delineated in Figure 2 if the following soil treatment action levels are exceeded:

Soil Treatment Action Levels:

cumulative lifetime carcinogenic risk	$=5 \times 10^{-4}$
cumulative chronic non-carcinogenic risk index	=5.0
lead concentration (mg/kg)	=1000

These action levels were selected taking into account treatment of the minimum area for treatment identified in Figure 2, site

characteristics and hazardous substances, and current EPA regulations, policies and guidance.

If these action levels are exceeded for a sample, the soil within the 20 foot square or 60 foot square (if the square is not subsampled) represented by this sample will be treated to a depth of 8 feet, unless sampling indicates that the soil does not exceed the action levels at depths between 4 and 6 feet, in which case the soil will be treated to a depth of 4 feet.

The treatment will be first by SVE and then by S/S unless the exceedance of the Soil Treatment Action Level can be corrected by removing VOCs, in which case only SVE need be used.

In Area C identified on Figure 2, in lieu of conducting SVE and in-situ S/S, the soil may be excavated and consolidated within the boundaries of the minimum area for treatment indicated on Figure 2, and the excavated soil treated by in-situ S/S along with the soils in such areas if the following conditions are met: 1) it is demonstrated that VOC emissions from the excavation and consolidation will not exceed the criteria for air emission in Section V.D; 2) the exceedance of the Soil Treatment Action Levels cannot be corrected by SVE; and 3) the total quantity excavated is limited.

If the sample from the soil pile (as shown on Figure 2 exceeds the Soil Treatment Action Levels, this pile will be spread onto other areas that require S/S and treated by in-situ S/S along with the soil below it.

If the treatability study and a pilot study show that the equipment used for the in-situ S/S has potential to achieve a 90% reduction in the soil concentrations of the following VOCs: benzene, methylene chloride, trichloroethylene, tetrachloroethylene, 1,1,1-trichloroethane, 1,1-dichloroethylene, trans-1,2-dichloroethylene, and vinyl chloride, and that the air emission requirements in Section V.D can be satisfied using the S/S equipment, SVE could be conducted using the same equipment and air pollution controls as used for the S/S.[1] In this case, the fresh air (or possibly heated air or steam) would be injected into the soil while the blades of the auger mix the soil and while the contaminated air is drawn off with the induced draft fan into an air pollution control device. Following the SVE operation, the same soil that was treated by SVE could be treated by S/S. The SVE must continue until there is a 97% reduction in total VOCs (but not less than three times the ambient level) in the off-gas prior to any air pollution control device during

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[1] In conjunction with the treatability study on S/S discussed in this section, EPA is conducting treatability tests simulating use of in-situ equipment for conducting the SVE.

vigorous agitation of the soils. Air emissions must be controlled in accordance with the requirements defined in Section V.D.

Alternatively, SVE would be conducted as a separate operation from S/S using vacuum and air injection pumps connected by pipes to a series of air injection and extraction wells. In addition, a low permeability cover may be required over the area being treated. The air pressure gradient would draw VOC-contaminated air from the soil pores. The removed VOCs would be required to be processed in a liquid-vapor separator and the air emissions would have to meet the requirements in Section V.D. The SVE must continue until treatment by in-situ S/S can be conducted in compliance with the air emission requirements in Section V.D, and there is a 97% reduction in total VOCs in the soils being treated (but not to a concentration less than ten times the detection limit of each constituent).

It is anticipated that the in-situ S/S system would utilize a crane-mounted mixing system. The mixing head would be enclosed in a bottom-opened cylinder to allow closed system mixing of the treatment chemicals with the soil. The bottom-opened cylinder would be lowered onto the soil and the mixing blades started, moving through the depth in an up and down motion, while chemicals are introduced. An induced draft fan would draw the contaminated air from the container into an air pollution control device and exhaust the treated air to the atmosphere. Because there is potential for causing substantial VOC emissions, the contaminated air must be treated by carbon adsorption or by another treatment process that is equally effective, and meet the criteria in Section V.D. At the completion of mixing at one location, the blades would be withdrawn and the cylinder removed. The cylinder would then be operated adjacent to and overlapping the previous cylinder. This would be repeated until the entire area is treated.

The formulations and ratios of reagents used for the S/S process will be established to provide permanent treatment, substantially reduce release of contaminants due to leaching, substantially reduce permeability, and to assure long term durability of the solidified material.

EPA is currently undertaking a treatability study on approximately ten binders being considered for use in S/S at Midco II. Those binders selected for use at the Facility must meet the below listed Minimum Performance Standards. In addition, based on the results of the treatability study, EPA may establish Final Performance Standards that are more stringent than or supplementary to the Minimum Performance Standards.

MINIMUM PERFORMANCE STANDARDS

STABILIZATION OF METALS

Using the Synthetic Precipitation Leaching Procedure (SPLP) test (method 1312 of SW-846 using extraction fluid #1) the following percentage reduction in the leachate concentrations shall be attained using the formula:

$$SPLP_{treated} \times DF / SPLP_{raw\ waste} \times 100$$

$SPLP_{treated}$ = concentration of constituent (i) in the leachate from sample treated by S/S

DF =dilution factor = (weight of waste being treated + weight of S/S blend added to that waste) / (weight of waste being treated)

$SPLP_{raw\ waste}$ = concentration of constituent (i) in the leachate from untreated waste sample

Alternatively, the $SPLP_{treated}$ can be reduced to the following Concentration Limits. If a parameter in the untreated sample is below its Concentration Limit listed below, no further reduction in leachate concentration is required, although the treated sample should not increase in leachate concentration to above the Concentration Limit.

CONSTITUENT	PERCENTAGE REDUCTION	CONCENTRATION LIMIT (ug/l)
arsenic	90	50[2]
barium	90	2000[2]
cadmium	95	5[2]
chromium	95	100[2]
copper	95	43[3]
lead	99	15[2]
nickel	95	100[2]

[2] These values are from the final or proposed Primary Maximum Contaminant Standards, 40 CFR Part 143.

[3] This value equals the 4-day average fresh water ambient water quality criteria for copper for protection of aquatic life times 3.6 at a hardness equal to 100 mg/l. The 4-day average fresh water ambient water quality criteria is from Ambient Criteria for Water 1986, EPA 440/5-86-001. The factor 3.6 is the estimated factor for dilution of the ground water by the surface water at Midco II.

vanadium	90	233[4]
zinc	90	1150[5]

STABILIZATION OF ORGANICS

Using total waste analyses (using methylene chloride extraction for semivolatile organics, and methanol extraction for volatile organics), a 50% reduction in concentrations shall be attained based on total waste analyses of the sample of untreated waste ($TWA_{raw\ waste}$) and the sample treated by S/S ($TWA_{treated}$) calculated in accordance with the formula: $TWA_{treated}$ X DF / $TWA_{raw\ waste}$ X 100 for the following compounds: anthracene; bis(2-ethylhexyl) phthalate; ethyl benzene; fluoranthene; naphthalene; phenanthrene; phenol; toluene; xylene.

PHYSICAL TESTS

i. Using method EPA 9100 from SW-846 (constant head, tri-axial with back pressure and air free water), the hydraulic conductivity of the material treated by S/S shall be less than or equal to 1 X 10^{-7}.

ii. Using method ASTM D1633-84, the unconfined compressive strength of the material treated by S/S shall be greater than 50 psi.

iii. Using ASTM D4843, the wet-dry durability test on the material treated by S/S shall result in less than a 10% weight loss.

iv. Using ASTM D4842, the freeze-thaw durability test on the material treated by S/S shall result in less than a 10% weight loss.

D. Requirements for Air Emissions:

1. Air emissions from the S/S system and from any SVE using the S/S system shall be controlled using carbon adsorption or

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[4] This value was calculated for a non-carcinogenic risk index equal to unity due to vanadium alone using the reference dose and procedures outlined in Appendix II.

[5] This value is equal to the 24-hour average fresh water ambient water quality criteria for zinc for protection of aquatic life times 3.6. The ambient water quality criteria value is from Quality Criteria for Water 1986, EPA 440/5-86-001. The factor 3.6 is the estimated dilution of ground water by the surface water at Midco II.

another treatment process that is equally effective.

2. Air emissions from the (i) ground water treatment, (ii) the soil S/S, (iii) SVE using the S/S system, or (iv) SVE separate from the S/S system shall be controlled to the extent necessary to assure that each operation does not have the potential to result in exposures to a hypothetical resident located at the Facility boundary that would cause an estimated cumulative, incremental, lifetime carcinogenic risk exceeding 1.0×10^{-7}, or from causing a non-carcinogenic risk index greater than 1.0. The risk levels will be calculated in accordance with the procedures outlined in Attachment V. Ambient air monitoring and air emission monitoring shall be conducted to determine whether this criteria is being met. The air emission monitoring data shall be input into an air model to estimate the potential exposure rates in order to determine whether controls such as carbon adsorption or other controls will be required for the emission sources. For the soil S/S system and SVE using the S/S system such controls (if any) shall be in addition to the controls required by paragraph D.1.

   Since there are multiple operations that cause air emissions as well as fugitive sources that can not be controlled, each operation that can be controlled must be controlled to the 1×10^{-7} risk level to assure that the total risk will be less than 1×10^{-6}. In addition, since some nearby residents and workers may have already been exposed to the chemicals at Midco I during its operation, it is imperative that this emission criteria be met.

3. In addition to the requirements of paragraphs 1 and 2 above, if cumulative emissions of VOCs as defined under the Clean Air Act from all operations at the Facility other than excavation exceed 3 pounds per hour, carbon adsorption or another technology that is equally effective shall be used to control air emissions from the ground water treatment system and all SVE.

4. Air emissions must be monitored and controlled to the extent necessary to comply with applicable OSHA regulations, and applicable State of Indiana air regulations, including Title 326 Indiana Administrative Code 6-4 for fugitive dust.

5. The effective stack height for air emissions from the ground water treatment, S/S, and SVE must be at least 30 feet above ground level.

6. For any carbon adsorption unit that is being or has been used for control of air emissions for the ground water treatment system, the S/S system or the SVE conducted with

the S/S system, access to the unit shall be restricted within 3 feet of the unit. For any carbon unit that is being or has been used for control of air emissions for SVE conducted as a separate operation from the S/S, access to the unit shall be restricted within 10 feet of the unit.

E. Handling and Treatment of Surface Sediments and Soils Beneath the Sediments:

The surface sediments in areas outlined in Figure 2 will be excavated to a depth that will leave the soils below the excavation less than the following soil CALs:

cumulative lifetime carcinogenic risk = 1.0×10^{-5}
cumulative chronic non-carcinogenic index= 1.0

These sediments and soils will be consolidated on-site and treated by S/S along with the subsurface soils.

F. Site Cover, Access Restrictions, Long Term Monitoring, and Further Remedial Actions:

For Alternative 10, a cover shall be installed over the Minimum Cover Boundary outlined in Figure 2 following the soil treatment outlined in Section II.C. above. This cover will be extended over Area C shown in Figure 2 if the results of sampling in that area indicate that the area-wide risk using the arithmetic average of the soil sampling results (see Appendix III) exceeds the soil CALs in Section V.E using the risk calculation procedures in Appendix IV. This cover shall meet or exceed the requirements for RCRA Subtitle C closure. This cover shall be designed to provide long term minimization of infiltration, minimize maintenance, promote drainage, and minimize erosion. These requirements will be deemed satisfied by a cover which consists of multiple layers including:

- a top layer consisting of a vegetated component, and a 24 inch soil layer comprised of topsoil and/or fill soil with a surface slope of at least 3 percent and not more than 5 percent;
- a geofilter in between the upper layer of soil and the middle layer of drainage material;
- a drainage layer of either 12 inches of soil with a minimum hydraulic conductivity of 1.0×10^{-2} cm/sec or a geosynthetic material with equivalent performance characteristics, and with a final bottom slope of at least 3 percent;

- a low permeability layer with 24 inches of compacted soil with a maximum in place saturated hydraulic conductivity of 1.0×10^{-7} cm/sec.; and

- Details of the site cover design shall also be consistent with the EPA Guidance entitled TECHNICAL GUIDANCE DOCUMENT EPA/530-SW-89-047 (July 1989) FINAL COVERS ON HAZARDOUS WASTE LANDFILLS AND SURFACE IMPOUNDMENTS.

Access restrictions will be imposed including installation of a six foot chain link fence, warning signs and possible deed restrictions. Deed restrictions limiting development and the placement of new wells will be sought voluntarily from owners or compelled to the extent authorized under any applicable local and State laws.

As in Alternative 8, the final site cover and access restrictions must be consistent with hazardous waste landfill closure requirements of the RCRA (40 CFR 264.111, 264.116, 264.117, and 264.310).

Following attainment of ground water CALs, ground water monitoring will continue for at least 15 years. The ground water monitoring must be consistent with the substantive requirements for ground water monitoring in 40 CFR 264.98, and where necessary 264.98(g) and 264.99.

If a ground water CAL is exceeded during this period due to a release from the Midco II site, the site cover shall be upgraded or repaired as needed; operation of the ground water pump treatment and underground injection system will be reinitiated; and steps will be taken to meet the ground water CALs. These actions must be consistent with the substantive requirements of 40 CFR 264.100 (except that the relevant ground water protection standards shall be the ground water CALs as defined in this ROD rather than concentration limits specified pursuant to 40 CFR 264.92).

G. Other ARARs and Applicable Regulations included in Alternative 8:

1. The requirements of Executive Order 11990, Protection of Wetlands, 40 CFR 6, Appendix A; and Clean Water Act Section 404, 40 CFR 230 and 231 shall be met. Contaminated wetlands will be replaced off-site at an appropriate ratio. This may be undertaken as part of an agreement between PRPs and the natural resources trustees.

2. The area of remediation must comply with the Migratory Bird Treaty Act.

3. Any residuals (such as spent activated carbon) from the ground water or soil treatment processes shall be considered a RCRA hazardous waste.[6] Therefore, these residuals must be stored on site, and disposed of or treated on-site or off-site in accordance with RCRA regulations, including the LDRs in 40 CFR 268, and 40 CFR 264 Subpart X for residues that are sent off site to be regenerated. It is possible that metals sludge from the ground water treatment process could be treated by S/S on-site, if Land Disposal Restriction requirements are met.

Any debris (such as tree trunks or crushed drums that can not be properly incorporated into the solidified mass) encountered during the S/S process or during excavations must be properly handled and stored on-site, and properly disposed of off-site or contained under the final cover if degradation of the material will not cause site cover maintenance problems. Any containerized or drummed liquid wastes encountered during the remedial actions shall be properly stored and properly disposed of off-site.

Any off-site transportation, treatment, or disposal must be in compliance with DOT and RCRA requirements, and EPA's Off-Site Policy.

VI. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This Section updates the evaluation in Section IX of the 1989 ROD. The 1989 ROD justified the elimination of alternatives other than Alternatives 7 and 8. It is now known that Alternative 7 should not be further considered. Therefore, this evaluation will only compare Alternative 8 to the new Alternative 10.

The following table compares some of the critical elements of Alternative 10 with Alternative 8.

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[6] The contaminated ground water and soil contains the following RCRA listed hazardous wastes: F001; F002, F003, F005, F007, F008, F009.

AREA OF COMPARISON	ALTERNATIVE 8	ALTERNATIVE 10
MEANS TO ADDRESS GROUND WATER CONTAMINATION	GROUND WATER EXTRACTION SYSTEM	NO CHANGE
GROUND WATER CALS	CR[7] = 1 X 10^{-5} NCRI[8] = 1.0 PMCLS[9] AWQC[10] X 3.6	NO CHANGE
MEANS OF GROUND WATER DISPOSAL	DEEP WELL INJECTION, OR INJECTION INTO THE CALUMET AQUIFER IN A MANNER THAT WILL NOT SPREAD THE SALT PLUME	NO CHANGE
GROUND WATER TREATMENT REQUIREMENTS FOR COMPLIANCE WITH RCRA PRIOR TO DEEP WELL INJECTION	RCRA LAND DISPOSAL RESTRICTIONS (BEST DEMONSTRATED AVAILABLE TECHNOLOGY) (LDRs)	RCRA DELISTING (6.3 TIMES HEALTH BASED LEVELS[11], MACs)

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[7] Cumulative Lifetime Carcinogenic Risk calculated for each ground water sampling location using the assumptions and procedures in Appendix II.

[8] Cumulative non-carcinogenic risk index calculated for each ground water sampling location using the assumptions and procedures in Appendix II,

[9] Primary Maximum Contaminant Levels (40 CFR 141).

[10] Chronic Ambient Water Quality Criteria for aquatic life. The AWQC values used in this RQD Amendment are listed in Appendix II.

[11] Health-Based Levels (HBLs) are concentrations of hazardous constituents that are used in the RCRA program for making decisions regarding whether a waste that is regulated as a hazardous waste under RCRA because it is listed under 40 CFR Part 261, Subpart D can be delisted so that it is no longer regulated as hazardous waste under RCRA because it is listed. In a delisting petition, it must be demonstrated that the HBLs will be met in a hypothetical receptor well. The HBLs are set at concentrations of constituents that provide protection for drinking water usage (Maximum Contaminant Levels from 40 CFR Part 141 are the HBLs when available, otherwise the HBL is set at the 10^{-6} risk level or the level that will not cause a non-carcinogenic risk assuming that 2 liters per day is ingested over a 60 year lifetime). See Section V.A.

MEANS TO ADDRESS PRINCIPAL THREATS FROM SOILS	TREAT BY S/S (AND SVE IF NECESSARY TO PROTECT GROUND WATER). S/S AND SVE WILL PROVIDE PERMANENT TREATMENT OF HIGHEST CONTAMINATED AREAS LOCATED ABOVE AND BELOW THE WATER TABLE. S/S MATERIAL WILL BE PROTECTED WITH A SITE COVER, AND MONITORED AND MAINTAINED OVER LONG TERM.	NO CHANGE EXCEPT SVE WILL BE REQUIRED WHERE S/S IS CONDUCTED.
MEANS TO ADDRESS RISKS FROM SOILS THAT ARE ABOVE THE WATER TABLE AND THAT PRESENT A LOW LONG TERM THREAT VIA GROUND WATER AND DIRECT CONTACT	TREAT BY S/S (AND POSSIBLY SVE). LONG TERM MAINTENANCE & MONITORING OF THE S/S WOULD BE REQUIRED. THIS WOULD PROVIDE SOME PERMANENT TREATMENT, REDUCE LEACHING TO GROUND WATER, AND REDUCE DIRECT CONTACT THREAT BY S/S AND COVER OVER THE S/S.	CONSTRUCT A RCRA COVER. LONG TERM MAINTENANCE AND MONITORING OF THE COVER WOULD BE REQUIRED. AS LONG AS COVER IS MAINTAINED WILL SUBSTANTIALLY REDUCE LEACHING AND THE DIRECT CONTACT THREAT BY COVERING WITH A FIVE FOOT THICK COVER.
SOIL TREATMENT ACTION LEVELS	CR = 1×10^{-6} NCRI = 1.0	AT A MINIMUM TREAT MINIMUM AREA FOR TREATMENT IN FIGURE 2. OUTSIDE THIS AREA: CR = 5×10^{-4} NCRI = 5.0
ESTIMATE OF QUANTITY OF SOIL TO BE TREATED	35,000 CUBIC YD.[12]	18,300 CUBIC YD.[13]

[12] This estimate is probably biased high because it is partially based on unreliable arsenic data (see Section III).

[13] This is a very rough estimate that assumes 50% more than the minimum amount will be treated as a result of further sampling.

PERFORMANCE STANDARDS FOR S/S	FOR IN-SITU S/S ASSURE ATTAINMENT OF GROUND WATER CALS.	SPECIFIC PERFORMANCE STANDARDS FOR BOTH INORGANICS AND ORGANICS BASED ON TESTS ON S/S
CRITERIA FOR SVE	CONDUCTED PRIOR TO S/S TO THE EXTENT NECESSARY TO MEET GROUND WATER CALS BASED ON MODELLING	WILL DEFINITELY BE CONDUCTED IN ALL AREAS BEING S/S'ed TO REDUCE VOCs IN SOILS BY 97% IF CONDUCTED AS A SEPARATE OPERATION, AND BY 90% OF CERTAIN VOCs IF CONDUCTED WITH IN SITU S/S EQUIPMENT.
MEANS TO ADDRESS RISKS FROM SOILS BELOW THE WATER TABLE THAT WILL NOT BE TREATED BY S/S	SOILS WILL GRADUALLY BE REMEDIATED BY THE GROUND WATER EXTRACTION OPERATION.	NO CHANGE
MEANS TO ADDRESS CONTAMINATION OF SURFACE SEDIMENTS	EXCAVATION AND ON-SITE S/S	NO CHANGE
SOIL/SEDIMENT CALS	CR = 1×10^{-5} NCRI = 1.0	NO CHANGE
AIR EMISSIONS CRITERIA	CR = 10^{-7} TO NEAREST RESIDENTS AND WORKERS FOR EACH EMISSION SOURCE, TO ASSURE ATTAINMENT OF CR = 10^{-6} OVERALL.	SAME AS ALT. 8 CRITERIA, PLUS NO GREATER THAN 3 LBS PER HOUR, AND EMISSION CONTROLS REQUIRED ON S/S SYSTEM.
SITE COVER SPECIFICATIONS	FOR IN-SITU S/S DEPENDED ON RESULTS OF S/S	CONSISTENT WITH RCRA SUBTITLE C
ACCESS RESTRICTIONS, DEED RESTRICTIONS, LONG TERM MONITORING	REQUIRED	NO CHANGE

AN ESTIMATE OF THE PRESENT WORTH	$19 MILLION[14]	$13 MILLION[15]

In Alternative 10 the extracted ground water must meet the MACs prior to deep well injection rather than meet the LDRs, which were expected to be used in Alternative 8. Treatment to the MACs is as protective or more protective than treatment to the LDRs because generally the MACs are more stringent for the more toxic compounds. However, treatment to the LDRs would be more difficult. Modelling will be conducted to confirm that injection of extracted ground water meeting the MACs (into the lower Mount Simon Formation) will be protective of drinking water aquifers. In Alternative 10, treatment beyond the MACs will be conducted if necessary to be protective of drinking water aquifers. See Section V.A.

In Alternative 10, SVE will definitely be conducted as described in Section V.C.2 prior to the treatment by S/S. In Alterative 8, SVE would be been required only if necessary to assure that leaching from the S/S material would not cause an exceedance of the ground water CALs.

In Alternative 10, areas of the site having soils located above the water table with calculated risks below CR = 5 X 10^{-4} and NCRI = 5.0, will be covered consistent with RCRA Subtitle C requirements without being treated by S/S or SVE. However, the site cover will not be installed until the ground water extraction system has operated for a few years. Such operation may further reduce VOCs prior to installation of the site cover. EPA considers that following treatment of the highly contaminated areas, the site cover will provide overall protection to CR = 1 X 10^{-6} and NCRI =1.0 levels. The cover will be multi-layered and five feet thick. The cover will substantially reduce the infiltration into the soil and, therefore, reduce the contamination of the ground water. It will provide an effective barrier to direct contact while it is maintained. During its operation any contaminants leached from the soils would be recovered by the ground water extraction system. In the unlikely event that long term leaching causes the ground water to exceed the ground water CALs, the ground water extraction system would continue to operate or be reactivated so that protection from any

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[14] This is a very rough cost estimate from the Feasibility Study and is likely biased high because it was partially based on unreliable arsenic data for the extent of soil treatment (see Section III).

[15] This is a very rough estimate based on the assumption that 50% more than the minimum amount of soil is treated, that SVE increases the cost of S/S by 50%, and certain ground water treatment assumptions.

ground water threat is assured.

In Alternative 8, compared to Alternative 10, VOCs in the lower contaminated areas may have been further reduced by operation of the SVE system, and the mobility of metals and other organics reduced by the S/S. However, as mentioned before for Alternative 10, any additional leachate from the soils would be recovered in the ground water extraction system so that protection from any ground water threat is assured. Alternative 8 may provide some additional protection compared to Alternative 10 from the direct contact threat in case the site cover is severely disturbed in the future because the low contaminated soils would be treated by S/S. However, it appears to be very unlikely that a five foot site cover would be so completely removed, and even if it was Alternative 10 provides for treatment of the most highly contaminated soils so that only the lesser contaminated soils would remain.

Since the time of the 1989 ROD, specialists in S/S treatment have developed specific tests for testing the permanence of S/S treatment for inorganics and organics. Therefore, these tests have been incorporated into Alternative 10 of this ROD Amendment.

Because of the difficulty in reasonably modelling the impact of VOCs on the ground water, it was decided to simply require SVE to provide substantial removal of the VOCs prior to treatment by S/S. The criteria is less stringent for conducting SVE with the in-situ S/S equipment compared to using a separate operation because it is much more difficult to monitor the removal of VOCs from the soils using the in-situ S/S equipment because the soil is treated by S/S immediately after the SVE operation.

The three pounds per hour limit on air emissions for Alternative 10 was added to be consistent with EPA's policies on control of photochemical oxidants. Because the emissions from the in-situ S/S operation could be substantial and unpredictable, it was decided that air emissions from the in-situ S/s system must be controlled.

A. Threshold Criteria: protection of human health and the environment; and attainment of applicable, and relevant and appropriate requirements (ARARs):

Both Alternatives 8 and 10 would be protective of human health and the environment, by extraction and treatment of the ground water, by treating the highly contaminated soils and sediments, and by cover installation. Both alternatives are expected to protect aquatic life in surrounding surface waters from hazardous substances from the Midco I site including attainment of Ambient

Water Quality Criteria for aquatic life[16] and restore the Calumet aquifer to drinking water quality[17] including attaining the Primary Maximum Contaminant Levels.

Both include deep well injection of the treated ground water (or reinjection into the Calumet aquifer in a manner that will not spread the salt plume). Both would comply with the RCRA LDRs prior to injection of the ground water: Alternative 8 by treating to LDR treatment standards; and Alternative 10 by delisting. Both include soil treatment by S/S and SVE. Both include excavation and S/S of contaminated sediments. Finally both include installation of a cover and site access restrictions.

While Alternative 8 includes treatment of a greater volume of soils than Alternative 10, the level of protection provided by Alternative 10 is not considered to be significantly different from the level of protection provided by Alternative 8 because low level contaminated soils will be contained by an effective cover that is consistent with RCRA Subtitle C closure requirements, and access to the site will be restricted. Furthermore, the additional soil treatment in Alternative 8 would not allow unrestricted future usage of the site because the S/S material and site cover would require long term monitoring and maintenance.

Under Alternative 10, if it is determined that it is technically impracticable from an engineering perspective to attain the ground water CALs by a ground water extraction system, contingency measures may be implemented (see Section V.B). These contingency measures will maintain protection of human health and the environment by institutional controls, by attaining the lowest achievable levels in the ground water, and by containment measures, as appropriate. If it is demonstrated that some primary MCLs, which are used in the ground water CALs, can not be attained in some portions of the aquifer due to technical impracticability, these ARARs will be waived provided that appropriate contingency measures are implemented.

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[16] Except possibly for the Ambient Water Quality Criteria for solids (dissolved) and salinity, for which a ground water CAL is not being applied since adjacent sources of this contaminant exist and are not being remediated.

[17] Except for total dissolved solids, chlorides, sodium and potassium, for which a ground water CAL is not being applied since adjacent sources of these contaminants exist and are not being remediated.

B. Balancing Criteria: long term effectiveness and permanence; reduction in toxicity mobility and volume; short-term effectiveness; implementability; and cost:

The short term effectiveness of Alternative 10 is expected to be essentially the same as Alternative 8. The pump, treatment and injection system will be installed first in Alternative 10. Access to the site will be controlled; so the delay in the soil treatment will not cause any health impact. For both Alternatives, VOC air emissions during the remedial actions may be the short term impact of most concern. These emissions should be controllable using carbon absorption or another treatment process that is equally effective.

Both Alternative 8 and 10 employ treatment technologies--ground water extraction and treatment, S/S, and SVE--that are expected to perform to substantially reduce the toxicity, mobility, or volume of hazardous substances at the Midco II site. Both Alternatives 8 and 10 provide for long-term effectiveness and permanence through soil treatment by S/S and SVE, by ground water extraction and treatment, deep well injection of treated ground water, site cover, long term maintenance, and ground water monitoring.

While Alternative 10 will result in treatment of a lower volume of soils than Alternative 8, Alternative 10 provides for a reduction of the toxicity and mobility of the more highly contaminated soil at Midco II. Furthermore, the additional soil treatment in Alternative 8 will not result in a reduction in the long term monitoring or maintenance requirements nor allow unrestricted future usage of the site. In the context of conditions at this particular site, the use of engineering controls such as site cover coupled with long-term (permanent) maintenance and monitoring of the site cover and ground water to address any remaining risks posed by soils with low level contamination is consistent with EPA's expectations for remedy selection regarding treatment of principal threats and use of controls for lower level threats as set forth in 40 CFR

300.430(a)(1)(iii) of the National Contingency Plan promulgated on March 6, 1990.

Alternatives 8 and 10 are identical in implementability in most respects, and no major problems in implementation are expected.

Very rough estimates of the costs of Alternative 8 and Alternative 10 in millions of dollars are compared in the following Table.

	CAPITAL	ANNUAL O&M	PRESENT WORTH
Alternative 8	12	0.73	19
Alternative 10	9	0.66	13

Typically cost estimates in the Feasibility Study are expected to have an accuracy of plus 50% to minus 30%. There is more than the usual amount of uncertainty in the costs for both Alternatives 10 and 8. However, Alternative 10 may be considerably less expensive than Alternative 8 primarily because most likely less soil will be treated, ground water treatment requirements may be reduced, and the sequence of implementation of remedial actions (see Sections V.C.1, V.C.2 and V.F) will be changed. Because the risk reduction and reduction in toxicity or mobility of the additional treatment required in Alternative 8 is small, it is not considered to be cost effective compared to Alternative 10.

Time for completion of the project depends on how fast the ground water CALs are attained. All other portions of the project are expected to be completed in no more than six years.

C. Modifying Criteria: support agency acceptance; community acceptance:

The Indiana Deparment of Environmental Management, involved in the process that lead to this ROD Amendment, formally concurred with U.S. EPA's remedy selection in this ROD Amendment in a letter dated January 6, 1992.

U.S. EPA prepared a Draft Proposed ROD Amendment and a fact sheet explaining the ROD Amendment, and held a public comment period on the proposed Amendments from February 7 through March 14, 1992. The Proposed Plan was mailed to approximately 300 persons in the communities near Midco II. The Draft Proposed ROD Amendment was available for review in the Hammond Department of Environmental Management and at the Gary Public Library. The Administrative Record for this action was available for review at the Region V, U.S. EPA, Chicago office. A public meeting was held on the proposed ROD Amendment on February 20, 1992.

One comment on the proposed ROD Amendment was received during the public meeting, and written comments were received from the Grand Calumet River Task Force and from U.S. Reduction Co. U.S. EPA's full response to these comments are included in the Responsiveness Summary, which is Appendix VI of this ROD Amendment, and is an integral part of this ROD Amendment.

The comment from the Grand Calumet River task force expressed concern about the public and environmental protectiveness of the

deep well injection operation and recommended use of a desalination plant for final disposal of the salt contaminated ground water, instead of deep well injection. In response to these comments, U.S. EPA describes the importance of the cost effectiveness of the remedy, and the precautions that will be taken to assure that the deep well injection process is conducted safely and in a manner that will be protective of human health and the environment.

The comment at the public meeting had to do with the completeness of the remedy apparently related to soil treatment by solidification/stabilization and disposal of ground water by deep well injection. In response to this comment U.S. EPA explained the basis for its belief that treatment by solidification/ stabilization would be effective, and that the deep well injection process would be conducted in a manner that will be protective of human health and the environment.

The comments from U.S. Reduction had to do with the completeness of the Administrative Record for the risk assessment, selection of deep well injection, and selection of solidification/ stabilization. U.S. Reduction also recommended that additional investigations be conducted. In response to these comments, U.S. EPA described in detail how the Administrative Record supports the risk assessment, and the selection of the deep well injection procedure, and solidification/stabilization.

No changes were made to this ROD Amendment following review of the public comments other than incorporating this section of the Summary for Record of Decision Amendment and the Responsiveness Summary, indicating that the State of Indiana has concurred in the remedy selection, and removing a reference in the Declaration that the administrative record would be updated at a later date to address public comments.

VI. STATUTORY DETERMINATIONS

Based on the description and evaluation of alternatives in the ROD Amendment, EPA selects Alternative 10 for implementation at Midco II. This Alternative is described in Section IV of this ROD Amendment.

Alternative 10, including the provision of contingency measures in case it is technically impracticable to attain ground water CALs, will be protective of human health and the environment, and will be cost effective. ARARs shall be attained except that some primary MCLs will be waived in portions of the Calumet aquifer, provided that it is demonstrated that it is technically impracticable from an engineering perspective to attain these standards, and that appropriate contingency measures are

implemented. The remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The State of Indiana concurs in the selected remedial actions.

Because the remedy will result in hazardous substances remaining on-site above health-based levels that would allow for unrestricted use, a review will be conducted within five years after commencement of remedial actions to ensure that the remedy continues to provide adequate protection of human health and the environment.

APPENDICES TO MIDCO II RECORD OF DECISION AMENDMENT

I. HEALTH BASED LEVELS FOR RCRA DELISTING FOR MIDCO II

II. PROCEDURES FOR CONDUCTING RISK BASED CALCULATIONS AND DETERMINATION OF GROUND WATER CLEANUP ACTION LEVELS AT MIDCO II

III. PROCEDURES FOR DETERMINING THE EXTENT OF TREATMENT FOR SOILS AND DEBRIS AT MIDCO II

IV. PROCEDURES FOR CONDUCTING RISK BASED CALCULATIONS FOR THE EXTENT OF SOIL TREATMENT AT MIDCO II

V. PROCEDURE FOR CONDUCTING RISK CALCULATIONS FOR AIR EMISSIONS

VI. RESPONSIVENESS SUMMARY

GLOSSARY

CALs : cleanup action levels.

delisting : If a waste fits the definition for a listed hazardous waste under RCRA, it can only be removed from regulation under RCRA by meeting the delisting requirements pursuant to 40 CFR 260.22.

EPA : United States Environmental Protection Agency.

F&W : United States Fish and Wildlife Service.

HBLs : health based levels used by EPA to make delisting decisions.

IDEM : Indiana Department of Environmental Management.

LDR : Land Disposal Restrictions under RCRA.

MACs : Maximum allowable concentrations. This term is defined in "A Guide to Delisting of RCRA Wastes for Superfund Remedial Responses" (9347.3-09FS) to be the maximum concentration in a waste or in a leachate from a waste that will still allow the waste to be delisted.

MCLs : Maximum Concentration Limits as defined under the Clean Water Act (40 CFR 141 and 143.

mg/kg : concentration of a constituent in soil expressed in milligrams of the constituent per kilogram of soil.

no migration petition: A petition submitted to EPA pursuant to 40 CFR 268.6 and 148 Subpart C that must demonstrate that deep well injection of a waste will not cause migration out of the injection zone within 10,000 years. EPA approval of such a petition is required prior to deep well injection of a hazardous waste restricted from land disposal under the LDRs without treatment to the LDR treatment standards.

PCBs : polychlorinated biphenols

PRC : Planning Research Corporation, Chicago, Illinois.

PRPs	:	potentially responsible parties. These generally include the site owners, site operators and entities that disposed of or arranged for disposal of wastes containing hazardous substances at the site.
RCRA	:	Resource Conservation and Recovery Act.
RI/FS	:	Remedial Investigation/Feasibility Study.
ROD	:	Record of Decision.
SVE	:	soil vapor extraction treatment.
S/S	:	solidification/stabilization treatment.
USDW	:	underground source of drinking water as defined in 40 CFR 144.3.
VOCs	:	volatile organic compounds.
VHS	:	Vertical Horizontal Spread model for modelling spread of contamination in the ground water.

APPENDIX I

HEALTH-BASED LEVELS AND SOLUBILITIES
FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1991

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
83 32 9	Acenaphthene	2	26	3.42	6
67 64 1	Acetone	4	4	1.0×10^{6}	6
75 05 8	Acetonitrile	2×10^{-1}	4	1.0×10^{6}	6
98 86 2	Acetophenone	4	4	5.5×10^{3}	15
107 02 8	Acrolein	5×10^{-1}	37	5×10^{5}	2
79 06 1	Acrylamide	Treatment Technique	42	$>1 \times 10^{6}$	15
107 13 1	Acrylonitrile	6×10^{-3}	5	7.9×10^{4}	6
309 00 2	Aldrin	2×10^{-6}	5	1.8×10^{-1}	6
62 53 3	Aniline (Benzeneamine)	6×10^{-3}	5	3.5×10^{4}	2
7440 36 0	Antimony	1×10^{-2}	27		
140 57 8	Aramite	1×10^{-3}	26		
7440 38 2	Arsenic	5×10^{-2}	13		
7440 39 3	Barium	1	13		
56 55 3	Benz(a)anthracene	1×10^{-5}	16	5.7×10^{-3}	6
71 43 2	Benzene	5×10^{-3}	14	1.75×10^{3}	6
92 87 5	Benzidine	2×10^{-7}	5	4.0×10^{2}	6
50 32 8	Benzo(a)pyrene	2×10^{-4}	27	1.2×10^{-3}	6
205 99 2	Benzo(b)fluoranthene	2×10^{-5}	8	1.4×10^{-2}	6
100 51 6	Benzyl alcohol	1×10^{1}	26	4×10^{4} (17°C)	15
100 44 7	Benzyl chloride	2×10^{-4}	5	3.3×10^{3}	6
7440 41 7	Beryllium	1×10^{-3}	27		
111 44 4	Bis(2-chloroethyl)ether	3×10^{-5}	5	1.02×10^{4}	6
108 60 1	Bis(2-chloroisopropyl ether)	1	4	1.7×10^{3}	6
117 81 7	Bis(2-ethylhexyl)phthalate	3×10^{-3}	5	4×10^{-1}	11
75 27 4	Bromodichloromethane	3×10^{-4}	5	4.7×10^{3} (22°C)	22
74 83 9	Bromomethane	5×10^{-2}	4	1.0×10^{3}	18
85 68 7	Butyl benzyl phthalate	7	4	2.9	10
88 85 7	2-sec-Butyl-4,6-dinitrophenol (Dinoseb)	7×10^{-3}	27	5×10^{1}	6
7440 43 9	Cadmium	5×10^{-3}	42		
75 15 0	Carbon disulfide	4	4	2.94×10^{3}	6
56 23 5	Carbon tetrachloride	5×10^{-3}	14	7.57×10^{2}	6
57 74 9	Chlordane	2×10^{-3}	42	5.6×10^{-1}	6
106 47 8	p-Chloroaniline	1×10^{-1}	4	3.9×10^{3}	24
108 90 7	Chlorobenzene	1×10^{-1}	42	4.66×10^{2}	6
510 15 6	Chlorobenzilate	7×10^{-1}	4	1×10^{4}	1
126 99 8	2-Chloro-1,3-butadiene (Chloroprene)	7×10^{-1}	26	3×10^{2}	1
124 48 1	Chlorodibromomethane	4×10^{-4}	5	4.4×10^{3} (22°C)	22
67 66 3	Chloroform	6×10^{-3}	5	8.2×10^{3}	6
95 57 8	2-Chlorophenol	2×10^{-1}	4	2.85×10^{4} (20°C)	15
107 05 1	3-Chloropropene (Allyl chloride)	2×10^{-3}	36	1×10^{2}	15

HEALTH-BASED LEVELS AND SOLUBILITIES FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1991

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
7440 47 3	Chromium	$1x10^{-1}$	42		
218 01 9	Chrysene	$2x10^{-4}$	8	$1.8x10^{-3}$	6
319 77 3	Cresols	2	4	$3.1x10^{4}$	6
57 12 5	Cyanide	$2x10^{-1}$	27		
94 75 7	2,4-Dichlorophenoxyacetic Acid (2,4-D)	$7x10^{-2}$	42	$8.9x10^{2}$	6
72 54 8	DDD	$1x10^{-4}$	5	$1x10^{-1}$	6
72 55 9	DDE	$1x10^{-4}$	5	$4x10^{-2}$	6
50 29 3	DDT	$1x10^{-4}$	5	$5x10^{-3}$	6
2303 16 4	Diallate	$6x10^{-4}$	26	$1.4x10^{1}$	6
53 70 3	Dibenz(a,h)anthracene	$7x10^{-7}$	8,17	$5.0x10^{-4}$	6
96 12 8	1,2-Dibromo-3-chloropropane	$2x10^{-4}$	42	$1.0x10^{3}$	6
74 95 3	Dibromomethane	$4x10^{-1}$	4	$1.3x10^{4}$	25
84 74 2	Di-n-butyl phthalate	4	4	$1.3x10^{1}$	6
95 50 1	1,2-Dichlorobenzene	$6x10^{-1}$	42	$1.0x10^{2}$	6
106 46 7	1,4-Dichlorobenzene	$7.5x10^{-2}$	14	$7.9x10^{1}$	6
91 94 1	3,3'-Dichlorobenzidine	$8x10^{-5}$	5	4	6
75 71 8	Dichlorodifluoromethane	7	4	$2.8x10^{2}$	6
75 34 3	1,1-Dichloroethane	$4x10^{-4}$	26	$5.5x10^{3}$	6
107 06 2	1,2-Dichloroethane	$5x10^{-3}$	14	$8.52x10^{3}$	6
75 35 4	1,1-Dichloroethylene	$7x10^{-3}$	14	$2.25x10^{3}$	6
156 59 2	cis-1,2-Dichloroethylene	$7x10^{-2}$	42	$3.5x10^{3}$	6
156 60 5	trans-1,2-Dichloroethylene	$1x10^{-1}$	42	$6.3x10^{3}$	6
75 09 2	Dichloromethane	$5x10^{-3}$	27	$2.0x10^{4}$	6
120 83 2	2,4-Dichlorophenol	$1x10^{-1}$	4	$4.6x10^{3}$	6
78 87 5	1,2-Dichloropropane	$5x10^{-3}$	42	$2.7x10^{3}$	6
542 75 6	1,3-Dichloropropene	$2x10^{-4}$	5	$2.8x10^{3}$	6
60 57 1	Dieldrin	$2x10^{-6}$	5	$1.95x10^{-1}$	6
84 66 2	Diethyl phthalate	$3x10^{1}$	4	$8.96x10^{2}$	6
56 53 1	Diethylstilbesterol	$7x10^{-8}$	26	$1.3x10^{4}$	15
60 51 5	Dimethoate	$7x10^{-3}$	4	$2.5x10^{4}$	6
119 90 4	3,3'-Dimethoxybenzidine	$3x10^{-3}$	26	$2x10^{3}$	1,23
119 93 7	3,3'-Dimethylbenzidine	$4x10^{-6}$	26	$7x10^{1}$	1,23
57 97 6	7,12-Dimethylbenz(a)-anthracene	$1x10^{-6}$	20	$4.4x10^{-3}$	6
105 67 9	2,4-Dimethylphenol	$7x10^{-1}$	4	$5.9x10^{2}$	9
131 11 3	Dimethyl phthalate	$4x10^{1}$	26	$4.3x10^{3}$	2
99 65 0	1,3-Dinitrobenzene	$4x10^{-3}$	4	$4.7x10^{2}$	6
51 28 5	2,4-Dinitrophenol	$7x10^{-2}$	4	$5.6x10^{3}$	6
121 14 2	Dinitrotoluene	$5x10^{-5}$	5,21	$1.32x10^{3}$	6
117 84 0	Di-n-octyl phthalate	$7x10^{-1}$	26	3	22
123 91 1	1,4-Dioxane	$3x10^{-3}$	5	$4.31x10^{5}$	6

HEALTH-BASED LEVELS AND SOLUBILITIES FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
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CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
122 39 4	Diphenylamine	$9x10^{-1}$	4	$5.76x10^{1}$	6
122 66 7	1,2-Diphenylhydrazine	$4x10^{-5}$	5	$1.84x10^{3}$	6
298 04 4	Disulfoton	$1x10^{-3}$	4	$2.5x10^{1}$	24
115 29 7	Endosulfan	$2x10^{-3}$	4	$5.3x10^{-1}$	22
72 20 8	Endrin	$2x10^{-4}$	13	$2.5x10^{-1}$	22
106 89 8	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	Treatment Technique	42	$6.0x10^{4}$	6
110 80 5	2-Ethoxy ethanol	$1x10^{1}$	26	$1x10^{5}$	1
100 41 4	Ethyl benzene	$7x10^{-1}$	42	$1.52x10^{2}$	6
60 29 7	Ethyl ether	$2x10^{1}$	4	$6.05x10^{4}$	12,2
106 93 4	Ethylene dibromide	$5x10^{-5}$	42	$4.3x10^{3}$	6
97 63 2	Ethyl methacrylate	3	26	$7x10^{2}$	1,6
62 50 0	Ethyl methanesulfonate	$1x10^{-6}$	28	$3.69x10^{5}$	6
52 85 7	Famphur	$1x10^{-3}$	41	$1.43x10^{2}$	15
206 44 0	Fluoranthene	1	4	$2.06x10^{-1}$	6
86 73 7	Fluorene	1	4	1.69	6
16984 48 8	Fluoride	4	39		
64 18 6	Formic acid	$7x10^{1}$	4	$1x10^{6}$	6
76 44 8	Heptachlor	$4x10^{-4}$	42	$1.8x10^{-1}$	6
1024 57 3	Heptachlor epoxide (alpha, beta, gamma isomers)	$2x10^{-4}$	42	$3.5x10^{-1}$	6
118 74 1	Hexachlorobenzene	$1x10^{-3}$	27	$6.0x10^{-3}$	6
87 68 3	Hexachlorobutadiene	$4x10^{-4}$	5	$1.5x10^{-1}$	6
77 47 4	Hexachlorocyclopentadiene	$5x10^{-2}$	27	2.1	6
67 72 1	Hexachloroethane	$3x10^{-3}$	5	$5.0x10^{1}$	6
70 30 4	Hexachlorophene	$1x10^{-2}$	4	$4x10^{-3}$	6
319 84 6	alpha-HCH	$6x10^{-6}$	26	1.63	6
319 85 7	beta-HCH	$2x10^{-5}$	26	$2.4x10^{-1}$	6
193 39 5	Indeno(1,2,3,cd)pyrene	$2x10^{-4}$	8	$5.3x10^{-4}$	6
78 83 1	Isobutanol	$1x10^{1}$	4	$7.6x10^{4}$	3
78 59 1	Isophorone	$9x10^{-3}$	5	$1.2x10^{4}$	15
143 50 0	Kepone	$2x10^{-6}$	29	7.6 (24°C)	15
7439 92 1	Lead	$1.5x10^{-2}$	44		
58 89 9	Lindane (gamma-HCH)	$2x10^{-4}$	42	7.8	6
7439 97 6	Mercury	$2x10^{-3}$	42		
126 98 7	Methacrylonitrile	$4x10^{-3}$	4	$2.5x10^{4}$	15
67 56 1	Methanol	$2x10^{1}$	4	$>1x10^{6}$	1
72 43 5	Methoxychlor	$4x10^{-2}$	42	$4x10^{-2}$(24°C)	24
74 87 3	Methyl chloride	$3x10^{-3}$	26	$6.5x10^{3}$	6
56 49 3	3-Methylcholanthrene	$4x10^{-6}$	30		
78 93 3	Methyl ethyl ketone	2	4	$2.68x10^{5}$	6
108 10 1	Methyl isobutyl ketone	2	4	$1.91x10^{4}$	2

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CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
80 62 6	Methyl methacrylate	3	43,26	2.0×10^{1}	6
298 00 0	Methyl parathion	9×10^{-3}	4	6×10^{1}	6
91 20 3	Naphthalene	1×10^{-1}	26	3.4×10^{1}	15
91 59 8	2-Naphthylamine	4×10^{-5}	31	5.86×10^{2}	6
7440 02 0	Nickel	1×10^{-1}	27		
98 95 3	Nitrobenzene	2×10^{-2}	4	1.9×10^{3}	6
79 46 9	2-Nitropropane	4×10^{-6}	26	1.7×10^{5}	38
924 16 3	N-Nitroso-di-n-butylamine	6×10^{-6}	5	6.7×10^{3}	1,23
55 18 5	N-Nitrosodiethylamine	2×10^{-7}	5	4.1×10^{5}	1,23
62 75 9	N-Nitrosodimethylamine	7×10^{-7}	5	2×10^{2}	1
156 10 5	N-Nitrosodiphenylamine	7×10^{-3}	5	4.0×10^{1}	10
621 64 7	N-Nitrosodi-n-propylamine	5×10^{-6}	5	9.9×10^{3}	1
10595 95 6	N-Nitrosomethylethylamine	2×10^{-6}	26	2×10^{4}	1
100 75 4	N-Nitrosopiperidine	8×10^{-6}	32	$>1 \times 10^{6}$	6
930 55 2	Nitrosopyrrolidine	2×10^{-5}	5	$>1 \times 10^{6}$	6
152 16 9	Octamethyl pyrophosphoramide	7×10^{-2}	26	$>1 \times 10^{6}$	1
56 38 2	Parathion	2×10^{-1}	26	2.4×10^{1} (20°C)	15
608 93 5	Pentachlorobenzene	3×10^{-2}	4	1.35×10^{-1}	6
82 68 8	Pentachloronitrobenzene	1×10^{-1}	4	7.11×10^{-2}	6
87 86 5	Pentachlorophenol	1×10^{-3}	19	1.4×10^{1}	6
108 95 2	Phenol	2×10^{1}	4	9.3×10^{4}	6
298 02 2	Phorate	7×10^{-3}	40	5×10^{1}	18
1336 36 3	Polychlorinated biphenyls	5×10^{-4}	42	3.1×10^{-2}	6
23950 58 5	Pronamide	3	4	1×10^{2}	1
129 00 0	Pyrene	1	4	1.32×10^{-1}	6
110 86 1	Pyridine	4×10^{-2}	4	4×10^{4}	1
94 59 7	Safrole	1×10^{-4}	33	1.5×10^{3}	6
7782 49 2	Selenium	5×10^{-2}	42		
7440 22 4	Silver	5×10^{-2}	13		
57 24 9	Strychnine and salts	1×10^{-2}	4	1.56×10^{2}	6
100 42 5	Styrene	1×10^{-1}	42	3×10^{2}	15
95 94 3	1,2,4,5-Tetrachlorobenzene	1×10^{-2}	4	6	6
630 20 6	1,1,1,2-Tetrachloroethane	1×10^{-3}	26	2.9×10^{3}	6
79 34 5	1,1,2,2-Tetrachloroethane	2×10^{-4}	5	2.9×10^{3}	6
127 18 4	Tetrachloroethylene	5×10^{-3}	42	1.5×10^{2}	6
58 90 2	2,3,4,6-Tetrachlorophenol	1	4	1×10^{3}	6
3689 24 5	Tetraethyl dithiopyrophosphate	2×10^{-2}	4	3×10^{1}	25
7440 28 0	Thallium	2×10^{-3}	27		
108 88 3	Toluene	1	42	5.35×10^{2}	6
95 80 7	Toluene-2,4-diamine	9×10^{-5}	34	4.77×10^{4}	6

HEALTH-BASED LEVELS AND SOLUBILITIES FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
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CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
823 40 5	Toluene-2,6-diamine	7	7	1.3×10^5	1
95 53 4	o-Toluidine	1×10^{-4}	26	7×10^2	1,23
106 49 0	p-Toluidine	2×10^{-4}	26	7.4×10^3 (21°C)	15
8001 35 2	Toxaphene	3×10^{-3}	42	5×10^{-1}	6
93 72 1	2,4,5-TP (Silvex)	5×10^{-2}	42	1.4×10^2	2
75 25 2	Tribromomethane (Bromoform)	4×10^{-3}	5	3.01×10^3	6
120 82 1	1,2,4-Trichlorobenzene	9×10^{-3}	27	3.0×10^1	6
71 55 6	1,1,1-Trichloroethane	2×10^{-1}	14	1.5×10^3	6
79 00 5	1,1,2-Trichloroethane	5×10^{-3}	27	4.5×10^3	6
79 01 6	Trichloroethylene	5×10^{-3}	14	1.1×10^3	6
75 69 4	Trichlorofluoromethane	1×10^1	4	1.1×10^3	6
95 95 4	2,4,5-Trichlorophenol	4	4	1.19×10^3	6
88 06 2	2,4,6-Trichlorophenol	3×10^{-3}	5	8.0×10^2	6
93 76 5	2,4,5-Trichlorophenoxy-acetic acid (2,4,5-T)	4×10^{-1}	4	2.4×10^2 (30°C)	2
96 18 4	1,2,3-Trichloropropane	2×10^{-1}	4	4×10^3	1
76 13 1	1,1,2-Trichloro-1,2,2-trifluoroethane	1×10^3	4	1×10^1	6
99 35 4	sym-Trinitrobenzene	2×10^{-3}	4	3.5×10^2	2
126 72 7	Tris(2,3-dibromopropyl) phosphate	3×10^{-5}	35	1.2×10^2	6
7440 62 2	Vanadium	2×10^{-1}	26		
75 01 4	Vinyl chloride	2×10^{-3}	14	2.67×10^3	6
1330 20 7	Xylene (mixed)	1×10^1	42	1.98×10^2	6
7440 66 6	Zinc	7	26		

APPENDIX II

PROCEDURES FOR CONDUCTING RISK BASED CALCULATIONS FOR DETERMINATION OF GROUND WATER CLEAN UP ACTION LEVELS AT MIDCO II

Risk based calculations shall be conducted for each sample. The calculation shall be the sum of the estimated risks produced by each constituent in the sample.

The carcinogenic risk based calculation for each sample is simply the summation of a lifetime averaged exposure rate via ingestion of the ground water for each constituent times that constituent's oral carcinogenic potency factor (slope factor), plus the summation of a lifetime averaged exposure rate via inhalation for each volatile organic compound times that volatile organic compound's inhalation carcinogenic potency factor (slope factor).

This is summarized in the following equation:

$$CR_s = \Sigma\ (OI)_i(OSF)_i + \Sigma\ (II)_i(ISF)_i$$

$$OI_i = (3.09 \times 10^{-2}\ l/kg/d)\ C_i$$

$$II_i = (9.74 \times 10^{-2}\ l/kg/d)\ C_i$$

CR_s = Cumulative lifetime carcinogenic risk for a sample

Σ = Summation of the carcinogenic risk from each constituent detected in the sample.

OI_i = Lifetime averaged exposure rate via ingestion for constituent i

OSF_i = Oral carcinogenic potency factor (or slope factor) of constituent i. These are listed in Table 2 of Appendix IV.

II_i = Lifetime averaged exposure rate via

inhalation for constituent i.

ISF = Inhalation carcinogenic potency factor (or slope factor) of constituent i. These are listed in Table 2 of Appendix IV.

3.09×10^{-2} l/kg/d = lifetime averaged ground water ingestion rate based on the following assumptions:

- The ground water intake averaged over 70 years (25550 days) corresponding to children age 2-6, with a body weight of 17 kg, and an ingestion rate of 1 liter of ground water per day for 5 years, equal to 4.2×10^{-3} l/kg/d.

- The ground water intake averaged over 70 years corresponding to children age 7-12 with a body weight of 29 kg, and an ingestion rate of 1 liter of ground water per day for 6 years, equal to 3.0×10^{-3} l/kg/d.

- The ground water intake averaged over 70 years corresponding to adults, with a body weight of 70 kg, and an ingestion rate of 2 liters of ground water per day for 58 years, equal to 23.7×10^{-3} l/kg/d.

$(4.2 + 3.0 + 23.7) \times 10^{-3}$ l/kg/d = 3.09×10^{-2}

9.74×10^{-2} l/kg/d = lifetime averaged ground water exposure rate via inhalation based on the following assumptions:

- Calculate the lifetime ground water inhalation intake while bathing. In order to do this, it is assumed that all subpopulations (adults, children age 7-12 and children age 2-6) bathe for 20 minutes each day and stay an additional 10 minutes inside the closed-door bathroom, where the concentration in the air of the compound volatilized from the ground water used for bathing increases from zero to the actual ground water concentration at the end of the bathing period, and then decreases to zero during the additional 10 minutes in the bathroom. To account for this increase/decrease in concentration, a factor of 0.38 is used in the equation to calculate the intake. The actual ground water concentration can then be used to calculate the risk. Additional assumptions include: (1) each bath will consume 200 liters of water; (2) the volume of the

shower stall is 3 m^3; and (3) the volume of the bathroom is 10 m^3. Also, the volume of air inhaled per hour is: 0.55 m^3 for adults, 0.6 m^3 for children age 7-12, and 0.49 m^3 for children age 2-6.

The inhalation intake can be calculated as:

$$0.38\ [(200\ 1/3\ m^3) \times (20\ min/60\ min/day) + (200\ 1/10\ m^3) \times (10\ min/60\ min/day)] \times [(0.55\ m^3 \times 58\ yrs)/(70\ kg \times 70\ yrs) + (0.60\ m^3 \times 6\ yrs)/(29\ kg \times 70\ yrs) + (0.49\ m^3 \times 4\ yrs)/(16\ kg \times 70\ yrs)] = 9.74 \times 10^{-2}\ l/kg/d.$$

C_i = Concentration of constituent i in the sample.

The cumulative chronic non-carcinogenic risk index is calculated as follows:

$$NI_s = \Sigma\ ((C_i)(3.09 \times 10^{-2}\ l/kg/d)/ORfD_i) + \Sigma\ ((C_i)(9.74 \times 10^{-2}\ l/kg/d)/IRfD_i)$$

NI_s = Cumulative chronic non-carcinogenic risk index.

Σ = Summation of chronic non-carcinogenic risk for all constituents detected in the sample that affect the same target organ.

$ORfD_i$ = Oral reference dose of constituent i. The reference doses for this Consent Decree are listed in Table 2 of Appendix IV.

$IRfD_i$ = Inhalation reference dose of constituent i. The reference doses for this Consent Decree are listed in Table 2 of Appendix IV.

Compounds detected below the background concentrations listed in the Table 1 of this Attachment will not be included in either the carcinogenic or non-carcinogenic risk based calculations.

The Primary Maximum Contaminant Levels (MCLs) are from 40 CFR 141. New primary MCLs will automatically be added to the

ground water CALs when they are promulgated.

The Ambient Water Quality Criteria (AWQC) for protection of aquatic life to be used in this Decree are listed in Table 2 of this Attachment. The ground water CALs for the AWQC are calculated by multiplying the AWQC from Table 2 by 3.6.

The CAL can not be less than the background concentrations listed in Table 1, nor be less than the analytical detection limits. The analyses shall at least attain the quantification limits necessary to evaluate attainment of the ground water CALs. However, quantification limits below the lowest practical quantification limits listed for each compound in Appendix IX of 40 CFR 264 shall not be required. If only one constituent is detected in a ground water sample that is calculated to potentially cause a lifetime, incremental carcinogenic risk of 1×10^{-5} or greater, and an MCL has been promulgated for this constituent pursuant to 40 CFR 141, then that constituent will not be used in either the carcinogenic nor the non-carcinogenic risk calculations, and the CAL for that constituent will be either the MCL or the AWQC times 3.6, whichever is less.

TABLE 1 OF APPENDIX II

GROUND WATER BACKGROUND CONCENTRATIONS *

Compound	95 % UCL Midco I	95 % UCL Midco II
ARSENIC	6.00E+00	1.51E+01
BARIUM	1.18E+02	1.87E+02
BERYLLIUM		
CADMIUM		
CHROMIUM (III)		1.50E-01
CHROMIUM (VI)	8.00E+00	7.50E+00
COPPER	8.00E+00	7.50E+00
IRON		2.52E+01
LEAD	3.88E+03	1.53E+04
MANGANESE		5.60E+00
MERCURY	1.60E+03	4.64E+02
NICKEL		2.50E-01
SELENIUM	5.80E+01	1.23E+01
SILVER		
THALLIUM		4.60E+00
VANADIUM		
ZINC	4.33E+00	
CYANIDE		1.47E+03
VINYL CHLORIDE	1.04E+01	1.58E+02
CHLOROETHANE	1.32E+00	2.20E+00
METHYLENE CHLORIDE		
ACETONE	1.30E+00	1.90E+00
CARBON DISULFIDE		6.90E+00
1,1-DICHLOROETHENE		
1,1-DICHLOROETHANE		
TRANS-1,2-DICHLOROETHENE		
CHLOROFORM	1.60E-01	6.10E+00
1,2-DICHLOROETHANE		
2-BUTANONE		
1,1,1-TRICHLOROETHANE		
1,2-DICHLOROPROPANE		
TRICHLOROETHENE		
BENZENE		
2-HEXANONE		4.00E-02

Compound	95 % UCL Midco I	95 % UCL Midco II
4-METHYL-2-PENTANONE		
TETRACHLOROETHENE		
TOLUENE		
ETHYLBENZENE		
XYLENES		
PHENOL		
BIS(2-CHLOROETHYL)ETHER		
BIS(2-CHLOROISOPROPYL)ETHER		
BENZYL ALCOHOL		
CRESOL		
NITROBENZENE		
ISOPHORONE		
2,4-DIMETHYLPHENOL		
BENZOIC ACID		
2,4-DICHLOROPHENOL		
NAPHTHALENE		
2-METHYLNAPHTHALENE		
ACENAPHTHENE		
4-NITROPHENOL		
2,4-DINITROTOLUENE		
DIETHYLPHTHALATE		
FLUORENE		
4-NITROANILINE		
PHENANTHRENE		
DI-N-BUTYLPHTHALATE		3.00E-01
N-NITROSODIPHENYLAMINE	2.60E-01	
PENTACHLOROPHENOL		
BIS(2-ETHYLHEXYL)PHTHALATE	1.50E+00	
DI-N-OCTYLPHTHALATE		
HEPTACHLOR EPOXIDE		
LINDANE		
DIELDRIN		
ENDRIN		
PCBs		

95 % UCL = 95 percent upper confidence limit of the average background ground water concentration at each site. From the Feasibility Study for each site.

*All values are given in ug/l.

TABLE 2 OF APPENDIX II

MIDCO I AND II - WATER QUALITY CRITERIA TO BE MET IN THE GROUND WATER

Compound	MIDCO I Surface Water Water Quality Criteria (ug/l)		MIDCO I WQC to be met (ug/l)	MIDCO II Surface Water Water Quality Criteria (ug/l)		MIDCO II WQC to be met (ug/l)
ARSENIC	4.80E+01		1.87E+02	4.80E+01		1.73E+02
BERYLLIUM	5.30E+00		2.07E+01	5.30E+00		1.91E+01
CADMIUM	1.20E+00-6.00E+00	H	4.68E+00	2.90E+00-4.49E+00	H	1.04E+01
CHROMIUM (III)	2.20E+02-1.19E+03	H	8.58E+02	5.58E+02-8.68E+02	H	2.01E+03
CHROMIUM (VI)	1.10E+01		4.29E+01	1.10E+01		3.96E+01
COPPER	1.30E+01-7.30E+01	H	5.07E+01	3.33E+01-5.28E+01	H	1.20E+02
IRON	1.00E+03		3.90E+03	1.00E+03		3.60E+03
LEAD	3.50E+00-4.80E+01	H	1.37E+01	1.49E+01-2.96E+01	H	5.36E+01
MERCURY	1.20E-02		4.68E-02	1.20E-02		4.32E-02
NICKEL	1.68E+02-9.57E+02	H	6.55E+02	4.40E+02-6.94E+02	H	1.58E+03
SELENIUM	3.50E+01		1.37E+02	3.50E+01		1.26E+02
SILVER	1.20E-01		4.68E-01	1.20E-01		4.32E-01
THALLIUM	4.00E+01		1.56E+02	4.00E+01		1.44E+02
ZINC	3.42E+02-1.89E+03	H	1.33E+03	8.78E+02-1.37E+03	H	3.16E+03
CYANIDE	5.20E+00		2.03E+01	5.20E+00		1.87E+01
PENTACHLOROPHENOL	1.30E+01	pH	5.07E+01			
HEPTACHLOR EPOXIDE	3.80E-03		1.48E-02	3.80E-03		1.37E-02
DIELDRIN	1.90E-03		7.41E-03			
ENDRIN	2.30E-03		8.97E-03			
PCBs	1.40E-02		5.46E-02			

WQC = freshwater chronic water quality criteria for the protection of aquatic life; H = hardness dependent, values shown are for the range of hardness present in surface water samples; pH = value is pH dependent (pH = 7.8 used).

Reference: Quality Criteria for Water 1986. U.S. EPA. EPA 440/5-86-001. May 1, 1986.

APPENDIX III

PROCEDURES FOR DETERMINING THE EXTENT OF TREATMENT FOR SOILS AND DEBRIS AT MIDCO II

To define the extent of the treatment by S/S and/or by SVE outside of the minimum area for treatment outlined in Figure 2, samples shall be collected on a square grid with 60 foot centers. The location of the initial grid point shall be determined by the random number technique, and the rest of the grid points measured from the initial point. The grid shall cover the whole soil sample collection area shown in Figure 2 excluding the minimum area for treatment. Split spoon samples shall be collected at each grid point from 1-3 and 4-6 foot depths.

In addition to this grid sampling, one composite sample shall be collected from the pile of contaminated soil in the north corner of Midco II. This composite sample shall be collected using a three dimensional simple random sampling strategy (Test Methods for Evaluating Solid Waste. U.S. EPA, SW-846, Volume 2, 1986.)

The following parameters shall be considered in determining whether the Soil Treatment Action Levels (defined in Section V.C.2) are exceeded at each sampling point:

METALS: total chromium, chromium (VI), lead, antimony, nickel, barium, cadmium, selenium, copper, iron, zinc, vanadium, manganese;

OTHER INORGANICS: arsenic, cyanide;

VOLATILE ORGANIC COMPOUNDS (VOCs): methylene chloride, trichloroethylene, tetrachloroethylene, 2-butanone, acetone, toluene, 1,1,1 trichoroethane, benzene, xylene, ethyl benzene, methyl isobutyl ketone, 1,1-dichloroethylene, 1,2 dichloroethylene, vinyl chloride;

ACID/BASE/NEUTRAL FRACTION: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3)pyrene, dibenz(a,h)anthracene, bis(2-ethylhexyl)phthalate, diethyl phthalate, di-n-butyl phthalate, isophorone, phenol;

PESTICIDE/PCB FRACTION: chlordane, aldrin, dieldrin, polychlorinated biphenyls.

For any of the grid sampling points that exceed the Soil Treatment Action Levels, either:

(a) The entire area within the 60 foot square centered at the grid point will be treated in accordance with Section V.C.2; or

(b) Further sampling and treatment will be conducted as follows:

(1) The 60-foot square centered at the grid point shall be subdivided into nine squares measuring 20 by 20 feet. The center 20-foot square, where the grid point is located shall be treated in accordance with Section V.C.2.

(2) Samples at 1-3 and 4-6 foot depth shall be collected at the center of each of the eight surrounding 20 foot squares. If any of these samples exceed the Soil Treatment Action Levels, the entire area within these 20 foot squares shall be treated in accordance with Section V.C.2.

(3) Samples at 1-3 and 4-6 foot depth shall be collected at the center of each 20 foot square that is along side a 20-foot square determined to exceed the Soil Treatment Action Levels based on the previous sampling. If any of these samples exceed the Soil Treatment Action Levels, the entire area within these squares shall be treated in accordance with Section V.C.2.

(4) The process in (b)(3) above shall be repeated until each 20 foot square along side a square containing a sample that exceeds the Soil Treatment Action Levels, has been sampled, even if this requires sampling of 20-foot squares that are part of 60-foot squares whose center grid point sample results are less than the Soil Treatment Action Levels.

APPENDIX IV

PROCEDURES FOR CONDUCTING RISK BASED CALCULATIONS FOR SOILS AND SEDIMENTS AT MIDCO II

Risk Calculations

Risk based calculations shall be conducted for each sample for both carcinogenic and non-carcinogenic risks. The calculation shall be the sum of the estimated risks produced by each constituent detected in the sample for the ingestion, dermal contact, and inhalation routes of exposure using a residential development scenario.

The carcinogenic risk based calculation for each exposure route shall be the summation of the lifetime average exposure rate for each constituent times that constituent's carcinogenic potency factor (slope factor). This is summarized by the following equation:

$$CR_s = \Sigma\,(OI)_i(OSF)_i + \Sigma\,(DI)_i(DSF)_i + \Sigma\,(II)_i(ISF)_i$$

CR_s = Cumulative lifetime carcinogenic risk for each sample

Σ = Summation of the carcinogenic risk for each constituent detected in the sample

OI_i = Lifetime exposure rate to constituent i via ingestion

DI_i = Lifetime exposure rate to constituent i via dermal contact

II_i = Lifetime exposure rate to constituent i via inhalation

OSF_i = Oral slope factor or carcinogenic potency factor (CPF) of constituent i

DSF_i = Dermal slope factor or carcinogenic potency factor of constituent i

ISF_i = Inhalation slope factor or carcinogenic potency factor of constituent i

The non-carcinogenic risk based calculation for each exposure route shall be the summation of the non-carcinogenic risk indexes for each constituent. The non-carcinogenic risk index is the ratio of the averaged exposure rate divided by the reference dose. This is summarized by the following equation:

$$NI_s = \Sigma\ (OCDI_i)/(ORfD)_i + \Sigma\ (DCDI)_i/(DRfD)_i + \Sigma\ (ICDI)_i(IRfD)_i$$

NI_s = Cumulative chronic non-carcinogenic risk index for each sample

$OCDI_i$ = Chronic daily intake of constituent i for the ingestion route of exposure

$DCDI_i$ = Chronic daily intake of constituent i for the dermal contact route of exposure

$ICDI_i$ = Chronic daily intake of constituent i for the inhalation route of exposure

$ORfD_i$ = Chronic oral reference dose

$DRfD_i$ = Chronic dermal reference dose

$IRfD_i$ = Chronic inhalation reference dose

Constituents that are not detected shall not be included in the risk calculations. The chemical analyses shall at least attain the quantitation limits necessary to evaluate attainment of soil CALs. However, quantitation limits lower than the detection limits listed in Table 1-7 of the Feasiblity Studies for Midco I and Midco II will not be required. Compounds detected below background concentrations shown in Table 1 shall not be used in the risk calculations. No OSF, ISF, ORfD or IRfD is presently available for lead. Therefore, the soil

treatment action level for lead is set at 1000 mg/kg in the soil, and the sediment/soil CAL is set at 500 mg/kg.

If NI_s exceeds 5.0 for the STALs or 1.0 for the soil/sediment CALs, the organ specific NI_s shall be calculated in a manner consistent with EPA guidance. Then the highest organ specific NI_s shall be used to evaluate whether the criteria for soil treatment is or is not exceeded.

The procedures for the calculations for each exposure route are summarized below:

FOR THE INGESTION ROUTE OF EXPOSURE:

CARCINOGENIC RISK CALCULATION

$$CR_{si} = \Sigma\, (OI)_{ii}(OSF)_i$$

$$OI_i = (2.34\ mg/kg/d)(C_i)$$

CR_{si} = Cumulative lifetime carcinogenic risk for each sample for the ingestion route of exposure

OI_i = Lifetime exposure rate to constituent i for the ingestion route of exposure

OSF_i = Oral slope factor or carcinogenic potency factor (CPF) of compound i. These are listed in Table 2. The CPFs in Table 2 are from the U.S. EPA "Health Effects Assessment Summary Tables", April 1989, OERR 9200.6-303-(89-2), except for the carcinogenic polyaromatic hydrocarbons, which are from the U.S. EPA Health Effects Assessment Group.

2.34 mg/kg/d = lifetime averaged soil intake based on the following assumptions:

- The soil intake averaged over 70 years (25550 days) corresponding to children age 2-6, with

a body weight of 17 kg, and an ingestion rate of 0.2 grams of soil per day for 5 years, equal to 8.4 x 10^{-4} g/kg/d.

- The soil intake averaged over 25550 days corresponding to children age 7-12, with a body weight of 29 kg, and an ingestion rate of 0.1 grams of soil per day for 6 years, equal to 3.0 x 10^{-4} g/kg/d.

- The soil intake averaged over 25550 days corresponding to adults, with a body weight of 70 kg, and an ingestion rate of 0.1 grams of soil per day for 58 years, equal to 12 x 10^{-4} g/kg/d.

(8.4 + 3.0 + 12) x 10^{-4} g/kg/d x 10^{3} mg/g = 2.34 mg/kg/d

C_i = Concentration of constituent i in the sample in milligrams contaminant per milligram soil.

NON-CARCINOGENIC RISK INDEX CALCULATION

$NI_{si} = \Sigma (C)_i(11.8 \text{ mg/kg/d})/ORfD_i)$

NI_{si} = Cumulative chronic non-carcinogenic risk index for the ingestion route of exposure

C_i = Concentration of constituent i in the sample in milligrams contaminant per milligram soil

11.8 mg/kg/d = Soil intake for children ages 2-6, based on a bodyweight of 17 kg and an ingestion rate of 0.2 grams of soil per day for five years

$ORfD_i$ = Chronic oral reference dose. The oral reference doses for this Decree are listed in Table 2. The RfDs listed in Table 2 are from the U.S. EPA "Health Effects Assessment Summary Tables", April 1989, OERR 9200.6-303-(89-2)

FOR THE DIRECT CONTACT ROUTE OF EXPOSURE:

CARCINOGENCIC RISK CALCULATION

$CR_{sd} = \Sigma (DI)_i(DSF)_i$

$DI_i = (C)_i(DF)_i(14.53 \text{ mg/kg/d})$

CR_{sd} = Cumulative lifetime carcinogenic risk for each sample for the dermal contact route of exposure

DI_i = Lifetime exposure rate to compound i for the dermal contact route of exposure

C_i = Concentration of constituent i in the sample in milligrams contaminant per milligram soil

DSF_i = Dermal slope factor or carcinogenic potency factor (CPF) of constituent i. These are listed in Table 2. The dermal CPFs in Table 2 were adjusted from the oral CPFs by dividing the oral CPF by the chemical-specific oral absorption factor that represents the percentage of ingested chemical that is actually absorbed. The absorption factors are also listed in Table 2.

DF_i = Desorption factor. This is a chemical-specific value that takes into account the desorption of a constituent from the soil matrix. The following desorption factors shall be used: volatile organic compounds = 0.25; semivolatile organic compounds = 0.10; inorganics = 0.01.

14.53 mg/kg/d = Lifetime soil to skin adherence based on the following assumptions:

- The soil adherence averaged over 70 years (25550 days) corresponding to children age 2-6, with a body weight of 17 kg, an exposed body surface area of 3160 cm^2, a soil-to skin adherence factor of 0.9 mg/cm^2 (Exposure Factors Handbook, Technical Report, U.S. EPA, 1989, Contract No. 68-02-4254) of soil per day, for 138 days per year, for 5 years, equal to 4.52 mg/kg/d. The exposed body surface area includes arms, legs and hands (50th percentile, children aged 3-4, from Exposure Factors Handbook, 1989).

- The soil adherence averaged over 70 years

(25550 days) corresponding to children age 7-12, with a body weight of 29 kg, an exposed body surface area of 4970 cm^2, a soil-to skin adherence factor of 0.9 mg/cm^2 of soil per day, for 138 days per year, for 6 years, equal to 5.00 mg/kg/d. The exposed body surface area includes arms, legs and hands (50th percentile, children aged 9-10 from Exposure Factors Handbook, 1989).

- The soil adherence averaged over 70 years (25550 days) corresponding to adults, with a body weight of 70 kg, an exposed body surface area of 3120 cm^2, a soil-to skin adherence factor of 0.9 mg/cm^2 of soil per day, for 55 days per year, for 58 years equal to 5.01 mg/kg/d. The exposed body surface area includes arms and hands (50th percentile adults from Exposure Factors Handbook, 1989).

NON-CARCINOGENIC RISK INDEX CALCULATION

$NI_{sd} = \Sigma (C)_i(DF)_i(63.25 \text{ mg/kg/d})/(DRfD_i)$

NI_{sd} = Cumulative chronic non-carcinogenic index for the direct contact route of exposure

C_i = Concentration of constituent i in the sample in milligrams contaminant per milligram soil

DF_i = Desorption factor. Use definition previously provided for the carcinogenic risk calculation.

63.25 mg/kg/d = The soil adherence corresponding to children age 2-6, with a body weight of 17 kg, an exposed body surface area of 3160 cm^2, a soil-to skin adherence factor of 0.9 mg/cm^2 of soil per day, for 138 days per year, for 5 years.

$DRfD_i$ = Chronic dermal reference dose. The chronic dermal reference doses for this Decree are listed in Table 2. The chronic dermal reference doses listed in Table 2 were adjusted from the oral reference doses by multiplying the oral reference doses by the chemical-specific oral absorption factor that represents the percentage of ingested chemical that is actually absorbed. The oral absorption factors are also listed in Table 2.

FOR THE INHALATION ROUTE OF EXPOSURE:

CARCINOGENIC RISK CALCULATION

$CR_{si} = \Sigma (II)_i(ISF)_i$

$II_i = (C)_i(D)_i(VP)_i(MW)_i(0.033)$

CR_{si} = Cumulative carcinogenic risk for each sample for the inhalation route of exposure

II_i = Lifetime exposure rate to constituent i for the inhalation route of exposure

ISF_i = Inhalation slope factor or carcinogenic potency factor (CPF) for constituent i. The inhalation CPFs are listed in Table 2 and are from: U.S. EPA, 1989, Health Effects Summary Tables, OERR 9200.6-303-(89-2).

C_i = Concentration of constituent i in the sample in milligrams contaminant per milligram soil

D_i = Diffusion coefficient of constituent i in the air, in cm^2/sec

VP_i = Vapor pressure of constituent i, in mm Hg

MW_i = Molecular weight of constituent i, in g/mole

$$0.033 = \frac{(INR)(ET)(EF)(ED)(A)(P^{4/3})(1000\ mg/g)}{(BW)(AT)(h)(u)(w)(L)(R)(T)}$$

INR = Inhalation rate in m^3/hour: 0.76 from 1-6 years; 0.89 from 7-12 years; 0.83 for adults

ET = Exposure time in hours/day: 21.1 from 1-6 years; 18.3 from 7-12 years; 21.1 for adults

EF = Exposure frequency in days/year: 350 for all age groups

ED = Exposure duration in years: 6 years from 1-6 years; 6 years from 7-12 years; and 58 years for adults

A = 1 E+6 cm^2 (a box 1 meter wide and 100 meters long)

P = Total soil porosity: 0.35

BW = Body weight in kg.: 17 kg from 1-6 year; 29 kg. from 6-12 years; and 70 kg adult

AT = Averaging time: 25550 days (365 days/year X 70 years)

h = Mixing height: 1.83 meters

w = Mixing width: 1 meter

u = Wind speed: 2.4 meters/sec.

L = Effective depth of soil cover: 30 cm.

R = Gas constant: 62,361 mm Hg/gmole/°K

T = Temperature: 290 °K

NON-CARCINOGENIC RISK INDEX CALCULATION

$NI_{si} = \Sigma (C)_i(D)_i(VP)_i(MW)_i(0.0938)/(IRfD_i)$

NI_{si} = Cumulative chronic non-carcinogenic index for the inhalation route of exposure

C_i = Concentration of constituent i in the sample in milligrams contaminant per milligram soil

D_i, VP_i, and MW_i are as defined above

$$0.0938 = \frac{(INR)(ET)(EF)(ED)(A)(P^{4/3})(1000\ mg/g)}{(BW)(AT)(h)(u)(w)(L)(R)(T)}$$

INR = Inhalation rate in m^3/hour: 0.76 for 1-6 year olds

ET = Exposure time in hours/day: 21.1 for 1-6 year olds

ED = Exposure duration in years: 6 years

BW = Body weight in kg.: 17 kg for 1-6 year olds

AT = Averaging time: 2190 days (365 days/year X 6 years)

A, P, EF, P, h, w, u, L, R, and T are as defined above

$IRfD_i$ = Inhalation reference dose for constituent i. The inhalation CPFs are listed in Table 2 and are from: U.S. EPA, 1989, Health Effects Summary Tables, OERR 9200.6-303-(89-2).

TABLE 1 OF APPENDIX IV

MIDCO I AND II - BACKGROUND SOIL CONCENTRATIONS *

COMPOUND	95% UCL (ug/kg)	COMPOUND	95% UCL (ug/kg)	COMPOUND	95% UCL (ug/kg)
ALUMINUM	8,175,837	1,2-DICHLOROETHANE	0	DIETHYLPHTHALATE	27.1
ANTIMONY	1,290	2-BUTANONE	6.7	FLUORENE	0
ARSENIC	14,014	1,1,1-TRICHLOROETHANE	0	N-NITROSODIPHENYLAMINE	0
BARIUM	80,492	1,1,2,2-TETRACHLOROETHANE	0	PENTACHLOROPHENOL	0
BERYLLIUM	0	TRICHLOROETHENE	0	PHENANTHRENE	131
CADMIUM	2,769	BENZENE	0	ANTHRACENE	0
CALCIUM	10,662,779	2-HEXANONE	0	DI-N-BUTYLPHTHALATE	0
CHROMIUM (III)	19,260	4-METHYL-2-PENTANONE	0	FLUORANTHENE	255
CHROMIUM (VI)	19,260	TETRACHLOROETHENE	0	PYRENE	248
COBALT	4,197	TOLUENE	2.0	BUTYLBENZYLPHTHALATE	112
COPPER	48,876	CHLOROBENZENE	0	BENZO(A)ANTHRACENE	158
IRON	13,673,722	ETHYLBENZENE	0	BIS(2-ETHYLHEXYL)PHTHALATE	985
LEAD	145,843	STYRENE	0	CHRYSENE	238
MAGNESIUM	3,386,934	TOTAL XYLENES	0	DI-N-OCTYLPHTHALATE	36.4
MANGANESE	117,133	PHENOL	0	BENZO(B)FLUORANTHENE	241
MERCURY	288	1,4-DICHLOROBENZENE	0	BENZO(K)FLUORANTHENE	154
NICKEL	17,348	2-METHYLPHENOL	0	BENZO(A)PYRENE	137
POTASSIUM	1,002,938	4-METHYLPHENOL	0	INDENO(1,2,3-CD)PYRENE	103
SELENIUM	0	CRESOL	0	DIBENZ(A,H)ANTHRACENE	0
SILVER	447	NITROBENZENE	0	BENZO(G,H,I)PERYLENE	108
SODIUM	81,517	N-NITROSODIPROPYLAMINE	0	ALDRIN	0
THALLIUM	1,477	ISOPHORONE	0	DIELDRIN	0
TIN	1,581	2,4-DIMETHYLPHENOL	0	ENDRIN	0
VANADIUM	20,553	BENZOIC ACID	0	4,4'-DDD	29.5
ZINC	312,974	2,4-DICHLOROPHENOL	0	4,4'-DDT	127
CYANIDE	0	NAPHTHALENE	0	CHLORDANE	4,098
METHYLENE CHLORIDE	9.4	4-CHLORO-3-METHYLPHENOL	0	AROCLOR-1242	0
ACETONE	13.9	2-METHYLNAPHTHALENE	0	AROCLOR-1248	0
1,1-DICHLOROETHANE	0	ACENAPHTHYLENE	0	AROCLOR-1254	0
TRANS-1,2-DICHLOROETHENE	0	ACENAPHTHENE	0	AROCLOR-1260	0
CHLOROFORM	0	DIBENZOFURAN	0	4,4-DDE	44.8

* 95% UCL = 95 percent upper confidence limit of the average background soil concentrations. From the Feasibility Study (both sites have the same soil background concentrations).

TABLE 2 OF APPENDIX IV

CHEMICAL SPECIFIC RISK FACTORS

CHEMICAL	CPF-oral $(mg/kg/d)^{-1}$	Chronic Oral RfD (mg/kg/d)	Inhalation CPF $(mg/kg/d)^{-1}$	Chronic Inhalation RfD (mg/kg/d)	Oral Absorption Factor	Dermal CPF[a] $(mg/kg/d)^{-1}$	Chronic Dermal RfD (mg/kg/d)
antimony	NA	4.00E-04	NA	NA	0.05	NA	2.00E-05
arsenic	1.75E+00	1.00E-03	5.00E+01	NA	0.98	1.79E+00	9.80E-04
barium	NA	5.00E-02	NA	1.00E-04	0.10	NA	5.00E-03
beryllium	NA	5.00E-03	8.40E+00	NA	0.001	NA	5.00E-06
cadmium	NA	1.00E-03	6.10E+00	NA	0.06	NA	6.00E-05
chromium(III)	NA	1.00E+00	NA	NA	0.01	NA	1.00E-02
chromium(VI)	NA	5.00E-03	4.10E+00	NA	0.05	NA	2.50E-04
manganese	NA	2.00E-01	NA	3.00E-04	0.05	NA	1.00E-02
mercury	NA	3.00E-04	NA	NA	0.15	NA	4.50E-05
nickel	NA	2.00E-02	8.40E-01	NA	0.05	NA	1.00E-03
selenium	NA	3.00E-03	NA	1.00E-03	0.60	NA	1.80E-03
thallium	NA	7.00E-05	NA	NA	0.05	NA	3.50E-06
tin	NA	6.00E-01	NA	NA	0.05	NA	3.00E-02
vanadium	NA	7.00E-03	NA	NA	0.05	NA	3.50E-04
zinc	NA	2.00E-01	NA	NA	0.50	NA	1.00E-01
cyanide	NA	2.00E-02	NA	NA	0.45	NA	9.00E-03
methylene chloride	7.50E-03	6.00E-02	1.40E-02	3.00E+00	1.00	7.50E-03	6.00E-02
acetone	NA	1.00E-01	NA	NA	0.90	NA	9.00E-02
1,1-dichloroethane	NA	1.00E-01	NA	1.00E-01	0.70	NA	7.00E-02
1,1-dichloroethene	6.00E-01	9.00E-03	1.20E+00	NA	0.93	6.45E-01	9.30E-03
chloroform	6.10E-03	1.00E-02	8.10E-02	NA	1.00	6.10E-03	1.00E-02
1,2-dichloroethane	9.10E-02	NA	9.10E-02	NA	1.00	9.10E-02	NA
2-butanone	NA	5.00E-02	NA	9.00E-02	0.90	NA	4.50E-02
1,1,1-trichloroethane	NA	9.00E-02	NA	3.00E-01	0.90	NA	8.10E-02
carbon tetrachloride	1.30E-01	7.00E-04	1.30E-01	NA	0.80	1.63E-01	5.60E-04
1,1,2,2-tetrachloroethane	2.00E-01	NA	2.00E-01	NA	0.90	2.22E-01	NA
1,2-dichloropropane	6.80E-02	NA	NA	NA	0.90	6.67E-02	NA
trichloroethene	1.10E-02	NA	1.30E-02	NA	0.95	1.16E-02	NA
1,1,2-trichloroethane	5.70E-02	4.00E-03	5.70E-02	NA	0.90	6.33E-02	3.60E-03
benzene	2.90E-02	NA	2.90E-02	NA	1.00	2.90E-02	NA
4-methyl-2-pentanone	NA	5.00E-02	NA	NA	0.90	NA	4.50E-02

CHEMICAL SPECIFIC RISK FACTORS

CHEMICAL	CPF-oral $(mg/kg/d)^{-1}$	Chronic Oral RfD (mg/kg/d)	Inhalation CPF $(mg/kg/d)^{-1}$	Chronic Inhalation RfD (mg/kg/d)	Oral Absorption Factor	Dermal CPF[a] $(mg/kg/d)^{-1}$	Chronic Dermal RfD (mg/kg/d)
tetrachloroethene	5.10E-02	1.00E-02	3.30E-03	NA	0.90	5.67E-02	9.00E-03
toluene	NA	3.00E-01	NA	1.00E+00	1.00	NA	3.00E-01
chlorobenzene	NA	3.00E-02	NA	5.00E-03	0.31	NA	9.30E-03
ethylbenzene	NA	1.00E-01	NA	NA	0.82	NA	8.20E-02
xylenes	NA	2.00E+00	NA	4.00E-01	1.00	NA	2.00E+00
phenol	NA	6.00E-01	NA	NA	0.90	NA	5.40E-01
1,4-dichlorobenzene	2.40E-02	NA	NA	7.00E-01	1.00	2.40E-02	NA
1,2-dichlorobenzene	NA	4.00E-01	NA	4.00E-02	0.90	NA	3.60E-01
cresol	NA	5.00E-02	NA	NA	0.90	NA	4.50E-02
nitrobenzene	NA	5.00E-04	NA	6.00E-04	0.90	NA	4.50E-04
isophorone	4.10E-03	1.50E-01	NA	NA	0.90	4.56E-03	1.35E-01
benzoic acid	NA	4.00E+00	NA	NA	0.40	NA	1;60E+00
2,4-dichlorophenol	NA	3.00E-03	NA	NA	0.90	NA	2.70E-03
1,2,4-trichlorobenzene	NA	2.00E-02	NA	3.00E-03	0.90	NA	1.80E-02
napthalene	NA	4.00E-01	NA	NA	1.00	NA	4.00E-01
4-chloroaniline	3.50E-02	4.00E-03	NA	NA	0.90	3.89E-02	3.60E-03
diethylphthalate	NA	8.00E-01	NA	NA	0.15	NA	1.20E-01
N-nitrosodiphenylamine	4.90E-03	NA	NA	NA	0.90	5.44E-03	NA
pentachlorophenol	NA	3.00E-02	NA	NA	0.90	NA	2.70E-02
di-N-butylphthalate	NA	1.00E-01	NA	NA	0.85	NA	8.50E-02
benzidine	2.30E+02	3.00E-03	2.30E+02	NA	0.90	2.56E+02	2.70E-03
butylbenzylphthalate	NA	2.00E-01	NA	NA	0.15	NA	3.00E-02
benzo(a)anthracene	1.15E-01	NA	NA	NA	0.50	2.30E-01	NA
bis(2-ethylhexl)phthalate	1.40E-02	2.00E-02	NA	NA	0.15	9.33E-02	3.00E-03
chrysene	1.15E-01	NA	NA	NA	0.50	2.30E-01	NA
benzo(b)fluoranthene	3.45E+00	NA	NA	NA	0.15	6.90E+00	NA
benzo(a)pyrene	1.15E+01	NA	NA	NA	0.50	2.30E+01	NA
indeno(1,2,3-cd)pyrene	1.15E-01	NA	NA	NA	0.50	2.30E-01	NA
dibenz(a,h)anthracene	1.15E+01	NA	NA	NA	0.50	2.30E+01	NA
aldrin	1.70E+01	3.00E-05	1.70E+01	NA	0.50	3.40E+01	1.50E-05
dieldrin	1.60E+01	5.00E-05	1.60E+01	NA	0.50	3.20E+01	2.50E-05
endrin	NA	3.00E-04	NA	NA	0.50	NA	1.50E-04

CHEMICAL SPECIFIC RISK FACTORS

CHEMICAL	CPF-oral $(mg/kg/d)^{-1}$	Chronic Oral RfD (mg/kg/d)	Inhalation CPF $(mg/kg/d)^{-1}$	Chronic Inhalation RfD (mg/kg/d)	Oral Absorption Factor	Dermal CPF[a] $(mg/kg/d)^{-1}$	Chronic Dermal RfD (mg/kg/d)
4,4'-DDT	3.40E-01	5.00E-04	3.40E-01	NA	0.50	6.80E-01	2.50E-04
chlordane	1.30E+00	5.00E-05	1.30E+00	NA	0.50	2.60E+00	2.50E-05
aroclor-1242	7.70E+00	NA	NA	NA	0.50	1.54E+01	NA
araclor-1248	7.70E+00	NA	NA	NA	0.50	1.54E+01	NA
aroclor-1254	7.70E+00	NA	NA	NA	0.50	1.54E+01	NA
araclor-1260	7.70E+00	NA	NA	NA	0.50	1.54E+01	NA
PCBs	7.70E+00	NA	NA	NA	0.95	8.11E+00	NA

NA Not Available
CPF Carcinogenic Potency Factor
RfD Reference Dose
[a] Dermal risk factors are calculated as follows:

$$\frac{\text{Oral CPF}}{\text{oral absorption factor}} = \text{Dermal CPF}$$

$$\text{Oral RfD} * \text{Oral Absorption Factor} = \text{Dermal RfD}$$

APPENDIX V

PROCEDURE FOR CONDUCTING RISK CALCULATIONS FOR AIR EMISSIONS

The carcinogenic risk calculations shall be the summation of a lifetime averaged exposure rate for each constituent times that constituent's inhalation carcinogenic potency factor. This is summarized in the following equation:

$CR = \Sigma (II)_i (ISF)_i$

CR = Cumulative lifetime carcinogenic risk.

Σ = Summation of the carcinogenic risk of each constituent in the air emission.

II_i = Lifetime averaged exposure rate to compound i. More information from the design will be needed to determine II_i for each process or combination of processes. However, the values for INR, ET, EF, ED, BW, and AT from Appenidix IV shall be used for exposures to residents. In addition IR for workers shall be 1.3 cubic meters per hour.

ISF_i = Inhalation carcinogenic potency factor (or slope factor) for compound i. The ISFs are listed in Table 2 of Appenidix IV.

The chronic non-carcinogenic risk index is calculated as follows:

$NI = \Sigma (II)_i / RfD_i$

NI = Cumulative chronic non-carcinogenic index

Σ = Summation of chronic non-carcinogenic risk for all constituents affecting the same target organ

II_i = Chronic exposure rate of constituent i. More process specific information is needed to calculate this number.

RfD_i = Inhalation reference dose of constituent i. The RfD_i are listed in Table 2 of Appenidix IV.